ArcNews

Esri | Summer 2020 | Vol. 42, No. 3

Briefly Noted

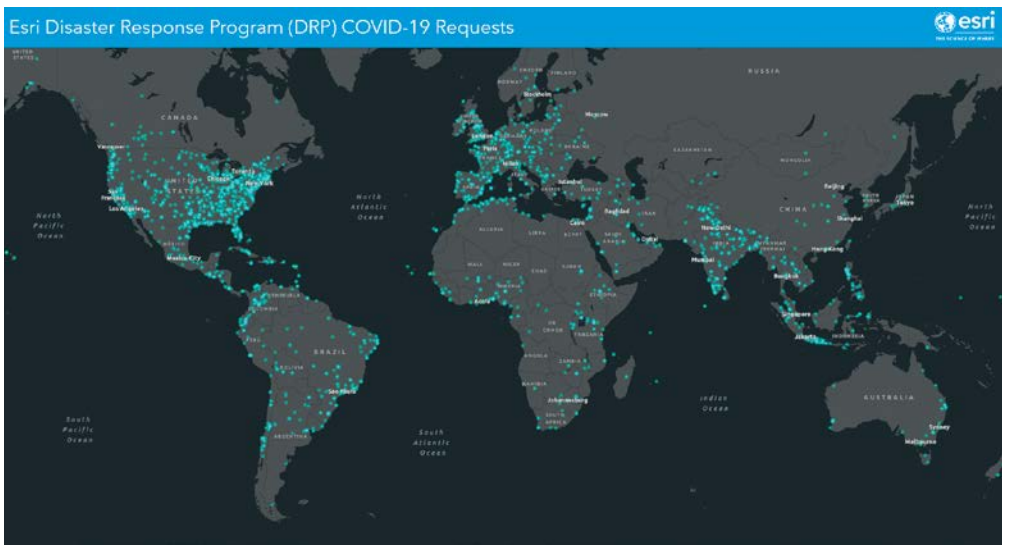
Attend the Esri User Conference Virtually
The 2020 Esri User Conference (Esri UC), July 13–15, is going virtual for the first time in the event's 40-year history. Go to esri.com/uc for more information.

Esri Provides Free Software to Groups Affected by COVID-19
For public health organizations responding to the coronavirus disease 2019 (COVID-19), Esri is providing the ArcGIS Hub Coronavirus Response template through a complimentary six-month ArcGIS Online subscription with ArcGIS Hub. Esri is also giving nonprofits and World Health Organization member states access to a COVID-19 Response Package to help with reporting and analysis. Esri is working with the Federal Emergency Management Agency (FEMA) to distribute mapping and analytics technology to FEMA partner entities and organizations across the United States. Via a new partnership with MCH Strategic Data, Esri is making data layers on US school closures available so educational organizations and families can better understand the situation in their communities. And for college and university students, Esri is providing free access to the ArcGIS platform and learning resources through Learn.ArcGIS.com.

Helping to Grow the US Transit System
A new enterprise licensing program allows small public transit authorities to use Esri software to better plan, organize, and monitor their transportation systems. To learn more, visit go.esri.com/Esri-Small-Transit-EA.

In the Face of Pandemic, GIS Users Around the World Respond

The coronavirus disease 2019 (COVID-19) has affected nearly every aspect of life. As the virus spread rapidly, traditional supply chains and transit networks were disrupted. Investors faced uncertainty and stock markets plummeted, stalling commercial investment and economic growth. Governments around the world implemented sweeping stay-at-home orders—closing schools, government buildings, most retail establishments, and entertainment venues—to help slow the disease's spread. Sporting events were canceled, restaurants and bars were shuttered or offered takeout and delivery only, and social distancing regulations were put in place to stop people from congregating.



↑ By mid-May, Esri's Disaster Response Program (DRP) had received more than 4,000 requests for assistance from around the world due to the coronavirus disease 2019 (COVID-19).

In addition to these measures, local, regional, and federal governments, along with health-care and nonprofit organizations, needed to figure out where and how the virus was spreading. Location intelligence was—and remains—central to that. Esri technology empowered users all over the world to respond to COVID-19 and start planning for reopening and recovery.

Esri spun up its Disaster Response Program (DRP) immediately to help users get access to critical technology fast. (See "A Disaster Like No Other" on page 7 for more on this.) The company set up a microsite on its home page (esri.com/covid-19) with links to resources for managing and responding to the crisis, maintaining business continuity, and reopening communities. The site includes dashboards, templates, apps, data, and even materials for at-home education. For more detailed GIS resources, Esri launched the frequently updated COVID-19 GIS Hub (go.esri.com/coronavirus), which has a five-step guide for understanding the impacts of COVID-19, along with more specific apps, datasets, best practices, and GIS tools that users can incorporate into their own solutions. In addition, a global map gallery (ow.ly/NFDY50zSTiG) showcases maps and

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ArcGIS Hub Enables Communities to Rapidly Share Up-to-Date Data on COVID-19

To keep the public informed about swiftly changing information throughout the coronavirus disease 2019 (COVID-19) pandemic, scores of governments and agencies have used ArcGIS Hub to create open data sites. These sites help increase transparency and build trust in local government—and they're especially important during a large event like a pandemic to communicate up-to-the-moment news and resources. With maps that show everything from community spread of the disease to updates on local school closures, these open data sites provide residents and local officials with the information they need to protect their communities, stay safe, prevent infections, and make data-informed decisions.

The following are several examples of open data sites, built with ArcGIS Hub, from across the United States that have given residents important resources and updates on COVID-19 throughout the crisis.

Maryland Provides Accurate and Timely Data

To coordinate content and updates going out to the community, the Maryland Department of Information Technology (DoIT) Geographic Information Office (GIO) created a site using ArcGIS Hub (ow.ly/9Van50zE59F) in partnership with several agencies, including the Maryland governor's office, the Maryland Department of Health (MDH), and the Maryland Emergency Management Agency (MEMA). The hub site

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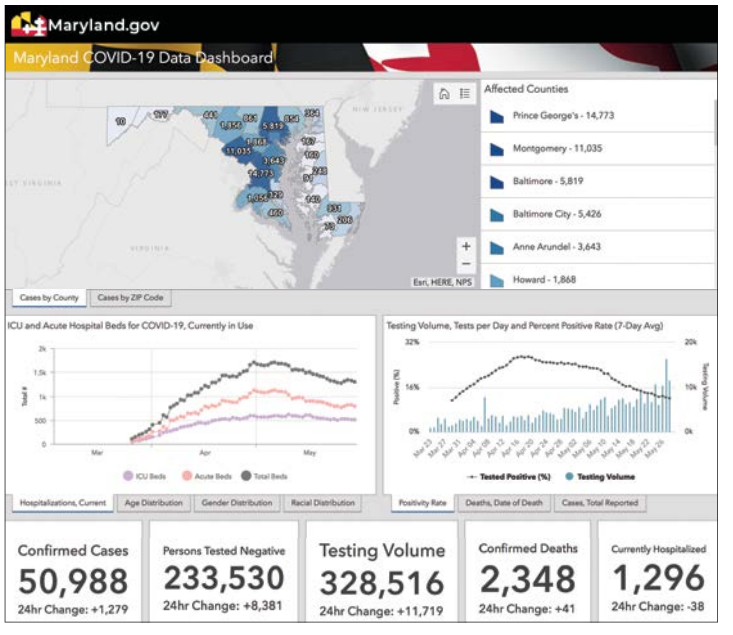

↑ The hub site for the State of Maryland gives users easy access to authoritative information about the coronavirus disease 2019 (COVID-19).

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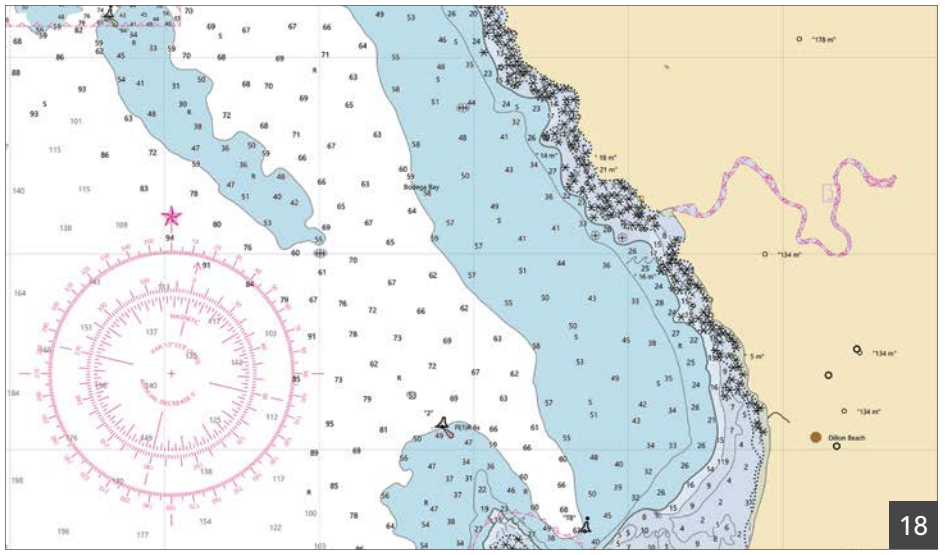
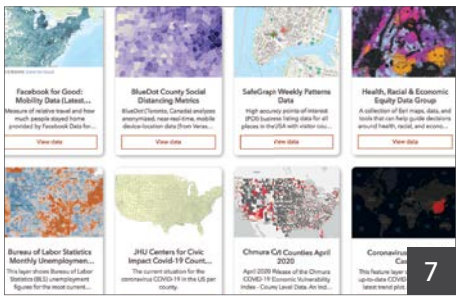


For hundreds of years, mariners have used paper nautical charts to steer their vessels near coastlines, through varying water depths, and around navigational hazards. But paper chart production is time-consuming and resource-intensive. That's why some hydrographic offices are starting to move toward charts on demand, putting Electronic Navigational Charts first.



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Monica Pratt

Managing Editor
Citabria Stevens

Graphic Designer
Takeshi Kanemura

Illustrator
Daniel Gill

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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

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In the Face of Pandemic, GIS Users Around the World Respond

dashboards that organizations around the world have developed to tackle COVID-19. All these resources are designed to help organizations move forward with their response and recovery efforts and are intended to help them streamline plans.

But that's not all. Esri distributors also helped users in their own countries and regions respond to this pandemic that has left virtually no place untouched. They have worked directly with national health ministries, nonprofit organizations, hospitals, and local municipalities to locate local cases of COVID-19, predict the disease's spread, do contact tracing, and help people and businesses get back to work safely. It's been a tremendous undertaking. And in many places, this focus on location—and on using GIS to gain a better understanding of COVID-19—is beginning to pay off.

Asia Pacific Countries React Fast

When COVID-19 first emerged in Wuhan, China, agencies throughout the region contacted Esri China (Beijing) to get help with applying location-based intelligence to their decision-making processes.

"Because of the urgency of the situation, we were tasked with developing a variety of systems in a very short period of time," said Francis Ho, president of Esri China (Beijing). "This included epidemiological mapping, the development of big data platforms for the operation of various coronavirus prevention and control centers, and dashboards to visually display current COVID-19 data for decision-makers."

Esri China (Beijing) supported the Shanghai Center for Disease Control and Prevention as it processed and analyzed spatial data to track the spread of the disease. It assisted one of its business partners in creating GIS-based epidemic surveillance command systems for both the Shanghai Center for Disease Control and Prevention and the Shanghai Municipal Health Commission. And in conjunction with the Chinese Center for Disease Control and Prevention, Esri China (Beijing) helped set up—in just four days—its New Coronavirus Infected Pneumonia Epidemic Distribution System.

"We did projects for both regional and national agencies that we continue to monitor and maintain," said Sam Zhang, GIS analyst at Esri China (Beijing), summarizing many other endeavors the distributor undertook.

In the Hong Kong Special Administrative Region (HKSAR) of the People's Republic of China, the government launched the Interactive Map Dashboard (ow.ly/QH0k50zsrJT) to monitor the status of COVID-19. Esri China (Hong Kong) provided technical support as part of a consortium that helped the Development Bureau and the Lands Department build and manage the dashboard.

"The sophisticated dashboard allows both the public and government agencies to easily view the current situation of COVID-19 in Hong Kong," said Dr. Winnie Tang, founder and chairman of Esri China (Hong Kong).

The dashboard allows users to see a map of buildings that have had confirmed cases of COVID-19, along with pop-ups that show more details about the cases, such as the person's age, when his or her symptoms started, and any buildings the person visited or resided in. The dashboard contains a time slider that shows how the disease has spread throughout Hong Kong, as well as a visualization of when cases have spiked and receded.

Farther south, Australia had just come out of one of its worst bushfire seasons in history when COVID-19 cases started surfacing there. Although emergency response agencies didn't get much of a break, having to immediately roll into the next crisis wasn't all bad.

"We were well oiled. We already had some pretty clear processes in place for how to deal with an emergency," said Mark Wallace, public safety lead at Esri Australia. "We had some learnings from the bushfires, so as soon as we realized that COVID-19 was going to be a thing, we were able to be much more proactive as opposed to reactive."

Esri Australia worked with users to make sure they knew about the DRP and helped customers ensure business continuity. In addition, the distributor worked closely with Emergency Management Spatial Information Network Australia (EMSINA), a nonprofit that, for 15 years, has brought together GIS managers from police, fire, ambulance, and disaster management agencies at all levels of government to improve emergency response by employing spatial information.

"We started to develop our Esri capabilities early on, when we saw that there was nothing coming out in a spatial sense for COVID-19," said Kane Orr, secretary of EMSINA. "We had done a lot of work with Esri Australia throughout the Australian bushfires, and that's where we started to see the capabilities of ArcGIS Hub—how it can aggregate a lot of different geospatial information in one area."

For the pandemic, EMSINA collaborated with Esri Australia to build the COVID-19 Resources hub site (covid19-emsina.hub.arcgis.com), which takes data from the Australian government's Department of Health and other authoritative sources to keep tabs on health-care resources across Australia. The

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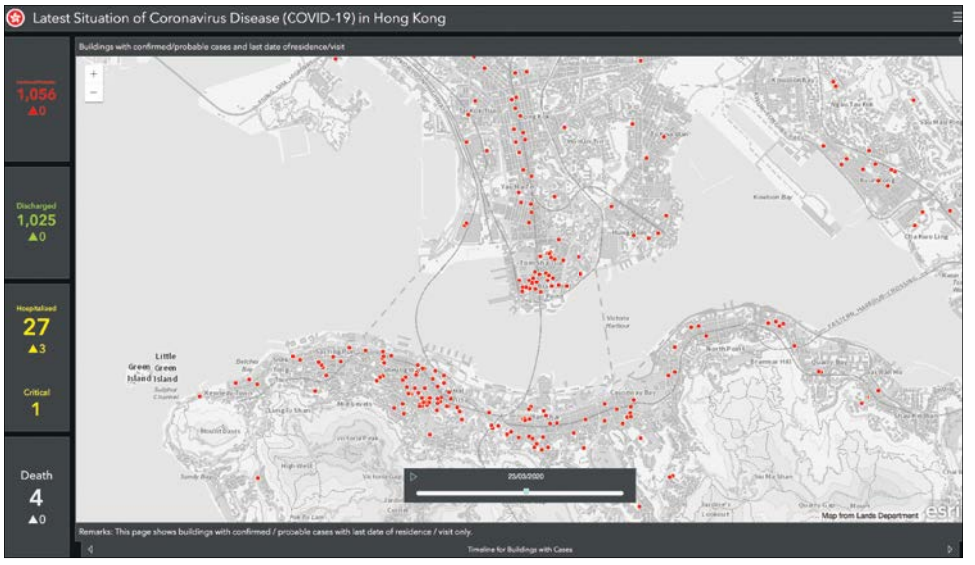

↑ An interactive map dashboard shows COVID-19 infections in Hong Kong over time.

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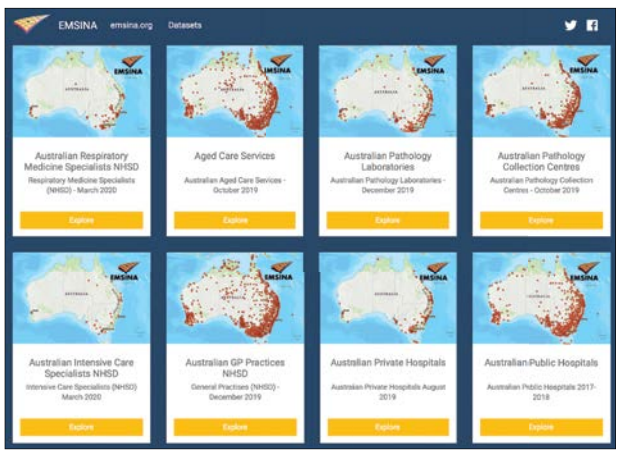
hub site also shows the latest statistics on COVID-19 cases and deaths and links to other, related apps. What's more, it's a cross-jurisdictional hub that allows health officials to see how the situation is unfolding across the country as well as state by state.

"Both with the bushfires and this crisis, Esri Australia and other partners have been so helpful in getting agencies to do things that they normally don't do: build new tools and figure out how to manage data in a different way," said Naomi Withers, cochair of EMSINA. "It's been fantastic, what we've been able to achieve, and some of the outcomes for the community have been so significant."



↑ With support from Esri Australia, Emergency Management Spatial Information Network Australia (EMSINA) developed a hub that aggregates authoritative spatial information about COVID-19 in one place.

Europe Monitors Virus and Prepares for Reopening

In Germany, which has been deemed a relative success story of the COVID-19 pandemic for keeping the number of cases and deaths quite low, a central approach to managing and sharing data about the virus has been key.

"Early on, we told the politicians that a dashboard was needed to keep every citizen in Germany informed about the crisis," recalled Gerd Buziek, business relations executive for Esri Germany. "We set up a prototype dashboard and asked the minister of state for digital affairs to talk with us about providing an official dashboard for Germany."

The minister, who is on German chancellor Angela Merkel's staff, supported the idea, and soon decision-makers throughout Germany had access to the dashboard. This opened the door for Esri Germany to work with the Robert Koch Institute (RKI), the German federal agency and research institute charged with disease control and prevention, to develop a dashboard and hub site that track COVID-19 case data on a daily basis. The platform allows RKI scientists to see their data on maps while also keeping the public well-informed.

"We have gotten more than 73 million hits on the dashboard, and it has up to 2 million requests per day," said Buziek. "We've had 125 million hits to the layers, meaning people are directly implementing them into their own dashboards and viewers."

Command and control centers across Germany have incorporated this data into their dashboards and apps, which track the transport of masks and other medical equipment to facilities and manage logistics for helping regions that have high case numbers.

Several cities are also using the data from the hub along with authorized data from RKI to manage the crisis locally.

"Munich is using ArcGIS Workforce, ArcGIS Collector, ArcGIS Navigator, and ArcGIS Survey123 to distribute materials needed for hospital care and monitor vehicles that drive around making important announcements to citizens," said Holger Ziehm, business development manager for safety and security at Esri Germany.

"As in every crisis, all the people and organizations helping out start from scratch. They have to come together and gather digital tools to do their work," said Buziek. "What we did was set up the central platform—via ArcGIS Hub—to provide that crisis-relevant information, and then we connected the crisis management teams to it. They can then use that to make their own local decisions."

In the United Kingdom, Esri UK quickly set up a response network to manage everything from software requests to customer engagement. In a whirlwind first few weeks, the distributor created new websites, pulled together webinars, and turned its technology research team into a COVID-19 support team. It also provided dashboards and other apps to help users track hospital bed and ventilator availability, maintain situational awareness, improve business continuity, and facilitate greater citizen engagement.

"We learned from Esri Spain about its GeoVolunteers program, so we implemented our own UK version," said Miles Gabriel, commercial manager and DRP lead at Esri UK. Volunteers—who include users, nonusers, furloughed workers, and students—support Esri UK's nonprofit customers, local authorities, and health care-oriented users in responding to COVID-19.

Turning toward recovery, Esri UK is working with organizations such as Sustrans, a charity that advocates walking and cycling, to help local authorities improve pedestrian access and upgrade bike paths.

"We're creating a national dataset that shows which pavements and walkways are too narrow for social distancing," Gabriel explained. "Local authorities can then use this to decide where to widen sidewalks, add cycling lanes, or implement alternate measures to encourage people to use these forms of transit as opposed to public transport."

Esri UK is also aiding with ongoing research on COVID-19 by partnering with University College London on a 12-month project called VirusWatch that will investigate infections out in the community. The team is hoping that 25,000 participants will regularly report on whether they have COVID-19 symptoms, and on their social behaviors. Out of those participants, Esri UK is aiming to get 10,000 people to consent to being tracked using ArcGIS Tracker so the team can analyze their movement patterns across space and time to better understand how social distancing affects people's risk of infection.

Emergency agencies in Portugal had to manage the COVID-19 pandemic while also preparing for fire season.

"Every fire station in Portugal now uses Survey123 to record the status of each firefighter," said António Salazar, solution engineer at Esri Portugal. "We know, in real time, if firefighters are working, at home in quarantine, or at home because they are sick. We can also see, in real time, all the fire stations' capacity to fight a fire."

Esri Portugal has been working with the Ministry of Health's Directorate-General for Health since the beginning on a dashboard that shows COVID-19 data on both the national level and a county-by-county basis. The distributor made two other dashboards as well—one that shows the evolution of the pandemic in Portugal and another that has county-level demographic information.

To help some of its users maintain business continuity throughout the crisis, Esri Portugal set up tools so they could monitor worker health.

"We had one client, a water utility, that could not stop its operations," said Ana Marques, Esri Portugal's marketing manager. "They used ArcGIS Dashboards to monitor which employees got sick so they could call in another person to do that work."

The armed forces have benefited from using Esri technology, too. In addition to monitoring how many members of the military have been infected with and recovered from the virus, the armed forces have used GIS to keep track of their support of public health entities and schools.

"In preparing to reopen schools, the armed forces cleaned them with specific disinfectants," said Rodrigo Gonçalves da Silva, sector lead for defense, security, and sea at Esri Portugal. "They have dashboards and surveys that tell them where the schools are and how many students and teachers they have. These tools help them keep up with their timeline for reopening schools."

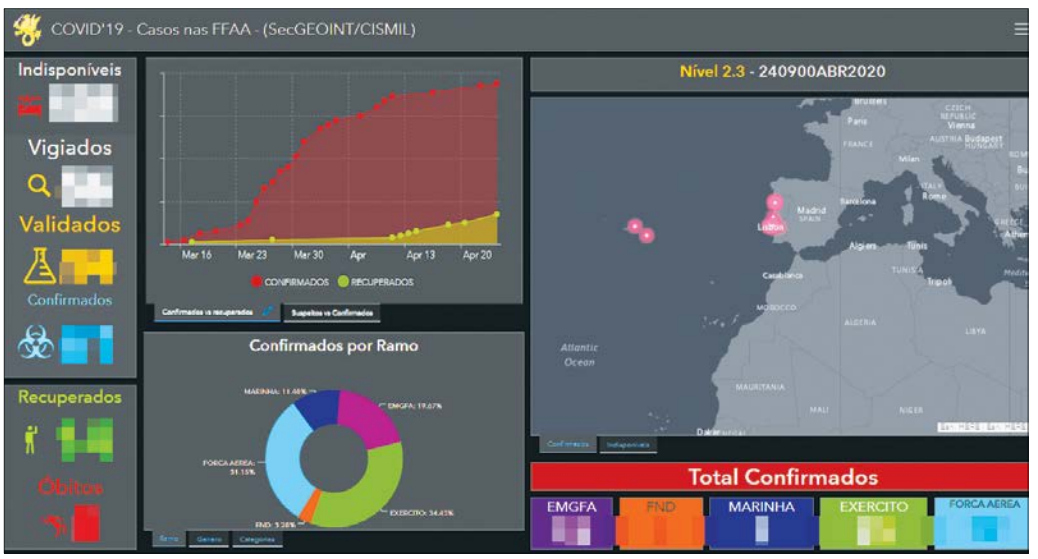
An Encompassing Response in Latin America

In Argentina, the federal government imposed strict lockdown measures when there were only 100 confirmed cases of COVID-19. Aeroterra, Esri's official distributor for Argentina and Uruguay, was in lockstep with these developments, providing technology to monitor not only the virus but also its corresponding effects.

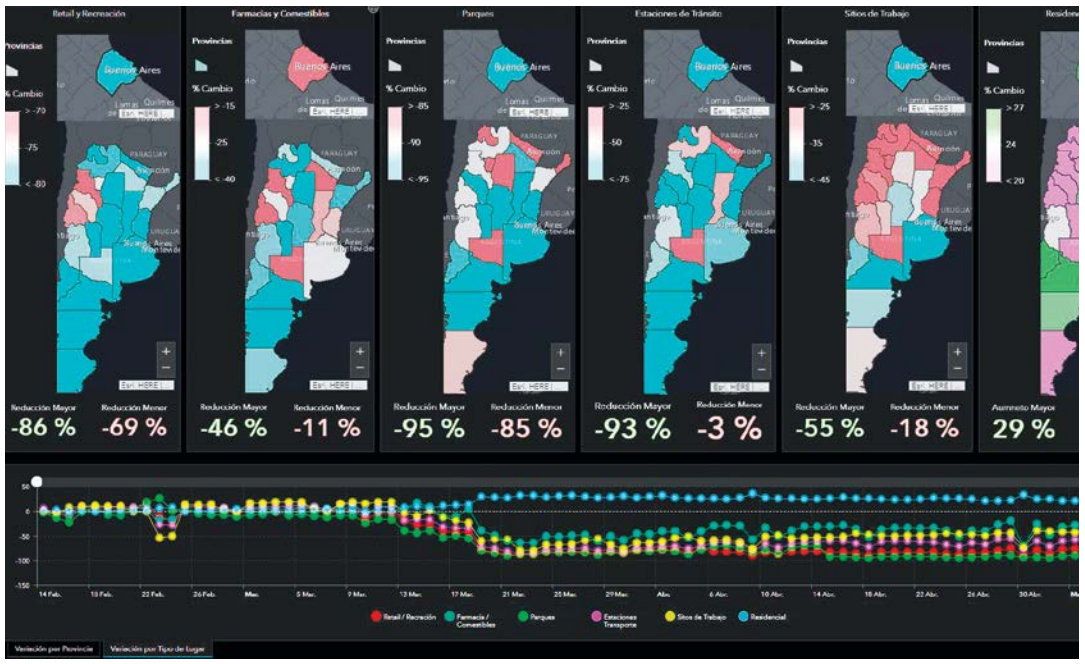
"What we did in the beginning was put together apps for understanding what was going on," said Eduardo Viola, CEO of Aeroterra. "From understanding, action can be taken."

The team at Aeroterra got in touch with a teaching hospital in Buenos Aires to help doctors and nurses provide care to people who likely had COVID-19 but weren't sick enough to be admitted. To keep these patients in regular contact with the hospital's health-care staff, they were asked to fill out a Survey123 form to

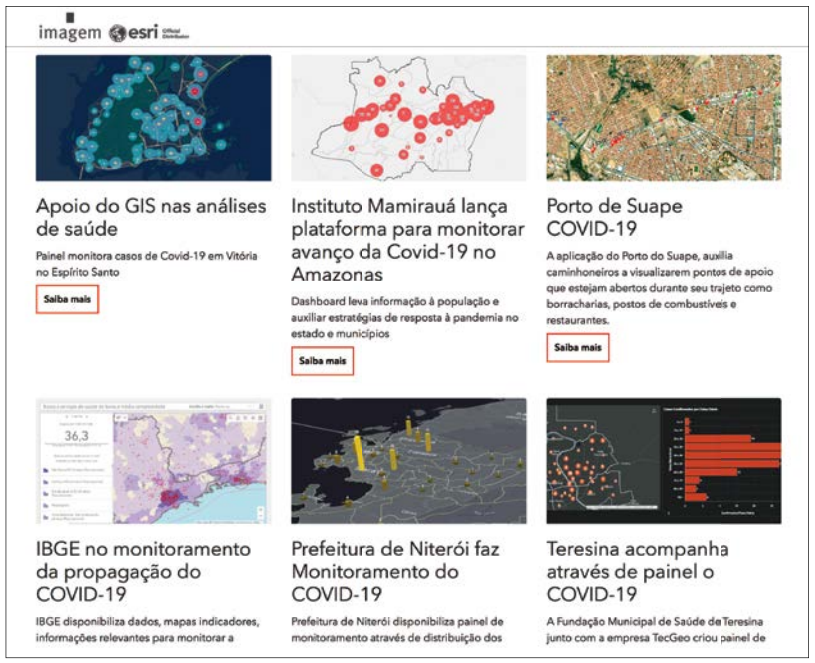
← Gerd Buziek (center) of Esri Germany and Anna Vetter (right) of Esri Switzerland showed a prototype dashboard to Germany's minister of state for digital affairs, Dorothee Bär (left).



↑ Portugal's armed forces have been using ArcGIS Dashboards to monitor how many members of the military have been infected with and recovered from the virus.



↑ Once Argentina started reopening after a strict lockdown, Aeroterra, Esri's official distributor there, began using dashboards to monitor mobility trends in each province.



↑ Imagem, Esri's official distributor in Brazil, put together a hub to display all the dashboards and apps it has prepared for users around the country.

report on their symptoms. Back at the hospital, doctors could monitor, on a dashboard, whether their patients' symptoms changed and also get an overview of where and how cases were developing in the community.

Aeroterra worked with public safety agencies as well to develop apps and dashboards that helped them keep tabs on how well people were following stay-at-home orders. And once the country started reopening, Aeroterra began monitoring mobility trends.

"We put that data, which was already available, into comprehensive dashboards for each province to show how mobility increased or decreased," said Viola.

Neighboring Brazil did not establish a strict lockdown, but the government did limit access to drugstores and shops. There, Esri's official distributor, Imagem, worked with telecommunications companies and their anonymized cell phone data to create dashboards that showed how many people were staying home and how many were going out.

"These companies tracked, in general, where people were and presented that information to the government so decision-makers could define some actions to take," said Felipe Barozzi Seabra, marketing manager for Imagem.

The distributor also worked with cities throughout Brazil to build dashboards that showed—sometimes down to the neighborhood level—the spread of the disease. Imagem made all these dashboards available on its COVID-19 hub (materiais.img.com.br/coronavirus).

"For Niterói, a city near Rio de Janeiro, they did some interesting analysis that shows case data in both 2D and 3D," said Leticia da Cunha Mose Ferreira, Imagem's marketing specialist for local and state government. "They can see the number of cases and some of the actions the mayor is taking, which shows how the city is responding. All the information is available in one story map, so citizens have everything they need in one link."

Moving north, Esri's official distributor in Costa Rica, Geotecnologías, worked extensively with government ministries to get a handle on the pandemic.

"We worked with the Costa Rican Social Security Fund, which is responsible for most of the country's public health sector, to build some dashboards that helped them manage all the hospitals in Costa Rica. They needed to know how many cases there were, how many people were being treated for COVID-19, and how many people were getting tested," said Edwin Solís, geospatial technology specialist at Geotecnologías. "They also asked us to create some epidemiological statistics so they could make important decisions about cases and how to organize the response."

Geotecnologías also worked with the Foreign Ministry to build a dashboard that showed all the Costa Rican citizens stranded around the world so the government could help bring them back. And the distributor made an app and a dashboard for the Ministry of Economy, Industry, and Commerce to monitor which businesses were trying to overcharge for basic products, such as isopropyl alcohol and toilet paper.

"Ultimately, we are trying to help our customers and country see that, OK, we are having this crisis, but there are a lot of people working to prevent it from getting worse," said Solís.

African Countries Use Targeted Technology

Several Esri distributors in Africa have been helping governments try to get a handle on COVID-19 infections as well.

The government in Rwanda is using a range of technology to implement a rapid, coordinated, and effective response to the pandemic, and it is relying on ArcGIS technology to better understand the spread of COVID-19, perform contact tracing, and predict where outbreaks might happen.

Esri Rwanda is working closely with the Rwanda Biomedical Centre (RBC), which manages the nation's health-care services, to map confirmed cases of COVID-19 throughout the country and communicate this information to the public via interactive dashboards. The distributor is also supporting contact tracing by mapping populations that are likely to have been exposed to confirmed cases.

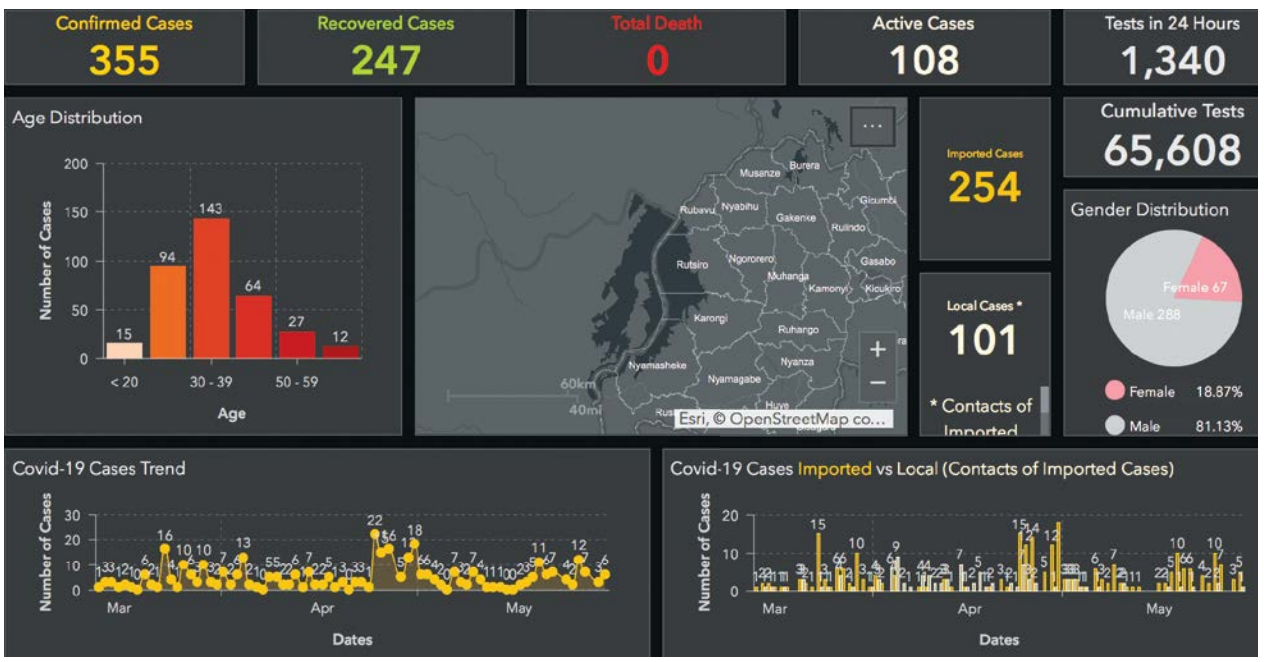
To do this, Esri Rwanda combines the data on confirmed cases with other local contextual data—such as where markets, restaurants, shops, and pharmacies are located, along with demographic and mobility data—to find out where people may need to undergo testing for COVID-19. From there, the government sends out a field team to conduct targeted interviews using Survey123, which feeds information back to a dashboard that then automatically selects sites for testing based on contact closeness indicators.

"We are using the most powerful location intelligence technology to geolocalize where there have been confirmed cases of COVID-19, and then we try to locate areas where those people could have met other people," explained Jean Pierre Gatera, managing director of Esri Rwanda. "This helps the government carry out rapid and targeted interventions."

In Ghana, key government officials—including the president, vice president, and cabinet members—have access to a COVID-19 dashboard (ghanahealthservice.org/covid19) that was built with support from Sambus Geospatial Limited, Esri's official distributor there. Most of the decisions being made about the pandemic in Ghana are based on the information shown on the dashboard, which includes case counts, the number of recoveries and deaths, external data from Ghana Statistical Services, and an interactive map.

Moreover, the Africa Centres for Disease Control and Prevention, the public health agency for the African Union, embedded an ArcGIS Dashboards app (africacdc.org/covid-19) on its website that shows all the latest COVID-19 cases collected from African Union member states. The site also has resources that include best health practices, scientific and public policy health updates, upcoming training events, and news and announcements.

It truly is a joint effort around the world to get a handle on the COVID-19 pandemic, and location data—fueled by Esri technology—is at the center of the crusade.



↑ The Rwanda Biomedical Centre (RBC) has a dashboard on its website that displays countrywide information about COVID-19 cases.

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ArcGIS Hub Enables Communities to Rapidly Share Up-to-Date Data on COVID-19

was designed to be an authoritative source of reliable information on COVID-19 and provide users with fast and easy access to resources.

"I want to instill confidence in Marylanders that their state government is providing accurate and timely data to all visitors to the site," said Julia Fischer, director of data services for business intelligence and GIS at DoIT. "The data is accessible to all Marylanders and is providing a clear and definitive picture of the state's response to the unprecedented events occurring right now."

Fischer said the DoIT GIO team selected ArcGIS Hub to create the new site because the Esri platform is what she and her staff know best. The team members created the initial site in about four hours, coordinating with staff at MDH, MEMA, and the governor's office so they could make content updates directly to the site.

The site includes a prominently placed dashboard that shares vital statistics regarding confirmed COVID-19 cases (broken down by county and ZIP code), hospitalizations, and testing results. The site also provides details regarding symptoms of COVID-19, how best to practice social distancing, links to local health departments, and more. It features practical resources such as links to information from the Centers for Disease Control and Prevention (CDC) and related highlights from governor Larry Hogan's official website.

"We are providing a site that includes…quick access to interactive maps and dashboards, as well as data analytic capabilities, ensuring that Marylanders are well-informed about health and safety topics related to COVID-19 in Maryland," said Fischer.

MDH continues to work to consolidate data to gain a clear picture of the statewide efforts to combat COVID-19, along with their effects. As such, the data featured on the site is derived from the work of MDH and its partners. Additional subpages that have recently been developed show the locations of congregate facilities and testing sites throughout the state to help visitors gain a clearer understanding of the impact of the pandemic.

The team updates the statistics on the site seven days a week and keeps refining it to improve its reliability and user experience. Since it launched on March 14, the site has had more than 214 million page views and almost 4.6 million users.

"I am immensely proud of the work my team has been doing," said Fischer. "Transparency of information is everything. Governments have an obligation to communicate data and empower all of us to make informed decisions for ourselves, our families, and our communities."

Montgomery County, Pennsylvania, Showcases the Power of GIS

Officials in Montgomery County, Pennsylvania, established a site with ArcGIS Hub when the county recorded its first case of COVID-19 in early March. The initiative began with a simple story map that showed the location of COVID-19 cases in both the state and the county and has since evolved into a full hub site with maps, resources, and information on the pandemic.

"It's turned into an information platform with a lot of links to resources and information—especially as we've gotten more cases. *[Our residents]* want to see maps and data and things like that," said county GIS manager David Long, GISP. "The goal of our site is to…put information out in a timely manner and showcase the power of our GIS program."

Long selected ArcGIS Hub because it integrated seamlessly with the GIS division's existing ArcGIS platform.

"*[Speaking]* as a GIS professional, it's not just the fact that it's available to us and is already part of our platform, but the functionality is much better. I just feel like it's easy," he said. "It just allows me to be able to work in a platform that I'm familiar with."

The Montgomery County hub site (ow.ly/9dus50zE5vh) provides basic but vital information about COVID-19, including what the virus is, how to prevent getting it, and symptoms of the disease. The site also displays county-specific statistics such as the age, gender, and municipalities associated with COVID-19 cases; local county news; and updates from governor Tom Wolf, including his plan for reopening the state. In addition, the hub hosts public testing registration forms that residents can use to preregister for a COVID-19 test.

A range of resources are available as well, including information from the CDC, links to the Pennsylvania COVID-19 site and the Pennsylvania Department of Health, and the Johns Hopkins University dashboard that shows global cases. Dr. Valerie Arkoosh, chair of the Montgomery County Commissioners, holds daily COVID-19 press conferences that are streamed live on Facebook. Those are archived on the hub site and available for anyone to view.

A stand-alone business page, accessible from the site, was created for the Montgomery County business community. This page includes information, such as how to apply for business loans, and a capability that enables businesses to indicate whether they're open or closed or are offering discounts. What's more, with help from Google Translate, the GIS team made the main page of the hub site available in Korean to serve the county's large Korean-speaking community.

Long and his team update the site daily after the county holds a press conference to release new numbers.

"I've been working remotely—all my staff has been—but we've been responsible for updating maps and the hub site daily," said Long. "So even though it hasn't been face-to-face, it has involved constantly contacting sources and verifying information daily."

Since its launch on March 7, the site has received more than 2.75 million unique views, according to Google Analytics, with about 60 percent of those on a mobile device. For Long, an additional benefit of ArcGIS Hub is that it responds well to the mobile environment. Feedback on the site has been positive, and it's been a big hit with county residents in particular, according to Long.

"ArcGIS Hub has made it simple to continually update our content," said Long.

In addition to a regional hub site, he has developed mapping content and data that includes COVID-19 statistics from other Pennsylvania counties.

"This disease doesn't stop at borders," Long said. That's why he and the GIS division are committed to continuing to provide the public with an array of up-to-date information.

County in Indiana Makes One-Stop Shop for COVID-19 Information

In Delaware County, Indiana, the Delaware County GIS Department manages a COVID-19 hub site (ow.ly/eha450zE5t6) in partnership with the Delaware County Emergency Management Agency and the Delaware County Health Department.

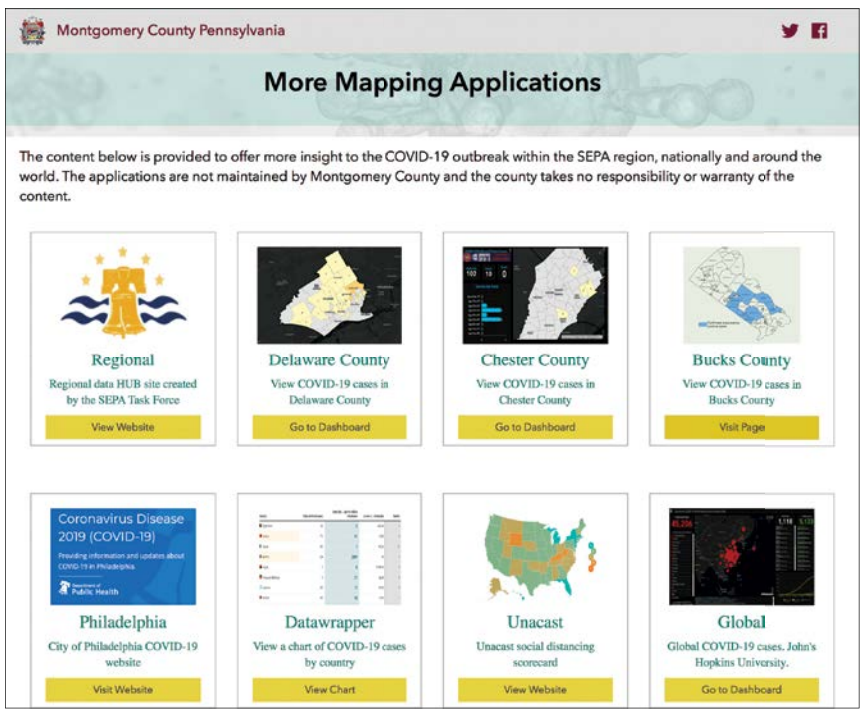
"The main purpose of our local coronavirus hub site is to be the official source for our community's response to the COVID-19 epidemic," said Delaware County GIS department's GIS coordinator Kyle Johnson, GISP. "Having a one-stop shop for all the most important local information on the response to the pandemic was very important."

Johnson had experience using ArcGIS Hub on a different project. He liked how easily it integrated with ArcGIS Online content, as well as its responsive design, so he thought it would be an ideal platform for the county's COVID-19 site. Implementation was easy, he said, thanks to the drag-and-drop interface.

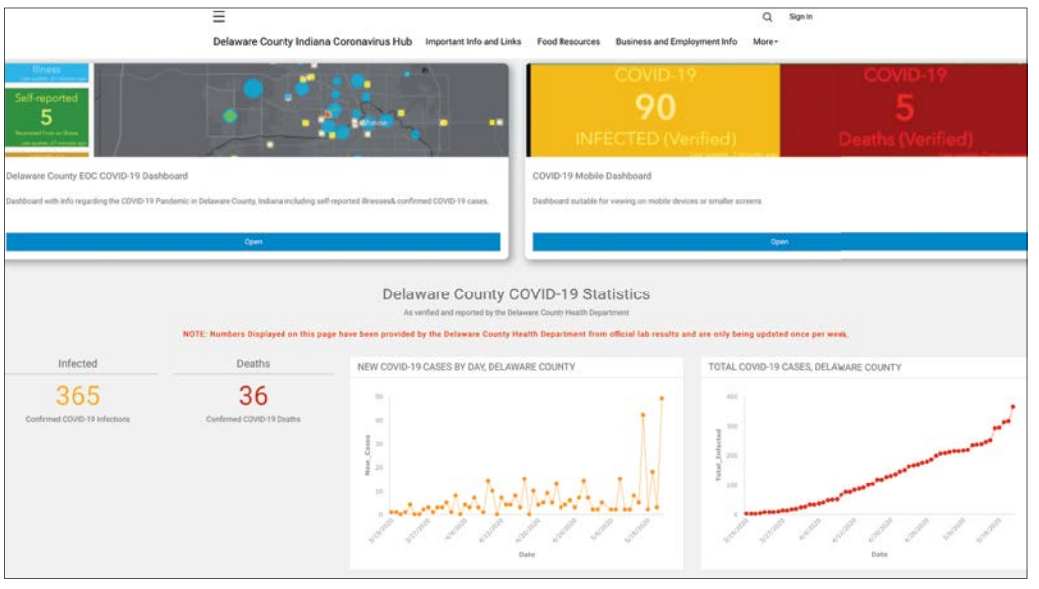
"Providing fast, important information to the public is always a challenge, especially during emergency situations. The ArcGIS Hub site and ArcGIS Online have made my job of disseminating information and making it available to the public much easier," said Johnson.

The county's Emergency Management Agency, which has been tracking self-reported illnesses and recoveries, is the primary data source for the site. A dashboard also gives users access to the State of Indiana's dashboard and the Johns Hopkins University global dashboard.

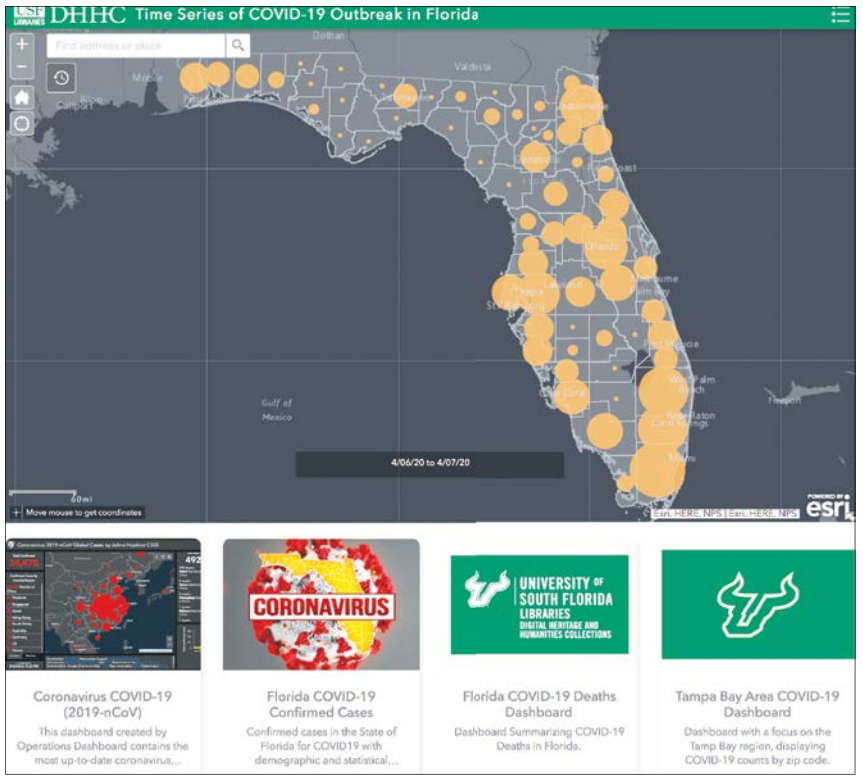
When food distribution programs began in the county, the GIS department also included maps on the hub that showed the locations of the distribution centers. Additional pages on the site focus on local resources, including details on school closures



← The Montgomery County COVID-19 hub has turned into an information platform with extensive links to resources, maps, and data.



↑ The Delaware County GIS Department manages a COVID-19 hub site together with the county's Emergency Management Agency and health department.



← The University of South Florida is using its hub to engage with researchers and learners at the university and with local and regional communities.

and student food pickup sites and daily briefing videos from the county's Emergency Management Agency. And now that the state has Back on Track Indiana, a road map to reopening, details of the plan are featured at the top of the page.

Two GIS department staff members update the site multiple times a day. The ArcGIS Hub site launched on March 11, and as of May 18, it had received more than 87,000 item views, with a maximum daily view of over 4,000.

"So far, all the feedback has been good," said Johnson. "Local officials like having important information on COVID-19 in one place, and our community can stay informed on this pandemic, which has impacted our state and community."

University of South Florida Collaborates with the Community It Serves

The Digital Heritage and Humanities Collections GIS team at the University of South Florida (USF) in Tampa developed the Florida COVID-19 Hub site (ow.ly/XDrv50zE5kr) with both a regional and statewide focus. The site—a collaboration with research director and principal investigator Lori Collins; GIS manager and lead developer and designer Benjamin Mittler, GISP; GIS analyst Garrett Speed, GISP; and several PhD and graduate students—is designed to provide a platform for data access, research, and visualization.

"We are trying to help serve our campus researchers and engaged community of learners and educators, as well as the broader local and regional areas," said Collins. "At this time, spatial data and its relationships to societal function and news are of vital importance."

The GIS team chose ArcGIS Hub because of its ability to host multiple types of apps and data. Also, a number of agencies and data creators in Florida were already building GIS dashboards that the team knew could be quickly incorporated and expanded on, using a hub approach.

"We chose to not duplicate efforts but be inclusive and collaborative from the start, making ArcGIS Hub an obvious choice for building out an application like this," said Mittler. "ArcGIS Hub allowed us to easily harvest data from other sources and display *[it]* in a simple way. Additionally, the Hub interface allowed us to add several important elements to our page with little to no coding."

"We wanted to provide people with a tool where they could just sort of easily land and get the resources they need to make on-the-ground decisions but also predictively look at things," said Collins. "ArcGIS Hub provided us with an easy mechanism to serve data out that way and to continue to add and grow the platform as new needs arose."

The Florida COVID-19 Hub site includes the hub app, four custom dashboards, one web app, nine web maps, two feature services, and nine feature services streamed from government agencies. The statistics, map, social media, and featured applications sections of the dashboard were all created using built-in ArcGIS Hub functionality. The site also has a map that displays the Florida case count by county, with symbology that emphasizes the largest outbreaks. In addition, a custom layer examines cases and deaths related specifically to nursing homes.

"The nursing home research began when the state started putting out spreadsheet information on this area of high concern in Florida," said Collins. "We have now expanded this to spatially examine trends and case numbers across the state. To the best of our knowledge, we are currently *[as of mid-May]* the only source for facility location information using GIS."

Resources on the site include embedded Twitter feeds for the Florida Department of Health, the University of South Florida, Hillsborough County, and Pinellas County to ensure that users get real-time information on local and statewide closures. Cards on the site link to local and national news sources for additional information as well.

The hub also connects to two different sources of spatial data. The first is an ArcGIS Online group site with curated and updated data that's relevant to COVID-19. The second is a storage folder that the Department of Health uses to export and archive data downloads each day.

The Florida COVID-19 site has been viewed about 500,000 times. Several USF faculty members are using its tools and data and are beginning to organize and share their own research through the platform.

"We are working with researchers in public health, education and policy, environmental sciences, business, data science, and geography—all coming together around the need to solve real-world problems with spatial data," said Collins.

Mittler also said that the public has found the hub useful. It's getting shared a lot, and there's increasing social media engagement around it.

USF libraries, which the GIS team is part of, plans to help with metadata and paradata creation. This will allow people to reuse the data in the long term and conduct continued studies of the pandemic in Florida.

"We're trying to be a good partner in our community and serve *[this]* data out in really usable, ready-made formats to keep policy makers, educators, researchers, and the public informed," said Collins. "Our ArcGIS *[Hub]* site has become a really good way to collaborate and be a part of the community that we serve."

A Disaster Like NO OTHER

Soon after the coronavirus disease 2019 (COVID-19) was first detected, requests for assistance began pouring in to Esri's Disaster Response Program (DRP). The DRP is a free service designed to help customers when their GIS capabilities are exceeded during an active crisis or disaster response.

"Our activation to support COVID-19 started in early February. Since then, we have had more requests for assistance than in the entire 25-year history of the DRP," said Ryan Lanclos, Esri's director of public safety solutions and the DRP. "We have helped thousands of organizations globally and responded to tens of thousands of requests to support response efforts."

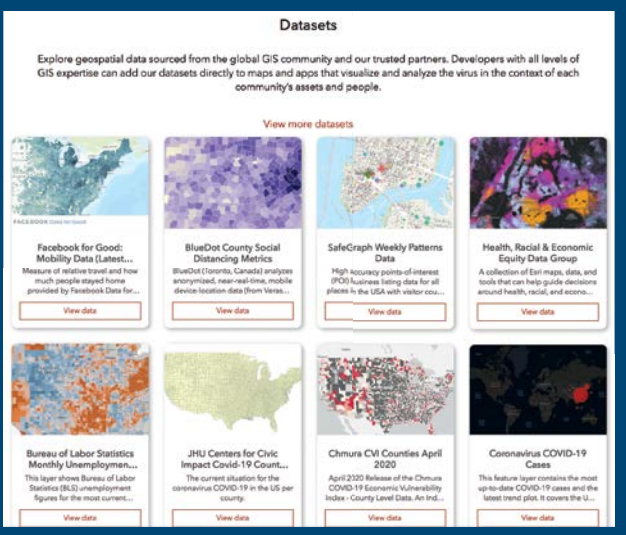
Because the pandemic has affected virtually everyone, Lanclos is grateful that Esri has been able to offer assistance to organizations on the front lines and those now working to get schools, businesses, and workplaces back up and running.

At the height of the response effort, Esri's DRP had hundreds of staff supporting customers tackling COVID-19. Among its services, the DRP resolves technical support issues, provides additional software when necessary, points customers to available data, and helps configure solutions to address common workflows for crisis response and recovery. Primary requests for product support include ArcGIS Online, ArcGIS Hub, ArcGIS Dashboards, ArcGIS Desktop, ArcGIS mobile apps, and ArcGIS Configurable Apps.

Esri's COVID-19 GIS Hub (go.esri.com/coronavirus) is a strategic part of the DRP's response efforts. The hub displays extensive resources for those seeking information about the virus and its effects or wanting to create their own maps and apps or even set up relevant ArcGIS Hub pages. It includes map templates, datasets, and apps that have been built in partnership with the global GIS community. In addition, the hub features a Request GIS Assistance button that allows those in need to reach the DRP for COVID-19 support.

The hub's collection of data is extensive and continues to grow as new maps and datasets are added. It is composed of ArcGIS Living Atlas of the World, global demographics, world population density, and data from Esri partners and other third parties that is useful for response and reopening efforts. Datasets specific to health care and social services include Definitive Healthcare's Hospital Database, the Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index, and the US Department of Housing and Urban Development's Continuum of Care Program grantee areas. Additionally, as many communities move toward reopening, visitors to the hub can now find datasets on mobility from Unacast, BlueDot, and Safegraph; social distancing metrics; and unemployment statistics.

"Working with the GIS community, we have been able to quickly release a number of ArcGIS solutions that are specific to reopening and recovery. These allow for tracking and reporting of health and economic indicators," said Lanclos. "We continue to work on efforts to enhance our solutions so we can provide people with useful, configurable tools to increase awareness of and insight about how we get past response and into our new normal."



↑ Esri's COVID-19 GIS Hub has extensive resources for those seeking maps, apps, and datasets about COVID-19 response and recovery.

To Balance Priorities in a COVID-19 World,

Geography Matters

By Este Geraghty, Chief Medical Officer, Esri

People select their career paths for myriad reasons. I began my career in medicine because I was curious about how human bodies work. What makes them sick, and how do we keep them fit and healthy in ways that maximize our individual life expectancies?

In truth, my motives were both altruistic and selfish. I absolutely wanted to be of service to others, but I also aspired to live a very long life of my own.

My point of view on that expanded, though, from a seemingly unrelated event: hiring a financial adviser. I had no money, just a pile of debt from medical school. Still, I thought it would be worthwhile to get expert advice on how to decrease my debt and develop wealth.

With great anticipation, I imagined the advice I would receive at my first meeting. What would I learn that would put me on the path toward financial independence? Imagine my surprise when my one action item at the end of the first meeting was to purchase supplemental disability insurance. What? No investment strategy? No debt payoff advice?

The simple fact shared with me that day was that you must first protect your most valuable asset: your ability to work. Without your health, everything is at risk—your livelihood, your future financial security, your sense of fulfillment, and your happiness. I started to see it.

That lesson stayed with me throughout my training in public health and in my everyday observations of the world, ranging from Apple founder Steve Jobs's dying of pancreatic cancer to the establishment of the United Nations Sustainable Development Goals (SDGs) that all, in some way, aim to protect people's health.

In the current coronavirus disease 2019 (COVID-19) pandemic, we hear about New York governor Andrew Cuomo debating a reporter about the importance of tackling the economic hardship caused by stay-at-home orders versus risking a potential rise in deaths due to increased COVID-19 infections. Compare that with a statement made by heart surgeon and television personality Dr. Oz about how reopening schools might result in a relatively low increase in the COVID-19 mortality rate but that it's a trade-off some people might accept. How do we prioritize actions? Can we achieve some balance?

While I certainly do not have all the answers, we can explore those questions.

Let's start with the notion of priorities. It's not surprising that I will always prioritize health. I see it as essential to all other things in life. Even so, the concept of prioritizing health is complex and nuanced.

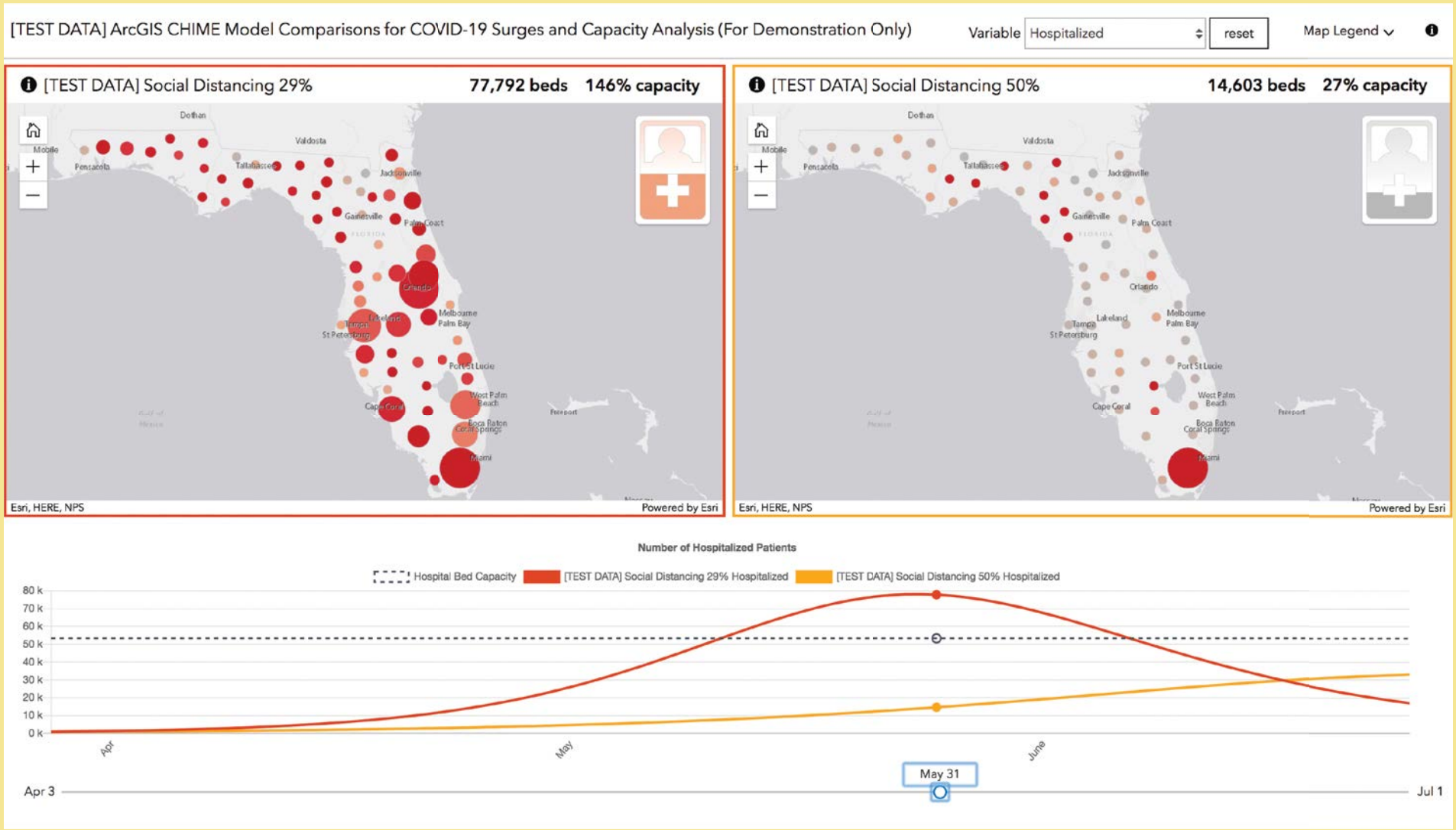
Health-care professionals, for example, prioritize differently than public health professionals do. In health care, the prime concern is always the individual who's looking for help and advice. Doctors, nurses, and other allied health professionals are trained to be strong advocates for their patients, directing all necessary resources toward their optimal health care. But in public health, we think about protecting populations over individuals, ensuring that scarce resources are focused where they will do the most good for the community as a whole.

For example, if you had $10,000 to spend, and you could offer only one of two choices—either providing 10,000 vaccines to young children or helping an older man with chronic lung disease get better—which would you choose? Well, it depends on whether you are that man's doctor or a public health professional.

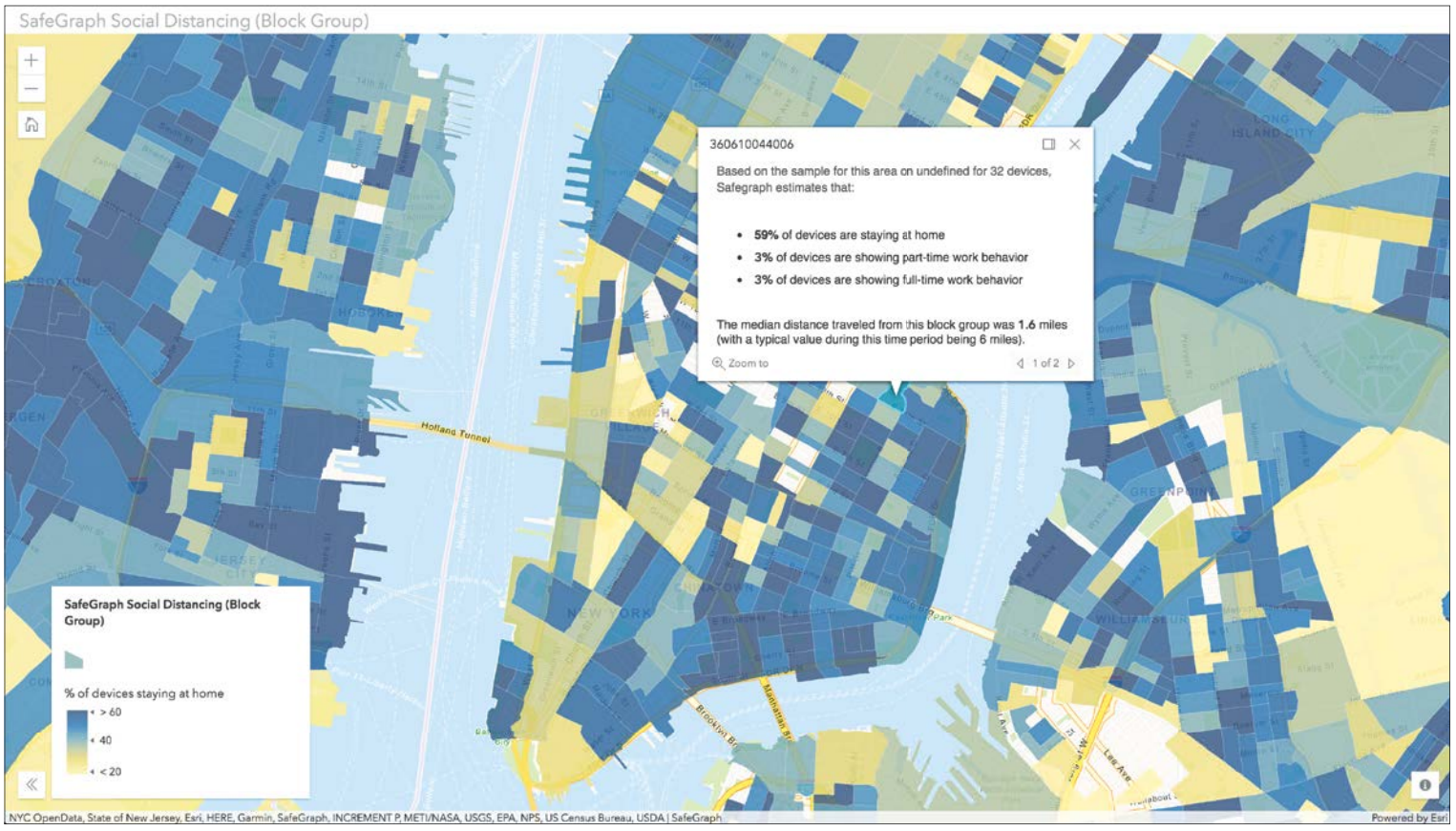
This is precisely why we have both professions—health-care providers who focus on individuals, and public health professionals who focus on populations—each with its own bucket of funding. Separating these roles keeps priorities in balance.

With COVID-19, however, there is the unwelcome scenario (which has happened in some countries) in which a lack of balance between health care and public health priorities forces doctors to choose who gets ventilators if they are in short supply. Even thinking about having to make this decision highlights how location intelligence should be used to plan for resource allocation in anticipation of hospital surges.

Spatial analysis and data visualization are enhancing surge capacity models that are meant to predict, over time, the number of people who will require hospital care, intensive care, and respiratory assistance with ventilators. Running those models to show various levels of adherence to social distancing policies and comparing the results with local health-care infrastructure capacity offer insight that can help plan for future needs. For example, if the current level of social distancing predicts a need for more hospital beds than a region has available, local leaders use GIS to site alternate treatment centers to augment capacity and better serve the community.



↑ Models can help local leaders predict where they'll need additional resources. The COVID-19 Hospital Impact Model for Epidemics (CHIME) from the University of Pennsylvania shows different levels of social distancing and compares their impact on hospital surge capacity. In areas with better social distancing (yellow), hospitals will be able to manage needs better than in areas with lax social distancing (red).



← Public health priorities during the coronavirus disease 2019 (COVID-19) pandemic have focused on prevention. This map, which shows anonymized data from mobile devices from Esri partner SafeGraph, reveals the percentage of time that people in New York City were staying home (as of May 14, 2020).

Public health priorities during this pandemic are foremost focused on prevention: how to decrease people's exposure to the disease. The most common answer is social distancing.

In California, where I live, state-ordered social distancing began on March 19 and wasn't given an end date. Some US states started reopening their economies at the end of April, while others sat tight. There is a tender balance between supporting people who face real economic hardship from not being able to work and addressing the need to protect ourselves, our families, and our communities from a rapidly spreading disease. I personally fear that I've seen that balance shift toward reopening too soon, despite continued growth in the US case count. It's premature.

Still, I understand why this is happening. Public health organizations and health-care practitioners know that it is tough to sell prevention. Think about it. The health community gives out a lot of advice: eat healthy; exercise 20 minutes per day; and get your flu shots, colonoscopies, and annual checkups. Why? So you get nothing!

It can be a challenge to motivate people to work hard for an outcome that essentially adds up to nothing. The same applies to COVID-19, as people watch their businesses vanish, lose their jobs, or simply can't survive on government stimulus checks. It's tempting to throw caution to the wind and get back to work.

Is that okay, though? How do we balance severe financial hardship with every person's responsibility to protect every other person from exposure to this disease? As Cuomo posited, "What is worse than death?"

The dilemma, in some ways, mimics the health-care-as-a-right versus health-care-as-a-privilege debate that's gone on for years. When you look around the globe, people in many countries believe that their own health, wealth, and happiness are only as real as other people's health, wealth, and happiness. Health care, in many of those places, is treated as a right. In other places, including the United States, people get the level of health care they can purchase. So health care is treated more like a privilege. These are longstanding philosophical and political belief systems that carry through to the policies we see today, culminating in the tug-of-war between protecting people's health and reopening the economy.

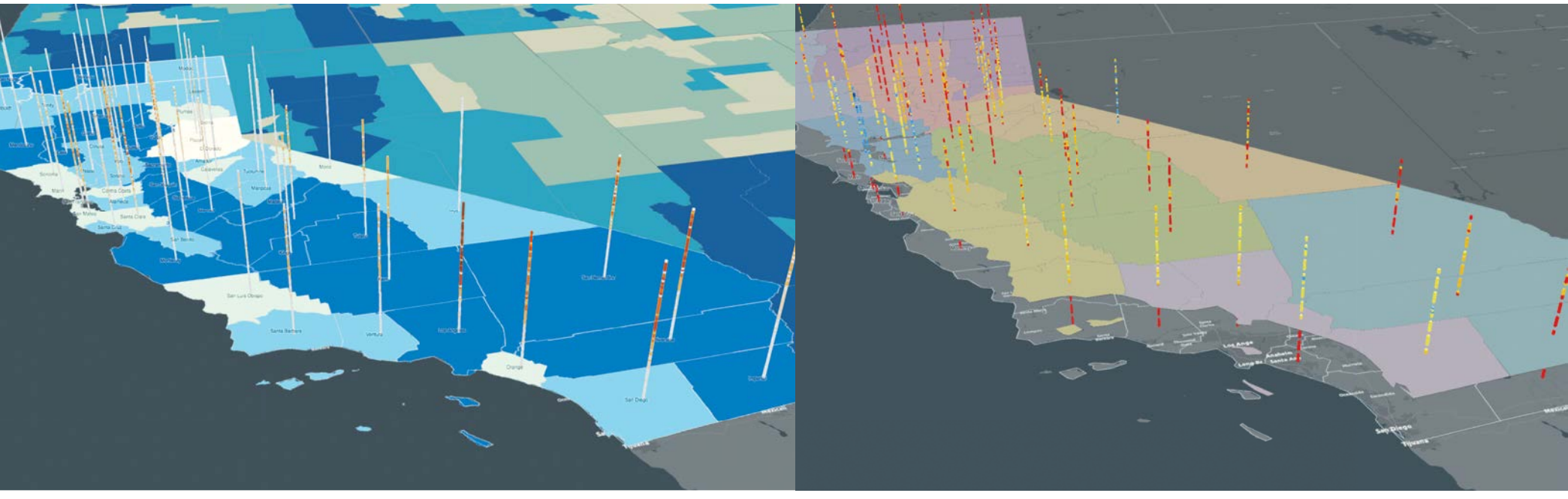
These decisions vary significantly by geography. Policies for reopening should consider both rural and urban landscapes, since some level of social distancing is naturally achieved in rural settings. Is it safer to get back to work sooner in those communities?

At the same time, doing an analysis of vulnerable populations could inform how urban areas open their economies. Can we develop a plan that protects older adults and people in nursing homes, assisted-living centers, and other kinds of communal habitations? How do we rationally consider racial inequity, economic vulnerability, and essential functions as well? Performing analyses that compare case data and social distancing data through space-time cubes across a landscape of vulnerability and regional boundaries can support better and safer decision-making.

There is no question that this pandemic qualifies as a disaster on all levels. As John D. Rockefeller once said, "I always tried to turn every disaster into an opportunity." I suspect that the COVID-19 pandemic is one of those once-in-a-decade events that will change the world. The question is, how do we prioritize and balance those changes? Can we use lessons learned and federal funding to improve infrastructure, disease surveillance systems, data-sharing agreements, and the ability to respond with speed and precision? I think we can, and GIS should be part of that every step of the way.

About the Author

Este Geraghty is Esri's chief medical officer. She heads Esri's worldwide health and human services practice and is passionate about transforming health organizations through a geographic approach.



↑ Performing analyses that compare social distancing and COVID-19 case data through space-time cubes across a landscape of vulnerability—in this case, social vulnerability levels and COVID-19 cases (left) and social distancing grades broken down by region (right) in California—can support decision-making that better protects vulnerable populations.

Finding Ways to Apply GIS in a Crisis and Every Day

↑ Terese Flores

As the coronavirus disease 2019 (COVID-19) pandemic ravaged New York City (NYC) this past March and April—causing almost 170,000 known cases and more than 13,000 known deaths in the city's five boroughs during that time alone, according to the New York City Department of Health and Mental Hygiene—heroes from all walks of life emerged. First responders and medical workers put their lives on the line to treat patients; cab drivers and public transportation employees still got people where they needed to go; grocers, bodega owners, and restaurant workers kept everyone fed; and the list goes on.

Terese Flores, a regional manager at the New York City Department of Parks & Recreation, shone brightly as a GIS hero during the crisis when she volunteered her time to help sustain some of the city's most vulnerable local residents. Donning a green mask that matched her Community Emergency Response Team (CERT) uniform, Flores spent one day each week doing back end data entry, delivery, volunteer management, and canvassing tasks to support critical food distributions while residents were under stay-at-home orders.

The city was running this program out of some of NYC Parks' recreation centers. Cab and car service drivers would show up at a distribution center, retrieve the food packages and paper work that went along with them, and go out to make the deliveries. They would record, by hand, whether each delivery was made.

"It's one of the more thankless jobs but possibly one of the most important because it's not fun, it's not sexy, but it's really important to know whether your system's working," said Michael DeMers, professor of geography at New Mexico State University and one of Flores's former teachers, who admires not only her work but also her big heart.

Although it's a bit unusual to have someone in a management role doing rote data entry, that experience took Flores back to her roots. When she first started working in GIS while pursuing a degree in geography from New Mexico State University, her bread and butter was data entry.

"I was very good at it," she said. "I would just put my headset on and listen to music and sing really loudly and enter data when nobody was in the office. I fell in love with data entry because it was so easy to do. And it got me through college."

After frequently working three jobs while going to school, jumping from one living situation to the next, and taking a three-year break from her education to travel and study Spanish as a native speaker in Spain, Flores got a job at the New Mexico Environment Department (NMED) during her last years of college.

"It was really great because it was the only job I had to hold down," she reflected.

While there, she digitized data about aquifer sensitivity; parcel maps from the tax assessor's office; and data on water wells, sewers, and septic tanks. The objective was to essentially upgrade—to digital formats—how different offices within the state viewed their data.

"This allowed them to quickly make decisions and speed up their inspection process," said Flores. "All this practical experience gave me the best, well-rounded understanding of GIS."

Once she finished college and her contract with NMED ended, Flores decided that she wanted to make one of her big dreams come true: moving to New York City. She signed up to attend an Esri business conference in Boston, Massachusetts, to meet people and look for job opportunities on the East Coast. At the conference Expo, she encountered Esri president Jack Dangermond and asked him to help her figure out how to move her career forward.

↑ Flores's interns work on projects that NYC Parks can use to improve parks around the city.

"I was thinking of pursing either management or computer programming. Jack told me to pursue management, and that is where I am now," said Flores. "It was two seconds of his life that changed my life forever!"

She ended up moving to New York City and took odd jobs to make ends meet—from waiting tables to doing temp work. At the same time, she started learning project management and management theory by studying on her own. And she was always thinking about how GIS could be applied to various problems she encountered in her new hometown.

"New York has so many wonderful GIS applications that it's just a fun place to be," she said.

Soon, Flores landed a job at NYC Parks as a borough analyst. She did a lot of work for the Manhattan borough commissioner and gave presentations on capital spending projects. One of her most memorable undertakings—which helped her earn the department's Rookie of the Year Award—was coming up with a way to distribute and display new accessibility signage at parks throughout Manhattan.

"I created maps of which locations needed what types of signs, so it was easy to distribute everything, and each district put the signs up quickly," Flores explained. "We had to be under federal compliance within a month, and I think I got it done early."

As soon as she was able to, Flores applied to the Department of Citywide Administrative Services (DCAS) Management Academy, and she got in on her second try. She then applied for a management job at NYC Parks and received the promotion.

"I was one of the younger managers, and to go from being an analyst to a manager is a big jump in city government," she recalled. "It was a challenge trying to prove myself. I worked very hard and got a ton of experience with New York City government, and I was able to see all the different benefits that GIS can bring to the city."

Flores was working so hard—and wanted to do so much more—that her supervisor suggested she take on interns. She started with one or two, then received an engineering student from France who went back and told all his friends about his experience. In the ensuing years, Flores ended up with more international students in her internship program.

"I had these really brainiac, intelligent people working for me, taking all the necessary measurements and working out how to fix stuff in parks," said Flores. "They really helped me figure out how to get things done."

Now, Flores has interns and volunteers that range from local high schoolers to college students from all over. She's trained more than 100 of them in GIS, project management, presentation skills, and field mapping techniques—usually on Saturdays. Flores, who received an Alma Award in 2018 from NYC Parks' Latino Society for this work, also sets up her interns and volunteers in dynamic teams. So college students become supervisors and high school students become teammates, and they all gain exposure to the working world.

"I was fortunate to work on a team made up of local New Yorkers and international interns, and that was very enriching," said Robert Celestin, a former intern from Marist College, who now works as a GIS analyst at Esri partner Tetra Tech.

"Learning technical skills like GIS, combined with the policies involved in operating public spaces, proved to be invaluable in both my graduate-level schooling and career development," said Jordan Ruggieri, a former intern from New York University, who is now a government relations manager at FlixBus.

Managing parks throughout Lower and Midtown Manhattan, along with staff, interns, and volunteers, is no easy task. But Flores relies, as she always has, on GIS to make decisions. And she loves what she does and where she does it.

"It's like I have my own little microenvironment in Manhattan, even though it's only a 13-mile-long island," she said. "There's so much to study. There are so many needs here, and there are so many applications for GIS. I'm just excited all the time."

← Standing with New York City parks commissioner Mitchell J. Silver, FAICP (center), and regional parks manager Terese Flores (far right) are summer 2018 interns (from left to right) Miles Mukamal, Eric Li, Jia Li Lily Liu, Eugene Hsiung, Jordan Ruggieri, Jonathan Marty, Angie Quilla, Oliver Barrett, Theresa Teng, and Mohammed Mahmuda. (Photo courtesy of Daniel Avila, New York City Department of Parks & Recreation.)

GIS Hero

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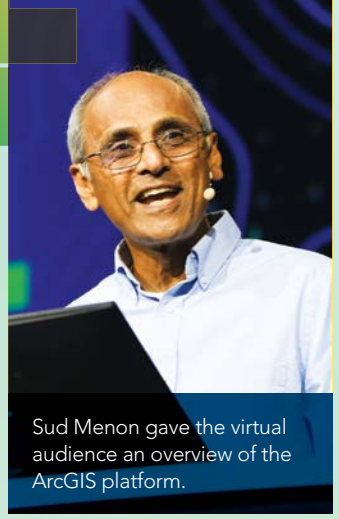
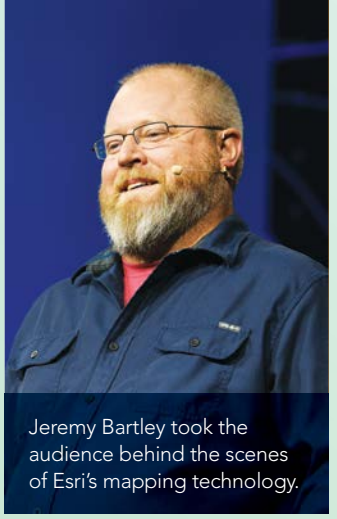
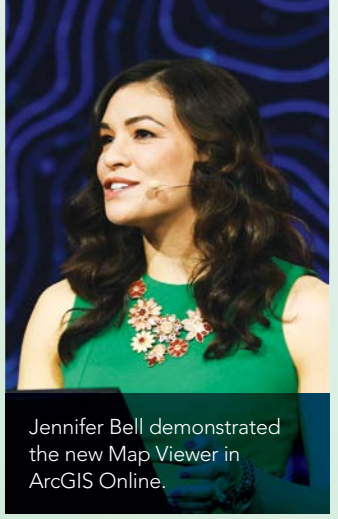


Sud Menon gave the virtual audience an overview of the ArcGIS platform.



Jeremy Bartley took the audience behind the scenes of Esri's mapping technology.



Jennifer Bell demonstrated the new Map Viewer in ArcGIS Online.

David Nyenhuis showed how to employ ArcGIS Arcade in ArcGIS Dashboards.

Jim McKinney encouraged users to upgrade to the latest developer technology.

Latest Developer Technology Inspires Creativity

The 2020 Esri Developer Summit (DevSummit) went virtual this year, drawing an online audience of more than 6,000 viewers via the livestream on esri.com and the Esri Facebook page. The event was held online due to concerns about the global coronavirus disease 2019 (COVID-19) pandemic.

App developers and others who livestreamed the event heard about the latest innovations in ArcGIS from a team of more than two dozen Esri developers, product engineers, and product managers. Over the past year, the development team has added new or improved capabilities to ArcGIS in areas such as mapping and visualization, spatial analysis and data science, deep learning and 3D mapping, custom web app development, and natural language processing. A new project to integrate ArcGIS with the capabilities of two gaming engines is also under way.

Jim McKinney, chief technology officer for ArcGIS Desktop, opened the DevSummit Plenary Session on March 10 by thanking the developer community and welcoming the audience to the event, now in its 15th year.

"Our goal is to share with you new technology, which you can do amazing things with—technology that is going to make your *[work]* more effective," McKinney said in his introduction to the event.

Esri president Jack Dangermond lauded the developers for what they do to help organizations create what he called "a digital transformation using geographic science." Dangermond said that the digital transformation, with the support of geospatial app developers, is driving advances in precision agriculture, conservation, public safety, public health, forestry, and water resource management.

"This doesn't happen by chance. It's not out of the box," Dangermond said. "It requires the creativity of you who are here and online around the world, engineering and thinking."

What the ArcGIS Platform Can Do for Developers

Esri director of software development Sud Menon gave a high-level overview of the ArcGIS platform, which integrates many data types including imagery, vector, real-time, multidimensional, unstructured, tabular, 3D, lidar, CAD, and building information modeling (BIM).

"It extracts all this data into layers to create a common language of maps, scenes, models, and tools that can be used by creators and analysts, as well as to power applications," Menon said.

He highlighted how ArcGIS Online can be used to deliver important information to an audience. "ArcGIS Online is a platform that allows you to create and share mapping applications that communicate important information at scale," Menon said. "A single trending mapping application, such as the live coronavirus dashboard from Johns Hopkins *[University]*, may receive many thousands of requests per second and have millions of concurrent users."

The COVID-19 dashboard from Johns Hopkins, which is maintained by the Center for Systems Science and Engineering at the Whiting School of Engineering, was built using ArcGIS Dashboards.

Visualizing Information in a New Way

The product presentations kicked off with a focus on mapping—the foundation of GIS technology—and ArcGIS API for JavaScript, which powers the web mapping capabilities for both 2D and 3D visualizations.

"Mapping is at the heart of what we do," said Jeremy Bartley, group development lead for ArcGIS Online and ArcGIS API for JavaScript. "We want to enable everyone to make amazing maps through dynamic and data-driven styling."

Jennifer Bell, senior product engineer from the ArcGIS Living Atlas of the World team, then demonstrated how capabilities in the new Map Viewer in ArcGIS Online—including fast filtering, enhanced labeling, and a dot density tool—make it easier to author useful and beautiful maps.

In her scenario, volunteers sent to Los Angeles area schools to encourage hard-to-reach Spanish speakers to participate in the US Census could use the Map Viewer in ArcGIS Online to better focus their efforts. They could create a map to locate where Spanish-speaking children aged 5 to 17 attend school.

Bell showed how to make a map like this using tools such as filtering, dot density, and ArcGIS Arcade. She then customized it to find exactly which schools in the Los Angeles area have 1,500 or more students who are Spanish speakers.

"These new updates *[to ArcGIS Online]* are all about exploring and understanding your data so quickly that you have the time to experiment, be creative, and ask deeper questions," she said.

Get the Most out of Your Data

Around the world, organizations are increasingly using dashboards to communicate a wide range of information clearly, including data on crime, public health, elections, and the environment.

"Dashboards unlock information hidden in your data and allow it to reach its full potential," said David Nyenhuis, product engineer on the ArcGIS Dashboards team. "They are interactive and engaging. Charts, indicators, and gauges summarize complex datasets and help inspire smarter decisions."

In his presentation, Nyenhuis showed how users can author expressions in ArcGIS Arcade to modify how data is displayed in ArcGIS Dashboards. Arcade is a scripting language for creating custom visualizations and labeling.

He demonstrated a dashboard built for a fire department chief monitoring calls for service in real time. The dashboard includes information such as the call volume; an incident feed with a brief description of the problem and a time stamp; a map displaying the incident locations; and the 30-day average dispatch, turnout, and response time.

Nyenhuis then showed how, right inside ArcGIS Dashboards, a user can employ an ArcGIS Arcade editor to write a simple expression to convey and display how long an incident has been open and when it was cleared. "*[With an ArcGIS Arcade expression]*, we can even reveal whether an incident is meeting or exceeding department guidelines for response time," he said.

A Nudge to Use Top Developer Technology

Although support for ArcObjects for building custom GIS solutions will continue for years, McKinney encouraged the developer community to shift its focus.

"If you are doing new development work, we strongly encourage you to use our latest developer technologies for ArcGIS Enterprise and ArcGIS Pro and to build stand-alone apps using ArcGIS Runtime," he said.

ArcGIS Pro SDK for the Microsoft .NET Framework, which now uses Visual Studio 2017/2019, supports customization for ArcGIS Pro.

McKinney said users can extend ArcGIS Pro using ArcGIS Pro SDK for .NET in three ways: with add-ins, solution configurations, or plug-in data sources.

He also strongly encouraged the audience to start using ArcPy and its Python modules for doing geoprocessing tasks, such as conducting geospatial analysis, in ArcGIS.

Besides adding new geoprocessing tools in ArcPy, Esri is simplifying the use of the tools. "*[This results]* in fewer lines of code you have to write to get your work done," said McKinney.

Custom Web Apps Get a Boost

Major improvements to ArcGIS API for JavaScript are driving some big changes in custom web application development. Case in point: developers can now build highly interactive web apps to visualize and do analysis on large datasets.

Kristian Ekenes, a senior product engineer on the ArcGIS API for JavaScript team, demonstrated a custom web app called One Ocean. Developed with ArcGIS API for JavaScript, it uses a global layer that includes attributes on ocean temperature, salinity, and the speed and direction of ocean currents at various depth levels. This data was derived from the Ecological Marine Units dataset from Esri.

"I've configured this application so, as the user hovers a mouse over a point *[on the map]*, it executes a query for the salinity attribute at all of the levels of depth throughout the ocean available on the client," Ekenes said. The salinity numbers quickly appear in a scatterplot to the left of the map.

"I get that fast performance because I'm taking advantage of the very fast client-side query engine of JavaScript API," he said.

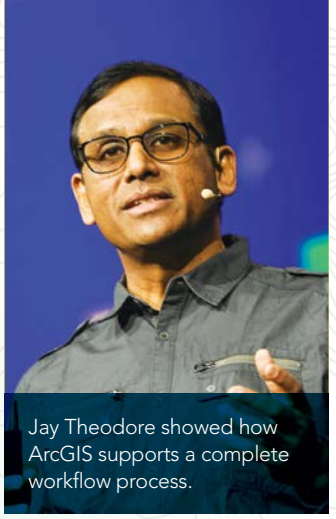
A Spatial Analysis and Data Science Platform

Jay Theodore, chief technical officer of ArcGIS Enterprise, walked the audience through how ArcGIS supports a complete workflow process: data preparation/engineering, visualization and exploration, spatial analysis, artificial intelligence integration, and big data analytics using modeling and scripting.

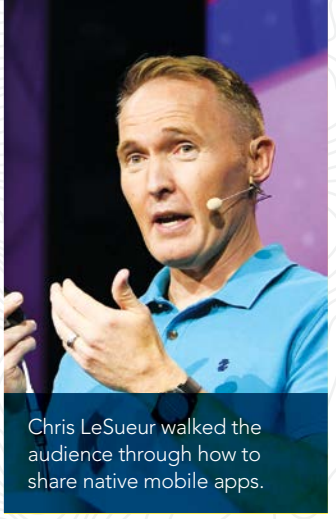
Esri staff highlighted the work they've done over the past year with multidimensional raster data collected by satellites, along with advances in mapping and analyzing unstructured data, lidar, and full-motion video.

The DevSummit audience also got to see an interesting demonstration of how ArcGIS can be used in the process of extracting geospatial data from unstructured text and then mapping that information.


Kristian Ekenes demonstrated a custom web app built with ArcGIS API for JavaScript.


Jay Theodore showed how ArcGIS supports a complete workflow process.


Lauren Bennett illustrated how to extract geospatial data from unstructured text.


Chris LeSueur walked the audience through how to share native mobile apps.


Jianxia Song demonstrated ArcGIS Experience Builder, a new way to build web apps.


Euan Cameron announced that ArcGIS is integrating with two popular game engines.

Lauren Bennett, lead product engineer for spatial analysis at Esri, showed how she used the arcgis.learn module in ArcGIS API for Python to help extract and map data from 1,500 text files of crime reports.

"Each of these reports is unstructured text that has a description of the crime, including things like the address, the date and time, and other details," Bennett said. "Traditionally, turning this kind of unstructured text into useful data would be really time-consuming."

Bennett created training data for deep learning by labeling certain aspects of the reports, including the type of crime, the weapon reportedly used, the address, the date and time of the crime, and the name of the reporting officer.

She then used the training data and the natural language processing built into the arcgis.learn module to train the EntityRecognizer model. After making sure the model could identify entities, such as the crime and the date, time, and address of the incidents, she used it to extract this information from each of the text files.

Now that the data was structured, Bennett used ArcGIS API for Python to geocode the locations and create a point feature layer. Each point represented the location of a crime. Bennett then generated a web map that showed these crimes in Madison, Wisconsin.

App Building Options with Little or No Coding

Esri staff demonstrated how to get apps into the hands of users easily with ArcGIS AppStudio and the new ArcGIS Experience Builder.

Chris LeSueur, the product manager for ArcGIS AppStudio, walked the audience through a workflow for sharing native mobile apps. The apps, built with AppStudio templates, can be shared to an ArcGIS Online organization and put into groups with named users and then shared with those users via ArcGIS AppStudio Player, an app that can be downloaded from app stores.

LeSueur also demonstrated an offline 3D mapping app that displays the beautiful terrain of Angeles National Forest in California. He developed this sophisticated app using AppStudio, which is built on top of ArcGIS Runtime SDK for Qt.

Esri also recently introduced a new tool for building web apps. ArcGIS Experience Builder gives people the ability to build web experiences using one of a series of templates, which come with widgets. Jianxia Song, product manager for ArcGIS Experience Builder and ArcGIS Web AppBuilder, demonstrated how it works.

Game On!

During the DevSummit Plenary Session, Euan Cameron, chief technology officer for developer technology at Esri, announced that an effort is under way to integrate ArcGIS with Unity and Unreal Engine, two popular game engines.

According to Cameron, game engines are a great development environment because they provide premium rendering and cross-platform hardware support, allowing developers to build experiences that come alive. This also generates an opportunity to build connections with game engine developers.

"There's an extremely large developer community, and we've been hearing from that developer community that they want to get ArcGIS content into their game engines to improve the applications that they are building," Cameron said.

Esri will build plug-ins for Unity and Unreal Engine that will provide the following:

- APIs to access ArcGIS services and local data
- The capability to display and honor real-world/geographic coordinate space
- Integration with the game engine developer experience
- Software developer kit resources such as samples and demonstrations

"In terms of ArcGIS functionality, you will be able to work with raster tiles, imagery, elevation, scene layers with 3D objects, and integrated meshes and point clouds," Cameron said. "Feature layers will be supported with points, lines, and polygons, and you will be able to get access to some of the other services that are available from ArcGIS, like geocoding and networking."

Keep DevSummit Going All Year Long

During the close of the Plenary Session, McKinney pointed out that for the past few years, Esri has tried to keep DevSummit going all year long with GeoDev webinars.

"Each month, we host a DevSummit-style tech workshop as a webinar, including a live Q&A *[session]*," he said. "If you haven't tuned in to one of these, check it out. They're really valuable and fun."

All DevSummit presentations and technical sessions are available on the Esri Events YouTube channel at ow.ly/YOBr50zSFoU.

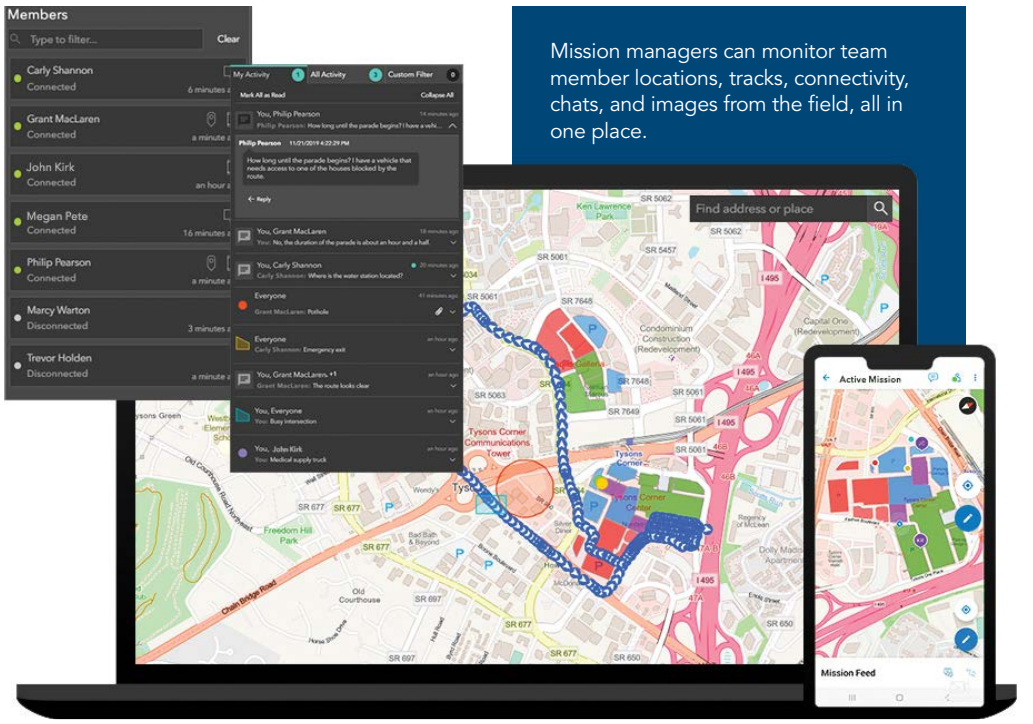
ESRI DEVELOPER SUMMIT

Improve Situational Awareness and Mission Management with ArcGIS Mission

ArcGIS Mission is a new geoenabled system that organizations—from public safety and law enforcement agencies to utility and natural resources companies—can use to streamline mission management; gain situational awareness during active missions; provide geospatial-based, peer-to-peer communication in the field; and conduct postmission reviews. The software enables teams to better understand their operations, make informed decisions in real time, and acquire new intelligence from completed missions.

Mission offers the core capabilities of other tactical situational awareness solutions, but it also streamlines mission workflows and integrates directly with other ArcGIS technology to provide new capabilities. Key features include

- **One platform for mission management.** By using Mission, organizations can reduce the number of systems they use to manage both planned and unplanned missions, events, and operations. As a single platform, Mission lets users create, manage, and save mission data that can be accessed within their organizations. This makes it easier for teams to plan, execute, and review missions. The software also streamlines the delivery of mission planning materials, allowing organizations to quickly share maps, images, location information, and other related content to team members in the field, who can download it all directly to their mobile devices.
- **Tactical situational awareness.** Mission lets people—both in the field and in the command center—see the locations of mission members in real time. This makes it easier to coordinate movements among team members based on in-progress events and activities. Everyone participating in the mission can monitor the situation and quickly make adjustments. Participants can also use location, photos, and other information from the field to identify team vulnerabilities early and plan effective responses.
- **Peer-to-peer communication.** By providing persistent, peer-to-peer (P2P) communication, Mission lets team members send messages to each other for stronger collaboration and real-time decision-making. They can also share locations and location tracks, map markups, photos, and videos so everyone on the team has the information they need. P2P communication is supported in connected, low-bandwidth, and disconnected environments.
- **Support for improved understanding.** With Mission, all the data created and collected during a mission is saved in ArcGIS. Organizations can leverage this continually updated mission data to gain new insights, increase transparency, and build trust. Saved data includes both the data created when the mission is defined and the data gathered while the mission is active, such as chat messages, photos, and the location tracks of team members. Once this data is saved, users can view and analyze mission data in other ArcGIS apps, such as ArcGIS Dashboards or ArcGIS Insights, to improve their understanding of mission activities.



Mission managers can monitor team member locations, tracks, connectivity, chats, and images from the field, all in one place.

What's Your Mission?

To learn more and add ArcGIS Mission to your organization's ArcGIS Enterprise deployment, get in touch with an Esri representative at go.esri.com/mission.

The three components of ArcGIS Mission are as follows:

- ArcGIS Mission Manager is a premium app that organizations can use to manage their missions, assign mission members, and distribute mission content.
- ArcGIS Mission Responder is a mobile app that mission members can use in the field to share location tracks, map markups, and photos.
- ArcGIS Mission Server is an ArcGIS Enterprise server role that enables peer-to-peer communication among all mission team members.

Head to go.esri.com/fedgis2020/arcgismission to watch Esri staff members use Mission at the 2020 Esri Federal GIS Conference in February to simulate searching for a person of interest and securing the Walter E. Washington Convention Center in Washington, DC.

Spatial Analysis Meets Data Science with ArcGIS Notebooks

Over the past few years, Jupyter notebooks have grown into a widely used workspace for analysts and data scientists alike. On the developer and data science platform GitHub, for instance, the community has created and publicly shared more than seven million Jupyter notebooks to date.

Given the increasing popularity of Jupyter and the continually evolving spatial data science community, Esri introduced a spatially optimized Jupyter experience called ArcGIS Notebooks—and it is now available across the ArcGIS platform.

Jupyter is best suited for users who want to learn and practice Python, do data engineering and transformation, perform statistical modeling, and develop machine learning and deep learning apps. What makes Jupyter an attractive and popular interface with the analytics community is that it enables data scientists to combine live code with visualizations, videos, and narrative text. This capability also allows them to create transparent and reproducible workflows that can be easily shared with others.

In early 2019, Esri introduced ArcGIS Notebooks in ArcGIS Enterprise. The new software was designed and built on top of Jupyter and optimized for spatial data science.

With ArcGIS Notebooks, users can access spatial analysis algorithms via ArcPy and ArcGIS API for Python and combine them with hundreds of open-source Python libraries, such as pandas, scikit-learn, and TensorFlow. ArcGIS Notebooks helps users ideate and iterate workflows within the secure and scalable environment of ArcGIS while encouraging collaboration across data science ecosystems.

Common workflows that users can perform within ArcGIS Notebooks include the following:

- **Automation:** With the built-in ArcGIS Python libraries—ArcPy and ArcGIS API for Python—users can automate and schedule repetitive administrative tasks in their Web GIS.
- **Data engineering:** By leveraging ArcGIS and open-source libraries, users can isolate an area of interest, identify anomalies, and enrich their analyses with data from ArcGIS Living Atlas of the World.
- **Spatial analysis:** Users can solve complex problems and arrive at statistically significant results by combining Esri's industry-leading spatial algorithms with open-source Python libraries.
- **Machine learning and artificial intelligence (AI):** Built-in tools with machine learning and deep learning frameworks allow users to train and perform inference on models.

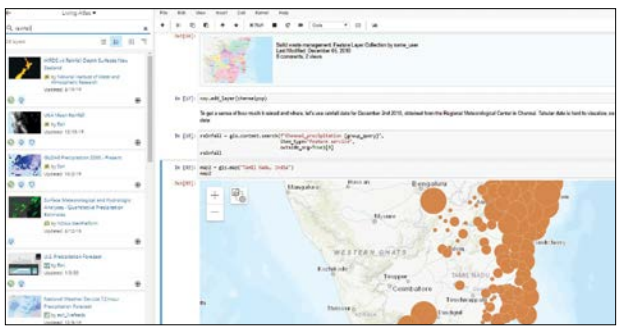
ArcGIS Notebooks is integrated across ArcGIS Pro, ArcGIS Online, and ArcGIS Enterprise. This gives users the spatial data science capabilities they need in the ArcGIS workspaces they prefer.

In ArcGIS Pro 2.5, ArcGIS Notebooks allows users to create, edit, and save notebooks as part of an ArcGIS Pro project rather than having part of an analysis within ArcGIS Pro and another piece of it in a separate Jupyter environment. Users can also work seamlessly in notebooks and the ArcGIS Pro user interface by moving data and results back and forth between the two. Additionally, users can dock their notebook pane within ArcGIS Pro, giving them the ability to launch it full screen or alongside their maps, charts, and data so they can see the complete analytics pipeline in one place.

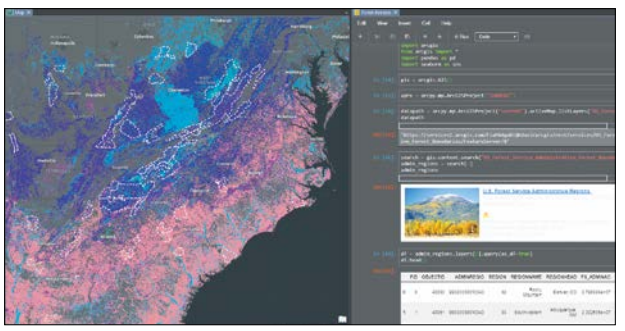
ArcGIS Online users can now leverage its software-as-a-service (SaaS) capabilities to access ArcGIS Notebooks from any device at any time. They can also take advantage of on-demand GPU support for computationally intensive machine learning and deep learning workflows, such as object detection, pixel classification, and image segmentation.

Starting with ArcGIS Enterprise 10.7, users can deploy ArcGIS Notebook Server behind a firewall so it runs within an organization's infrastructure and complies with that organization's security regulations. In addition, when leveraged alongside ArcGIS GeoAnalytics Server, ArcGIS Image Server, and ArcGIS GeoEvent Server, ArcGIS Notebooks enables users to make sense of big, real-time, and raster data more efficiently.

For more information on ArcGIS Notebooks, visit the product page at **go.esri.com/arcgisnotebooks**.



↑ The software-as-a-service (SaaS) capabilities in ArcGIS Online let users access ArcGIS Notebooks from any device.



↑ Users can now create, edit, and save notebooks as part of an ArcGIS Pro project.

↑ Users can combine Python code, charts, and maps within their ArcGIS Pro projects.

What's New in ArcGIS Online

With more than eight million users and one million public layers, ArcGIS Online is the world's largest mapping and data-sharing ecosystem. Its users create valuable maps and apps that millions of people concurrently view and interact with to understand their world.

To support the important work that users do every day, Esri continually updates ArcGIS Online to improve and expand its functionality and reliability. For the March update, the team added new 3D capabilities, a refreshed user profile page, additional editing permissions, and much more.

The User Profile Page Gets a Refresh

The My profile page has been refreshed to make it easy for users to view and access their items and settings. When signed in, users can quickly identify items they shared with their organization and with the public. Two tabs, Public items and Organization items, display the user's top 12 items—based on views, quality, and authoritative status—in each category.

The refreshed profile page also allows users to showcase their public items and profile. When a user's profile visibility is set to Everyone (public), the public portion of the profile page serves as a live portfolio that can be shared on professional networks and social media. The user's top public items are displayed in an easy-to-navigate gallery. Groups that the user is a member of and which are set to Everyone (public) are also shown on the profile page, along with the user's image and bio.

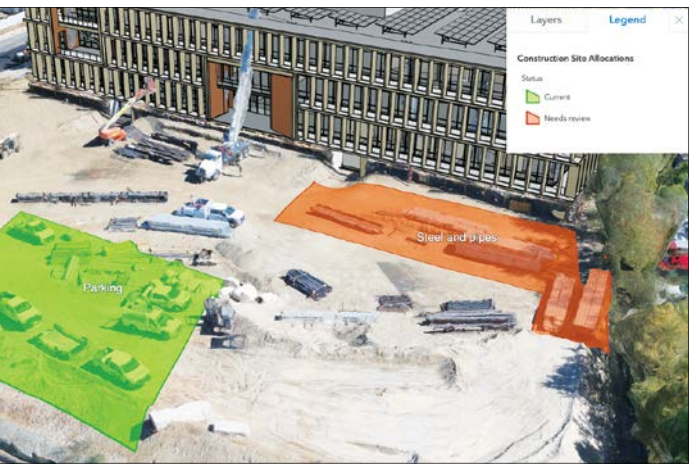
And now, the new My settings page organizes users' personal settings into four tabs. The General tab includes each user's profile information and linked ArcGIS Online accounts. The Security tab has each user's password and security question. The Licenses tab includes the person's user type; role; licensed products; and, if licensed, the option to download ArcGIS Pro. And the Credits tab provides an overview of the user's credit quantity (if the organization administrator has turned on credit budgeting).

Additional Editing Permissions

ArcGIS Online provides many fine-grained editing permissions. With the latest update, hosted feature layer owners and organization administrators can configure layers to allow editors to update attributes only. With this setting, feature geometries and locations are maintained even when feature attributes are changed.

New 3D Capabilities

Drape-to-mesh, a new functionality in Scene Viewer, enables users to drape features above and below integrated mesh scenes, making those features easier to see. This is especially helpful for planning special events. Say, for example, that before an event, a public safety agency uses ArcGIS Drone2Map to capture an area of interest as an integrated mesh scene layer. Event planning staff can then sketch planning features—such as the locations of guards, perimeters, and assets—using a 2D web app and then contextualize and communicate those plans in a 3D app.

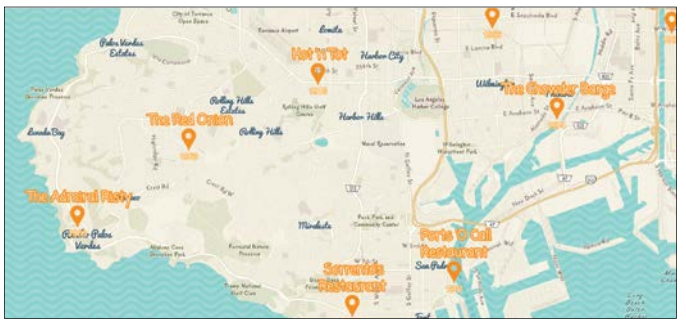


↑ Drape-to-mesh lets users drape features onto integrated mesh scenes.

Users can also now maintain their scene layer's item ID and URL by replacing the contents of a scene layer published from a scene layer package rather than having to republish the layer altogether. The scenes and apps that contain the scene layer will then have the updated contents. This improved workflow saves users time and provides a convenient way for them to assess the quality of their content before bringing it into a production web scene.

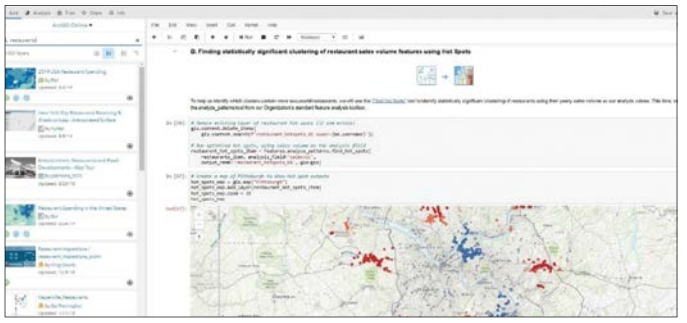
Transition to HTTPS Only

Esri is committed to providing strong security for the ArcGIS platform by using the latest industry standards and best practices for security protocols. That's why ArcGIS Online will begin to enforce the use of all encrypted communication (HTTPS). To help organizations using ArcGIS Online transition to all HTTPS, users will be notified when they add an item that uses HTTP. Additionally, the ArcGIS Online Security Advisor tool in the ArcGIS Trust Center instantly identifies HTTP links. Starting December 8, 2020, ArcGIS Online will no longer support communication over HTTP, so users must update all their items to HTTPS before then.



↑ In Map Viewer Beta, users can tailor their labels, and longer labels now automatically wrap into multiple lines.

↑ The new configuration experience in the Minimalist beta configurable app provides instant visual updates.



↑ ArcGIS Notebooks beta lets users combine code, on-the-fly visualizations, analysis tools, and maps in the notebook environment.

↑ ArcGIS Dashboards beta allows users to visualize summary statistics for percentiles, as this Fire Accreditation Dashboard does.

Beta Products Accessible Through ArcGIS Online

ArcGIS Online users have access to many innovative beta products that invite experimentation and allow users to provide feedback to Esri to guide product development. The following beta products either are new or have received notable updates.

Map Viewer Beta has received several enhancements since the last ArcGIS Online update. One key improvement is label authoring. Now, longer labels automatically wrap into multiple lines, and users can tailor their labels by

- Specifying when they appear based on zoom level.
- Rotating and repositioning them.
- Using new fonts.
- Incorporating ArcGIS Arcade expressions.

The Minimalist beta configurable app allows users to showcase the maps they author in Map Viewer Beta. The new configuration experience in Minimalist includes express setup and provides instant visual updates to streamline app creation. The draft mode enables users to view the mobile experience while building the app.

ArcGIS Notebooks beta integrates Jupyter notebooks directly within ArcGIS Online. Users can combine code, on-the-fly visualizations, analysis tools, and maps in the notebook environment. Notebooks can also be used to automate administrative tasks, such as managing users and content. (See "Spatial Analysis Meets Data Science with ArcGIS Notebooks" on page 15 for more information.)

ArcGIS Dashboards beta has improved usability, including summary statistics for percentile and count, the capability to draw more features on the map, and better overall map performance. Dashboards beta also allows users to compose ArcGIS Arcade expressions directly in both list and indicator elements for conditional formatting, value conversions, and more.

Brief Mentions

A new feature layer template is now available for collecting tabular data, such as sales data. And when purchasing a new ArcGIS Online organizational subscription, customers can choose the region—the United States or Europe—where their geospatial data will be stored.

To learn more about these updates, read the blog articles from the ArcGIS Online product team at **go.esri.com/ArcGISOnlineUpdate**.

New ArcGIS User Type Tailored to Storytellers

Human brains crave great stories. That's one of the reasons why most consumers want to internalize digital content in the form of a story.

Esri's next generation ArcGIS StoryMaps app is the best way to create beautiful digital narratives using ArcGIS web maps and app content. To this end, Esri launched a new user type, Storyteller, earlier this year to accompany the six other ArcGIS user types.

For just $100 per year, those with the Storyteller user type license can access ArcGIS StoryMaps. This is ideal for people who only want to create StoryMaps stories—for example, marketing and communications professionals, public relations teams, and any other people in an ArcGIS organization who tell stories.

Storytellers can embed shared organizational content that's been created in ArcGIS Online into their stories. They cannot, however, create their own content with ArcGIS Online or any other ArcGIS apps or products. Esri's classic story maps templates—such as Esri Story Maps Cascade, Story Maps Tour, and Story Maps Journal—cannot be accessed with the Storyteller user type license, either. As with the content produced by other user types, stories made with the Storyteller user type can be published and shared publicly, shared only within an organization, or not shared at all.

Those who want to purchase the Storyteller user type license must have an existing ArcGIS Online organizational account. Those who already have the Creator user type license can add as many Storyteller user types as they'd like to their accounts, either through the Esri Store or Esri Customer Service.

Since the Storyteller user type is a more affordable way to access ArcGIS StoryMaps, many content creators in an organization should find it useful for inspiring audiences around the world.

For more information, go to esri.com/storymaps.

Nautical Charts Go Digital with Help from GIS

For hundreds of years, mariners have used paper nautical charts to steer their vessels near coastlines, through varying water depths, and around navigational hazards. Now, new technology and technological requirements are changing the landscape—or seascape, if you will—around chart production. Hydrographic offices are starting to move away from the idea that they have to make traditional paper nautical charts and more toward the notion that mariners need—and want—updated navigation charts on demand.

"Paper charts are typically very labor-intensive and time-consuming to build, so they can lag behind electronic charts in terms of getting information out quickly," said Craig Greene, product manager for ArcGIS Maritime at Esri.

"A new paper chart used to come out two years after the data for that chart became available," said Guy Noll, maritime consultant at Esri. "And it's been like that for decades."

Lots of mariners still like the look, feel, and function of traditional paper charts, though. So while this doesn't mean that paper charts are going away, it does mean that the way they're made is changing.

Chart production is becoming an electronic-first endeavor, where all the data is pulled from one standardized, GIS-based system. From there, mariners can access charts on electronic navigation or mobile devices, or as PDFs that can be printed out. The information on the charts will be timelier and more accurate, and in some parts of the world, mariners will be able to tailor their charts to exactly where they'll be piloting their vessels.

"This is completely turning on its head how traditional paper charts are made," said Greene. "These charts are still going to be safe for navigation, but they're going to look different. It's a big change."

And it's where the industry, by and large, is heading.

Time to Streamline

The National Oceanic and Atmospheric Administration (NOAA) Office of Coast Survey is at the forefront of this transition. In late 2019, the office informed mariners that, within five years, it would wind down its production of traditional paper and raster nautical charts and replace them with a web app that would allow anyone to make a chart using the most up-to-date Electronic Navigational Chart (ENC) data from NOAA.

The NOAA Custom Chart app (devgis.charttools.noaa.gov/pod), which is still a prototype, is being built in close collaboration with Esri using ArcGIS Maritime, an extension for ArcGIS Desktop and ArcGIS Enterprise that streamlines and accelerates nautical chart production.

"We meet on a regular basis with NOAA and the team that manages the NOAA Custom Chart app," said Greene. "We're working alongside them to implement things that will lead people to adopt the app so NOAA can eliminate paper chart production by January 2025."

The reasons the Office of Coast Survey wants to stop producing paper charts are twofold, according to Craig Winn, the portfolio manager for high-density (HD) charting in the office's Marine Chart Division.

"The industry is relying more heavily on Electronic Navigational Charts for navigation and planning, so paper has been moving into a backup role," he said.

And for far too long, the Office of Coast Survey has been supporting two separate workflows: making the ENCs, which consist of vector data, and making the raster charts, which are currently used to produce paper products. This puts a lot of demand on time and resources.

"Those are distinct workflows requiring distinct personnel who use different pieces of software," Winn said.

This isn't just a problem for the Office of Coast Survey, either. The Canadian Hydrographic Service (CHS) is facing similar difficulties.

"Right now, CHS needs to support full synchronicity between three product lines: ENC, raster, and paper," said Louis Maltais, director of navigation geospatial services and support at CHS. "And on top of these three things, I need to maintain the updating system for the ENC, the updating system for the raster, and the updating system for the paper. It's a nightmare to maintain."

Which is why Canada, too, is looking for ways to streamline, accelerate, and even automate paper chart production.

"We need to have the portfolio be as agile as possible," said Maltais.

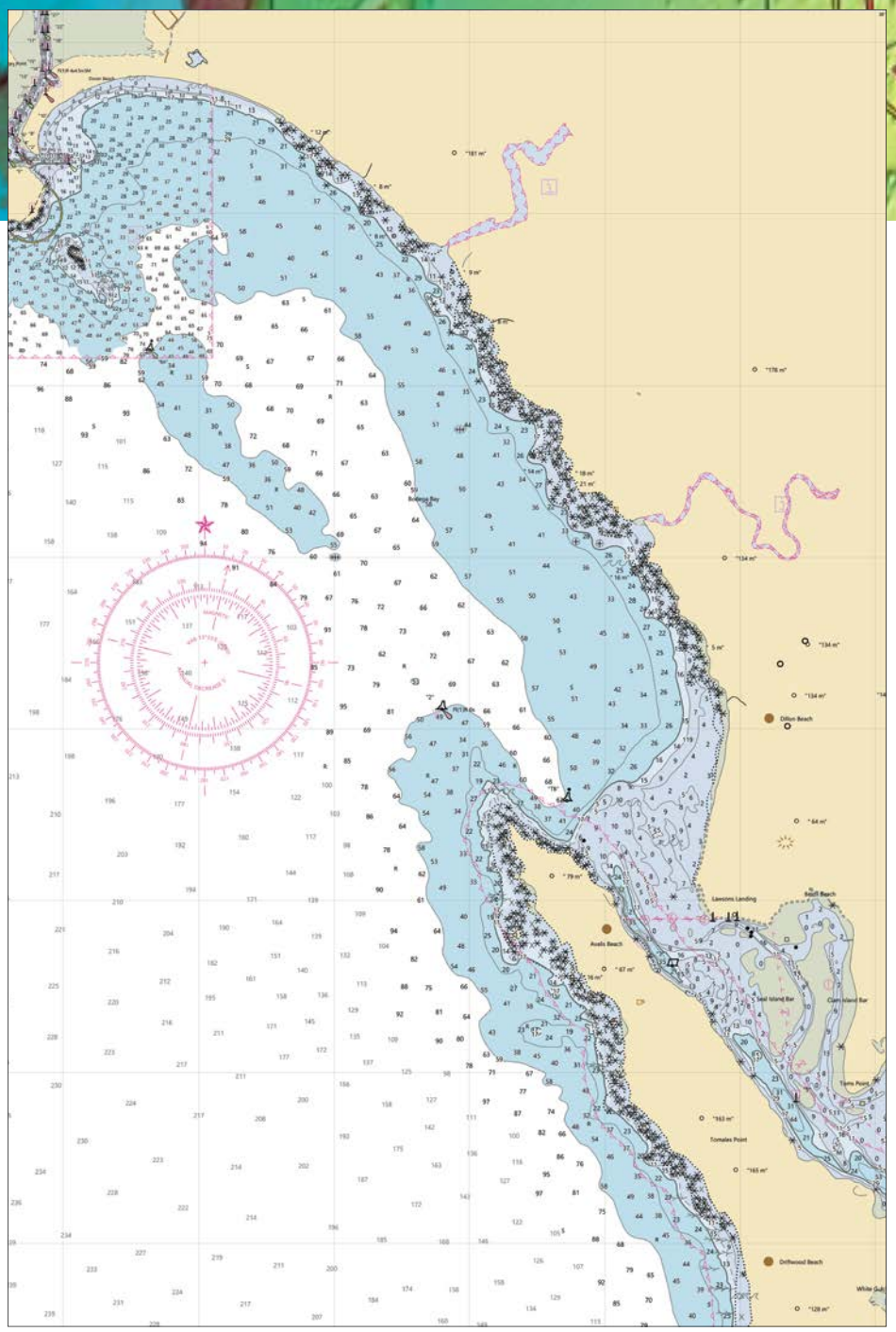
Winn echoed this sentiment. "At the Marine Chart Division, we see this as an opportunity to devote our efforts to maintaining the ENCs and then being able to support other products from that dataset," he said.

A Shift to Data Maintenance

The maritime industry started veering toward electronic-first navigation in 2009, when the International Maritime Organization (IMO) required all merchant ships to use an Electronic Chart Display and Information System (ECDIS) to comply with chapter V of the International Convention for the Safety of Life at Sea, an international maritime treaty.

"Most hydrographic offices are structured around building traditional paper nautical charts. They spend a lot of their time, money, and energy on those," Greene explained. "And with that mandate from the IMO, coupled with increased reliance on modern electronic systems, paper charts are essentially becoming the backup."

There is still a place for paper charts, however, especially if a ship's electronic system fails—which happens more often than most people think, according to Maltais.



↑ The Marine Chart Division at the National Oceanic and Atmospheric Administration (NOAA) is building its NOAA Custom Chart app—which produced this chart of Tomales Bay, California—in close collaboration with Esri.

"Hydrographic offices still need to produce them," said Greene, "but they can't afford to have their entire organization built around making traditional cartographic paper products."

So the focus is shifting to curating and maintaining the vector data used to make ENCs rather than designing paper charts. This will also help the maritime industry more robustly embrace new international data standards, including the S-100 universal hydrographic data model and the S-101, the new product specification for ENCs. Both of these, along with the S-57 data standard—what's currently used for ENC production—also contribute to building what's known as a Marine Spatial Data Infrastructure (MSDI), which will help agencies all over the world share hydrographic data and services at national and regional levels.

"With an MSDI, countries can use the content they've already created to enable a future where their manual work can add repeatable value rather than product-by-product value," said Noll. "They can set up the pattern, automate that pattern, and then focus on the data rather than trying to create the pretty-picture products of the past, which took a lot of time per product."

Charts on Demand

With all these changes rolling in, the maritime team at Esri wanted to come up with a solution.

"Products on Demand *[PoD]* was essentially our response to this," said Greene. "We thought, well, look at what modern technology can do. We can make a web app that can automatically generate a PDF—a paper chart—directly from the electronic chart data."

It was a cutting-edge idea, and NOAA's Office of Coast Survey quickly came aboard. Already a longtime user of ArcGIS Maritime, the office would employ the ArcGIS Maritime server extension as it always had—to generate REST or web map services directly from its electronic chart data. But instead of having its ENCs reflect paper charts, which had been done for decades, the Marine Chart Division would flip it so paper charts come from ENCs. That's where the Products on Demand functionality of ArcGIS Maritime adds value.

"ENCs are essentially attributed data—features and attributes—and we have a central database solution for making them," explained Winn. "We go in and make whatever changes we need to make to our central database, and then we push those changes out through ArcGIS Maritime. These changes are exported as updated ENCs.

Versions of those ENCs are placed in the same server location as the web application, and then the tools that Esri has developed extract the information from those files and present it to users for them to make their own PDFs, which they can print somewhere if they need to."

Having all the data in a central database makes ENCs more uniform; more accurate, since new data can be added quickly; and more accessible than traditional paper charts.

Helping Mariners Make the Switch

The challenge now is to get mariners to use either ENCs or these new paper charts that are based on ENCs.

Although CHS is still in the exploratory phase of implementing a solution that will streamline its paper charts and ENCs, the organization is already trying to gauge how readily Canadian mariners will take to something like this.

"They're telling us that there are two things they like about the paper charts," said Maltais. "They feel that, for planning purposes, it's really good to have a wide view of where they're going so they can plan their routes. And they want to have the paper chart somewhere as a backup, to make them feel safe."

But the future is electronic charts, as Maltais emphasized. So one idea he has for what he calls paper charts 2.0 is to have mariners subscribe to a service.

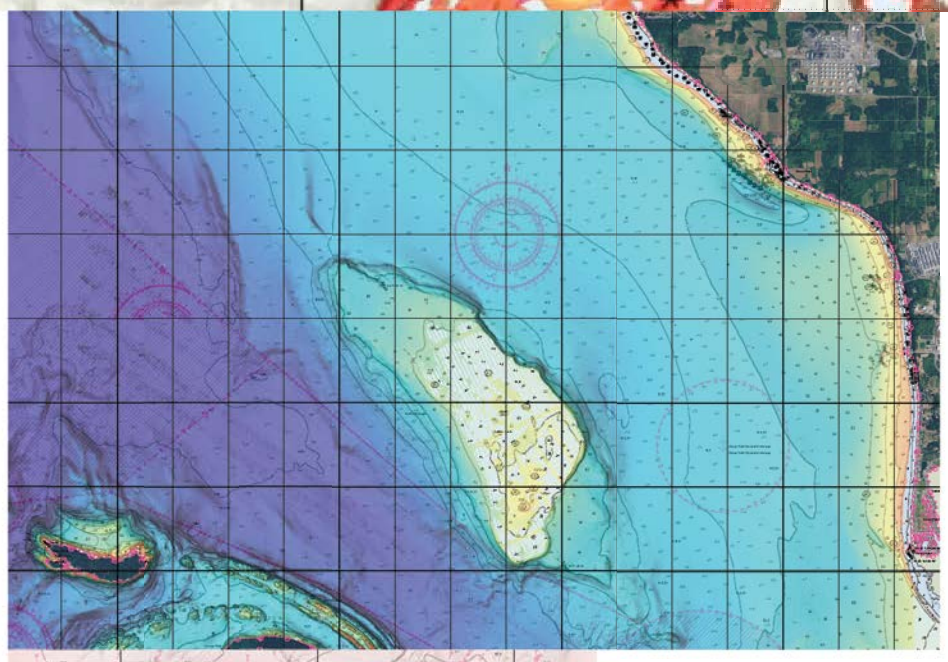
"This is where we're going in Canada in terms of our S-100 suite of services," said Maltais. "You will subscribe to a service, and once you connect to that service, you don't need to worry if you're up-to-date or not. You're connected to the service, so you're always going to be up-to-date."

NOAA's Marine Chart Division is taking similar mariner concerns into consideration, though it's moving more quickly to sunset traditional paper chart production and cancel old paper charts altogether. But the agency is being careful.

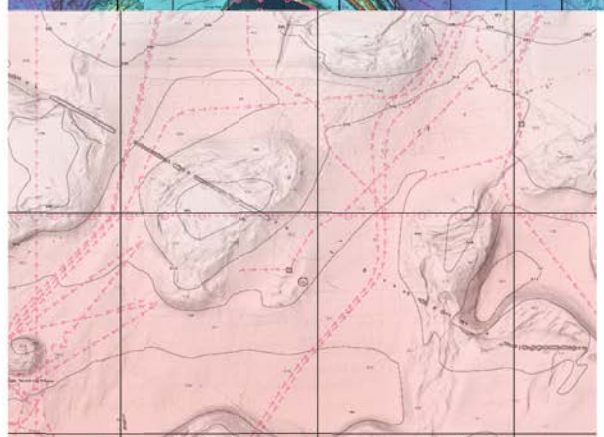
"I want to be sure that when a chart gets canceled, equal or better digital data is available in that area," said John Nyberg, chief of NOAA's Marine Chart Division. "I want mariners to choose the ENC, not be forced to use it. If we're providing better, more up-to-date data with more detail that's easier to update, I hope they will choose to use it."

The NOAA Custom Chart web app is showing promise at making charts on demand work in the United States, both for mariners and for the Office of Coast Survey.

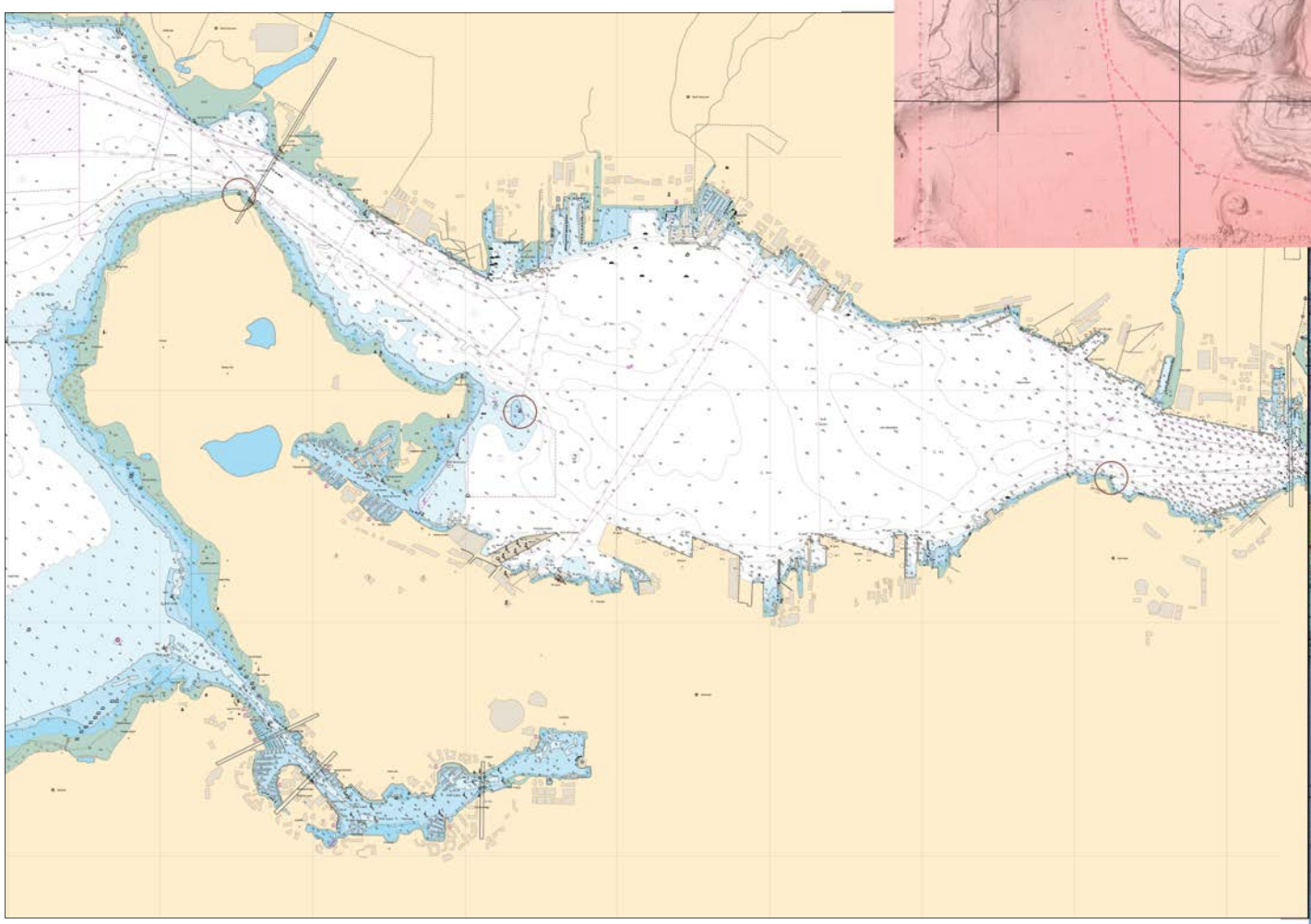
"We see this being something that a lot of people will use, if not daily, then certainly on a regular basis to access static copies of our datasets—charts, essentially," said Winn. "We're not there yet, but once people get used to it and they're using it, they may say, Why didn't we do this 10 years ago?"



↑ New functionality in ArcGIS Maritime Server lets users incorporate more data sources to make charts like this one, of Cherry Point near Bellingham, Washington.



← ArcGIS Maritime allows users to incorporate numerous data sources into charts like this one, which shows the latest bathymetry data that comes from the National Centers for Environmental Information (NCEI) along with petroleum infrastructure in the Gulf of Mexico.



↓ This chart of waters near Sitka, Alaska, was made with the ArcGIS Maritime server extension, which integrates with several data sources, including ArcGIS Living Atlas of the World.

↑ The Canadian Hydrographic Service (CHS) needs its portfolio of charts to be as agile as possible, which is why it is developing what it calls paper charts 2.0, which look like this one of Vancouver Harbour.

For Book Deliveries,

Local Library Turns to GIS

The value of being able to read is immense. Literacy affects how far people make it in school, which jobs they get, how much money they make, whether or not they tend to vote, how well their children can read, and much more. And that's not to mention its role in improving comprehension, developing the imagination, and learning new things.

These are just some of the reasons the City of Burnaby—the local government for the third-largest city in British Columbia, Canada—has a decades-old program that delivers library services to Burnaby residents who are unable to visit the library themselves. The Home Library and Accessible Service (HLAS) Department, a branch of the Burnaby Public Library, delivers library materials to patrons who are challenged by health, mobility, or transportation issues or other obstacles that make visiting the library infeasible.

Hundreds of patrons use the service. Challenged to deliver so many books, the HLAS team partnered with the City of Burnaby's GIS division to improve the route planning and delivery processes. Using ArcGIS Navigator, the GIS division was able to help the HLAS team automate daily route planning. Ultimately, this has enabled HLAS staff members to better serve their patrons.

"ArcGIS Navigator is helping the Home Library and Accessible Service team meet *[its]* goals of providing an efficient delivery service to the community," said Simone Behrens, a mapping technician 2 for the City of Burnaby.

↑ The Burnaby Public Library used its bookmobile to deliver books to residents from 1956 to 1971. (Photo courtesy of *Burnaby Now*.)

The Value of GIS for Home Deliveries

Library materials are delivered to patrons four days a week by two HLAS employees. The schedule is based on a four-week rotation beginning on Tuesday and ending on Friday. For the two employees, each day involves somewhere from 10 to 25 stops in the city.

Previously, to plan routes, the HLAS team used its database to search the addresses of the delivery stops and then manually created routes for the following day's deliveries. The process was time-consuming and inefficient, taking time away from packing, preparing, and making the deliveries.

Having attended the Esri Canada User Conference in Vancouver, Canada, several years ago, Jorge Cardenas, acting branch manager for the Burnaby Public Library, discovered the value of GIS and believed it could benefit the HLAS program. He contacted the City of Burnaby's GIS division to have it help implement GIS technical support to modernize HLAS's routing workflow and mapping approach. Cardenas wanted a new solution that could help automate route mapping to streamline day-to-day operations.

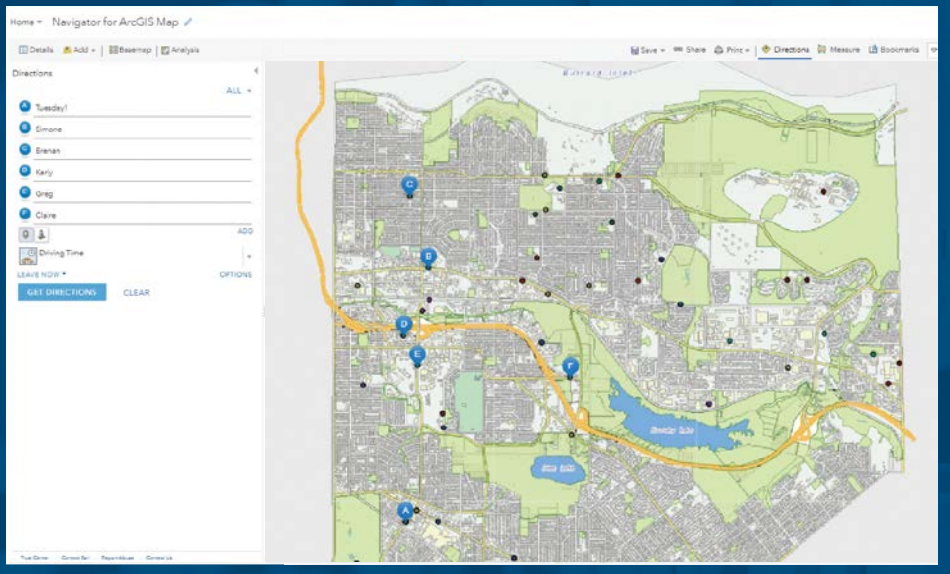
This was somewhat new territory for the GIS division. "We had never worked with the library before," said Chad Huntington, manager of GIS and engineering systems for the City of Burnaby. "I want to emphasize the fact that we had a GIS champion in Jorge, who saw how *[GIS]* would be helpful for HLAS."

A Manual Process Moves to an Automated System

Behrens was tasked with streamlining HLAS's existing workflow. At the time, she was a practicum student at the British Columbia Institute of Technology. Huntington suggested that she try ArcGIS Navigator because the GIS team had not previously worked with it, and he wanted to gain some familiarity with the app.

Each week, HLAS staff members update their proprietary database with patron data. The GIS team employed extract, transform, and load (ETL) tools to automatically push this data to the city's ArcGIS Enterprise environment. Once the data was housed there, Navigator, which uses GIS to route field personnel and create customized travel routes, integrated seamlessly with the city's existing systems. This made implementation straightforward, according to Huntington.

Using ArcGIS Enterprise, Behrens created four different web maps for every week of the month. Each week contains individual delivery days that reflect the actual deliveries



↑ Staff members from the Home Library and Accessible Service (HLAS) Department can easily route all the stops they have to make in a day by using ArcGIS Navigator.

that need to be made. From these web maps, HLAS staff members can select the rotation week and specific day they're assigned to and click the Route to All button to create a customized delivery route. The route is then automatically available on an iPad with Navigator installed.

When creating routes, users have the option of manually ordering stops or choosing the fastest route. For example, if they know a certain patron has to receive deliveries in the morning, they can rearrange the order to accommodate that. Otherwise, if there are no special considerations, they can pick the fastest route.

Training HLAS staff was fairly simple, according to Behrens. Based on notes and processes she used when developing the new automated system, Behrens created two manuals for HLAS staff members to learn how to use Navigator: one with step-by-step instructions for how to create routes and use the app, and one with standard operating procedure workflows.

Behrens said that despite the learning curve and having staff switch from a manual process to an automated service, Navigator has been well received. Three regular HLAS employees use the app, as do several auxiliary workers who help with driving.

"The drivers themselves are happy with it. They've learned how to use this new technology in their day-to-day practices," said Behrens. "It's really been beneficial to show them the benefits of GIS, and they can expand off of it in the future."

Better Serving Staff and Patrons

Since its implementation, Navigator has streamlined planning and route creation for the city library. Route planning used to involve HLAS staff posting a paper map on the wall, putting pins in the map to mark delivery addresses, and finding the best route from there. Huntington said that going from this manual system to automatically creating a route in a matter of seconds has enabled the team to assist the community more effectively.

"This is the first opportunity we've had to provide an application that can provide turn-by-turn directions in an automated fashion," said Huntington. "I think this is really useful for them just to be able to open up their app, click on the day and where they're delivering to, and have all the information there already."

The route automation is also helpful for auxiliary staff who may be unfamiliar with the HLAS system or the delivery area. Behrens said that because it's much easier to obtain routes, automation increases their comfort level and helps them be more efficient.

During route planning, Navigator also has several features that help drivers stay safe when they go out on the roads, including the ability to avoid various obstacles. For example, ongoing construction in Burnaby used to make it difficult for staff to navigate and reroute their paths. Now, Navigator automatically creates a new route when the original path is deviated from, allowing drivers to better navigate construction and other road impediments.

HLAS always staffs two people in each van—one driver and one passenger. With Navigator available on mobile devices and tablets, the passenger can use an iPad to look at the route and dictate directions or relay the voice navigation, allowing the driver to focus on the road.

"The key advantage of the new Navigator system is that delivery no longer requires years of experience of driving around Burnaby," said Damian Trasler, home library and accessible services clerk for the City of Burnaby. "I've been working for HLAS for almost three years, but I still have trouble remembering the best routes for deliveries. It's nice to be able to pass the responsibility on to the iPad rather than the passenger."

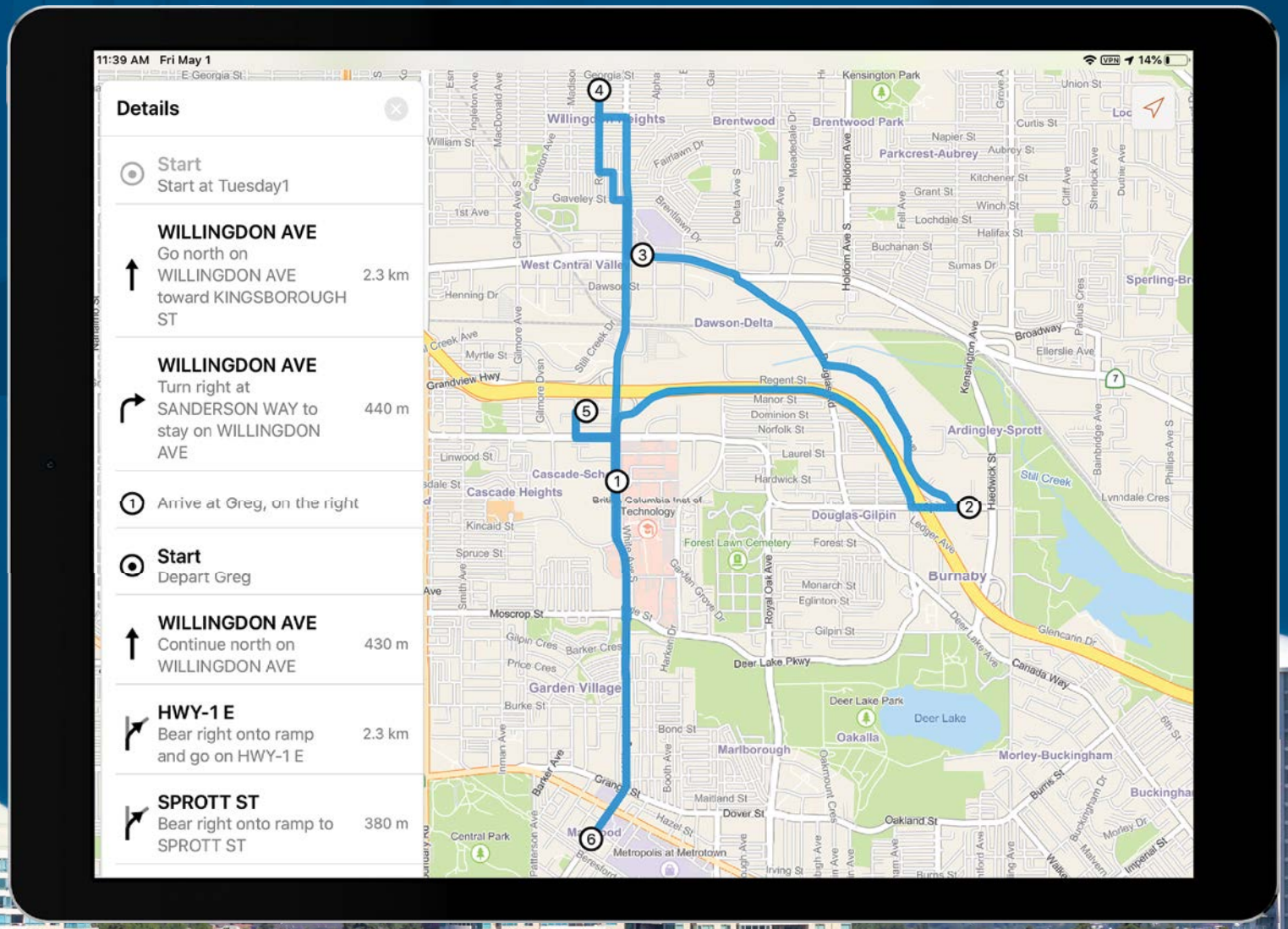
Another beneficial feature of the new system is that it delivers important details on patrons, which also helps improve the delivery process. HLAS staff can click on any point on the web map and see all the attributes associated with each patron, such as their reading likes or dislikes and telephone number. All details are kept confidential in ArcGIS Enterprise while allowing easy access to the information in the field via the iPad.

"The information is visible right away, and everyone's information is available with the click of a button," said Behrens.

Huntington said the initial goal of creating a new system was to have something that's self-serve for the library, due to the limited availability of support staff.

"We're unable to provide a daily or a weekly support system to them, so the new system *[with Navigator]* is very user-friendly," he said. "Somebody who's unfamiliar with GIS can go into it, log in, create routes, and then deploy them to drivers.

"If *[staff members are]* spending less time trying to figure out where to go and navigate through the city and more time…either getting recommended books for the customer or spending time with them at their homes, they're better able to build relationships," said Huntington. "If they have an extra five minutes to spend with the customer to chat with them and help them with their daily lives, then that's something that we're happy to be a part of."



← The key advantage of using Navigator is that doing book deliveries no longer requires years of experience driving around Burnaby.

In Quick Move to Virtual Classes, Professor Enlisted ArcGIS Insights

Students at Villanova University Used the Technology to Discover Trends and Patterns in Their Data

↑ Goldsmith had to bring indoors what is usually an outdoor environmental geology class.

When his outdoor environmental geology class moved online in March 2020 due to the coronavirus disease 2019 (COVID-19) pandemic, Steven Goldsmith, associate professor at Villanova University's Department of Geography and the Environment, needed to update his curriculum. Online courses are not a new concept, of course, but rapidly transitioning to virtual classes can be challenging for even the most dynamic instructors.

Unique circumstances require creative solutions, so Goldsmith embraced ArcGIS Insights, analysis software that fuses location analytics with open data science and business intelligence workflows. This technology enabled him to seamlessly continue his semester online despite the abrupt shift to his traditional pedagogy.

An Outdoor Lab Moves Indoors

Like many teachers and professors in the spring of 2020, Goldsmith realized that his curriculum required significant modifications to make it work for remote learning. He only had four days to develop a plan to migrate his material online. His outdoor lab needed to come indoors and had to be made virtual.

Having already heard of ArcGIS Online, Goldsmith saw its use as a potential path forward. But there was one problem: he was not a GIS expert. He had attended his last official GIS course in 2008, and an immersive ArcGIS refresher seemed out of reach, since it would take too much time for him to relearn so much while the clock was ticking. He had to rewrite and finalize his class exercises right away.

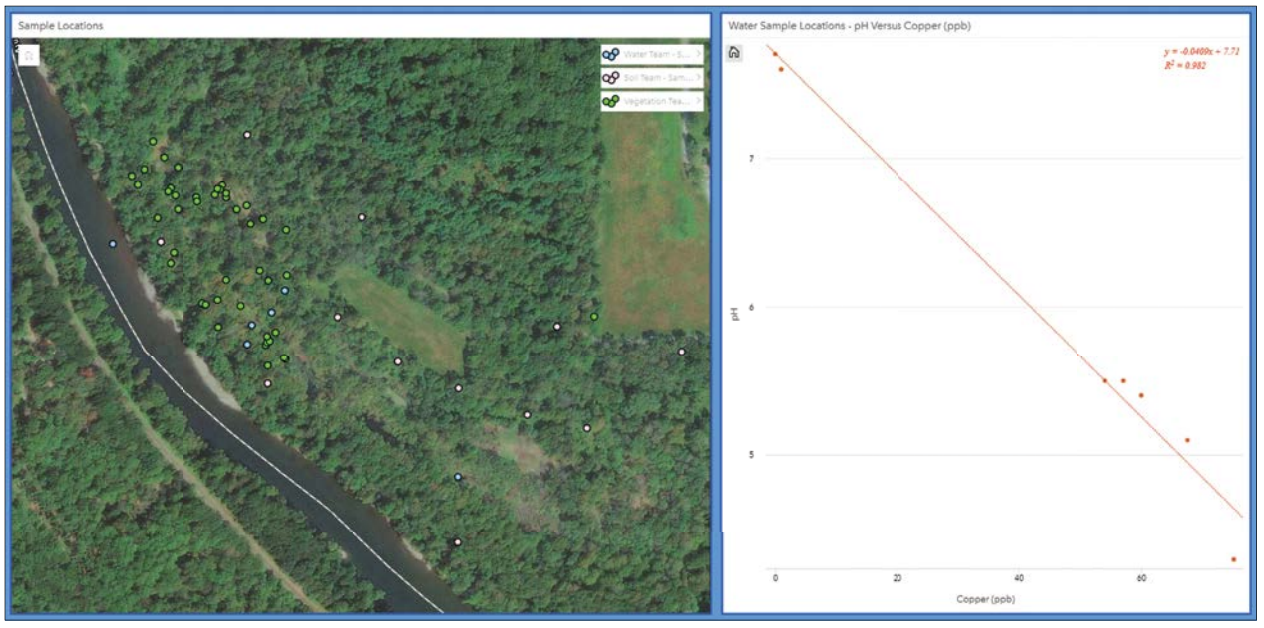
With almost no time to spare, Goldsmith had to make decisions on how to update his curriculum.

A Simple Way to Do Spatial Analysis

Goldsmith reached out to Esri solution engineer Eric Wagner—who had worked with some of his research students in the past—to see what options were available to him for teaching. Goldsmith ended up being able to take advantage of some of the significant advances in capabilities and functionality that have been made to the ArcGIS platform since he had last used GIS, many years ago. Guided and trained by Wagner, Goldsmith quickly learned about many of the geospatial apps immediately available to him and his students—specifically Insights.

With spatial analysis and visualization at its core, Insights enabled Goldsmith and his students to create more than a dozen different types of interactive graphs, maps, charts, and tables on the fly. This would help them better understand their data through spatial and nonspatial relationships. Using a simple drag-and-drop interface, the students could continue their environmental analyses—which involved working with soil, water, air, and vegetation chemistry data—online.

↑ Students in Steven Goldsmith's class were able to quickly discover socioeconomic trends in their data using maps and charts.



↑ ArcGIS Insights let students view their field data and calculate complex relationships between variables.

"It was definitely way easier to create graphs and charts," said Jayne Hickey, a senior who is earning a double major in environmental science and communications. "We could play around and try different approaches to see which was the best representation of our information much *[more easily]* than if we were just using *[Microsoft]* Excel."

Being miles away from campus did not stop Goldsmith's class from learning, and using Insights allowed students to better understand their data through a geographic lens.

"I was not only impressed with the data visualization capabilities of ArcGIS Insights but also its ease of use," said Goldsmith. "I was able to understand its functionality and capabilities after interacting with an Esri solution engineer for less than an hour, which, in turn, allowed for an easy introduction of the app to my students."

An App That's Here to Stay

Change is never easy, especially when the allotted time to adapt is limited. But Insights brought new geospatial acumen into Goldsmith's redeveloped course almost overnight.

Initially, he was only going to use Insights in one laboratory exercise, but because of its ease of use and powerful analytics, he included it in other class activities as well. After discovering that the app could enrich existing spatial data with a wealth of demographic and socioeconomic data, Goldsmith and his students used it to uncover environmental justice trends along with their earlier environmental science findings. The students even used analytics from Insights for their final projects as a means to share the patterns they discovered in their analyses.

"Overall, I liked using ArcGIS Insights and would use it again," said Hickey.

Though the 2020 spring semester was Goldsmith's first experience using Insights, it certainly will not be his last. The app made analysis and visualization easy, even for those who are new to or long removed from working with ArcGIS technology.

Goldsmith looks forward to keeping Insights in his environmental geology class, where he introduced it, as well as bringing it into the introductory-level environmental science and advanced watershed biogeochemistry courses he teaches.

"ArcGIS Insights allowed my students to visualize their data at the click of a button," said Goldsmith. "The platform enhanced their ability to independently explore data relationships and take ownership of the process."

What started as a challenge to overhaul his class with only a few days' notice turned into an opportunity to leverage modern GIS technology in a non-GIS class. Goldsmith's Insights app-based laboratory exercises are here to stay.

Academic institutions with an Esri Institutional License or Academic Departmental License have access to ArcGIS Insights through ArcGIS Online. Users should contact their ArcGIS Online organizational account administrators to update their permissions.

Scientific Currents

By Dawn Wright
Chief Scientist, Esri

How Esri Contributes to—and Advances—Science

I am very excited by this opportunity to have a regular column in *ArcNews* to further inform the Esri user community about how Esri actively supports and participates in science. Yes, science—that wonderful endeavor in which someone investigates a question or problem using reliable, verifiable methods and shares the results broadly.

Science has always been about increasing our understanding of the world around us. And did you know that science is part of our DNA at Esri? *The Science of Where* is not just a tagline. Scientific endeavor and expression are part of our passion and part of Esri's toolset.

In what is now a transdisciplinary, interdisciplinary world, we at Esri seek to communicate to scientists and nonscientists alike that geography and location are two sides of the same coin. In the 21st century, the science of digital geography is one key to changing and saving our planet. Indeed, what the world needs now is the power of deep, integrative geographic science.

The coronavirus disease 2019 (COVID-19) pandemic is one compelling example of this. A digital geographic lens—powered by dashboards, story maps, and other tools—has brought into clearer focus the complex spatial interactions that have been spreading and aggravating the virus. These tools have also been able to show the geographic implications of the first responses to it.

I think there are no better ways to bring nonspecialists into the field of geographic science than by way of dashboards and stories. Dashboards are easy yet powerful information displays that employ multiple visualization elements—including maps, graphs, and pie charts—on a single screen. Viewers don't have to be scientific experts to immediately get the picture of what's going on. For experts, dashboards have the additional advantage of providing near real-time displays for monitoring instruments, events, or activities, which can enhance at-a-glance decision-making.

No doubt the dashboard from associate professor Lauren Gardner's team at the Johns Hopkins University Center for System Science and Engineering—available at esriurl.com/covid19—has made a considerable impact on the world. The dashboard has been particularly effective at pulling together several sources of open data to convey a real-time, map-based understanding of the spreading disease. Authorities from local to national levels have been using similar dashboards and maps to display data at different scales.

At Esri, the global marketing strategy and business analytics teams built on this by putting together the Impact Planning for COVID-19 dashboard, accessible at ow.ly/AqbX50zSVSA. Combining the real-time global feed from Johns Hopkins with county-level data on COVID-19 cases and deaths, it shows how each of the 3,220 counties and municipalities in the United States and Puerto Rico has been affected and where planning efforts should be targeted. This app has been continuously updated, as has the "Mapping the novel coronavirus pandemic" story, available at ow.ly/ihys50z4Ugm, from Esri's StoryMaps team.

In addition, several of Esri's leaders—including chief medical officer Este Geraghty and director of public safety solutions and the Disaster Response Program (DRP) Ryan Lanclos—have written a steady stream of articles and blog posts about COVID-19. These include "To Balance Priorities in a COVID-19 World, Geography Matters," on page 8; "Mapping Epidemics: From SARS, Zika, and Ebola to the Pandemic of COVID-19," available at ow.ly/QtZe50zSVX5; and "Smart Maps Guide COVID-19 Investigations and Actions, and Monitor Effectiveness," at ow.ly/GLQ950z504Q.

All these examples show how ArcGIS brings clarity, rigor, and storytelling to—in this case—health and human science. I would now like to introduce another place where these examples—and more—appear. I hope you will bookmark this link and continue to visit the site repeatedly. It is Esri's new online science portfolio, available at esri.com/sciences.

This is the one place where users can discover how Esri supports and actively participates in the scientific community. Esri connects GIS and spatial data science to research at universities, independent research institutes, government agencies, the United Nations, the World Health Organization, nongovernmental organizations (NGOs), and nonprofits. In turn, Esri uses these connections to further evolve ArcGIS into a comprehensive geospatial platform for science.

In addition to featuring COVID-19 resources specifically for scientists, Esri's science portfolio has six enduring categories to explore. They each have their own featured projects; user stories; detailed resources to empower related scientific exploration; links to relevant Esri collaborators; and prompts to learn more about specific ArcGIS capabilities, apply for Esri programs, and connect with Esri teams. These sections consist of the following:

- **Open Science:** See how Esri's interoperable, standards-compliant platform is essential for advancing science.
- **Weather and Climate Science:** Explore geospatial resources for forecasting, preparedness, and adaptation.
- **Ocean Science:** Witness Esri's continued commitment to exploring, mapping, visualizing, analyzing, and protecting the earth's last frontier.
- **Solid Earth Science:** See how geospatial technology is a force multiplier for the science of the earth's surface and subsurface. Explore how this relates to hydrology, geology and geophysics, agricultural science, ecology, conservation biology, polar science, and hazard science.
- **Geographic Information Science:** Discover more about the original "science behind the systems," now also known as spatial data science.
- **Social Science:** Learn about how GIS can be used to understand how the earth looks and how humans change its appearance and function—for better and for worse.

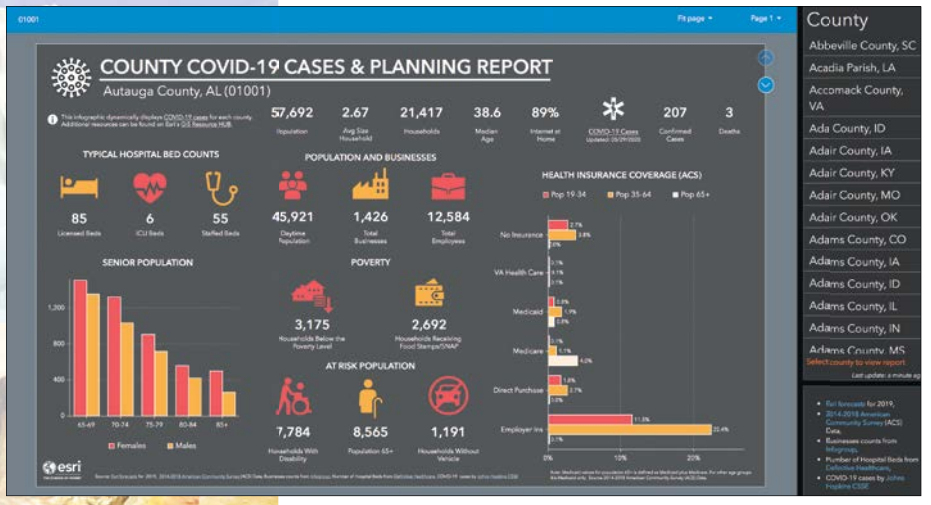
The website has pages dedicated to additional resources. The Maps and Apps tab leads visitors to free, geoenabled maps and apps that can help accelerate scientific data exploration, interpretation, and communication. The Events tab lists events, conferences, trainings, and workshops happening throughout the scientific community for the current year that Esri attends, hosts, or sponsors. The News tab features the latest books, articles, and scientific papers from Esri and its partners, including *GIS for Science: Mapping and Spatial Analytics* from Esri Press. Finally, the Resources button points to a comprehensive catalog of Esri science resources aimed at helping users accelerate their science and science communication; update and extend their GIS skills; engage in citizen science; and explore the many advisory boards, editorial boards, councils, and high-level committees to which Esri contributes as a member of the scientific community rather than as a vendor.

Underpinning all Esri's science initiatives is ArcGIS Living Atlas of the World, a premier compilation of government and commercial geographic information that has a growing academic catalog. This resource enables great mapping and analytics for science, secure sharing and collaboration, compelling science communication via storytelling, and an ecosystem where users can share models and beautiful maps to further the understanding of virtually any topic.

At Esri, we are so excited about all the things we're doing across the sciences. There are so many great things happening that we are currently updating the science portfolio website about every two to four weeks. I am encouraging Esri users and staff members alike to engage with the site as an ongoing record of what Esri is doing to strengthen the foundation of its software and services for science; to research, publish, communicate, and serve alongside the scientific community; and to inspire positive change in society.

Explore the site, enjoy it, and do let me know how you would like to be involved and how we can serve you and science better! My email address is dwright@esri.com.

↑ Esri's new online science portfolio helps users discover how Esri supports and actively participates in the scientific community.



→ The Impact Planning for COVID-19 dashboard shows how each US county and municipality has been affected by the disease and where planning efforts should be targeted.

About the Author

As chief scientist of Esri, Dawn Wright aids in strengthening the scientific foundation for Esri software and services while also representing Esri to the scientific community. A specialist in marine geology, Wright has authored and contributed to some of the most definitive literature on marine GIS.

Data Visualization App Increases Financial Transparency

Public Works Department in Topeka, Kansas, Uses ArcGIS Insights to Organize and Present Budget Information

The Public Works Department for the City of Topeka, Kansas, designs, builds, renovates, and operates public projects. These range from bridges, traffic signs and signals, and city-owned trees to streets, sidewalks, and parking meters and garages. The department strives to deliver programs and projects that enhance public health and the quality of life for everyone who lives in and visits Topeka.

Because the department relies on public funds, it has to collect and share accurate data about its programs and projects to enable leaders to make informed decisions about how funds are spent, as well as to increase transparency with the public. Tracking this information is the responsibility of the department's technical support group (TSG) division.

Toward the end of 2019, the TSG decided to upgrade how it displays the Public Works Department's budget information. It wanted to do this in a clear way so the public could understand where funds are allocated and others at the city could more easily see how finances are distributed among various departments. The division chose to use ArcGIS Insights for its advanced analytics capabilities and engaging visual displays.

A Need to Share Financial Information

According to TSG division manager Brandon Bayless, various divisions and departments within the City of Topeka were not sharing financial information, which meant there were likely no larger discussions going on about the data. This made it difficult for different units to collaborate and get the details they needed to make data-informed decisions. What's more, residents didn't have a good idea of how public funds were being used.

"For the city, there's been a big push to have reliable, timely, and accurate information *[to help]* make better decisions based on support data," said Bayless. "A lot of the information was not necessarily being shared or analyzed." The data was there, he said, but were various departments able to infer anything from it?

Bayless explained that ArcGIS Insights ended up being a great solution to this problem because it had all the tools the TSG needed to display data in a web-based platform. Darren Haag, a solutions architect in the TSG division, agreed.

"When I was going through and building different pieces for open data, I knew I wanted to utilize ArcGIS Insights, and I thought the budgets were a good *[way]* to use it," said Haag. "Even though we don't necessarily need to map that data, I felt like ArcGIS Insights is a powerful business intelligence-type application that we could use for financial data."

With ArcGIS Insights, the TSG can bring in information that, when applied to real-world situations, gives the city a more holistic picture of what's going on.

"Everything that's done around the city, whether it be fixing potholes or fixing water main breaks, has a location," said Bayless. "Being able to analyze that and show people on a map or *[provide]* information *[visually]* is extremely beneficial."

More than Numbers on a Spreadsheet

With ArcGIS Insights, the TSG division can provide city employees and the public with more than just numbers on a spreadsheet. It can present information visually, making it easier to understand.

Within the Public Works Department, ArcGIS Insights has improved data collection and analysis. According to Bayless, managers used to spend the majority of their day trying to access and extract data using the city's financial software, which produced spreadsheets and standard text reports. It took them from an hour to an hour and a half to pull the data, create a ZIP file, and post it to an FTP site. Now, however, managers can easily collect any data requested by the public, city council members, or others and make it available to download via a link on the city's open data website.

"ArcGIS Insights reduces the time needed to pull data. Now it's a very simple email response," said Bayless. "That's one of those efficiencies that makes things work smoother because we're not having to put pressure on somebody to do all this manual work."

While the Public Works Department is still in the process of setting up ArcGIS Insights on its internal enterprise GIS platform, it is already realizing how beneficial the analytics app is.

"In the short time we have been using ArcGIS Insights, it has become apparent how much more efficiently our time will be used in exploring and analyzing our data," said Bayless.

The Public Works Department is employing ArcGIS Insights to house the budgets and financial data for three of its divisions. This has saved time and improved accuracy. The ease of data input and analysis has enabled division managers to better track their actual spending, analyze trends, and find areas where additional funding is needed or where budgets can be reduced.

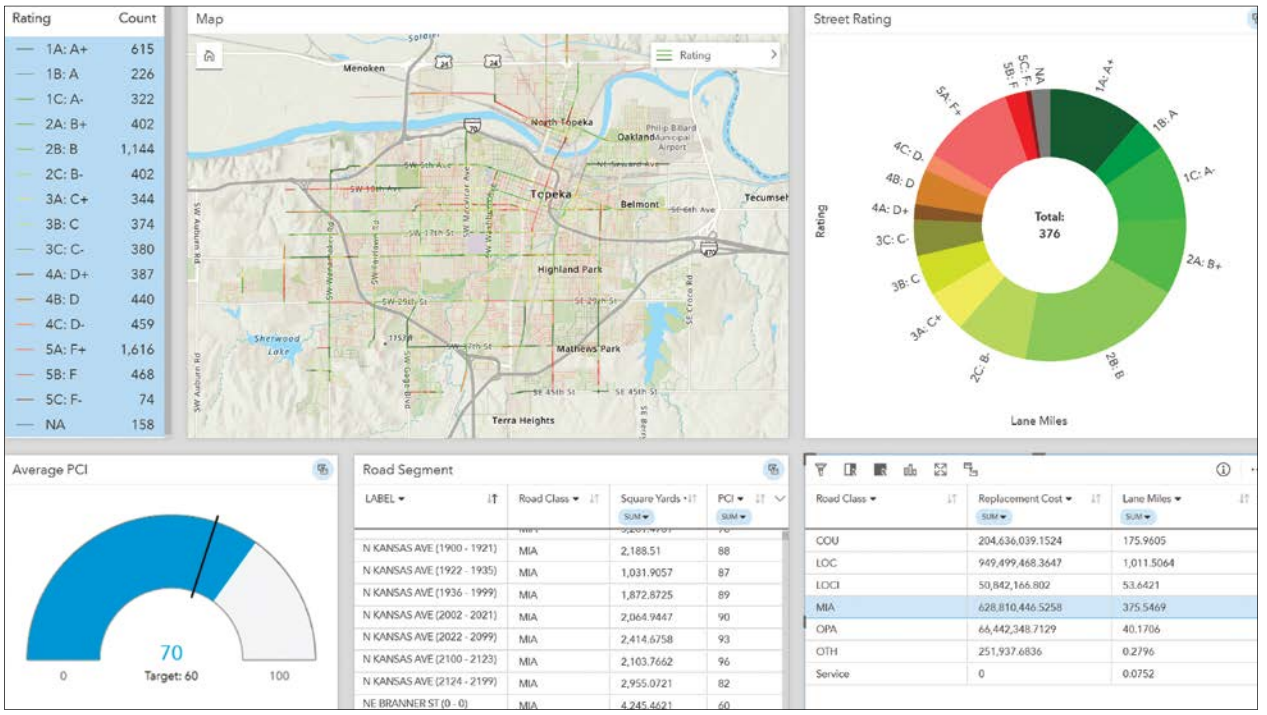
"The data and analytics that we provide with ArcGIS Insights or that we empower other departments to use help them make better decisions, which benefits the community," said Bayless.

For residents, having access to the eye-catching charts, graphs, and tables in ArcGIS Insights empowers them to find answers to their questions. This frees up city staff so they can focus on the services they provide.

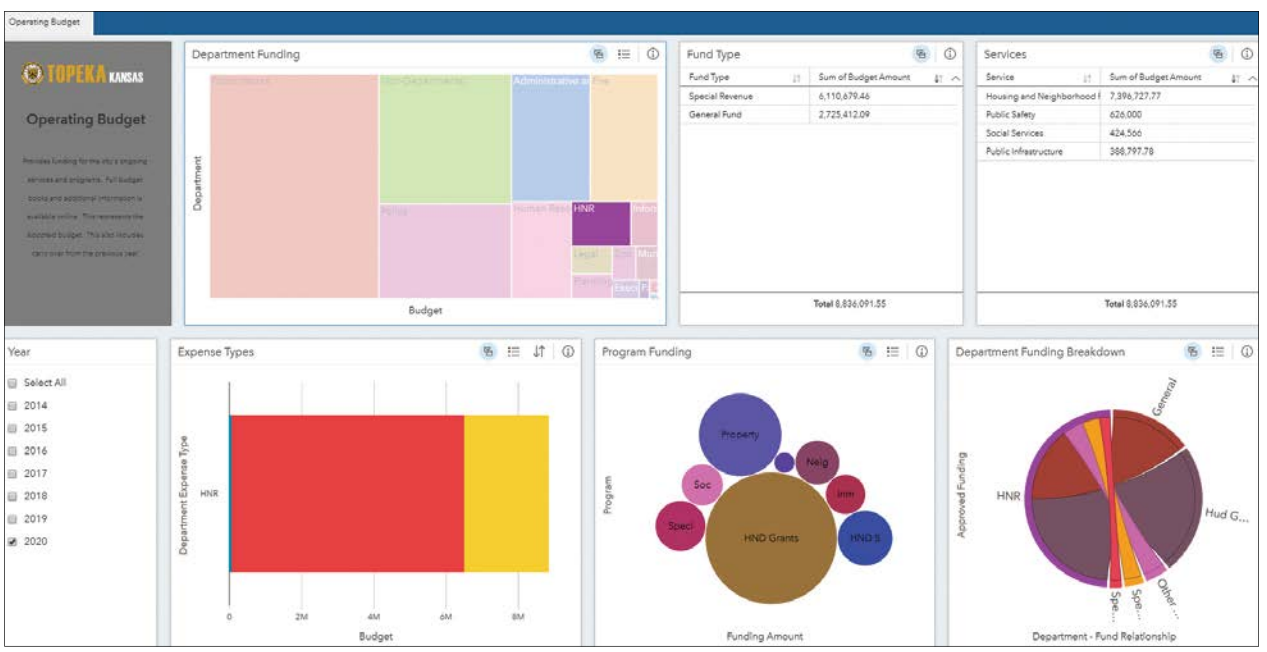
Haag said ArcGIS Insights is easier to use and better organized than other tools the department tried. While he believes that it could elicit more questions from residents once they review the data, Haag welcomes those questions because they help staff know what's important to people.

"They possibly see trends or look at things and ask questions like, Why is this showing this? or Why aren't you doing something here?" said Haag. "It opens up that line of communication, which can help make the organization work better."

"We're able to more effectively and more efficiently provide services to residents," added Bayless.



↑ The City of Topeka is embarking on a large asset management program that will use ArcGIS Insights to track the condition of all city assets and join that information to other data in its enterprise GIS platform.



↑ Having budget information available in Insights enables division managers to better track spending and analyze trends.

When Tragedy Precipitates Innovation

By Brian Arnold, City of Dayton, Ohio

In the last year and a half, Dayton, Ohio, has endured an unprecedented amount of tragedy and destruction. But as the city begins to emerge from these tough times, it will employ some recently developed, GIS-based technological enhancements that will result in smoother responses in the future.

A Difficult Year

In February 2019, a large water main break depressurized the city's entire system, causing approximately 400,000 customers to be without water. And that was just a precursor of what was to come.

Just three months later, over Memorial Day weekend, a white supremacist group descended on downtown Dayton. While the rally was planned (and permitted because of free speech laws in the United States), a lot of preparation and resources went into making sure no violence took place. Senior leadership at the City of Dayton, along with staff from the police and fire departments, were able to watch the event live using cameras, which was valuable for everyone involved.

Before the emergency operations center for the rally was even taken down, 13 tornadoes ravaged the surrounding Miami Valley region. There was significant damage, and both Dayton water treatment plants lost power, causing 400,000 households to lose water again.

In August, a gunman walked down a city street, where hundreds of people were socializing in and around bars and restaurants, and started to shoot. In the aftermath, 9 people died, and 23 others were wounded. The actions of seven police officers saved countless lives.

Also in 2019, a Dayton police officer was mortally wounded while serving a search warrant, and a young Dayton firefighter died.

To say that 2019 was one of the toughest years in Dayton history is certainly an understatement. Everyone thought that 2020 would be a much better year. How could it not? The city of Dayton and its residents had gone through death and destruction but had risen to each challenge with the grit and tenacity that Dayton is known for.

A New Way to Plan for Emergencies

Late in 2019, after the dust from these crises had settled, the Department of Water's GIS Division began planning to build a solution to assist all city departments when the emergency operations center opened or the city was planning a large-scale event.

With help from Captain Merritt Colton, an emergency planner with the Dayton Fire Department, and Sergeant Stephen Clark, the homeland security and emergency operations supervisor at the Dayton Police Department, the plan originally involved building web apps and dashboards—all within a story map structure.

During the planning process, the GIS Division reached out to Esri and spoke with Mike Cox, the director of Esri's fire and emergency services solutions, and Kelly Auman, an account manager with Esri's public safety team. Cox and Auman demonstrated some great solutions from around the country, which helped shape the final product.

Once the planning phase was complete and all involved parties were satisfied, the difficult process of building the solution got under way.

A Five-Part Solution

The first phase of development was to create the web app with editing capabilities that would be used for planning large-scale events. This app is useful for employees of the fire, police, public works, and water departments who may not have the expertise of a GIS professional but are able to put a point or polygon on a map and enter some basic data.

The next piece of the solution was to create a briefing story map. This is useful for large events, wherein personnel are staged at specific locations and certain areas are closed off. The GIS team put three, time-enabled web apps inside the story map that show the locations of road closures, areas and physical assets, and personnel. Emergency operations staff and leaders from the police and fire departments can play through each of the three web apps individually, or there is a static web app that shows all these details and is not time enabled.

The third part of the solution is for event management. This was the most challenging piece of the solution to develop because of the different components that went into it. The GIS Division used ArcGIS Workforce, ArcGIS Dashboards, and GeoAdaptor (formerly known as GeoMax) from Esri partner Geographic Technologies Group to build it.

Near the end of the planning stage, right before training was set to begin, Colton said he wanted a way to track fire equipment and personnel while events are in progress. Every fire vehicle already has an iPad in it, so at the beginning of each shift, personnel assigned to that piece of equipment can now log in to Workforce to allow their locations to be tracked. Using GeoAdaptor, which makes nonspatial data spatial, a query runs at a specified interval and uses x,y coordinates or addresses to place points on a map.

The GIS Division also created dashboards to show police and fire incidents and public works and water service requests. In addition, there is a dashboard that displays the current weather. Taken together, all this allows those in the emergency operations center to see the overall picture, no matter what type of event the city is experiencing.

The last part of the solution is a social media map that shows Twitter, Instagram, Flickr, webcam, and YouTube feeds. This would have been very useful during each of the emergency events that took place in 2019. For the tornadoes, this part of the solution would have given multiple departments a better understanding of where the initial damage was. During the mass shooting, police could have viewed social media to understand where additional victims may have been located.

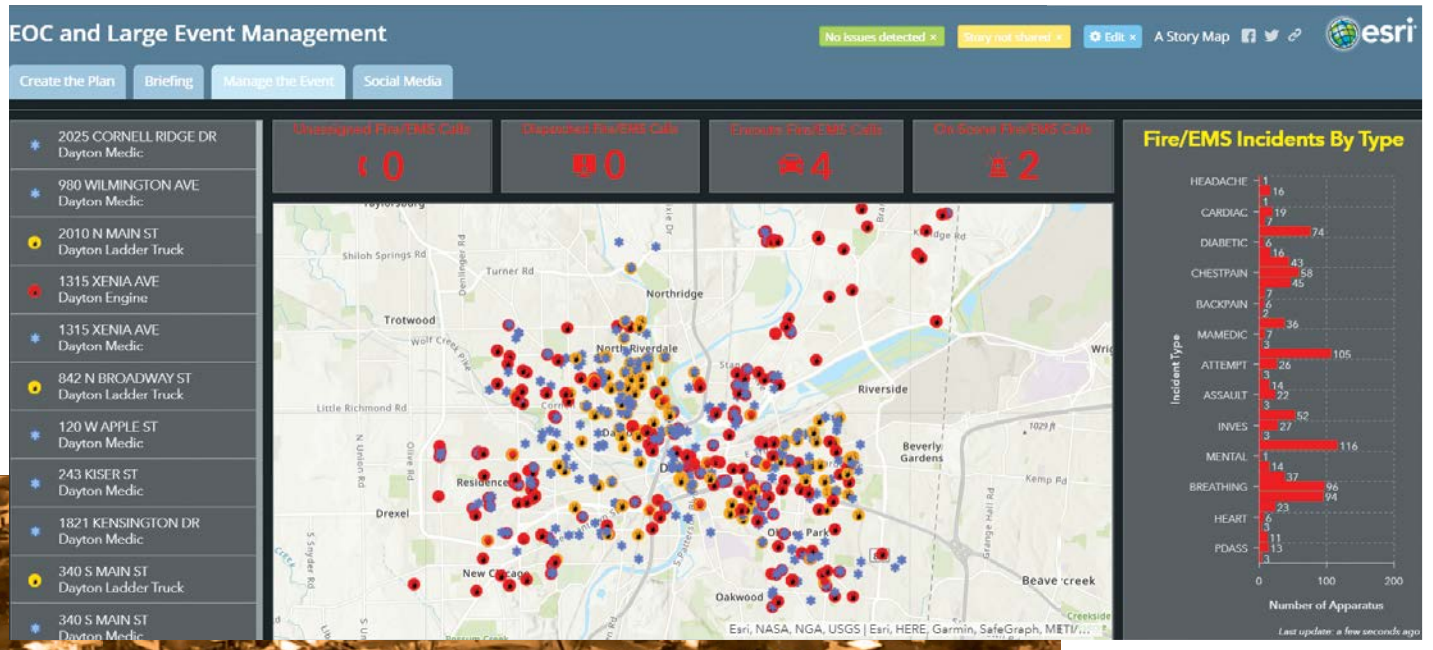
A Hitch in the Rollout

Once the solution was finished, the GIS Division showed it to Colton and Clark, who began planning to use it for the First Four, a large college basketball event played as part of March Madness. Before the plan could be completed, however, the coronavirus disease 2019 (COVID-19) pandemic hit the United States.

While the pandemic has dealt a terrible blow to the nation and the world, some helpful things have come from it. It has prompted the City of Dayton to identify a few issues with its new Emergency Operations Center and Large Event solution that hadn't been seen before, such as ways to give it a better structure and access to new data sources. In addition, the pandemic led the city to create a data team, which now has a head start in being able to stand up new dashboards.

Since the early stages of the COVID-19 pandemic, the data team has been responsible for giving city and department leaders insight into what is happening. City leadership wanted to see data from every department. Early on, the deputy city manager requested data on fire and police calls for the previous seven-day period, incoming fire and police calls in near real time, and public works and water service requests for the previous two weeks.

Because the city had done all the work to develop the Emergency Operations Center and Large Event solution, this project was easier to take on. The only extra piece that had to be incorporated into the solution was to put the dashboards into ArcGIS Hub Coronavirus Response Template. This allowed the GIS Division to more quickly turn data around that would be useful to city and department leadership.



↑ The City of Dayton can track all fire apparatus via a dashboard, which helps with responding to large events.

← In the summer of 2019, 13 tornadoes ravaged the Miami Valley region, near Dayton.

About the Author

Brian Arnold is the GIS coordinator for the Department of Water at the City of Dayton. He has been with the city since 2015.

GIS Helps Prioritize Repairs for Washington, DC's Heavily Trafficked Roadways

In 1791, president George Washington commissioned French engineer Pierre Charles L'Enfant to plan and design the District of Columbia, the permanent capital of the recently founded United States of America. L'Enfant envisioned important buildings and monuments occupying strategic locations based on changes in elevation and the contours of local waterways. He took inspiration from European cities, with the National Mall patterned in part after the Champs-Élysées in Paris, France, and streets radiating out from the city center to resemble Karlsruhe, Germany.

Today, the capital's roadway network is maintained primarily by the District Department of Transportation (DDOT) and includes 1,100 miles of public roads, both local and federal; 1,495 miles of sidewalks; and 358 miles of alleyways.

Because of heavy traffic throughout the year and adverse weather conditions during winter months, the window to repair and maintain the capital's roadway network is small. It starts each spring and continues into the fall, requiring a concerted effort to accomplish all the necessary work.

In 2018, mayor Muriel Bowser announced the launch of the PaveDC Paving Plan, a comprehensive initiative to fix all roads rated in poor condition in Washington, DC, by 2024. PaveDC has four priorities: road rehabilitation, road maintenance, alley repair and reconstruction, and sidewalk reconstruction.

"For the PaveDC initiative, we first created the PaveDC Asset Repair Prioritization Model," said Dr. Ting Ma, performance manager at DDOT. "We began by assembling three different datasets. The primary dataset comes from our annual pavement condition index. This is created by surveying every road in the district. Then, the roads are assigned a value from 0 to 100 based on their condition—how many potholes, how many cracks, and so on. Those roads with the lowest scores need the greatest attention."

DDOT derives another dataset from its 311 service call request line, which residents use to report nonemergency roadway problems. The calls are tabulated according to location and the type of repair requested and then compiled into a dataset. In addition, DDOT has an Americans with Disabilities Act (ADA) compliance dataset to ensure that people of all abilities can travel safely around the city.

"These three datasets are compiled and then an algorithm is applied to the data that creates a new index, called the Roadway Repair Index," said Ma. "It is used to rank the need for repair of each roadway in the district and prioritize the repair and construction work. Using these three separate datasets provides us with a more comprehensive and holistic evaluation of roadway conditions."

PaveDC enables the DDOT to pave more roads more quickly. In 2018, for example, the department paved 55 miles of roadway, whereas in 2019, it paved more than 100 miles of roadway—the most DDOT has ever done in a single year.

DDOT is using the Esri Roads and Highways extension to build its digital roadway network and maintain the data. For the PaveDC analyses, Ma uses a segmentation tool and geoprocessing tools in ArcGIS Pro to aggregate the data from three sources down to the block level. From there, she can visualize the data and apply weights to test different cost estimates for road repairs. This data visualization is used to balance road repairs in all eight wards to ensure that DDOT maintains roads equally throughout the district.

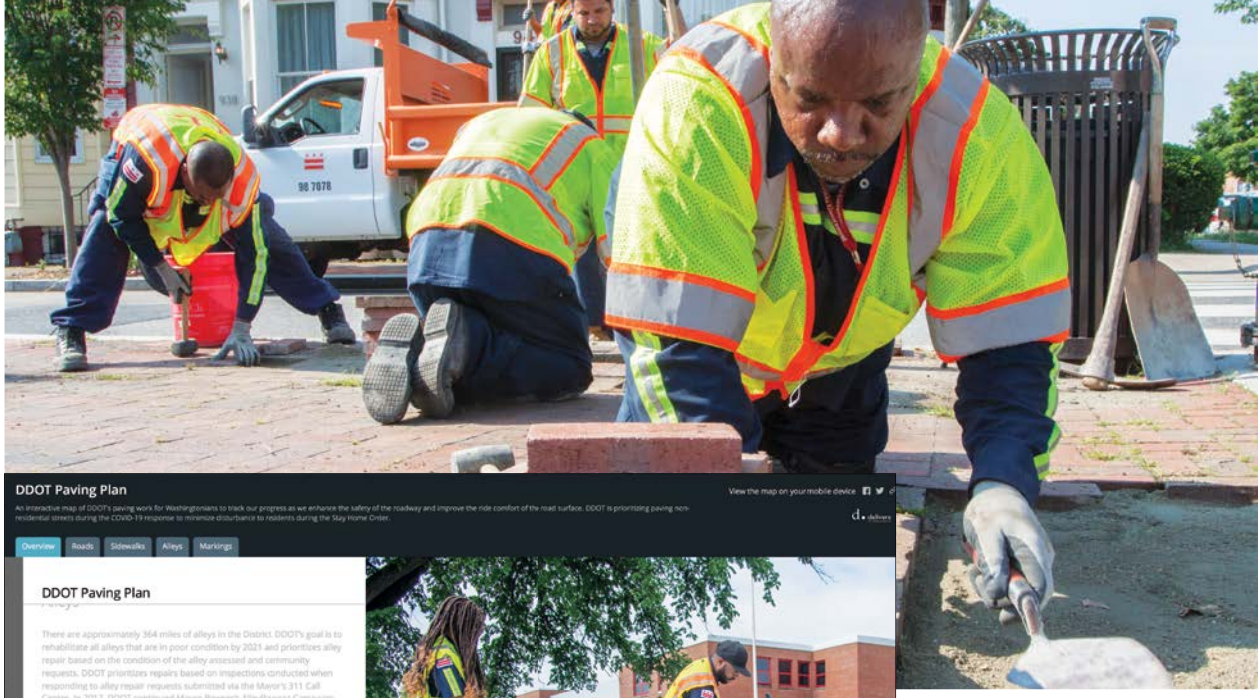
In addition, DDOT used ArcGIS Web AppBuilder to create an app that supports collaborative editing and data verification and has street view images from Esri partner Cyclomedia.

"Our engineers and inspectors use this app to determine whether or not there is a conflict on the roads we intend to repair with underground utility work being performed in the same area," said Ma.

To keep the public informed about its work, DDOT created and launched the DDOT Paving Plan website (ddot.dc.gov/pavedc) in 2018. It's the agency's first interactive and real-time paving plan communication tool for the public to explore asset repair and work plans and track the status of projects. By

← The District Department of Transportation (DDOT) built an app that supports collaborative editing and data verification and has street view images from Cyclomedia.

→ Washington, DC, has 1,495 miles of sidewalks that often need maintenance and repair, like this one on French Street.



presenting an overview of the various services PaveDC provides, the website informs users about what to expect before and during construction. Users can find specific information on roadway paving, sidewalk and alley repair, and pavement-marking improvements on four separate dashboards. The dashboards are interactive, allowing users to click on assets to find information about them or review specific wards or the advisory neighborhood commissions (ANCs) they are interested in. The website uses several ArcGIS products, including ArcGIS StoryMaps, ArcGIS Dashboards, and ArcGIS Online maps, to convey details about the projects DDOT is working on. It shows the status of the repair work, how many miles of roadway are currently being repaired, and how many miles have been completed. To communicate more effectively and directly with residents, DDOT posts PaveDC updates to its Twitter account as well, using the hashtag #PaveDC to connect the posts.

"The website allows us to provide greater transparency and engagement with the general public," said Ma. "Our residents love our PaveDC website. Since its launch, it has received more than 30,000 visits."

The website also keeps various divisions within the transportation department up-to-date on progress, which provides an incentive to continue doing innovative work, according to Ma.

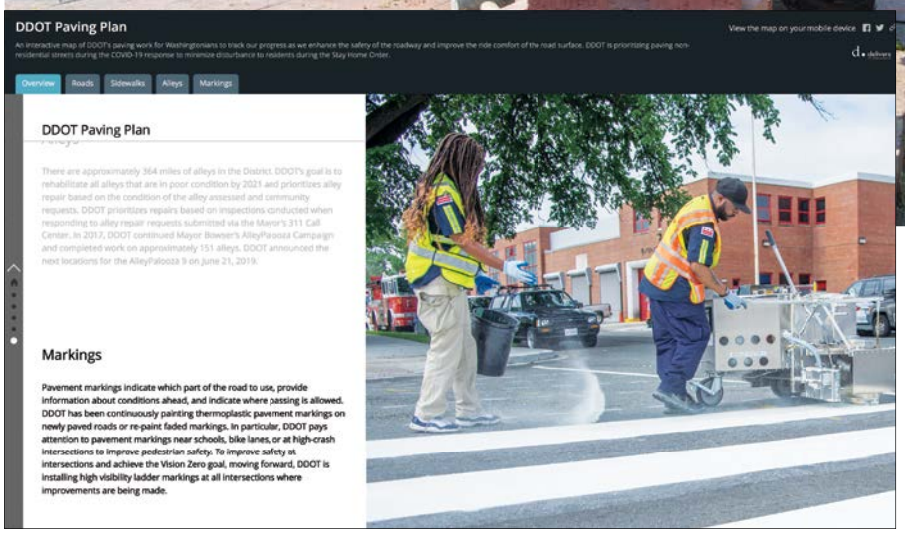
"We use it to present a status report on the work we have accomplished during the past week," she said. "This takes place at our weekly meetings with the executive team. So internally, PaveDC is also a performance management tool."

PaveDC provides a good example of how technology and accurate data can transform the way transportation agencies manage their infrastructure assets.

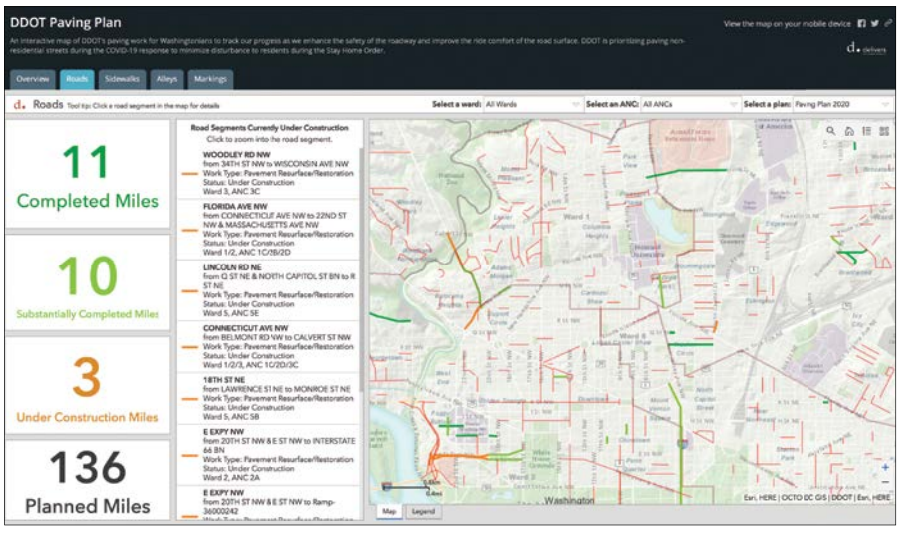
"At DDOT, we keep exploring and learning new technologies to improve our PaveDC work," said Ma.

DDOT is currently automating its geoprocessing and data prioritization process using ArcPy and other open-source data science libraries. It is also beginning to investigate the use of artificial intelligence (AI) to determine roadway repair needs more quickly.

"In 2017, it took us nine months to complete our survey of the district's roadway network. This was before the inception of the PaveDC project, which reduced this time," said Ma. "But AI technologies, such as machine learning, can further reduce the survey time and speed up roadway repairs. We are all excited about learning emerging technologies, and we are committed to leveraging them to provide better and safer roads to Washingtonians."



← The DDOT Paving Plan website is an interactive and real-time paving plan communication tool that keeps the public informed about road, sidewalk, and alley projects.



← Using four separate dashboards set up in an ArcGIS StoryMaps app, website visitors can see how many road, sidewalk, and alley repair projects are either in progress or already finished.

From the Meridian

By Michelle Kinzer
Government Relations Manager
American Association of Geographers

How Can We Assess Geography Education in a Future Without Assessments?

The 2018 results of the National Assessment of Educational Progress (NAEP) are in. The good news is that we now have access to the most up-to-date information on how well eighth grade students in the United States understand geography. The data is ready and waiting to be shared, analyzed, and understood.

The bad news? The results aren't great. Compared to 2014, the average geography score in 2018 on the nationally representative exam dropped by three points, and neither of these scores differs significantly from the first NAEP geography results, which came out in 1994. The latest figures show that only 25 percent of students performed at or above the NAEP Proficient level of understanding, while 29 percent tested below the NAEP Basic level. US students' collective understanding of geography is insufficient, and it's not making progress.

Meanwhile, the geospatial tech sector is booming. The geospatial services industry generated $400 billion in revenue in 2016, according to a report from strategy and economic advisory firm AlphaBeta. The US Bureau of Labor Statistics projects a 6 percent job growth rate for geoscientists from 2018 to 2028, which is in line with average growth rates for other fields. So the geography-adjacent job market is keeping pace with other industries, yet students' understanding of geography in the United States is flatlining.

The NAEP exam framework covers geography's basic components by testing the content areas of space and place, environment and society, and spatial dynamics and connections. These components recognize that geography education involves much more than identifying state capitals. However, the entirety of geography's reach can be difficult to account for, since students can't gain a comprehensive understanding of most other subjects without incorporating a geographic perspective.

In the geography community, the interdisciplinary nature of our subject is both a blessing and a curse. While it is clear that teaching with a geographic perspective adds value to other subjects, geography constantly runs the risk of blending into the background and losing its credibility as a stand-alone subject.

But geography stands alone as a discipline for many reasons, one of which is that it grants students a basic yet critical skill: the ability to read a map. The power of being able to understand a map during early education is a ticket to seeing parochial problems through a global lens and imagining solutions that extend far beyond the classroom. A student who has the capacity to critically analyze and understand a map will carry that for a lifetime. And with the ever-growing expanse of data and information available from disparate outlets, being able to sift for reliable sources and comprehend visual analyses is an essential skill.

As access to information grows, so, too, does the availability of visual displays that help us make sense of it all, and our next generation can't be expected to cut through the noise without the underpinnings of a geography education. It seems that a shared goal of the GIS community should be equipping grade school students with the basic building blocks they'll need to understand the world from a geospatial perspective.

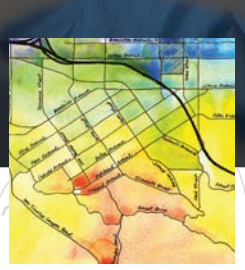
If this commitment seems self-evident, then consider the importance of accountability. National-level assessments compel us to take a hard look at the makeup of our future populace. We can find dozens of reasons to support K–12 education and make promises to do better by students, but how can we achieve any of our goals without an honest evaluation of their achievements?

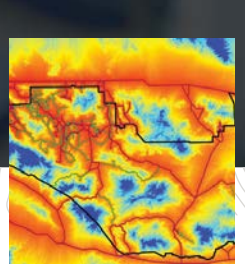
K–12 education can and must develop students to meet the demand of a booming GIS and geoscience job market. Already, the geography community heavily supports and advocates for geospatial critical thinking in K–12 curricula to prepare students for college, careers, and beyond. But our measure of progress is at risk. Due to a recent decision by the National Assessment Governing Board, geography assessments have no future on the NAEP schedule. As it stands, 2018 will be our last and most recent nationwide accountability check on our commitment to K–12 geography education.

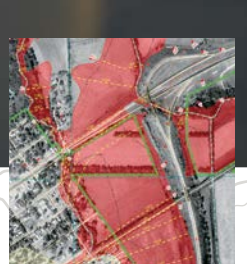
We cannot build a geoliterate nation without identifying current gaps in student achievement. It is up to our elected officials and governing institutions to reemphasize and reimagine comprehensive achievement measures so we can change course as needed while continually striving to build a future generation as capable as the GIS technology waiting at its fingertips.

About the Author

Michelle Kinzer is the government relations manager for the American Association of Geographers (AAG). She serves as the association's public policy advocate and engages with lawmakers on behalf of its members to advance the interests of the broader geography community. Kinzer is a graduate of Virginia Polytechnic Institute and State University (Virginia Tech), where she earned her BA in urban planning with a concentration in global development.







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To Meet New Regulatory Requirements, Utility Upgrades Field Workflows

With ArcGIS Utility Network and ArcGIS Collector, AltaGas Utilities Reduces Inspection Times by 50 Percent

In 2015, leaders in the natural gas industry in the United States published a collaborative document called ASTM F2897 that specifies how pipeline attributes—including the materials they're made of and their manufacturers—should be identified via a standard, 16-digit bar code.

"ASTM F2897 is the standard that the gas utility industry is rallying around to address the requirements of tracking and traceability," said Tom Coolidge, Esri director of gas utility and pipeline industry solutions, referring to the need to find where assets were installed (tracking) and locate them based on attributes (traceability).

Being in compliance with ASTM F2897 requires that utilities have a bar code-based method to collect and store this data.

AltaGas Utilities, a regulated Canadian natural gas distribution utility with more than 13,000 miles (21,000 kilometers) of pipeline, has spent the last several years putting plans in place to comply with this standard proactively. Its GIS team has spent three years updating the utility's digital as-builting process (which involves collecting location and other information about newly installed assets before they are backfilled underground) so it works with bar code scanning.

"Our intention is for a bar code to be scanned on all polyethylene *[PE]* assets during installation," explained AltaGas Utilities GIS manager Mathew Desbiens. "Then we can go back and trace exactly where those underground assets are by using our GIS."

To do all this, AltaGas implemented the new ArcGIS Utility Network extension and ArcGIS Collector, along with the Arrow Gold Global Navigation Satellite System (GNSS) receiver from Esri partner Eos Positioning Systems and rugged tablets from Samsung. Now, the utility has everything it needs to comply with ASTM F2897.

Gearing Up with Durable Technology

For three years, AltaGas worked closely with Esri and Esri Canada to update its GIS. This included participating in the Utility Network beta program.

Esri has enhanced the Utility Network extension and Collector to streamline ASTM F2897 compliance, which worked out great for AltaGas.

"We wanted to move to the Utility Network for our GIS because Esri made it directly compatible with the ASTM F2897," said Desbiens. "There is already a field with associated domains for every required attribute to go into Esri's Utility Network schema."

Moreover, Collector now has ArcGIS Arcade scripting, which makes it possible to display decoded bar code data in the field, even in disconnected areas.

"The recent improvements to Collector can result in a simpler and more efficient tracking and traceability workflow when combined with an ArcGIS 10.7 or higher enterprise geodatabase," said Tom DeWitte, Esri's natural gas industry technical lead.

To make Collector work for the utility's needs, Desbiens looked for a GPS receiver that was compatible with Collector to replace its legacy, all-in-one GPS data collection devices. The Arrow Gold GNSS receiver provides centimeter-level accuracy with real-time kinematic (RTK) corrections or submeter accuracy via free, satellite-based augmentation system (SBAS) wide area augmentation system (WAAS) corrections. This is what Desbiens was looking for, along with devices that could stand up to Canada's often harsh environment.

"Two of the other receivers we tested could not withstand the harsh Alberta climate," Desbiens said. "Now we've got 22 Arrow Gold receivers out there, and they've been working flawlessly. And the Eos technical support we required for interfacing with Collector was outstanding."

By using a paid RTK subscription in urban areas, AltaGas achieves several centimeters of accuracy. In rural areas without RTK, the utility achieves below 1 meter.

"We like to have 30-centimeter accuracy or better in most cases," said Desbiens. "And below 1 meter is more than adequate for us in rural areas."

Desbiens Bluetooth-paired the Arrow Gold GNSS receivers with Samsung Galaxy Tab Active 2 tablets loaded with Collector. These tablets tested best among mobile devices.

"They avoided the Bluetooth connectivity issues we had with other devices," said Desbiens. "And the installation and operation of Collector were seamless."

Inspectors and Drafters Save Time

AltaGas Utilities rolled out the new field data collection system to 50 contractors and employees.

In the past, only internal employees were able to do the company's as-builting work because legacy devices didn't allow fieldworkers to sync their data to a server in the cloud.

"You had to work for the company, AltaGas Utilities, to access any of the data," said Desbiens.

Now, independent inspectors, who already visit installation sites to provide safety oversight and inspect assets before they're powered up, can also collect data on as-built assets.

"Just by scanning a bar code and getting rid of *[drop-down menus]*, we're saving 50 percent of our field time for inspectors," said Desbiens. "This made our business case very clear."

Once the data is collected, drafters back in the office use a custom geoprocessing tool in ArcGIS Pro to decode the collected bar codes and add them to AltaGas's tracking-and-traceability attributes, which are based on tables in the ASTM F2897 document.

"Collector will automatically decode the bar code, autopopulate the derived attributes, and display the decoded information immediately after the new GIS feature is submitted by Collector," said Doug Morgenthaler, Esri's program manager for Collector.

AltaGas Utilities created a custom JavaScript geoprocessing tool in ArcGIS Pro to perform bar code translations. The company also enabled a capability that groups together multiple bar codes as one feature.

"Our inspectors can save a lot of time because they can scan, scan, scan, and submit a single feature," said Desbiens.

While AltaGas built its workflows, Esri Canada director of utilities Brian Bell acted as an adviser to ensure that everything collected in the field was supported back in the office GIS.

"My team helped them build their knowledge to make the right decisions," said Bell. "In return, they gave our product teams crucial feedback as to where they needed to focus to deliver a solution for their business challenge."

Looking Ahead to Wider Use

Under the guidance of Desbiens, AltaGas Utilities is currently assisting in the development of similar workflows at its sister utility Pacific Northern Gas.

AltaGas has also purchased its own Arrow Gold base station, which will eliminate its need for third-party RTK network subscriptions and save the utility $1,500 per year, per user.

"Not only will adding the base station eliminate their subscription costs," said Bernard-Luc Gagnon, an authorized Eos representative who installed the Arrow Gold base station, "but now they will have more people in the field who can benefit from survey-grade accuracy."

The base station provides 1–3 centimeters of accuracy within a 30-mile (50 kilometer) radius.

"This will cover a considerable amount of our urban areas," said Desbiens. "We feel very positive about the business case we presented, the results we have been able to achieve, and our preparation for potential upcoming regulatory requirements."

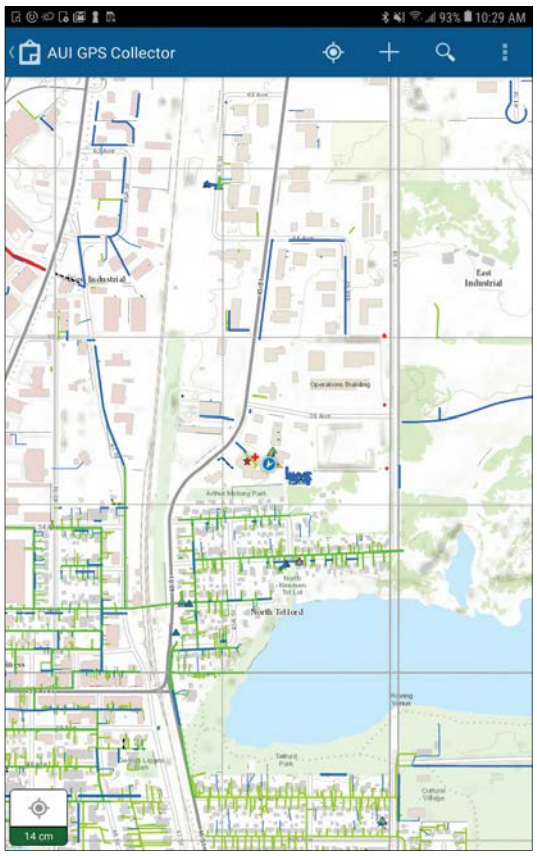
Meanwhile, the utility's three-year pilot program has helped Esri ensure that its enhancements to the Utility Network and Collector have meaningful value for other gas operators facing upcoming regulations.

"AltaGas Utilities was an early adopter," said Esri global director of utility industry solutions Matt Piper. "My expectation is that virtually every gas utility will find its way toward using these kinds of capabilities."

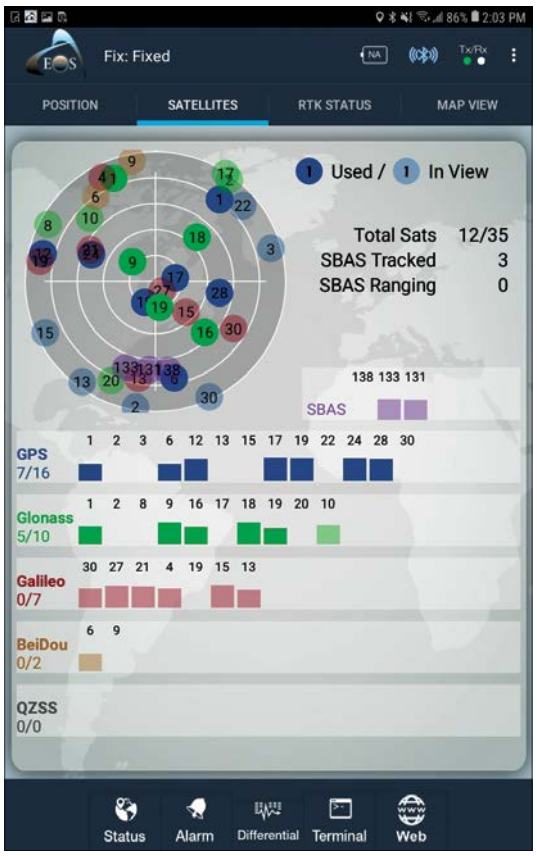
Bar code capture improves how quickly field staff collect data and reduces the amount of information they have to gather manually.

↑ When a pipe gets replaced in a neighborhood, AltaGas can see, on a map, the GPS coordinates of each asset's bar code.

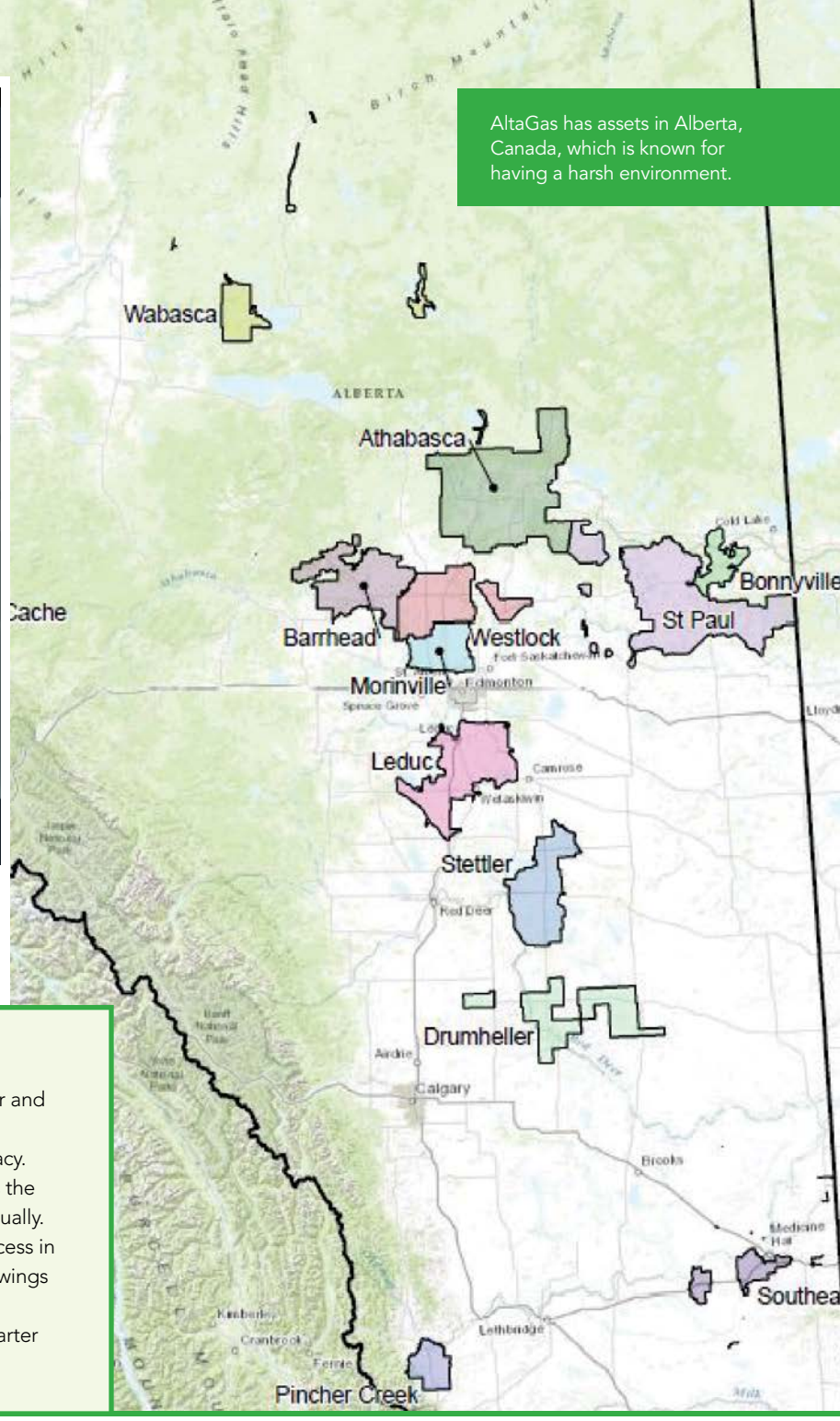
↑ AltaGas Utilities' polyethylene (PE) assets were fitted with bar codes that are compliant with the ASTM F2897 standard.



↑ ArcGIS Collector automatically decodes bar codes, autopopulates the derived attributes, and displays the decoded information immediately.



↑ Eos Tools Pro communicates between Collector and the Arrow Gold GNSS receiver, providing a high level of accuracy during fieldwork.



AltaGas has assets in Alberta, Canada, which is known for having a harsh environment.

The Benefits of Using ArcGIS Collector for Tracking and Traceability

- **Improved attribute data quality:** Using Collector eliminates having to translate data to and from paper and interpret handwritten information.
- **Increased accuracy:** Bluetooth integration with high-precision GNSS receivers improves location accuracy.
- **Speedier data collection:** Bar code capture improves the speed at which data is collected and reduces the amount of information (e.g., material, diameter, manufacturer, and model) field staff have to gather manually.
- **Increased productivity:** Digitally collected data is immediately available for the GIS department to process in an enterprise geodatabase. Mapmakers no longer have to manually transpose paper-based redline drawings and can instead append field-collected geospatial features directly to their maps.
- **Safer field operations:** Having timelier access to new construction data means everyone is working smarter when they're in the field.

The Relevance of Cartography

A Cartographer's Perspective

By Tim Trainor
President, International Cartographic Association

Countries Need an Integrated Geospatial Information Framework

Maps need data. Cartography is—and has been—at the forefront of the development of geospatial data, GIS, GIScience, geospatial standards, visualization, generalization, and related topics.

Digitized paper maps transformed map data and map design into new types of databases. The 1980s and 1990s were innovative periods in which point, line, and area symbols, augmented with names and colors, were transformed to digital data, sparking a technological and data revolution. Governments, academia, and the private sector pursued different database constructs, which culminated in two common approaches that differed significantly.

The first focused on automating the mapping process so maps could be produced and printed with computer assistance. Emphasis on manual techniques was reduced to save time and materials (and presumably cost, which largely wasn't realized). New technologies were applied to this digital data repository that stored map content and design in ways that replicated maps as if they were produced via traditional processes. In fact, that was the goal: to make a machine copy of cartographers' skilled artwork. Today, the limitations of this approach are clearly understandable, but at the time, the excitement—coupled with the unknown potential of computers—led to different ideas for modernizing the mapping process.

The second database "design" was structured to accommodate each geographic feature rather than the cartographic representation of the geography. In this way, digital data reflecting geographic objects in the form of features—such as a class of road, a type of boundary, or the relationship between the position of one geographic feature to another—was encoded. Relationships among geographic phenomena in a database were made possible with the development of topology (which, in cartography, can be traced back to James Corbett's book *Topological Principles in Cartography*). Digitizing and encoding geography required thoughtful database designs and lots of hard work (which is one reason why automating mapping was rarely cost-effective, particularly in initial efforts). The benefits of giving a geographic structure to the data lay in the many applications and uses of the information that extended well beyond the creation of the specific content and design of a topographic map.

The biggest challenge in the early days of GIS was a lack of digital geographic data. In much of the developing world, this is still the case.

Initially, data was encoded locally for a specific project. National efforts to create and manage what today is called geospatial data began in the 1980s and continue today. As a way to organize, standardize, and manage a national resource of digital geospatial information, the concept of the National Spatial Data Infrastructure (NSDI) was introduced in the early 1990s. The NSDI concept helped assign the responsibilities of creating and maintaining geospatial data within a country. One objective was to reduce different organizations' duplicative efforts. For some countries, and for a period of time, endeavors to create and maintain an NSDI were a sufficient approach.

Developing countries are often at a disadvantage if they do not have an NSDI. The lack of digital geospatial information precludes some countries from using available technical capabilities, and outdated maps or the absence of a national mapping effort add to the challenges that these nations face. This has made it difficult for some countries to attain an NSDI. Advances in technology—such as satellite imagery and software that extracts and encodes some of that data—make it possible for developing countries to leapfrog prior efforts to acquire, store, and use geospatial information. However, other geospatial data does require more effort, expertise, and expense to obtain, transform, and use.

For those who work to collect, manage, and disseminate geospatial information, it is no longer sufficient to continue using past approaches associated only with an NSDI. The question today is, What is needed to establish and maintain a geospatial capability? Furthermore, what is needed to answer basic questions related to economic, social, and environmental interests and challenges that are influenced by location information? And how can geospatial information support national priorities and circumstances while securing a safe and beneficial data ecosystem for that country's population?

The United Nations' (UN) response to these questions is the Integrated Geospatial Information Framework (IGIF). The IGIF addresses why geospatial information is important for all countries and needs to be strengthened from within. It describes, via nine strategic pathways, what is needed to build and maintain the capabilities required to manage and offer geospatial information to users.

In countries that have an NSDI, the IGIF builds on those efforts, and for countries that don't, the IGIF is a good starting point since it supports responses to important interests and challenges that every jurisdiction faces. As the graphic of the concept shows, each section of the IGIF is integrated, like a puzzle. On the website ggim.un.org/IGIF/part2.cshtml, the UN Statistics Division outlines how to implement geospatial information frameworks and, in the Solving the Puzzle section, introduces individual country-level action plans designed to help nations build and maintain their own IGIFs.

Today, geospatial information is so prevalent—even if we're not aware of its presence and all it has to offer. For example, while many people may take for granted the GPS on their smartphones, this technology provides data-rich opportunities. Just by knowing a user's geographic coordinates and where he or she wants to go, different apps in that smartphone can give the person the best route for getting there.

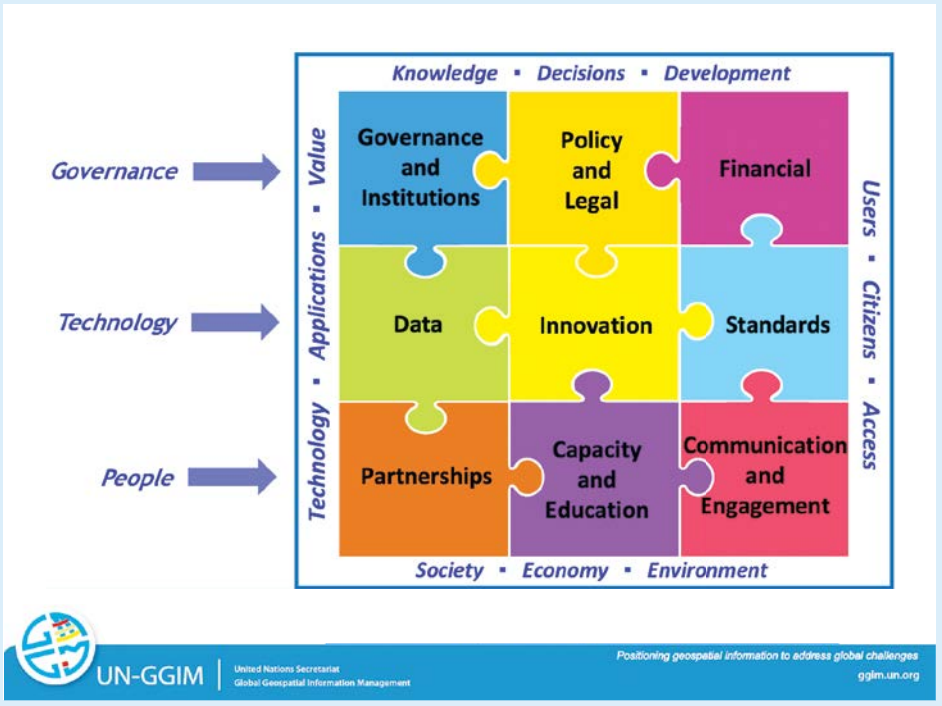
Use of technologies ranging from cell phones to credit cards increases the volume and types of data that are available. And each data element is likely to be geospatially referenced, meaning it has location. While traditionally this data may not be thought of as geospatial, the value of integrating it with fundamental geospatial data themes—such as addresses, elevation and depth, orthoimagery, and population distributions—is groundbreaking. It offers so many new opportunities to see the world and our lives in different ways.

Statistics that are linked to a geographic location are a prime example of geospatially referenced data. For instance, the population of a town is a statistic that applies to the entire area included within that town's geographic boundary. Similarly, the number of people employed within a specific industry type for a given metropolitan area can be mapped to show comparisons with other metropolitan areas.

From the perspective of responding to the coronavirus disease 2019 (COVID-19) pandemic, geospatially referenced statistics aid in making sound decisions about the virus's prevalence, trends regarding the spread and control of outbreaks, the locations of population groups most susceptible to contracting it, the rate of testing by neighborhood, and eventual inoculation at the individual level.

To map all this, decision-makers need accurate and up-to-date data so they can plan and take necessary actions. Currently, much of this data is not available at the appropriate geographic level to make the best decisions. The need for this type of geospatial and statistical data will only continue to grow—not only in response to COVID-19 but also for future pandemics that will likely challenge our communities.

The IGIF provides nations with a comprehensive approach to answering critical questions. Most often, maps are used as tools to visualize current situations and project future impacts. The topics are limitless. Whether it is arresting the spread of a deadly virus or mapping a community's economic opportunities, the existence of an Integrated Geospatial Information Framework makes it possible for everyone to contribute to the process, propose and act on solutions, and enjoy the benefits of the outcomes.



↑ All the pieces of the Integrated Geospatial Information Framework (IGIF) coalesce, just a like a puzzle.

About the Author

Tim Trainor is a part-time consultant to the UN and is the former chief geospatial scientist for the US Census Bureau. He is a member of the US Federal Geographic Data Committee's National Geospatial Advisory Committee, has served as cochair for the UN Committee of Experts on Global Geospatial Information Management, and was the senior agency official for geospatial information for the US Department of Commerce.

Startup Uses Geosocial Data to Analyze Consumer Behavior

By Jocelyn Dale and Nicole Meads, TSCG; and Lyden Foust, Spatial.ai

With more than 328 million individuals in the United States, it can be very difficult for retailers to predict people's preferences and purchasing choices. In recent years, GIS professionals have relied on demographics as the best proxy for making true behavioral predictions. But there's a problem: people who appear to be demographically identical may have different interests and preferences. While demographics are helpful, they don't tell the whole story. The missing piece is how humans actually behave at the individual level.

Every day, people across the country discuss their thoughts, opinions, preferences, and interests on social media. Esri startup partner **Spatial.ai**, a location intelligence and geosocial data provider, takes that data and studies it to better understand how humans experience the world and live their lives.

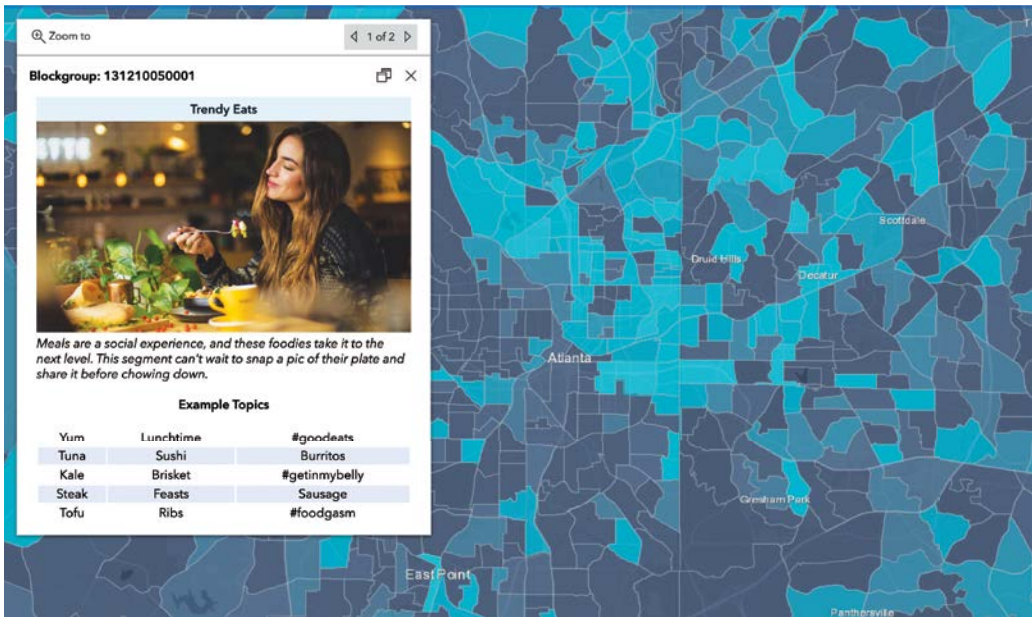
To uncover genuine behavioral trends, Spatial.ai uses geosocial data based on 72 behavioral segments that focus on people's interests, lifestyles, relationships, entertainment preferences, and culture. These segments—which include Smart Chic, Yoga Advocates, and Foodies—are organized at the block group level, a census measurement of about 40 city blocks, and are intended to help users visualize a community's interests and moods.

"Rather than boxing consumers into small subgroups, geosocial data creates connections between actions and activities, so it reflects that consumers are more than their demographic or psychographic labels," noted Helen Thompson, group lead for content and applied analytics at Esri.

Spatial.ai develops its geosocial observations by sourcing data from residents of a given area who publicly post comments on social media. Privacy is important, so the startup only accesses data from users who have deliberately set their geolocated posts to be public, and no individual user data is collected.

Recently, TSCG Analytics, a division of TSCG (formerly The Shopping Center Group), was tasked with helping a high-end thrift retailer choose a new location in Atlanta, Georgia. The real estate advisory firm is on the cutting edge of leveraging key behavioral datasets to address the most pressing problems facing the retail real estate industry today. It helps clients with site selection, market optimization, trade areas and franchise territory definition, general mapping services, data access, and the development of online dashboards.

To enhance its already advanced geospatial techniques, TSCG partnered with Spatial.ai for this project to take advantage of the startup's continually evolving data and resources. Being able to examine various aspects of a given community, such as people's sentiments, personalities, and behaviors, enabled TSCG to create a brand profile for the thrift retailer that goes deeper than a simple demographic report. This allowed the client to form a clear understanding of the customer base surrounding its prospective store site.



↑ Spatial.ai's behavioral segments focus on people's interests, lifestyles, relationships, entertainment preferences, and culture.

Over the last three years, the market for secondhand stores has grown 21 times faster than the retail apparel market, and it's expected to be a $51 billion industry by 2023, according to data from GlobalData, a retail analytics firm. So there was a lot at stake for the thrift retailer in choosing the right spot for its first shop in Atlanta.

The client wanted TSCG to help it understand which submarkets should be strategically considered based on how well potential customers' characteristics aligned with the retailer's current top-performing stores. There wasn't much data to go on, though. The client didn't generally collect any customer information, and there was limited existing access to resources and data that would help.

TSCG used a combination of mobile location sources, Esri Tapestry Segmentation data, and Spatial.ai's detailed geosocial data to analyze potential locations for its client's new store. TSCG collected the mobile location data through opt-in mobile apps, which allowed the firm to get a general understanding of people's shopping patterns in certain areas of the city. It used the Tapestry Segmentation data—which classifies groups of people based on their values, interests, and lifestyles—to identify the overall psychographic segments of the block groups where local shoppers reside. And the firm used Spatial.ai's geosocial data to refine its understanding of the behavioral groups that strongly represent the brand profiles of the client's existing and potential resale store locations.

Two psychographic segments were targeted using Esri's Tapestry data: Trendsetters, a segment of young, diverse, and mobile residents, and Metro Renters, who are typically young and educated singles. This allowed analysts to see that the brand's customers were largely single urban dwellers who stay up-to-date with the latest technology, who often rent rather than own their homes, and to whom image is important.

Using Spatial.ai's social activity analysis data, TSCG then created a more detailed brand profile for its client by identifying five top geosocial elements within a 10-minute walk of the company's top-performing stores in other locations. These segments were Film Lovers, LGBTQ Culture, Artistic Appreciation, Mindfulness & Spirituality, and Yoga Advocates. A fuller picture of the brand's audience began to emerge.

What set this high-end thrift shop's customers apart was their love of indie films, support for the LGBTQ movement, appreciation of fine art, and connection with yoga and meditation culture. Esri's Tapestry Segmentation data and Spatial.ai's geosocial insights complemented each other by bringing additional context to each dataset. On its own, the Tapestry data represented interesting marketing observations, but TSCG was also able to quantify and map the areas that fit the demographic social profiles of the brand's customers.

TSCG combined these variables into a high-end thrift index to capture each Atlanta neighborhood's affinity for quality resale shopping. It then analyzed mobile location data to discover which block groups within that profile also housed Trendsetters and Metro Renters. Retail sites close to those block groups were given priority.

Taking Esri's Tapestry Segmentation data together with Spatial.ai's datasets allowed TSCG Analytics to not only identify specific submarkets in Atlanta but also rank retail sites within those markets that met the brand's demographic profile according to which areas would likely receive heavy visitation from matching customer types. In the past, this would have required TSCG to perform a large number of demographic analyses and spend hundreds of hours doing qualitative interviews and in-store intercepts. Spatial.ai was able to help TSCG capture all this information in less than a day. Even better, with this experience as a model, TSCG Analytics was able to lay the foundation for the thrift retailer to develop a powerful hyperlocal marketing strategy to use going forward.

About the Authors

Jocelyn Dale is the director of GIS and analytics at TSCG. Nicole Meads is a GIS analyst at TSCG. Lyden Foust is the CEO of Spatial.ai.

Esri Partners Awarded
for Innovative ArcGIS Projects and Services

At the 2020 Esri Partner Conference, held in March, Esri recognized 19 partners in 10 award categories for their important and innovative contributions to GIS. Read on to find out about their noteworthy solutions and services.

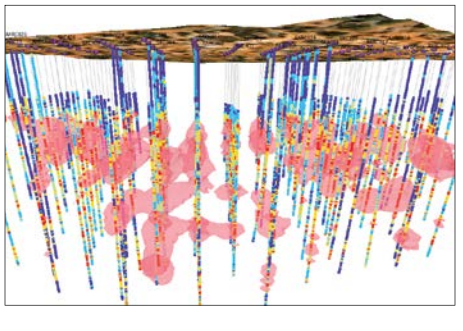
Bringing Esri Analytics and Insights to Customers

Infrastructure Data Solutions | ids.consulting

Infrastructure Data Solutions (IDS) provides evidence-based decision-making solutions and services for transportation agencies, municipalities, and water utilities that address complex challenges and ensure reliability and sustainability. When the City of Vernon, Canada, needed a 20-year plan for risk-based asset management, IDS implemented the cloud- and ArcGIS software-based IDS Asset Optimizer solution to help with in-depth infrastructure analysis.

Seequent | seequent.com

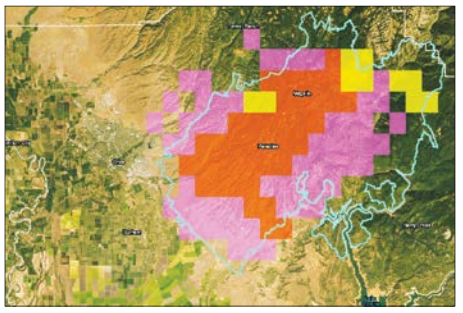
Seequent delivers powerful geoscience analysis, modeling, and collaborative technologies that make it easier to solve complex problems and manage risk. The company's Target for ArcGIS Pro solution, built on the latest release of ArcGIS Pro, allows users to easily import, view, and analyze geologic data. Users can see drill hole and subsurface data attributes in both 2D maps and 3D scenes. Using the solution with ArcGIS Online facilitates collaboration.



Delivering Creative Content for ArcGIS

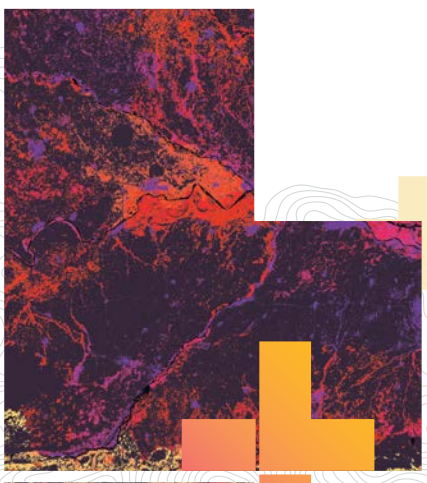
DTN | dtn.com

DTN provides customers in the agriculture, energy, utility, weather, and finance fields with actionable data that can reduce risk, enable smarter business decisions, and drive better results. DTN helps utility companies deliver real-time weather information—to fieldworkers, for example—shared via a variety of data services. The Esri partner also produces apps, available on the ArcGIS Marketplace, that enhance data delivery.



SafeGraph | safegraph.com/geospatial

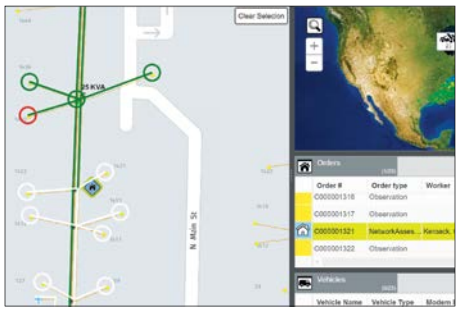
SafeGraph is the source of truth for physical places data. Its point-of-interest (POI) data, geofences, and store visitor insights give companies better geolocation, retail analytics, and marketing capabilities. SafeGraph enriches its data with useful context, such as brand affiliation, North American Industry Classification System (NAICS) business categorization, and foot traffic counts. Its POI data is available on the ArcGIS Marketplace.



Driving Systems of Engagement

Clevest | clevest.com

Clevest works with more than 240 utilities worldwide to increase reliability, reduce risks, improve response times and safety, and save money. Clevest Mobile Workforce Management helps utilities of all sizes automate and optimize fieldwork. Working with Esri partners Geotab and SAP, Clevest integrated advanced location technology into the solution and developed an add-on component that streamlines work order management.



ETI Software Solutions | etisoftware.com

ETI Software Solutions is driving systems of engagement in telecommunications by equipping providers with solutions and services to manage complex systems more efficiently, reduce operating costs, and ensure optimal quality of service. ETI's Beamfly, a real-time geospatial dashboard that employs ArcGIS Dashboards and ArcGIS GeoEvent Server, helps providers deliver quality service throughout the customer life cycle.

Leveraging Esri Technology in Unique and Innovative Ways

Earthcube | earthcube.eu

Combining state-of-the-art techniques in both computer vision and machine learning, **Earthcube**'s solutions enable users to monitor wide areas and places that are difficult to capture by automatically detecting, segmenting, and classifying objects of interest. Earthcube integrates artificial intelligence (AI) with multiple data sources, such as very high-resolution (VHR) satellite imagery, proprietary algorithms, and geospatial analysis, via the ArcGIS platform.

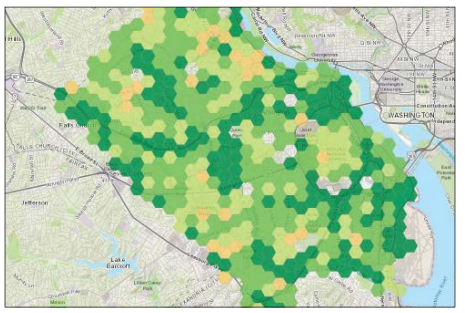
UDC | udcus.com

UDC delivers system implementation services and operational solutions to gas and electric utilities in the United States and Canada. Its High-Fidelity Export Import Data Exchange (HEIDE) tool helps users with ArcGIS Utility Network migration. UDC's Gas Outage Management System (OMS) solution, which is based on ArcGIS Enterprise and started as a project with the Northeast Gas Association (NGA), automates gas outage and restoration processes.

Ensuring Customer Success Through a Comprehensive Suite of Services

GeoMarvel | geomarvel.com

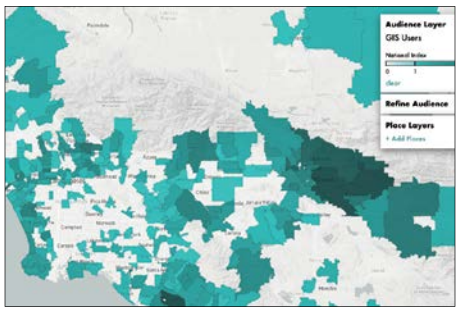
GeoMarvel empowers users with cloud computing, systems implementation, data analysis, mobile and interactive web apps, and technical consulting services. In partnership with Earth Day Network, GeoMarvel released the Earth Challenge 2020 mobile app—built with ArcGIS AppStudio, ArcGIS Hub, and ArcGIS Online—which enables people around the world to collect data to help mitigate threats to environmental and human health.



ArcGIS Marketplace

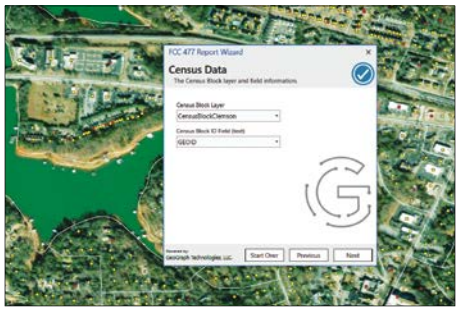
Dstillery | dstillery.com

Dstillery helps organizations maximize customer data using custom AI models. The Esri partner combines web browser and location data to deliver fresh and accurate results that identify certain behaviors in a given geography. To gain more in-depth intelligence, users can combine these insights with other audience data and apply it to market segmentation projects. Dstillery's census block group and tract datasets are on the ArcGIS Marketplace.



GeoGraph | geograph.tech

GeoGraph helps clients predict, understand, and resolve challenges in managing fiber, copper, and coaxial networks. The company's CrescentLink Network Manager solution for ArcGIS makes it easier for telecommunications companies to manage equipment. And FourSevens, an ArcGIS Pro add-in available on the ArcGIS Marketplace, has a wizard that helps companies remain compliant with Federal Communications Commission reporting requirements.



Web GIS Transformation

Larson Design Group | larsondesigngroup.com

Among its offerings, Larson Design Group (LDG) supports smart community initiatives. For the Beaver County Regional Council of Governments (BCR-COG), which represents 43 municipalities in Pennsylvania, LDG developed The Citizen Report app, an extension to BCR-COG's ArcGIS Enterprise software-based Citizen Problem Reporter solution. Residents and visitors submit data through the app to help municipalities identify where and when concerns need to be addressed.

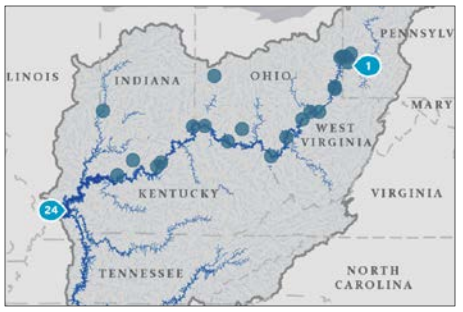
Pro-West | prowestgis.com

Pro-West provides GIS consulting services, solution and app development, and ArcGIS implementations to a range of government and private sector customers. When Renville County, Minnesota, began its smart community transformation—which involved modernizing its land management system—Pro-West built on the county's substantial gallery of ArcGIS Online solutions and implemented ArcGIS Hub, ArcGIS Pro, and ArcGIS Parcel Fabric.

Telling Stories That Resonate Using ArcGIS StoryMaps

Blue Raster | blueraster.com

Blue Raster partners with organizations around the world to help them tell stories using interactive mapping technology. It recently collaborated with the National Geographic Society, the Lenfest Institute, and nonprofit media organizations on "Good River: Stories of the Ohio," which profiles the Ohio River watershed. Blue Raster developed maps for the project and used ArcGIS Pro and ArcGIS StoryMaps to produce an interactive tour of the river.



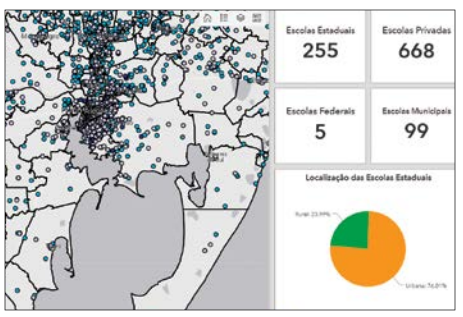
Royal HaskoningDHV | royalhaskoningdhv.com

Royal HaskoningDHV's team of 6,000 people delivers engineering and project management consulting to customers in more than 140 countries in the fields of aviation, building, energy, industry, infrastructure, maritime, mining, transport, urban and rural development, and water. Its iReport tool provides an innovative way to access digital maps, data, reports, images, and animations for projects using ArcGIS StoryMaps. The solution offers transparency and drives stakeholder engagement.

Achieving Financial Success

Codex Remote | codexremote.com.br

Recently, Codex Remote worked with the Brazilian state of Rio Grande do Sul and its spatial data infrastructure, known as IEDE/RS, to develop a geospatial data repository composed of ArcGIS Enterprise, ArcGIS Online, and ArcGIS Pro. The project, which supports economic and social development, included implementing a geodatabase and geoservices; thematic symbology; Open Geospatial Consortium, Inc. (OGC), standards configuration; metadata; and Web GIS apps.



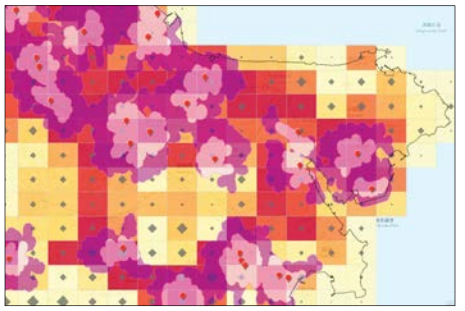
Bringing New or Existing Customers to the ArcGIS Platform

arx iT | arxit.com

The team at arx iT delivers spatial data services, engineering, web mapping, mobile apps, custom solutions, training, and consulting for customers in a variety of markets. arx iT's geoIoT offering increases user access to geographic data; addresses smart city initiatives; and helps businesses, municipalities, and individuals make better-informed decisions. With arx iT's real-time monitoring solutions, Geneva, Switzerland, keeps track of traffic trends and improves management of public parking terminals.

Fujitsu | fujitsu.com

Fujitsu's team of approximately 132,000 employees provides a wide range of solutions in the enterprise GIS field for customers in more than 100 countries. Supported by a strong customer base in the public, retail, finance, transportation, defense, manufacturing, and education industries, Fujitsu works with cutting-edge technologies such as AI, the Internet of Things (IoT), and 5G to help its clients pursue digital transformation.



HDR | hdrinc.com

HDR's scientists, economists, builders, analysts, and artists specialize in providing engineering, architecture, environmental, and construction services. By helping its federal, transportation, and utility clients employ the ArcGIS platform, HDR enables them to build intelligent enterprises. HDR participates in the Esri Partner Network's ArcGIS Online and Utility Network Management specialties, and it was the first company to implement ArcGIS Utility Network for a water utility in the United States.

Esri partners represent a rich ecosystem of organizations around the world that work together to amplify *The Science of Where* by extending the ArcGIS platform and implementing it in distinct ways to solve specific problems. Search for and discover partners, solutions, and services that meet your needs at **esri.com/partners**.

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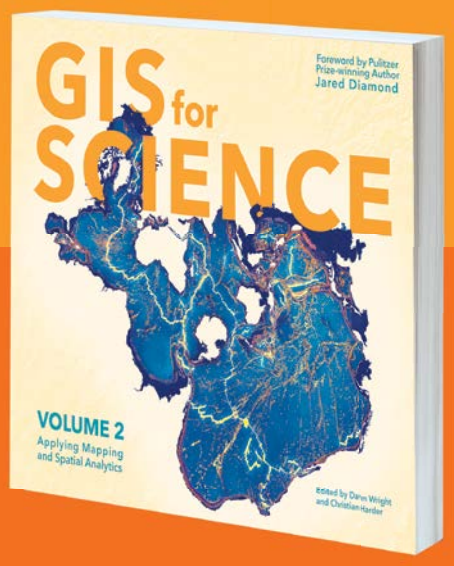

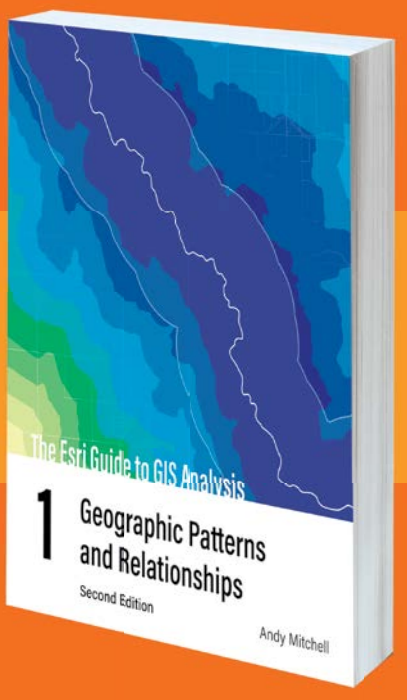

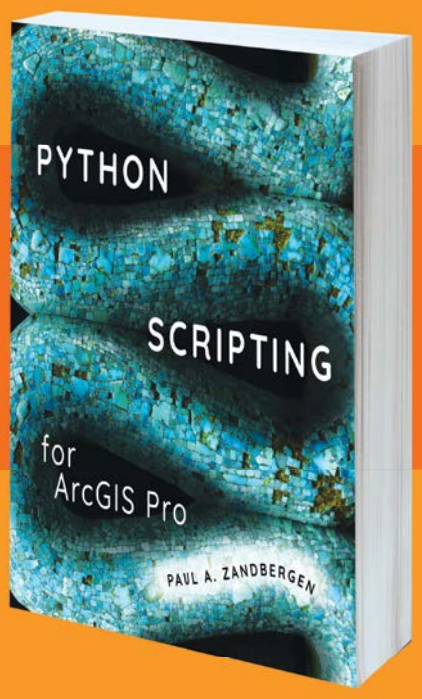

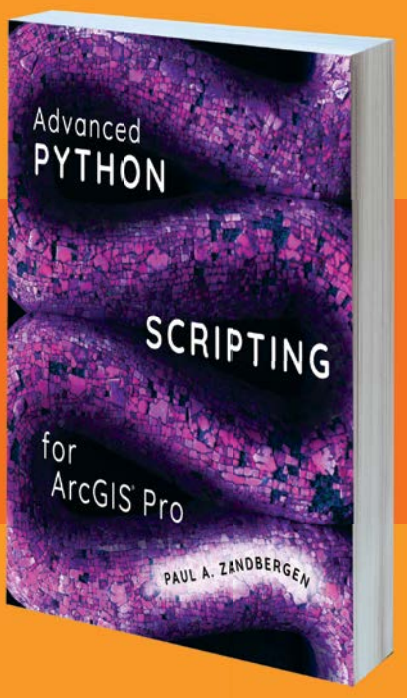

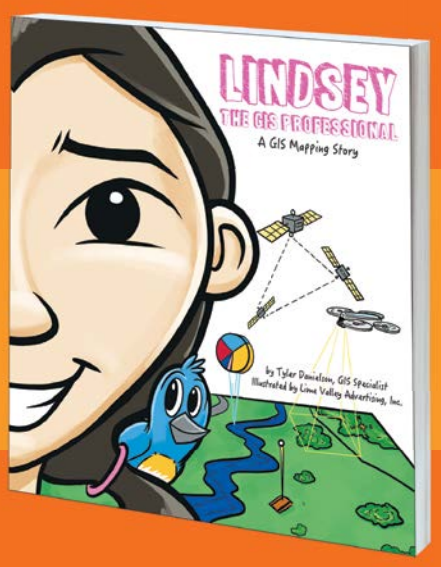

GIS for Science, Volume 2: Applying Mapping and Spatial Analytics

Edited by Dawn J. Wright and Christian Harder

GIS for Science, Volume 2: *Applying Mapping and Spatial Analytics* brings to life a continuing collection of current, real-world examples of scientists using GIS and spatial data to expand our understanding of the world. Coedited by Esri chief scientist Dawn Wright and Esri technology writer and information designer Christian Harder, with a foreword by Pulitzer Prize winner Jared Diamond, *GIS for Science*, Volume 2, is part of a global effort to find ways to sustain all life on this planet. The book's contributors represent a cross section of scientists who employ data gathered from satellites, aircraft, ships, drones, and myriad other remote-sensing and on-site technologies. This collated data is brought to life by GIS and the broader realm of spatial data science to study issues including epidemiology; sustainable precision agriculture; geologic processes that occur below the surface of the earth; disaster response, recovery, resilience, and reporting; and air quality monitoring. These stories also show, in very practical terms, how ArcGIS software and the ArcGIS Online cloud-based system work as a comprehensive geospatial platform to support research, collaboration, spatial analysis, and science communication across many settings and communities. A supplementary website, gisforscience.com, includes actual data along with additional maps, videos, web apps, story maps, workflows, and snippets of computer code for readers who want to learn more. September/October 2020, 250 pp. E-book ISBN: 9781589485884 and paperback ISBN: 9781589485877.

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/May 2020, 312 pp. E-book ISBN: 9781589485808 and paperback ISBN: 9781589485792.

Python Scripting for ArcGIS Pro

By Paul A. Zandbergen

Python Scripting for ArcGIS Pro is the definitive, easy-to-follow guide to writing Python code with spatial data in ArcGIS Pro—and is beneficial whether you're new to programming or not. The book starts with the fundamentals of Python programming and then dives into how to write useful Python scripts that work with spatial data in ArcGIS Pro. Readers learn how to execute the tools in Python, describe data, and manipulate and create data in addition to a number of more specialized tasks. Helpful points to remember, key terms, and review questions are included at the end of each chapter to reinforce readers' understanding of Python, and corresponding data and exercises are available online. Learn the versatility of Python coding and increase your productivity in ArcGIS Pro with *Python Scripting for ArcGIS Pro*. July 2020, 420 pp. E-book ISBN: 9781589485006 and paperback ISBN: 9781589484993.

Advanced Python Scripting for ArcGIS Pro

By Paul A. Zandbergen

Building on *Python Scripting for ArcGIS Pro, Advanced Python Scripting for ArcGIS Pro* teaches experienced developers how to create geoprocessing tools out of their scripts, automate tasks in ArcGIS Pro, share tools with others, and grasp several other specialized tasks. Some of the essential subjects that author Paul A. Zandbergen covers include writing specialized scripts using ArcPy, creating Python script tools, writing Python toolboxes, managing Python packages and environments, creating custom functions and classes, and migrating scripts and tools from ArcGIS Desktop to ArcGIS Pro. Each chapter ends with review questions, key terms, and helpful points to remember to reinforce readers' understanding of Python. Companion data and exercises are available online. July 2020, 290 pp. E-book ISBN: 9781589486195 and paperback ISBN: 9781589486188.

Lindsey the GIS Professional

By Tyler Danielson

The first in a science, technology, engineering, art, and math (STEAM) career-themed picture book series, *Lindsey the GIS Professional* describes what GIS is, what information is needed to make a map, and how to collect that information. Lindsey then shows readers how to take all that and create a map of her favorite park. This book, for grades 1–5, is perfect for encouraging spatial thinking! It includes a glossary. May 2020, 24 pp. Paperback ISBN: 9781589486126.

Getting to Know Web GIS, Fourth Edition

By Pinde Fu

In the fourth edition of *Getting to Know Web GIS*, readers build state-of-the-art skills that they can use to create compelling, useful, and fun Web GIS apps—no programming experience required. Author Pinde Fu features the latest advances in Esri's Web GIS platform, from what's new in ArcGIS Online, ArcGIS Enterprise, and ArcGIS Web AppBuilder to new products including ArcGIS Experience Builder, ArcGIS Indoors, and ArcGIS QuickCapture. Each chapter employs a holistic approach to teaching the Esri Geospatial Cloud and has a good balance of big-picture principles and hands-on exercises, plus a list of resources for more information. *Getting to Know Web GIS*, Fourth Edition, is ideal for classroom lab work and on-the-job training for GIS students, instructors, analysts, managers, web developers, and other professionals. June/July 2020, 490 pp. E-book ISBN: 9781589485938 and paperback ISBN: 9781589485921.

GIS Tutorial 1 for ArcGIS Pro: A Platform Workbook

By Wilpen L. Gorr and Kristen S. Kurland

Updated for ArcGIS Pro 2.4, *GIS Tutorial 1 for ArcGIS Pro: A Platform Workbook* is an introductory text for learning ArcGIS Pro, the premier professional desktop GIS app. In-depth exercises that employ ArcGIS Pro, ArcGIS Online, and other ArcGIS apps show readers how to make maps, create and analyze spatial data, and manage systems with GIS. Readers learn to obtain spatial data and build a geodatabase, explore the functionalities of ArcGIS software, understand the elements of map design, analyze spatial data, automate GIS, and design real-world apps. The book, which incorporates detailed exercises, Your Turn sections, and expanded homework assignments, is best suited for learning GIS in a classroom. ArcGIS software is required. Readers can download a free trial at esri.com/arcgis/trial, contact their school or business Esri Educational Site License administrator, or purchase a student or individual license through the Esri Store at esri.com/store. March 2020, 480 pp. E-book ISBN: 9781589485907.

The International Geodesign Collaboration: Changing Geography by Design

Edited by Thomas Fisher, Brian Orland, and Carl Steinitz

The world faces challenges that supersede and ignore national and regional boundaries and cannot be solved by a single individual, nation, science, or profession. Preparing for the outcomes of population growth and rising global temperatures requires multidisciplinary approaches and collaboration among all stakeholders. In *The International Geodesign Collaboration: Changing Geography by Design*, editors Thomas Fisher, Brian Orland, and Carl Steinitz introduce readers to a geodesign approach that enables multiple disciplinary teams to collaborate and design at geographic scale using GIS and design tools that allow them to explore alternative future scenarios. April 2020, 186 pp. E-book ISBN: 9781589485730 and paperback ISBN: 9781589486133.

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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. Currently, all instructor-led courses are taught online in real time and offered in multiple US time zones.

If you are a brand-new ArcGIS user who wants to use maps and apps to enhance your work, a GIS professional who needs to knowledgeably apply the latest ArcGIS tools to maintain accurate land records data, or an administrator at a utility organization, the following courses can help you achieve the results you're after:

- **ArcGIS Online: Essential Workflows:** This one-day, hands-on course is ideal for new members of an ArcGIS Online organization or ArcGIS Enterprise portal website. Participants get to explore web maps and apps and learn how to access, create, and share content that infuses projects with geographic context, additional business intelligence, and visual impact.
- **Working with Parcel Data in ArcGIS Pro:** This course teaches attendees how to maintain accurate, authoritative parcel data using the parcel fabric in ArcGIS Pro. Participants learn a standard workflow for creating a parcel fabric in a file geodatabase, adding parcel data to the fabric, and editing parcels to reflect real-world changes. Familiarity with land records terminology is expected.
- **Configuring Utility Networks in ArcGIS:** In this course, learners discover how to create a utility network in an enterprise geodatabase so they can realistically model their organization's utility assets and complex infrastructure. Attendees apply key workflows to optimize the utility network and support operations. Course exercises can be completed using electric, gas, or water utility data.

Grow Your Professional Skill Set with Esri MOOCs

Massive open online courses (MOOCs) are free and convenient, offering a great way to keep up with 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.

Upcoming courses include the following:

- **Do-It-Yourself Geo Apps:** Over four weeks, attendees get hands-on experience creating beautiful custom web and mobile apps that include powerful geospatial capabilities—and no coding is required. The course runs from July 29 to August 26. Learn more and register at go.esri.com/learn-geo-apps.
- **Going Places with Spatial Analysis:** Esri's original MOOC will be offered again from August 12 to September 23. Join this course to learn how spatial analysis differs from other kinds of data analysis, and work with ArcGIS Online tools to complete real-world analysis workflows. Learn more and register at go.esri.com/going-places-mooc.

Certification

If you're looking to validate your ArcGIS software expertise with an Esri Technical Certification but are unable to travel to a testing center, you'll be interested to know that Esri's testing partner, Pearson VUE, offers exam testing online through its secure OnVUE delivery method. With OnVUE, individuals can take an exam from the comfort and convenience of their own work spaces while being monitored by an off-site proctor.

Taking a certification exam using OnVUE just requires three simple steps:

1. Run a system test.
2. Schedule an exam appointment.
3. On exam day, log in and take the exam.

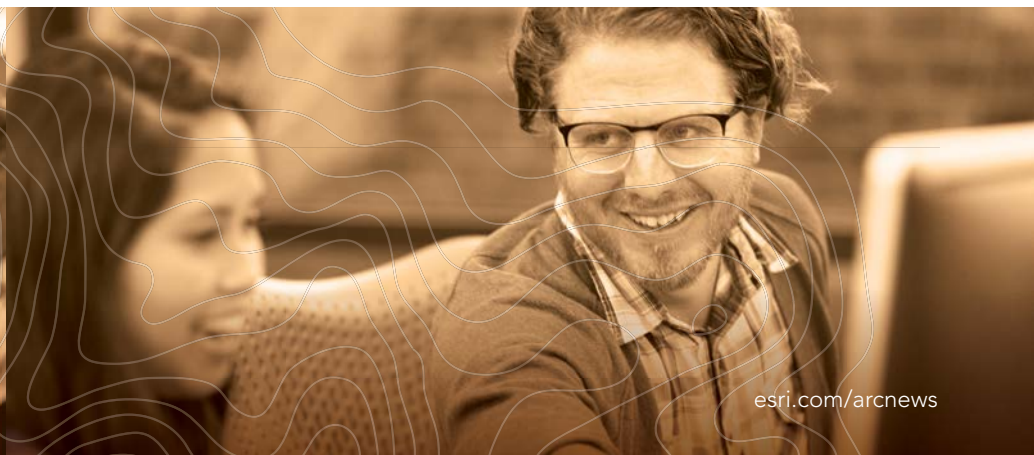
To view system requirements, visit pearsonvue.com/onvue.

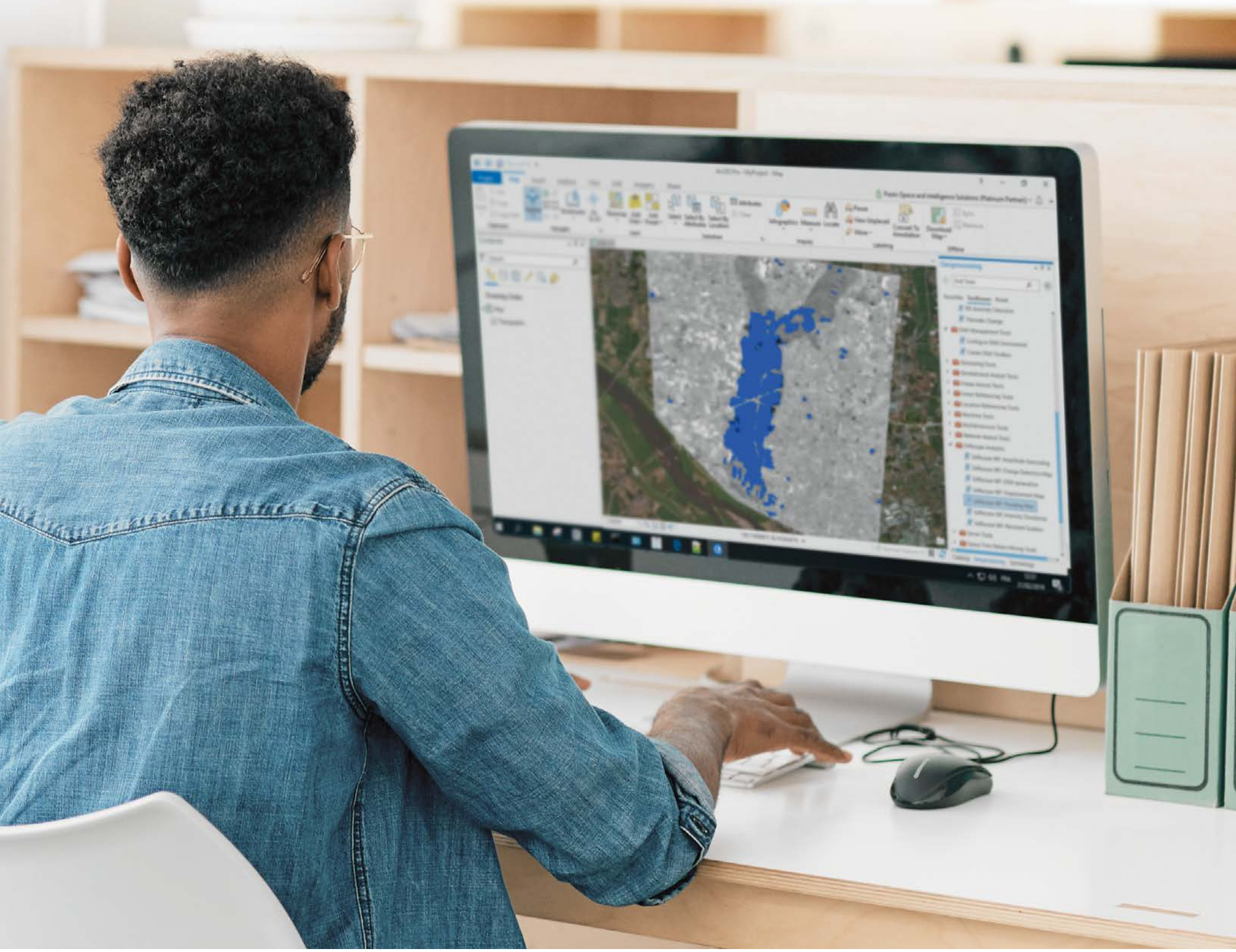
Esri is planning to release a new specialty exam in September. Like the current ArcGIS API for JavaScript and ArcGIS API for Python specialties, the new ArcGIS Utility Network specialty is designed to validate knowledge and skills on a focused topic. Those who want to earn this (or any) specialty certification must have previously earned a core Esri Technical Certification at version 10.3 or higher.

To explore the latest Esri Technical Certification exams, visit 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.

Looking for inspiration for your GIS journey? View all certification success stories at go.esri.com/certification-success.

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.





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