ArcNews

Briefly Noted

Agreement Makes NASA Data More Widely Available

Esri signed a Space Act Agreement with the National Aeronautics and Space Administration (NASA) to give the broader GIS community greater access to NASA's geospatial content. New datasets from nearly 100 spaceborne sensors that measure atmospheric health, land-based phenomena, and characteristics of the oceans are getting added to ArcGIS Living Atlas of the World. The agreement makes NASA data increasingly available to more than 10 million GIS users in ArcGIS and Open Geospatial Consortium, Inc. (OGC)-based formats.

Esri Joins Effort to Share Interoperable Open Map Data

To help build interoperable open map data, Esri joined the Overture Maps Foundation, a collaboration founded by Amazon Web Services (AWS), Meta, Microsoft, and TomTom that aims to give geospatial developers and professionals access to reliable map data under an open data license. Esri will help curate data from its well-established Community Maps Program that contributors have chosen to share as open data and will make Overture data available through its ArcGIS software and other services.

New Web App for Detecting Changes in Land

The new Sentinel-2 Land Cover Explorer, available in ArcGIS Living Atlas of the World, is a dynamic, ready-to-use web app of Esri's high-resolution global land-cover map. Derived from European Space Agency (ESA) Sentinel-2 satellite imagery, the app makes it easier for decision-makers to detect and report changes in land cover and use. Try it at livingatlas.arcgis.com/landcoverexplorer.

Washington, DC, Pursues Equity and Transparency in Vision Zero Campaign

Washington, DC, mayor Muriel Bowser adopted the Vision Zero initiative in 2015 to transform transportation safety and work toward the goal of having zero traffic-related fatalities or serious injuries on the city's streets. The program is founded on developing data-driven approaches to street design, operations, and maintenance; increasing targeted education campaigns about why traffic injuries and fatalities happen; boosting targeted enforcement of traffic laws; and improving post-crash care.

In 2022, Bowser and her team updated Washington, DC's Vision Zero initiative to ensure that it prioritizes policies and projects that promote greater equity in decision-making. The revised strategy seeks to provide the most extensive benefits to neighborhoods with streets that have experienced historic disinvestment and contain high numbers of vulnerable populations, such as people who walk or use mobility devices.

This program modernization effort included building a new Vision Zero DC website. Working with Esri partner SymGEO, a Maryland-based GIS company specializing in ArcGIS Hub, ArcGIS Online, and state and local government solutions, the Vision Zero team at the District Department of Transportation (DDOT) used ArcGIS Hub to create a consolidated home for information on current and upcoming traffic safety projects. The site includes dashboards and maps that provide an interactive user experience and display information, such as detailed crash and road improvement project statics and crash locations, overlaid on demographic data. The hub site, available at visionzero.dc.gov, also serves as a robust educational tool for promoting safe traveling behaviors.

"The new Vision Zero DC website will help us work closely with community members to identify problems and build solutions," said DDOT Vision
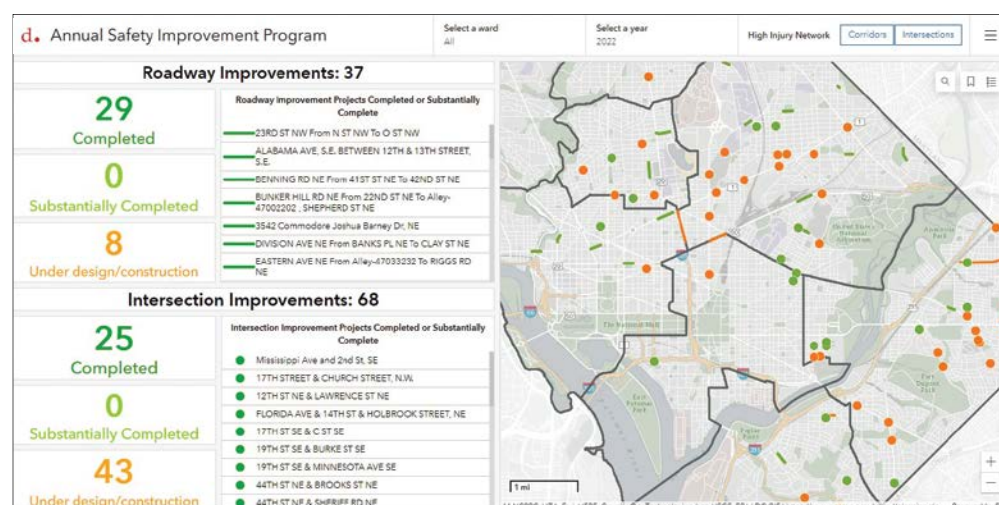
↑ The tables and map in the Annual Safety Improvement Program dashboard show the roadway and intersection improvements the city has made.

Women in GIS Fosters a Vibrant, Welcoming Community for Everyone

When Danielle Bram got her start in GIS about 20 years ago, she felt a little isolated.

"Part of that was just because I was new to the field, but GIS was also very male dominated at the time," recalled Bram, who is now the director of the Center for Geospatial Science and Technology at California State University, Northridge.

She remembers sitting alone at lunch at her first Esri User Conference (Esri UC), not knowing anyone and not knowing what to do about it.
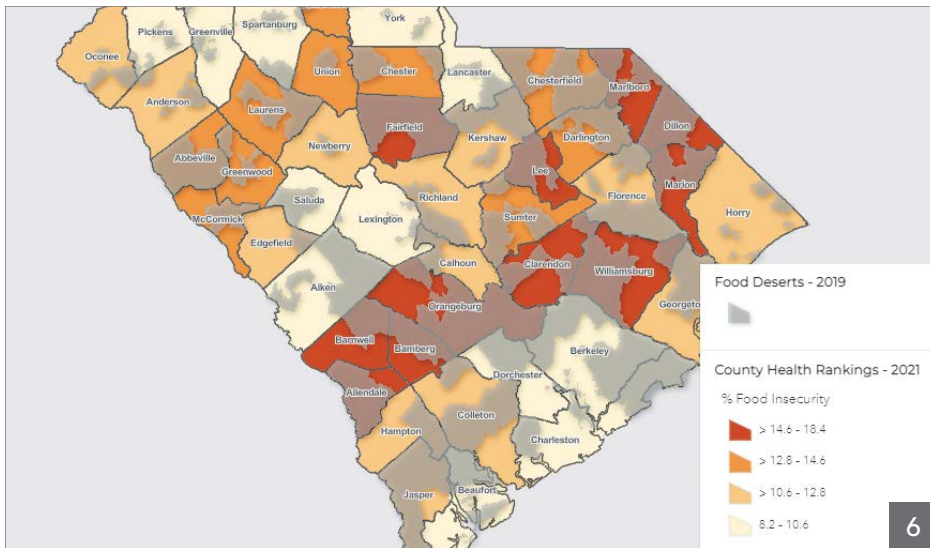
"I even felt intimidated by some of the groups that hosted open meetings at the conference," Bram said.

It's one of the reasons she eventually cofounded Women in GIS, an international professional organization and social advocacy group for women and their allies that seeks to foster unity among women in GIS and anyone else who feels that they could benefit from a vibrant, active, and welcoming community. The organization serves as a safe place for women and others from all geospatial fields to work together to overcome common barriers, such as job discrimination, professional isolation, and lower pay. Through workshops, regular Communities of Practice meetings, formal and informal gatherings at conferences, and more, members of Women in GIS develop meaningful and lasting relationships and share valuable resources to help one another succeed.

"We create spaces where there's no judgment and people feel comfortable talking," said Eva Reid, senior IT data manager for DC Health, who also serves as chair for the Women in GIS Outreach

Women in GIS members gather at conferences, such as the 2023 Esri Federal GIS Conference, where outreach committee lead Eva Reid (second from left) met with other women geospatial practitioners.

Arc**News**

To help address the needs of vulnerable children, researchers at the University of South Carolina's Institute for Families in Society used ArcGIS Hub to create a site that allows visitors to explore interactive web maps that show communities' social determinants of health. These geospatial visualizations of data on poverty, childcare deserts, and access to health care can be used to create strategic plans to support young children at risk of facing developmental challenges.
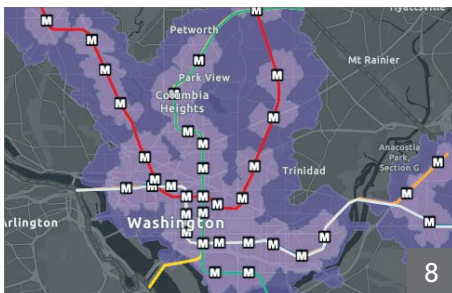
Table of Contents

Cloud-Native GIS, Ready for Your Enterprise

Many organizations are making the transition to cloud-native computing. According to the Linux Foundation, an open-source technology hub, this means that "managing containerized applications at scale is the order of the day (or soon will be)."

Containerization simplifies software management by packaging an app's code together with the files and libraries it needs to run. Kubernetes is an open-source system that automatically deploys, scales, and manages containerized apps. It ensures that containerized software is highly available—that is, it can operate continuously at a high level, without intervention, for a given period—and resilient, meaning it can recover from system failure. A Kubernetes deployment system decreases downtime for users during updates and disruptions and makes it easier to run software at scale.

Deploying ArcGIS Enterprise on Kubernetes allows organizations to easily add users and new deployments to their enterprise systems and share data among them all. It also handles unpredictable demand well. And now, ArcGIS Enterprise on Kubernetes is available to anyone who's interested in cloud-native GIS, with or without an enterprise agreement.

Consistent Performance and Hassle-Free Upgrades

Every time an organization's software experiences an outage due to increased demand or the need to do updates, the costs to business and productivity can be staggering. A one-hour outage of Amazon in 2021 cost the company an estimated $34 million in sales, according to a report from *The Independent*. A six- to seven-hour outage of Facebook and its subsidiaries in the same year cost the company nearly $100 million, according to *Fortune*. And the effects of outages extend far beyond revenue loss. Employee productivity goes down and, in some cases, customers lose trust in a brand.

Kubernetes can keep a deployment stable. When an organization's apps or software are hit by an unpredictable rise in demand, Kubernetes can load balance and distribute network traffic. This cuts down on the amount of hardware an organization needs to install and prevents unnecessary spending. Plus, Kubernetes is a self-healing system that keeps services running while fixing failures. So end users don't get disrupted, and administrators don't need to intervene.

Since Kubernetes is architected with containers, deploying ArcGIS Enterprise in a Kubernetes environment is fast. Whereas it can take days or weeks to set up an enterprise deployment on physical machines (depending on the size and needs of an organization), with Kubernetes it can take less than an hour. Kubernetes also makes it quicker and easier to perform upgrades. It generally requires less than an hour to upgrade ArcGIS Enterprise on Kubernetes so that it's running the latest version. In fact, one user reported that it took just 20 minutes to upgrade their organization's ArcGIS Enterprise on Kubernetes deployment.

Cost-Effective Enterprise GIS, Even as Demand Grows

Esri recently released a new subscription pricing model for ArcGIS Enterprise on Kubernetes that allows organizations to simplify licensing and avoid having to forecast demand to estimate future licensing costs in advance.

For organizations that already use ArcGIS Enterprise on Windows and Linux and are considering moving to a cloud-native deployment, it is typical to continue hosting ArcGIS Enterprise on physical servers while adding an ArcGIS Enterprise on Kubernetes subscription. This enables these organizations to keep their existing infrastructure as they deploy parts of their system onto a managed Kubernetes service on Amazon Web Services (AWS), Microsoft Azure, Google Cloud, or Red Hat OpenShift. As these organizations transfer more of their data and systems to a cloud-native environment, they can reduce their usage of Windows and Linux.

Esri account managers can help individual organizations evaluate how best to deploy ArcGIS Enterprise on Kubernetes in their current environments in a way that supports their IT modernization strategies.

Faster Insight and Better GIS Experiences

Working with Kubernetes impacts many areas of business, from the IT and GIS departments to anyone who uses GIS data. Early adopters of ArcGIS Enterprise on Kubernetes are seeing significant improvements in system performance. They can provide geospatial insight to stakeholders more quickly than before and deliver better GIS experiences to their users.

Esri partner Managed Business Solutions, LLC (MBS), for example, tested ArcGIS Enterprise for Kubernetes as a potential deployment environment for one of its federal government customers and found that, using a map service that contained more than 26 million records, the system processed an impressive 38,000 requests in less than three minutes. In a proof-of-concept article published about the trial, MBS's GIS team said that "MBS, the client, and Esri were extremely impressed with the performance results… when compared to a traditional environment. ArcGIS Enterprise on Kubernetes…deserves strong consideration when architecting high-load GIS systems."

To learn more about ArcGIS Enterprise on Kubernetes, visit go.esri.com/learnK8s. For specifics on pricing and setup, current Esri users should contact their account managers.

Giving Geospatial Context to Videos and Imagery Improves Situational Awareness

When disaster response agencies, local and state governments, and utility companies support humanitarian and disaster relief efforts, it is critical that they assess the damage in affected areas rapidly while helping reduce risks to life and property. Aerial, drone, and satellite imagery play an important role in aiding analysts who remotely inspect disaster areas.

ArcGIS Excalibur, a web-based imagery analysis app, provides easy-to-use tools and workflows that enable analysts to conduct inspections and assess infrastructure remotely. Later this year, Esri will release ArcGIS Video Server, which will integrate with Excalibur and allow users to index, search, publish, and stream video services with geospatial and temporal context to improve situational awareness.

Critical Tools for Disaster Response

In disaster situations that change quickly and require urgent action, decision-makers and responders rely on analysts to help them understand problems, develop recovery strategies, facilitate search-and-rescue efforts, identify hazards, and document damages. To gather, analyze, and report this information, analysts often use web-based software to look for and access relevant images and videos. With these, they can compare before-and-after scenes, provide geographic context, note changes in objects, record observations, and share the results with their planning teams via reports.

Agencies use the reports generated by analysts to prioritize recovery efforts, document damages to infrastructure, detect cascading impacts, and design future hazard mitigation projects. For example, analysts can use imagery from a previous hurricane to identify areas that are prone to specific hazards, such as repeat flooding, to help decision-makers come up with hazard mitigation projects. Additionally, imagery from previous storms can inform how resources are distributed during current disasters and in anticipation of future natural hazards.

To help organizations quickly and efficiently plan and strategize during disaster response operations, ArcGIS Excalibur makes imagery the main data source. It supports a variety of image services and gives users access to imagery online, via web services, rather than making them available only locally on desktop machines.

ArcGIS Video Server will make it easier for organizations that collect large amounts of video content via drones, security cameras, and sensors to seamlessly integrate this video with all their other data. Video is simply treated as another spatial data source. Playing a server role in ArcGIS Enterprise, Video Server will allow users to create, consume, and view web-enabled video layers in Excalibur and other ArcGIS apps.

Using Excalibur with Video Server, staff working on disaster relief efforts will be able to access and share archival and live video of impacted areas over the web. From there, they can mark the videos up with their observations, such as missing or moved vehicles, damaged facilities, dams blocked by debris, and fallen power lines. With this intelligence, teams can better plan their emergency operations so that they target areas where search and rescue, debris removal, and utility service restoration are likely to be most effective.

In Excalibur, analysts can also add their observations from the videos to after-action reports and corresponding dashboards to provide stakeholders with timely updates of the current situation. For instance, during the after-action process for a wildfire, when staff from fire departments, government agencies, and disaster relief organizations are appraising how the response went, analysts can extract telemetry data from videos and map it to generate geographic insight about how long it took to respond to certain areas; the total extent of the fire; and where new hazards might present themselves, such as in areas with burn scars. Using Excalibur, analysts can easily measure and count objects in videos and images, conduct visual change detection, and export screenshots to share critical information quickly.

The Key Features of Video Server in Excalibur

Once Excalibur is connected to Video Server, users will be able to access, analyze, and share both imagery and video in Excalibur and extract geospatial information from both kinds of media. Here's how it will work:

Access Imagery over the Web

Analysts can create new image layers in Excalibur by publishing files stored on local machines as web-enabled services—and they will soon be able to do this for videos, too. By making images and videos available on the web, analysts extend searchable access to them to the rest of the organization. Existing image and video layers can be used as the focus layer in the Imagery Exploitation Canvas to allow users to view, inspect, analyze, and collect observations. Providing web-enabled imagery and video as services is an efficient way to see what image and video layers are available for use.

Analyze Imagery and Play Videos

In Excalibur, analysts can view images—and will soon be able to play videos—right next to a map of the area where the media was recorded so that they can get an immediate geographic reference for them. Within the map panel, the Imagery Exploitation Canvas contains tools that analysts can use to mark up, count, or measure objects in the adjacent image or video. The video player will also include a range of controls to do things such as change playback speed, skip forward or go backward, and mute audio.

Organize Projects and Share Analyses

To stay organized, analysts can create a project in Excalibur and use project-specific tools to generate bookmarks, provide instructions to other users, and collect or edit observations in the map focus panel. They can also use the tools in the Imagery Exploitation Canvas to take screenshots, export images, and create reports.

How to Get Started

ArcGIS Excalibur—with its imagery analysis tools that enable remote inspection—is available now for ArcGIS Enterprise users to purchase. The ArcGIS Video Server release this fall will give analysts access to new video analysis tools and adaptive bitrate streaming (which adjusts video quality based on network conditions), that will make it easier to generate timely insight in Excalibur.

To find out more about ArcGIS Excalibur, visit go.esri.com/excalibur. To receive notifications about ArcGIS Video Server and find out when it will be available, sign up for product news at go.esri.com/videoserver.
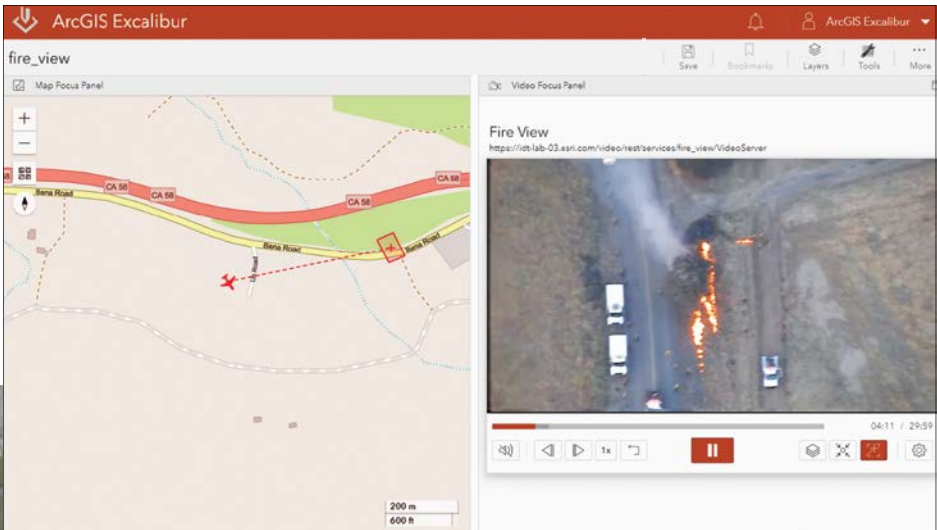
← The map on the left shows where the drone was located when it recorded this video of a fire.

↓ Analysts can mark their observations on videos and imagery, such as where debris is blocking a dam following a storm.

Debris blocking dam

Washington, DC, Pursues Equity and Transparency in Vision Zero Campaign

Zero director Linda Bailey. "SymGEO iterated quickly and efficiently on design ideas and built a very engaging platform solution for DDOT."

A New Focus on Equity in Traffic Safety

Bowser's 2015 Vision Zero initiative started as an all-hands-on-deck approach to traffic safety, with DDOT working closely with community members to identify problems, build solutions, and design streets that are safe for everyone. Since the initiative's inception, more than a dozen of Washington, DC's most dangerous corridors have been made safer by reducing conflicts at 15 high-crash intersections and along segments of major corridors. Safety has also increased in school zones by significantly expanding the District's school crossing guard program.

DDOT's *Vision Zero 2022 Update* focuses on achieving equity in traffic safety and taking a holistic approach to making Washington, DC's transportation system safer.

"We know our efforts must ever evolve by applying lessons learned and data-driven solutions, especially to our most vulnerable street users and populations," said DDOT director Everett Lott. "We also know the burden of traffic violence falls disproportionately across DC, with Wards 7 and 8 hit hardest—and that's why we remain so keenly focused on equity."

The plan fosters collaboration among 30 District agencies, with 5 key agencies deeply involved and the Metropolitan Police Department playing an integral role. It also adopts the national Safe Systems approach, which is based on how an entire interconnected transportation system can become a safer environment for everyone by understanding that humans make mistakes and that human

↑ The Vision Zero DC hub site is a robust educational tool for promoting safe traveling behaviors.

bodies are vulnerable to crash forces. The Safe Systems approach centers on five key elements: safe people, safe streets, safe vehicles, safe speeds, and post-crash care. All these components of Washington, DC's Vision Zero plan are featured prominently on the new hub site.

A Well-Organized, Audience-centric Data Hub

The Vision Zero DC site is organized into easily navigable tabs and subsections based on audience interest. It is also mobile responsive and designed to be broadly accessible.

On the home page, site visitors can learn what Vision Zero is, get tips for safe driving, hear from crash victims, and find out what to do after a traffic crash occurs. The Overview tab contains information on the Safe Systems approach, reports on progress toward reaching the goal of zero traffic crash fatalities, and infographics that show traffic- and crash-related statistics. The 2022 Update tab presents a wealth of information about how the Vision Zero initiative has progressed since 2015, what goals the mayor's office will be pursuing over the coming years, and how the city is going to act on those plans.

The Education tab features educational campaigns that promote safe driving and good pedestrian habits throughout Washington, DC. Via ArcGIS StoryMaps narratives that contain videos, charts, and graphs, this section gives site visitors a poignant look into the human costs of dangerous driving and unsafe behaviors. The Safety Campaigns section gives visitors detailed overviews of the biggest threats to pedestrians, cyclists, and other vulnerable travelers on Washington, DC's roadways—such as aggressive and impaired driving—through statistics and an overview of related laws and penalties.

Looking at the Engineering tab, visitors can see the significant progress that DDOT and the city have made in designing solutions to benefit both vehicular and pedestrian traffic. Part of this is organized in the Safety Treatment Toolbox, which has expandable sections that show the various tools the city is using to protect walkers and bikers, improve visibility, reduce turn conflicts, and much more. The Annual Safety Improvement Program dashboard, located below the toolbox, shows—via tables and a map—the roadway and intersection improvements that have been made throughout the city. Additionally, the DDOT Safety Intervention Dashboard gives site
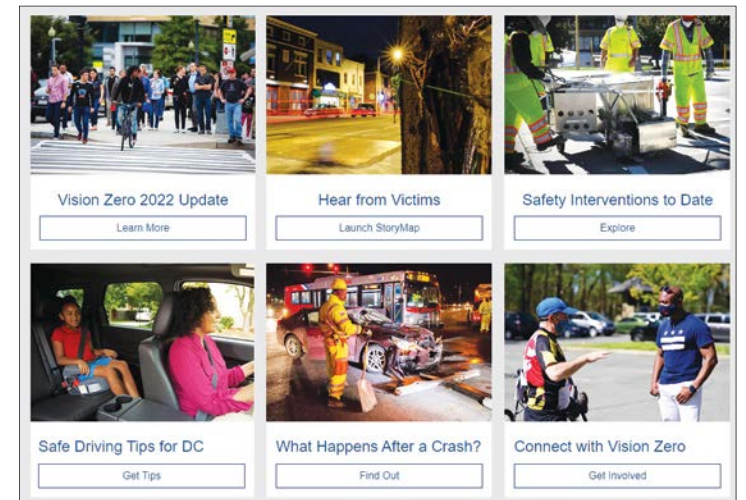

↑ The Vision Zero DC hub site is organized by area of interest.

visitors a visual and interactive map-based view of where DDOT has implemented tools that improve safety, such as bike lanes, new stop signs, and dedicated bus lanes.

The Crash Analysis tab allows people to take a deep dive into the data that's fueling the city's push for zero fatalities on Washington, DC's roadways. A dashboard, organized in an ArcGIS StoryMaps story, shows details on traffic crashes and fatalities and lets users filter the map- and chart-based data by mode of transportation and injury severity. This tab also includes information on what to do after a crash, comparisons of crash data with other major American cities, and crash statistics juxtaposed with demographic data.

Two additional tabs on the site—the Safety Grants tab and the Get Involved tab—give visitors details on safety programs, grants, and helpful publications put out by the DDOT's Highway Safety Office. These sections also encourage site visitors to stay connected to and up-to-date with the city's Vision Zero initiative via social media and by getting involved with other organizations working toward similar goals.

For more information on the Vision Zero DC hub site, email DDOT Vision Zero director Linda Bailey at linda.bailey@dc.gov or SymGEO principal Kevin McMaster at kevin.mcmaster@symgeo.com.
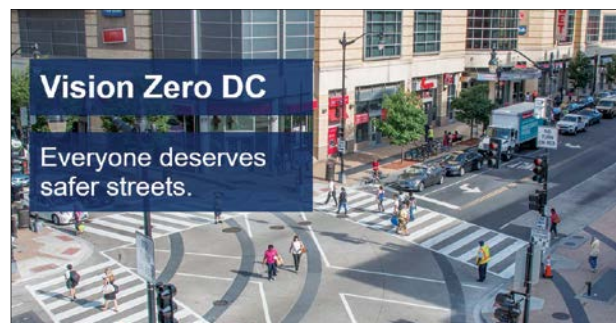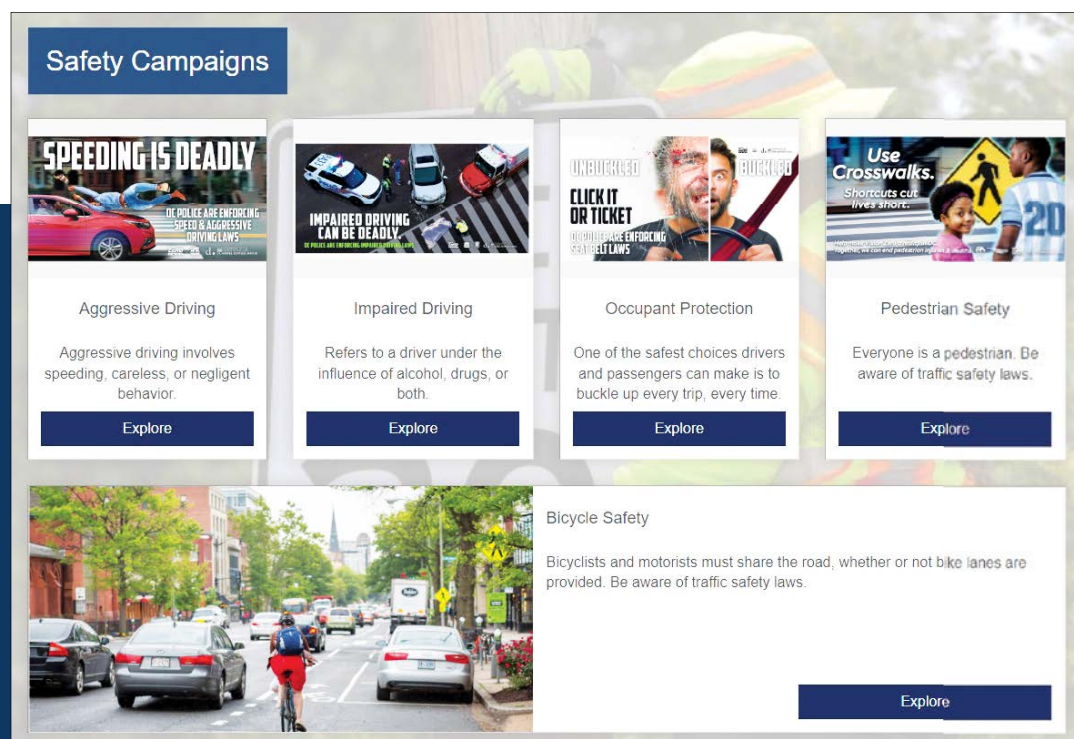
↑ Safety campaigns give detailed overviews of the biggest threats to pedestrians, cyclists, and other vulnerable travelers, such as aggressive and impaired driving.

→ Traffic violence in Washington, DC, is concentrated in certain areas, so viewing a map of crash locations overlaid on demographic data can be informative.
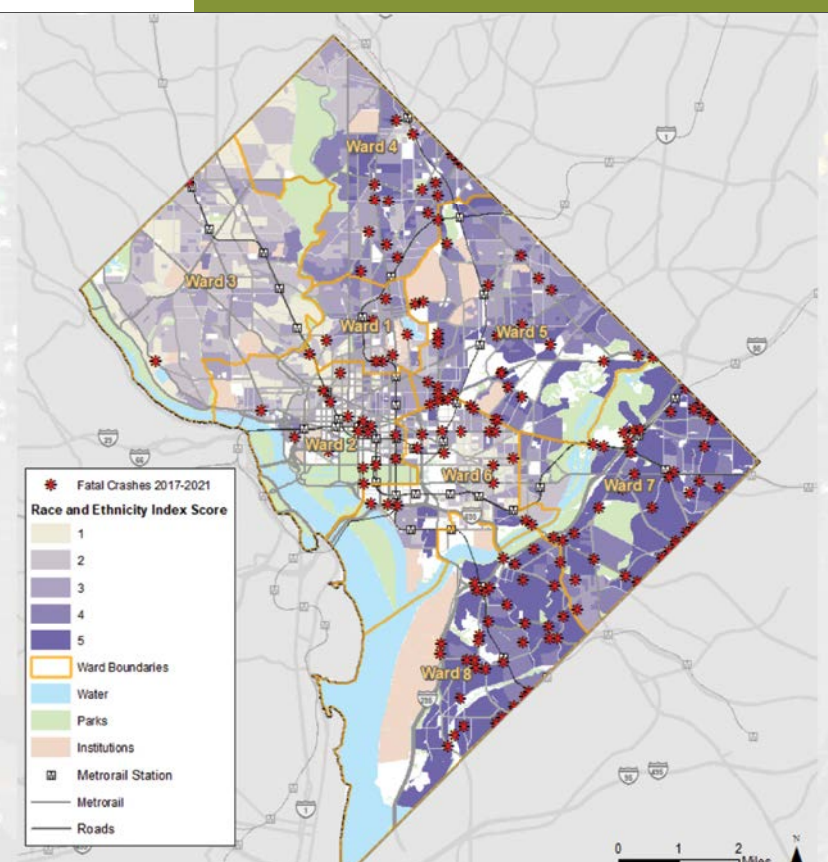
An Information Hub Helps Curtail Developmental Challenges in Children

By Courtney Baskin, Seth Church, Rebecca Wilkerson, Kathy Mayfield-Smith, Dr. Ana Lòpez-De Fede, and Dr. Cheri Shapiro, University of South Carolina Institute for Families in Society

In South Carolina, thousands of children struggle with developmental challenges every day. Addressing these issues early, when intervention can mean the most, starts with forming a clear understanding of the characteristics of the children and families most at risk for negative developmental outcomes.

A critical part of creating strategic plans to support vulnerable children is identifying continuity-of-care options across a community's medical, public health, social services, behavioral health, and educational systems. Gaining this level of understanding requires putting together an integrated, comprehensive picture of a community's known patterns of risk and existing resources.

At the University of South Carolina's Institute for Families in Society (IFS), researchers developed the Geospatial Environmental Scan (GeoEScan) to help people geographically explore South Carolina residents' health characteristics and associated community resources. Although IFS staff members relied on GIS to do their research and present their analyses, the GeoEScan data was presented to non-GIS users in a bundled PDF that allowed them to explore maps and related data.

Recently, the team sought to move away from the PDF bundles and build a solution that would allow visitors to more easily interact with the data. After securing a grant from the Duke Endowment, IFS staff members used ArcGIS Hub to create the Children's Health & Resource Geographic Exploration for Data-Driven Decisions (CHARGED[3]) initiative. Now, site visitors can use interactive web maps to explore and analyze different aspects of communities' social determinants of health—such as poverty, childcare deserts, and access to health care—to help holistically address the needs of South Carolina's children from the time they're born until they reach age five years.

An Engaging, Accessible Geospatial Experience

The IFS team already used ArcGIS Pro and ArcGIS Online to store and process its GIS data, so it was a natural choice to implement ArcGIS Hub as the technology behind CHARGED[3]. It would give people who were already familiar with the bundled PDF a more engaging and accessible geospatial experience.

Employing ArcGIS Hub enabled the team to leverage IFS's existing data; clearly organize and communicate the GeoEScan research; and create a comprehensive, branded web tool that allows users to interact with data in a web mapping experience. What's more, the built-in content library in ArcGIS Hub helped the team easily manage the maps, metadata, and supporting documentation that would eventually be shared with the audience via the hub site.

Once the GIS team had established the CHARGED[3] initiative in ArcGIS Hub, the site-editing capabilities made it easy to create and edit content. They also allowed team members to collaborate seamlessly with IFS's design and graphics team. As development progressed, everyone involved could clearly and quickly solicit and communicate feedback about the site, as well as send updates to other stakeholders.

One of the goals of the CHARGED[3] hub site was to be able to engage with people who use the website to ensure that the resources on it are helpful and usable. The team incorporated an ArcGIS Survey123 smart form into the hub site that lets users provide feedback on the content and usability of the site, as well as suggestions for additional content to feature. Submitted feedback goes directly into ArcGIS, where IFS developers can access and analyze the data. The team also added Google Analytics to the hub site to learn how visitors engage with the site and determine what needs to be improved in future updates.

Maps, Tables, and Metadata in a Single Experience

When visiting CHARGED[3] Hub, users can explore the GeoEScan, see and download a snapshot of children's well-being statistics for South Carolina, get background information on the initiative's framework, and explore more information on contextual factors that can lead to developmental challenges—such as food insecurity and lack of childcare—through text, maps, charts, and ArcGIS StoryMaps stories.

The hub site's GeoEScan section features a data-rich interactive web map that shows the total population of children ages 0–5 years throughout South Carolina and lets users filter the data to have the map focus on particular regions or topics or show specific facilities, such as hospitals and childcare centers. The GeoEScan also exhibits a statewide summary table and extensive metadata, all in a single experience.

When community leaders, policy makers, and other stakeholders use the GeoEScan on CHARGED[3] Hub, they can examine questions such as, Where are children with special needs located in the Midlands communities of South Carolina, and what resources are available to their families? Users can select the basemap that shows the percentage of children under age five years with a disability and zoom in on the Midlands region of the state. Then, they can activate facilities that promote children's development and early interventions to find answers to their questions.

The authoritative data featured on the hub site comes from a variety of sources, including the United States Census Bureau's American Community Survey, local and state agencies such as the South Carolina Department of Health and Environmental Control and the South Carolina Department of Social Services, and national agencies such as the Centers for Disease Control and Prevention and the National Healthy Start Association.

Since IFS announced the August 2021 launch of CHARGED[3] Hub on social media, the site has seen regular traffic from new and returning users. Approximately 270 users per month download information from the hub site, with more exploring the site's content. Additionally, IFS staff members have been invited to present the hub site at various events and introduced the work to agencies that run programs focused on early childhood development.

For more information, visit the IFS website at ifs.sc.edu or email IFS associate director Dr. Ana Lòpez-De Fede at ADEFEDE@mailbox.sc.edu.
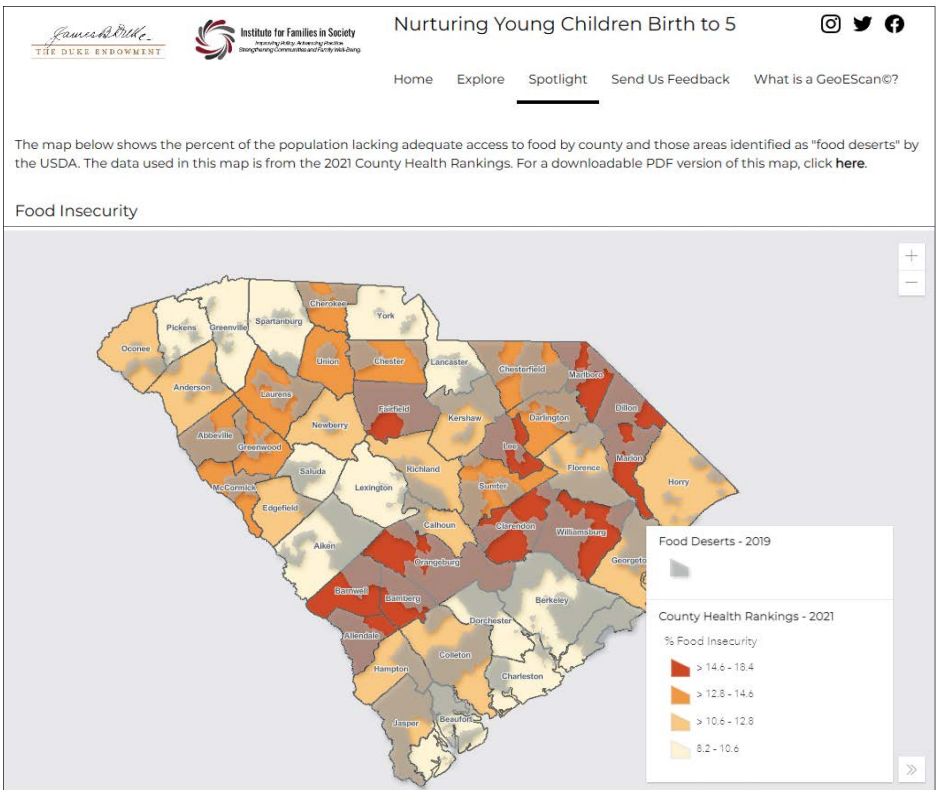
↑ A web map embedded in the site shows where children face food insecurity, as well as areas in South Carolina that are considered food deserts.
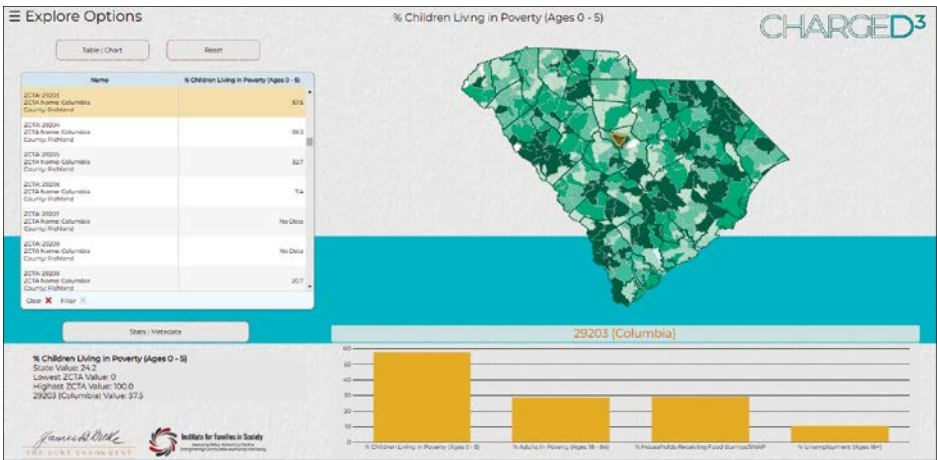
↑ Visitors to CHARGED[3] Hub can explore the Geospatial Environmental Scan (GeoEScan), which shows children's health characteristics alongside community resources on interactive maps, tables, and charts.

About the Authors

Courtney Baskin is a research associate and geospatial web developer for the data science and visualization team at IFS. Seth Church previously worked with the IFS as a web developer on the data science and visualization team. Rebecca Wilkerson, GISP, is a senior research associate and manager of the data science and visualization team at IFS. Kathy Mayfield-Smith is an associate director of IFS. Dr. Ana Lòpez-De Fede is a research professor at the University of South Carolina and an associate director of the IFS. Dr. Cheri Shapiro is the director of IFS.

Taking a Geographic Approach to Sickle Cell Disease Treatment

More than 300,000 babies are born each year with sickle cell disease (SCD), according to the World Health Organization. This inherited disorder causes red blood cells to become hard and sticky and distorts them into a crescent, or sickle, shape. This disrupts their flow through the body's circulatory system. The cells also deteriorate quickly, causing a constant shortage of red blood cells, which carry oxygen from the lungs to the rest of the body.

St. Jude Children's Research Hospital in Memphis, Tennessee, is a pediatric treatment and research facility that focuses on children's catastrophic diseases. It is home to a regional pediatric SCD clinic that provides care for children with the disorder. Because St. Jude is a research institution, patients are involved in both therapeutic and nontherapeutic clinical trials. One of the nontherapeutic trials is the Sickle Cell Clinical Research and Intervention Program (SCCRIP), which follows participants with SCD throughout their lives to better understand clinical outcomes.

Recently, investigators at SCCRIP began to examine the social and environmental characteristics of the communities in which patients live. The analysis allows researchers to determine if there are factors, such as exposure to hazardous materials or the ability (and opportunity) to adhere to specified disease management programs, that may impact SCD treatment outcomes. ArcGIS Pro and several of its geoprocessing tools have been key to deriving location intelligence from the data and developing geospatial models to inform future treatment options.

Understanding Socioenvironmental Factors

Since SCCRIP began at St. Jude in 2014, several other prominent medical facilities have joined the program, expanding the number of patients participating in research initiatives. More than 1,300 participants, representing 92.3 percent of eligible patients, have enrolled in the SCCRIP protocol. The study group lives in the Southeast and Midwest regions of the United States.

"We are investigating the correlation between our SCD patients…and socioenvironmental factors in their respective communities that can affect treatment," said Jason R. Hodges, director of clinical trials management in the Department of Hematology at St. Jude. "Through SCCRIP, we collect medical data in order to help us evaluate health outcomes in SCD patients, as well as identify their risk factors for adverse events. The overarching goal is to determine new ways to screen and treat patients with SCD, which will reduce the burden of their experience and increase their quality of life."

Each year, SCCRIP institutes a data freeze, wherein its data team ceases new data collection and cleans and curates the data it already has. During this process, the team uses ArcGIS Pro to geocode participants' addresses and obtain the census block groups in which they live.

"We then use indices, such as the Centers for Disease Control and Prevention's Social Vulnerability Index and the Economic Hardship Index of those census block groups to understand what types of neighborhoods they live in," Hodges explained. "This helps us determine the impact of the neighborhood environment on their SCD-related outcomes."

In one project, researchers examined how access to food affects rates of acute health-care utilization among children living with SCD. The analysis found that individuals living in census block groups with limited access to better quality food had greater rates of emergency service visits and hospitalizations.

"ArcGIS was also used to analyze how living in a *[census block group]* with a higher level of economic hardship—including crowded housing, poverty, unemployment, low educational attainment, and alcohol or drug dependency—impacts adherence to SCD-related medication," Hodges said. "Our analysis found that participants living in *[census block groups]* with greater hardship had evidence of lower medication adherence as assessed by certain lab biomarkers."

Models Point Toward Tailoring Therapies

Fetal hemoglobin (HbF) is a type of hemoglobin that fetuses growing in the womb have in high levels but that declines when babies reach about six months of age. HbF red blood cells don't form the sickle shape that causes them to get caught in and clog up the body's circulatory system. Thus, SCD patients who have higher levels of HbF in their bodies have more rounded red blood cells in their circulatory systems and tend to experience fewer symptoms, which include severe body pain, leg ulcers, osteonecrosis (the destruction of bone tissue), and acute chest syndrome (a pneumonia-like illness that can be fatal). This is why many SCD patients take hydroxyurea medication. It increases their HbF levels and reduces the impact that sickled cells have on their bodies.

To better understand how patients' social and physical environments affect the levels of HbF in their circulatory systems during hydroxyurea therapy, researchers at SCCRIP used ArcGIS Pro to develop a geospatial model.

"We hypothesized that patients living in neighborhoods reflecting a higher Economic Hardship Index *[EHI]* would have a lower HbF in comparison with those living in places with higher EHI scores," said Hodges.

This would reflect hardships that make it difficult for patients to adhere to taking their hydroxyurea medication.

"The criteria included those with at least one higher-level HbF lab value collected *[who]* had received hydroxyurea treatment," Hodges added.

The study group included SCD patients living in Shelby County, Tennessee, which represents roughly 85 percent of SCCRIPS clinical population. If the study produced interesting results, researchers would explore the hypothesis further.

Using ArcGIS Pro, researchers geocoded participant addresses and aggregated them by census block group. They then used the Cluster and Outlier Analysis, High/Low Clustering, and Hot Spot Analysis geoprocessing tools to identify clusters of patients who had high or low HbF values according to their lab work. Finally, researchers used the Geographically Weighted Regression tool to test explanatory variables for identified HbF clusters, such as patients' ages, the duration of their hydroxyurea therapy, the EHI of their communities, and how far they live from a clinic. The researchers ended up confirming their hypothesis.

"Our findings point toward the importance of tailoring hydroxyurea therapy, including addressing potential barriers to hydroxyurea adherence that include contextual factors, such as the economic hardships observed in an individual's neighborhood," said Hodges.

Future Uses of GIS for SCD Research

As Hodges pointed out, thanks to SCCRIP's participants and their families, investigators have been able to advance SCD research, expand care guidelines, and create better treatment options.

The team has high hopes for continuing to use GIS to analyze how SCD outcomes are affected by patients' socioenvironmental factors. For example, SCCRIP collects location data related to the presence of asthma in its study areas, along with the number of hospitalizations SCD patients experience due to acute chest syndrome.

"I would like to examine how proximity to certain environmental hazards—heavily used roads, distribution centers, and superfund sites—impacts the health and treatment of our patients," said Hodges.
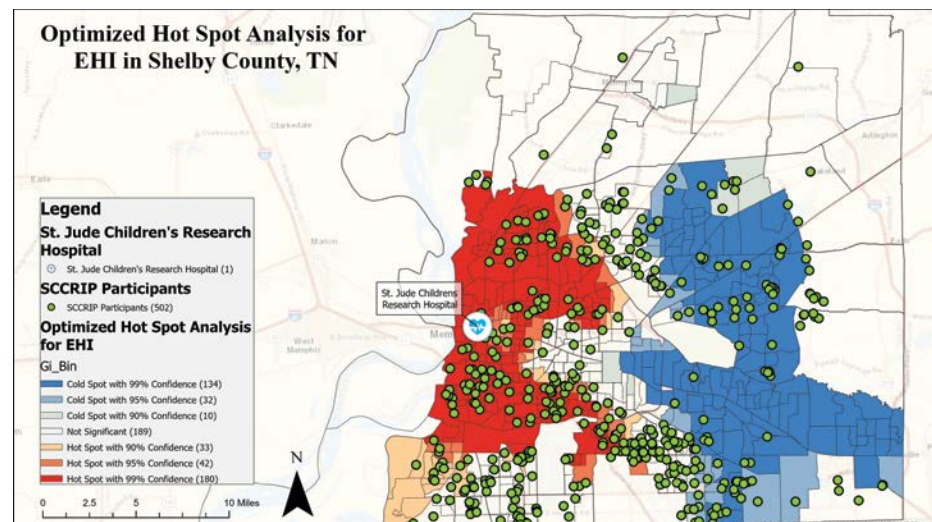
↑ Researchers use indexes, such as the Economic Hardship Index (EHI), to understand factors in sickle cell disease (SCD) patients' social and physical environments that could affect treatment.
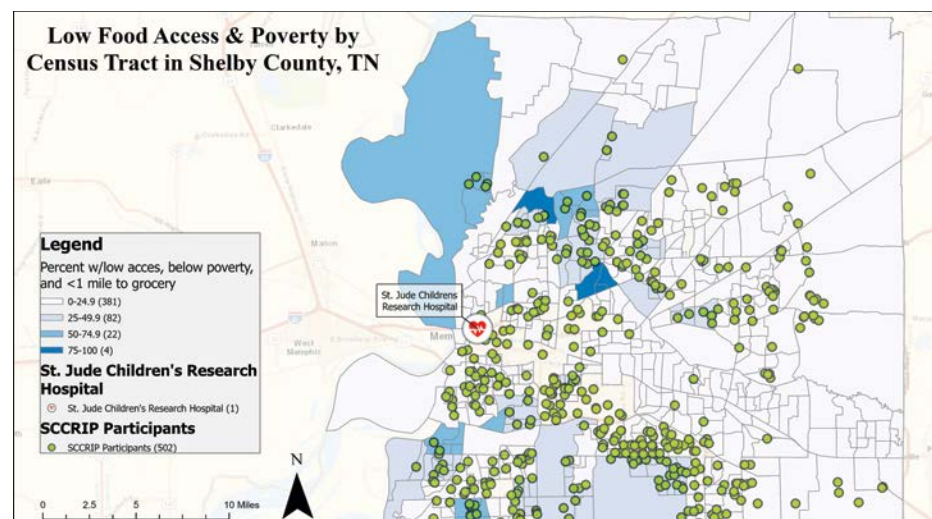
↑ SCD patients who live in areas that lack access to good-quality food have greater rates of emergency room visits and hospitalizations.
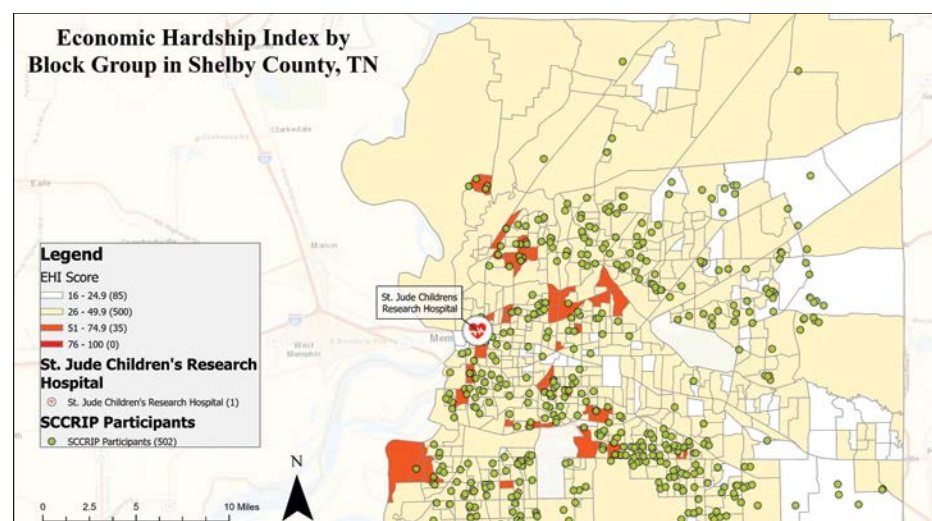
↑ Researchers developed a model to see if patients living in areas with higher EHI scores also had lower levels of fetal hemoglobin (HbF) in their bodies.

Map Viewer in ArcGIS Online Gets New Spatial Analysis Tools

→ A walkshed analysis of Washington, DC, shows communities that are located within a half-mile (light purple) and mile (dark purple) walk of metro stops.

Spatial analysis employs location as a connective thread to help people understand where things are happening, how they are related, and where patterns exist. Putting various data types into geographic context helps people make decisions for today and predict the impacts of those decisions on tomorrow. For users of ArcGIS Online, it is now possible to leverage new feature and raster analysis tools in Map Viewer.

Map Viewer allows ArcGIS Online users to create, visualize, and analyze data. It is designed to be approachable and accessible, making it useful for a wide range of users—from novices to experts, and from those who work independently to people who are part of a large organization. With the right tools and techniques, GIS practitioners of any level and in any field can perform an array of spatial analysis operations, including taking simple measurements, completing complex geoprocessing tasks, and uncovering patterns and relationships in data.

The new spatial analysis tools in Map Viewer can benefit myriad ArcGIS Online users in their daily work. Read on to find out how.

The Differences Between Feature and Raster Analyses

The spatial analysis tools in Map Viewer can be split into two main categories: feature analysis tools and raster analysis tools. The latter is available to users who have the ArcGIS Image for ArcGIS Online user type extension.

Feature analysis focuses on vector data, which represents geographic features expressed as points, lines, and polygons. Doing feature analysis involves examining the spatial relationships among individual features, such as their location, size, shape, and attributes.

Raster analysis, on the other hand, centers on raster data, which represents geographic features as a grid of cells, and each cell has its own value. Performing raster analysis entails examining the spatial relationships between these cells, such as differences in their values and other patterns.

Choosing which kind of analysis to perform depends on the problem that needs to be solved and the type of data that's available. Whether employing feature or raster data, Map Viewer enables users to analyze the data and visualize the results. Additionally, while each form of analysis is powerful on its own, integrating multiple tools in a single workflow in Map Viewer offers the greatest impact.

A Roundup of Key New Analysis Tools in Map Viewer

A broad array of spatial analysis tools is available in Map Viewer now, with more to come. Check out what a few of them do and get an idea of how to use them.
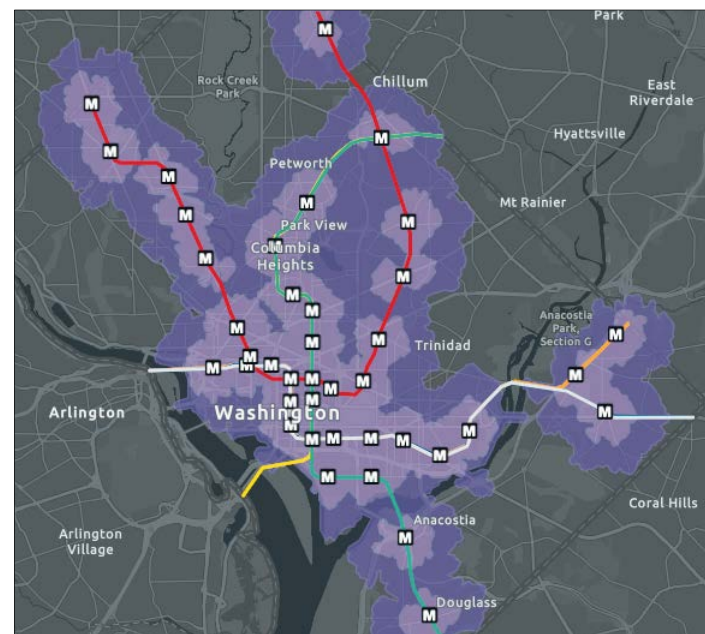
Generate Travel Areas

The Generate Travel Areas tool calculates the area that can be reached within a specified time or distance along a street network based on travel mode. Multiple travel modes are available, including walking, driving, and trucking. This tool employs street network data—such as one-way streets, speed limits, and other rules—to calculate the service, or reachable, area. Depending on the use case, the service area polygon can also include reachable streets, meaning the streets that can be traveled within the time or distance specified.

How to use it: Transit planners frequently employ this analysis tool to determine things like where to build charging stations for electric vehicles and how to design public transit corridors and walkable cities. When looking at public transit in Washington, DC, for example, a walkshed analysis can show communities that are located within a half-mile and mile walk of metro stops.

Enrich Layer

The Enrich Layer tool makes thousands of data attributes for more than 170 countries available in Map Viewer. In addition to common census data, this tool has lifestyle, consumer habits, and spending data. The data can be added to any point, line, or polygon geometry to supplement analysis and visualization. Through the process of apportionment, the data is aggregated at the requested area, allowing for usage outside traditional geographies such as states, counties, and census tracts.

How to use it: A store owner wishing to expand her business could use the Enrich Layer tool to examine the demographics of the areas surrounding her current, successful locations. By identifying patterns in these demographics, such as population age, disposable income, and consumer habits, she could find potential locations for new stores with similar demographics, indicating that these areas might contain additional target markets.

Find Hot Spots

Find Hot Spots is a powerful tool that identifies statistically significant clustering in the spatial pattern of data. Every dataset can exhibit some degree of potentially random spatial clustering. Performing a hot spot analysis identifies areas on a map where high or low values are located next to similarly high or low values. Analyzing the data in context with neighboring features helps determine where statistically significant clustering is occurring. This kind of analysis is important to do on datasets that might show clusters due to high population, such as crime or internet access datasets. Doing a hot spot analysis would help determine if crimes in an area are occurring at a higher-than-average rate or if fewer than the average number of households has access to the internet. This kind of analysis can also be performed to find higher- or lower-average costs of medical care, numbers of traffic accidents, and more.

How to use it: Over the past few years, it has become more important than ever to ensure that people have at-home access to the internet so that they can work, learn, utilize telehealth services, and more. The Appalachian region, which spans 13 eastern US states and encompasses large rural areas and economically disadvantaged populations, has historically faced challenges in building and maintaining infrastructure. The goal of performing a hot spot analysis in this case would be to determine if any regions within Appalachia lack decent internet access. Counties and census tracts with higher-than-average percentages of households without internet access can be represented by one color (red), while higher-than-average percentages of households with internet access can be shown in another color (blue).

→ Users with the ArcGIS Image for ArcGIS Online extension can use the Detect Object with Deep Learning tool, which can detect objects such as swimming pools in imagery.

Summarize Within

The Summarize Within tool calculates statistics where an input layer overlaps a boundary layer. Not only does the tool tally the number of times the layers overlap, but it also can calculate the statistics for any numerical attributes of the points, lines, or areas within the input layer. This tool is useful in cases where data needs to be analyzed inside a specific geography, such as a county or state, or binned into squares or hexagons.

How to use it: A legislative analyst might be interested in summarizing the number of toxic release facilities within each congressional district. Or in cases where data privacy is a concern, such as in health care, an analyst might choose to summarize flu cases within hexagon bins, since they aggregate data outside typical geographies and don't require attaching additional location information.
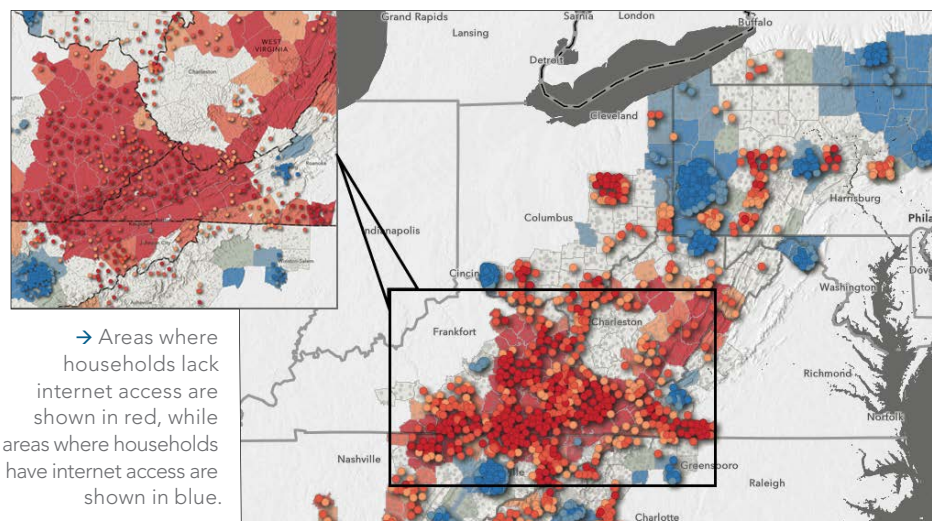
Detect Object with Deep Learning

With ever more imagery available from a variety of sources, it is becoming increasingly important to automate and scale the creation of foundational GIS content, such as building footprints. For users who have the ArcGIS Image Online extension in Map Viewer, they have access to several raster analysis tools built around deep learning. One such tool is Detect Object with Deep Learning, which employs a deep learning model to locate and identify desired objects within an image.

How to use it: For GIS analysts, digitizing features can be time-consuming. Using the Detect Object with Deep Learning tool, analysts automate the process of identifying features within an image, and the features' locations get stored in a feature layer. Map Viewer also has specific deep learning tools to support different business needs, such as extracting building footprints for urban planning, classifying damaged infrastructure to expedite insurance processes, or creating impervious maps for taxation purposes.

Get Started with Spatial Analysis in Map Viewer

In addition to being able to leverage the new feature and raster analysis tools in Map Viewer, users can always take advantage of the ready-to-use layers and authoritative content available in ArcGIS Living Atlas of the World. Together, these and other features make ArcGIS Online and Map Viewer indispensable to anyone's GIS arsenal.

To learn more about how to leverage Map Viewer in ArcGIS Online, explore in-depth use cases and tutorials at go.esri.com/map-viewer-tutorials. To find out more about the recent spatial analysis additions to Map Viewer, head to go.esri.com/analysis-mv-announcement.

→ Areas where households lack internet access are shown in red, while areas where households have internet access are shown in blue.

Change Is Afoot with the US Survey Foot

For more than 60 years, the United States has had two definitions of the foot to measure length. One is the US survey foot, which dates to 1893 and is expressed as a fraction: 1200/3937 meters, or 0.3048006096… meters. The other is the slightly shorter and more exact international foot—0.3048 meters—which was adopted in 1959.

This all changed on December 31, 2022, when the National Institute of Standards and Technology (NIST) and the National Oceanic and Atmospheric Administration (NOAA) officially deprecated the US survey foot.

To most people, the difference is barely discernible and equates to approximately one-eighth of an inch per mile. But for those, like surveyors, who measure over long distances, the impact can be significant. There will be implications for GIS professionals as well.

That said, it will take a few years for the change to become permanent and for the international foot to be widely employed throughout the United States. In the meantime, Esri has verified that ArcGIS technology distinguishes between the two different definitions of a foot and is working with the National Geodetic Survey (NGS) to ensure that the international foot is fully supported in its software.

Mix-Ups Lead to Substantial Errors

Operating with two definitions of the foot was not only a nuisance, but it also posed some very real challenges for the National Spatial Reference System (NSRS), especially in state plane and other projected coordinate systems that GIS professionals frequently encounter. For decades, people have confused the two feet.

Using the wrong foot definition—the US survey foot instead of the international foot, or vice versa—can result in a substantial horizontal error. When employing the state plane coordinate system (SPCS) zones from the North American Datum of 1983 (NAD 1983) for Arizona's Central Zone, for example, the error ranges from about one to five feet. When using universal transverse Mercator (UTM) coordinates from NAD 1983—which covers portions of Montana, Idaho, and Wyoming; all of Utah; most of Arizona; and a few surrounding areas—the error can range from 23–27 feet. The largest SPCS errors in NAD 1983, which run upwards of 50 feet, can be found in the Michigan North and Nevada East Zones. If use of the wrong foot definition is left undetected, discrepancies can result in substantial errors, such as replacing a valve on the wrong fire hydrant or even constructing a building on the wrong property.

NGS is currently recalibrating the coordinates of the NSRS to address shortcomings. As that process takes place, NGS is also collaborating with NIST and NOAA to provide a uniform definition of the foot to measure length. And the more precise international foot has prevailed.

Change Takes Time

While the deprecation of the US survey foot at the end of 2022 has a ring of finality to it, taking all the necessary steps to change over to the international foot is a process that will take time. For GIS professionals who are feeling a sense of urgency to comply with the new standard and are wondering what they should be doing, the simple answer is nothing—yet.

States that currently use the US survey foot in their state plane coordinate systems (not all of them do) need to revise their state laws to address the change in what constitutes a foot measurement. They'll likely do this when they address the other updates being made to the NSRS. The modernized NSRS, which uses the international foot exclusively and will be called SPCS 2022, isn't expected to be rolled out until mid-2025. Until that happens, no action needs to be taken.

If an individual state or organization elects to move to the new coordinate system earlier than that, affected GIS practitioners should verify with their organizations whether they need to convert their existing data at that time or wait for the release of SPCS 2022 and apply the international foot to data collected thereafter.

Esri is working closely with NGS in anticipation of the NSRS modernization. When NGS releases a beta version of SPCS 2022, Esri will do thorough testing to make sure that all zones are fully supported in ArcGIS software. The zones will not be added to the software, however, until NGS releases the final version, which is expected to happen in 2025.

In addition, teams at Esri already identified places in ArcGIS Pro that didn't differentiate between the two distinct foot definitions and updated them in ArcGIS Pro 3.0. Esri technology will also continue to support the US survey foot for existing and new data collected in SPCS 83 and SPCS 27 (which is based entirely on the US survey foot).

No Need to Act—Yet

NGS has pledged to support legacy uses of the US survey foot forever for the 40 states that officially employ it for SPCS 83 and SPCS 27. However, NGS will not support the US survey foot for any zones in the state plane coordinate system come 2025, and Esri will follow suit.

As more information on the NSRS modernization becomes available, Esri will update users on how best to prepare for the change. For now, users don't need to take any action on their own.
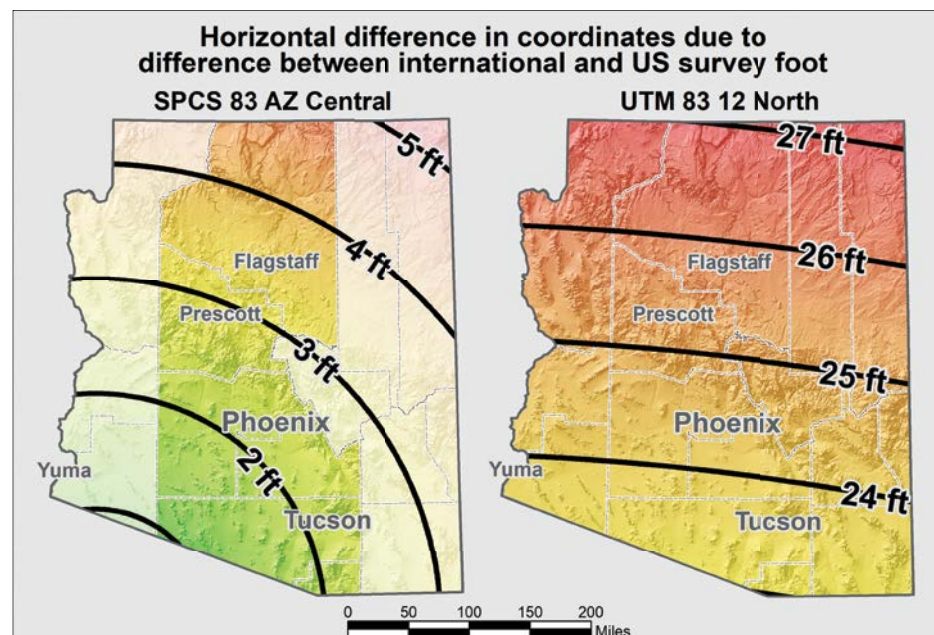
↑ Using the US survey foot instead of the international foot, or vice versa, can result in a substantial horizontal error. (Image courtesy of the National Geodetic Survey.)

Women in GIS Fosters a Vibrant, Welcoming Community for Everyone

Committee and leads the Washington, DC, chapter of the organization. "People can jump in with ideas, and nobody says, 'You can't do that.' Instead, everyone says, 'Oh, cool! Do you want to run with that project?' Women in GIS is, in many ways, the best of what people hope to have in their workplaces."

The Need to Support Women Working in GIS

The idea for Women in GIS came about at the 2015 California GIS Conference, known as CalGIS.

"A group of us met to talk about being women in geospatial fields, and we said, 'Wouldn't it be great if there was more of a forum and support for women in GIS?'" said Bram. "As far as we knew, there was nothing like that. So we said, 'What if we just threw a website up and got people to connect by facilitating networking?'"

Bram and several others from that original CalGIS meetup started off small when they cofounded Women in GIS before realizing that the group could—and should—get more involved.

"Women in GIS just kept growing organically," Bram said. "We wanted to develop opportunities for chapters to form, and we wanted to collect membership fees to be able to better support women. To do that, Women in GIS needed to become a nonprofit."

The organization gained fiscal sponsorship from the Northern California chapter of the Urban and Regional Information Systems Association in 2017 and then secured critical funds from Esri. This enabled Women in GIS to become a 501(c)(6) organization in 2020, meaning donations can be written off as a business expense.

"We've been growing from there, developing our board and having more women get involved," said Bram, who served as a past president of Women in GIS and is currently the chair of internal affairs. "It's really exciting to see where we are now."

"When Women in GIS was formed back in 2017, it met a tremendous need within the geospatial community, particularly in North America," said Esri chief scientist Dawn Wright, who is a member of the organization. "Women in GIS has grown to be a strong and positive force for women."

A Glocal Community That Keeps Growing

According to Caitlin Hagar-Kuhn, the current president of Women in GIS and a senior GIS consultant at Esri partner Locana, Women in GIS is a "glocal" community that has evolved both from the top down and from the grassroots up.

"We have the parent organization acting as the global virtual community, which really helps people who are experiencing professional isolation if they are, say, the only GIS person in their organization," she said. "And then the local chapters also give members the opportunity to meet regularly in person. So both the affiliates and the chapters are huge contributors to the growth of the organization."

While most Women in GIS members are based in the United States, it is a thriving international organization.

"We have members from around the world, and we want people from everywhere to get involved," said Bram. "We understand that it can be challenging to do this in areas where these kinds of opportunities are sparse, so we are working on ways to facilitate that."

"At the last Esri UC, we had quite a few folks come to our booth who wanted to start chapters in other countries," Hagar-Kuhn added. "That was very exciting, and we hope to see more of that. With technology that makes it easier to translate to other languages and record presentations so people can watch them at convenient times in their own time zones, we're exploring a lot of new options in the accessibility realm."

Women in GIS is also open to people of all genders and those who work in GIS-adjacent fields.

↑ Women in GIS had a booth at the 2022 Esri User Conference (Esri UC). Current president Caitlin Hagar-Kuhn (center) and cofounder Danielle Bram (far right) were part of the crew that worked the booth.

"We've had men join because they want to donate funds and support women that they know in the field," said Bram. "We had a geography professor join once because he wanted to figure out how to get memberships for a whole bunch of his female students."

Reid, who has worked in GIS for 30 years but is now in more of an IT management role, has found Women in GIS to be welcoming and engaging even though she doesn't work with GIS every day anymore.

"When I took my current job, I had a moment where I wondered if I belonged in the GIS field anymore," she said. "Being a member of Women in GIS showed me that I do. I may not be doing mapping day-to-day anymore, but I still feel very welcome here. I think that that speaks to the value of the membership and what a great community this is."

The Myriad Benefits of Being a Member

To get involved with Women in GIS, Hagar-Kuhn recommends visiting the organization's website at womeningis.org. There, visitors can find information about membership and sponsorship opportunities, listen to the new interview-style *Geography without Borders* podcast, and follow the organization's social media accounts.

"Social media is probably the best way to find out about what's going on," said Hagar-Kuhn. "People can dip their toes in and see if they want to attend a workshop or become a member."

Members of Women in GIS get discounts on workshops, including the quarterly professional development one; the ability to upload a résumé to the organization's job board for free; and access to committees, mentoring, and monthly Communities of Practice meetings. Pricing is tiered, and for anyone who doesn't have the means to pay out of pocket, Women in GIS offers a limited number of financial assistance opportunities. Because Women in GIS is volunteer based, all membership fees, sponsorships, and donations go back to the community to fund workshops, scholarships for undergraduate and graduate students, grants for professional development, and more.

The job board is a valuable resource for members and sponsors, who can all post job openings.

"Companies and organizations used to ask us to post job announcements for them because they wanted to hire more women," said Bram. "Now we actually have a way to connect employers with people who are looking for jobs."

Women in GIS also has a booth at three Esri conferences per year, including the Esri UC and the Esri Developer Summit.

"The number of women in the developer space of GIS is increasing so quickly, so I'm hoping we can reach a lot of people in that realm," said Hagar-Kuhn.

Wright thinks they will, given that several of the organization's meetings at conferences have been standing room only.

"The gatherings that Women in GIS holds at Esri conferences have been a boon for attendees and even Esri," she said. "I have also found their Communities of Practice meetings, held over Zoom, to be extremely helpful."

These meetups are organized by topic, such as infrastructure, natural resources, and the public and private sectors, and they are largely unstructured in order to give attendees the chance to speak their minds.

"I've had a number of people come up to me and say, 'This has been a really great space to just have conversations about things that are happening in my job,' or, 'I'm looking for new opportunities, and these meetings are helping me figure out what's next,'" said Reid.

Women in GIS lets members be as involved as they want to be.

"If you'd like to volunteer for a committee, that's great! We could always use more hands on deck," said Reid.

"That said, we are all very respectful of each other's bandwidths," Hagar-Kuhn added.

A Gratifying Experience

For Bram, Reid, and Hagar-Kuhn, it is fulfilling to witness so many women and their allies—who work in GIS or adjacent fields and hail from all over the world—get involved with and learn and grow through Women in GIS.

"I have seen people network through the organization and find their first big-hit job or internship or even meet a mentor who guides them through the early stages of their careers," said Hagar-Kuhn.

"There is so much opportunity within this organization to learn and give," said Reid.

"It's really gratifying to be a part of it," added Bram.

From the Meridian

By Dr. Jieun Lee
University of Northern Colorado

Groundbreaking Support for Trailblazing Women

Women have been cartographers far longer than anyone knows. For millennia, Indigenous women all over the world have been the locators and stewards of land and water—using spatial and mapping practices that researchers are now connecting to newer technologies, such as remote earth observation. In fourth-century China, the unnamed sister of a high-ranking official embroidered a map to protect it from wear and tear, according to geographer and historian Judith Tyner. And 16th-century Flemish cartographer Gerardus Mercator, who created the Mercator projection, reportedly employed a cadre of women as colorists on his maps.

Yet even today, when people's gender identities don't (or shouldn't) preclude them from pursuing certain professions, it can be challenging and isolating to be a woman mapper. This is especially true for women who move to other countries to work in academia. Their gender identities intersect with new cultural expectations and experiences; the need, oftentimes, to speak another language; and—for many women working in the United States, at least—the presumptions surrounding their racial status as women of color.

For women geographers and geospatial scientists from other countries who are making their careers in the United States, a new program is available that offers a safe space for them to process and enhance their professional and personal experiences. Called Golden Compass, the program seeks to help participants achieve their career and leadership goals, create meaningful professional networks, and share their adventures and struggles of living and working in the United States.

Founded on Lived Experience

Women geospatial scientists who are foreign nationals working in academia in the United States are a special group of scholars. They are likely women of color who speak English as a second (or third, or fourth) language. As qualified academic professionals, they have rich subject-matter expertise that can help advance the discipline. Yet many lack the social, economic, and cultural capital needed to fully take advantage of their talent and maximize their careers' impacts.

As a woman geographer from South Korea who lives and works in the United States, I brought my lived experience to an inspiring program that I participated in two years ago. The Training and Retaining Leaders in STEM - Geospatial Sciences (TRELIS) program is an initiative of the University Consortium for Geographic Information Science (UCGIS) that is supported by the National Science Foundation and put on in cooperation with the University of Maine. TRELIS champions the professional development of women cartographers and GIS scientists through training and networking. I was a TRELIS fellow in 2021, and I got so much out of my experience that I created Golden Compass, a similar program specifically for foreign national women working in geography-related academia and living in the United States.

Golden Compass was initially funded by UCGIS and TRELIS through the Carolyn Merry Mini-Grant program. To create the organization, I collaborated with other TRELIS alumni, including Dr. Mônica Haddad of Iowa State University and Dr. Huyen Le of Ohio State University, as well as TRELIS leader Dr. Laxmi Ramasubramanian of San José State University. We supplemented the generous funding from TRELIS with support from organizations including the American Association of Geographers (AAG), the University of Northern Colorado, and the Korea-America Association for Geospatial and Environmental Sciences.

To attract attendees to the first Golden Compass gathering, held in 2022, we asked TRELIS alumni to nominate international women geospatial scholars who are faculty members at academic institutions in the United States. These nominees were then
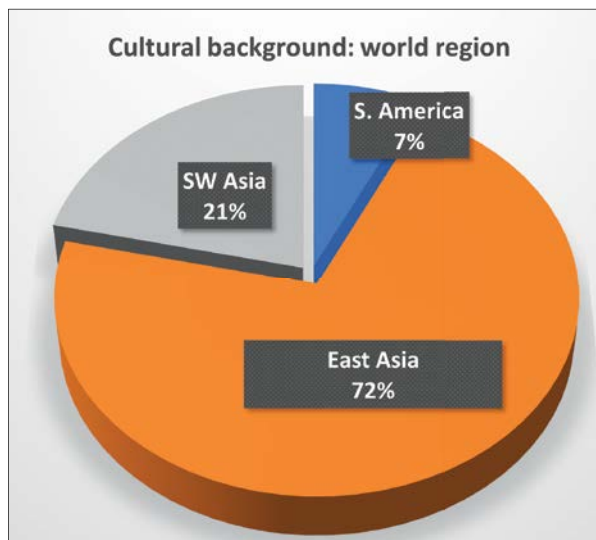
↑ The women who attended the inaugural Golden Compass gathering were chosen for their expertise, faculty rank, and cultural background or national origin. (Chart courtesy of Dr. Jieun Lee.)

↑ Participants shared surprisingly similar experiences when talking about how they balance academic work with their personal lives. (Photo courtesy of Dr. Jieun Lee.)

asked to apply to the program if they were interested in it. The 16 women who were selected to attend the first Golden Compass meeting were chosen for their expertise, faculty rank, and cultural background or national origin.

A Safe Space for Sharing

On May 21 and 22, 2022, an exceptional cadre of women geospatial scientists from around the world gathered at the University of Colorado Denver to participate in intensive and supportive discussions, presentations, and relationship-building exercises. The first day of Golden Compass focused on introductions, networking, and mentoring. Participants were asked to look back at their own career paths and share guidance and wisdom they had received from mentors who understood the unique experiences and challenges that foreign national women face as they strive to be leaders in the United States.

On the second day, in the beautiful space of the university's Center for Faculty Development and Advancement, the group took an in-depth look at communication and language. We celebrated the linguistic capital in the room, noting how everyone could converse in several languages, yet acknowledged how nonnative speakers of English are often presumed to be incompetent. (For further reading on this, see *Presumed Incompetent: The Intersections of Race and Class for Women in Academia*, edited by Dr. Gabriella Gutiérrez y Muhs, Dr. Yolanda Flores Niemann, Carmen G. González, and Angela P. Harris.) The discussion encouraged participants to strategize about how to make themselves heard.

After that, esteemed speakers Dr. Vonu (Piyushimita) Thakuriah of Rutgers University, Dr. Justine Blanford of the University of Twente, and Dr. Kerry (Li) Fang of Florida State University guided participants in an exploration of several career trajectories and career planning topics. During this workshop, the speakers and participants covered how they got to where they are now, cultural differences between their home countries and the United States, obstacles they've faced while living and working in the United States, and lessons they've learned from mentors and mentees. The workshop employed several techniques to create a sense of trust, freedom to speak, and safety among participants, including paired discussion, role playing, interest group-based conversation, and the World Café method for group dialogue.

While my co-organizers and I built the space for Golden Compass to take place, the participants filled it with their own

thoughts, views, experiences, and passions related to their academic careers and life in the United States. The flame of their enthusiasm for excellence was fierce to spread, and it inspires me to continue supporting women's excellence and leadership in higher education, especially in my beloved discipline of geography and geospatial science.

Continued Support for a Special Group

The first Golden Compass workshop succeeded for two reasons. First, it centered on encouraging a trailblazing group of scholars in accomplishing their personal and professional endeavors. Second, the workshop created a safe, supportive community for everyone who participated in it. In fact, all attendees of the inaugural 2022 workshop signaled an interest in continuing to support other international women scholars who work in geography and geospatial science at US academic institutions.

My co-organizers and I are now in discussion with several professional organizations—including UCGIS, AAG, the Association of Collegiate Schools of Planning, and the National Center for Women & Information Technology—to create a working group or steering committee that will generate systemic support for international women scholars who are faculty members and postdoctoral researchers at US institutions. Additionally, we are working to share the successes of the first Golden Compass workshop to attract more support for these exceptional women scholars.

About the Author

Dr. Jieun Lee is an associate professor in the Department of Geography, GIS, and Sustainability at the University of Northern Colorado. Her research focuses on urban transportation sustainability with a special interest in social and health disparities. She is a cofounder of the Golden Compass workshop initiative.

From the Meridian is a regular column from AAG, a nonprofit scientific and educational society whose members, from nearly 100 countries, share interests in the theory, methods, and practice of geography. Find out about AAG's programs and membership at aag.org.

A New Kind of Business Education

Dr. Thomas Horan

For several decades, industries and governments have been undergoing a digital transformation wherein they employ ever more complex software to achieve their missions. Each digital advancement presents new challenges, and business schools must adapt their curricula to show students how to leverage the latest technology not only for the benefit of their companies but also for the greater good of society.

Dr. Thomas Horan, the H. Jess and Donna Senecal endowed dean of the School of Business & Society at the University of Redlands in Redlands, California, has spent nearly three decades teaching graduate students and business professionals how to use GIS to advance their careers, improve their organizations, and better serve their communities. He recently spoke to Esri about the changing landscape of location intelligence in business schools and the corporate world.

Throughout your career, how have you supported academia in responding to business organizations' needs for GIS talent and innovation?

My journey started in 1997 when I was asked to teach a class in GIS at Claremont Graduate University in Claremont, California. I said, What's that? Then I went to Esri, got my floppy disks of software, and started teaching GIS. At the time, a lot of the applications for GIS were in the public sector, and that was the orientation for the technology. With the rise of technology in the workplace, universities needed to adjust the training they provided in GIS to not just be about the technology but also about its use within public, private, and nonprofit organizations. Now, spatial business should be fully integrated into business school curriculum. At the University of Redlands, we partner with Harvard Business School, the University of Minnesota, and others to continually develop new research, courses, and programs in GIS and location analytics.

GIS and location intelligence can be applied within many types of organizations. How do spatially mature businesses adopt GIS, and what makes them successful?

We've done surveys on this, and organizations that fully utilize GIS and location analytics have five things in common. First, location analytics is perceived as valuable, whether it's used in marketing, sales, or operations. Second, the use of location analytics is tied to a clear business strategy and is done in service of reaching the organization's overall goals. Third, there is a champion for geospatial technology in the C-suite, whether that's the chief financial officer, chief information officer, or chief executive officer. Fourth, these organizations have best-in-class technology. You can have great ideas, but if the technology isn't up to the task, you won't be successful. Fifth, the companies can articulate, quantitatively and/or qualitatively, the return on investment they receive from using location intelligence.

One of the key concepts we have developed with our collaborators is the location value chain. It builds on Harvard Business School economist Michael Porter's notion of the value chain, which evaluates a company's competitive advantage through identifying the activities that lead to higher profits or lower costs. The location value chain says that in each part of the value chain—marketing, sales, operations, supply chains, or sustainability—value can be added by understanding the spatial dimension, such as where desirable customers are or where supply chain disruptions happen. What's more, the value chain represents different entry points for a company to use location analytics—for example, in the marketing or operations departments. Then as time goes on, GIS often migrates from one of those entry points to other areas of the organization.

As the demand for talent with business and geospatial skills has grown, how has the University of Redlands School of Business & Society incorporated GIS and location analytics into its curriculum and industry research?

The first thing we did was make sure that we fully integrated GIS into our curriculum. At the undergraduate level, GIS for Business is a required course. At the Master of Business Administration level, it's a concentration. For a Master of Science in Business Analytics, it's a cornerstone of our data science classes. And in our Master of Science in GIS, we're working to have it include a business analytics track.

We've also integrated it into research. For example, industry clustering is an area that the University of Redlands studies a lot. This involves understanding regions and how predominant industries—such as medical device development or automotive manufacturing—get established and grow in specific places. Where a company is located matters in terms of access to talent, proximity to suppliers, and the presence of potential customers. This notion of industry clusters is very well suited for studying with location analytics and has implications for where organizations should establish themselves.

In addition, outreach in the community is important because not all business education occurs within the four walls of a business school. We've put on a spatial business academy with managers and directors from big-name organizations, and we've done events at companies where students use their location analytics skills to solve real-world problems. Companies have also helped us write case studies, enabling us to bring these outside-the-classroom learnings back into the curriculum.

The University of Redlands School of Business & Society recently evolved its name and mission to include "society." What external shifts influenced this update?

We saw the business climate changing. In 2019, the Business Roundtable said that the purpose of business is broader than profitability and includes committing to benefiting multiple stakeholders, from customers, employees, and suppliers to communities and shareholders. When the pandemic hit in early 2020, it became obvious that a business cannot be contemplated outside the context of the societal conditions in which it exists.

These events motivated us to expand our offerings and curriculum to include examining business functions and their impacts; evaluating different styles of purposeful leadership; and spatially analyzing business's effects on communities, particularly pertaining to social responsibility and the environment. This is the new business education.

As we became the School of Business & Society, we were presented with a wonderful opportunity to merge with the Presidio Graduate School in San Francisco, California. It has a distinctive MBA in Sustainable Solutions and an inspiring network of alumni. Once Presidio moves its graduate programs to our Marin campus, the University of Redlands will offer a strong Northern California component to its business education.

Esri Press recently published *Spatial Business: Competing and Leading with Location Analytics,* which you coauthored with two of your University of Redlands colleagues, Dr. James Pick and Dr. Avijit Sarkar. What were the key drivers behind publishing that material?

When we began offering location analytics courses within our business school, there was no defining book about it. There are lots of very good books on adjacent topics, but there was nothing that we could use as a cornerstone for connecting GIS and location analytics to the broad business functions we embrace. So we wrote the book on that, and we are very proud of it.

The book opens with several chapters on the fundamentals of spatial business before getting into how these concepts are used to maximize organizational, corporate, and social value. It covers how organizations achieve spatial excellence and the role of leadership in making this happen. It also contains case studies that demonstrate how to apply location analytics in a business setting. We wrote *Spatial Business* to be useful for both business students and professionals who want to advance their careers via these ideas and methods.

When you look ahead, where do you see the business applications of GIS heading, and what role will business education play in shaping that future?

We are very excited about the future because we see greater awareness of the value of location analytics in a range of organizations. New GIS applications geared toward business continue to evolve and get students interested in the field. My fellow business educators and I have seen how the technology works for marketing, operations, and sales. Now we need to push the envelope on how socially responsible and responsive companies use location analytics not only to be successful businesses but also to be good corporate citizens.

Startup Fights Wildfires with Drones and Real-Time GIS

By Heidi Ogle, the National Park Service; and Jordan Hahn, Overwatch Aero, LLC

↑ Personnel from Overwatch Aero and the United States Forest Service (USFS) actively monitor the unpiloted aerial systems' (UAS) flight path and remotely control the thermal camera.

Wildfires rage throughout the United States at an average rate of 70,000 per year, according to the National Interagency Fire Center (NIFC). Incident commanders and other wildfire response authorities are under increasing pressure to make quick and accurate tactical decisions, including where and when to deploy crews and resources. When making these decisions, having access to accurate, up-to-date, and readily understood geospatial data is key to ensuring the safety of firefighters and local residents.

In response to the need for improved situational awareness, the United States Forest Service (USFS) partnered with the Bureau of Land Management (BLM) and Esri startup partner Overwatch Aero, LLC (overwatchaero.com), to deploy a new technology called long-endurance unpiloted aerial systems (UAS). UAS technology employs remotely piloted aircraft to go where humans can't, gathering imagery and data that otherwise would be impossible to collect. Whereas traditional commercial UAS can fly for about 45 minutes at an altitude of 500 feet for a range of 2–3 miles, long-endurance commercial UAS can fly for 12–14 hours at an operational altitude of 5,000 feet and a range of 50 miles.

For four wildfires that burned in California, New Mexico, and Oregon in 2022, Overwatch Aero worked with premier UAS operator Precision Integrated Programs to collect and disseminate aerial imagery data in real time. Leveraging Esri software and apps, including ArcGIS Pro and ArcGIS Experience Builder, the startup provided USFS, BLM, and other firefighting agencies with live situational awareness, dynamic perimeter mapping, and hot spot detection. The end users were impressed.

"Drones are the future of aviation for not only fire but *[also]* aviation in general," said John Crotty, air operations branch director for the California Interagency Incident Management Team 15.

Revolutionizing Drone Imagery Data Collection

During active fires, GIS specialists traditionally generate and update fire perimeters using geospatial data that field observers collect on the fire line or that's created by interpreters who analyze imagery acquired by piloted aircraft equipped with infrared cameras. These methods, however, cause delays between obtaining the data and producing maps, which can lead to poor tactical decision-making and endanger firefighters' lives.

Providing geospatial data in real time to on-site personnel has long been a goal in fire mapping. This becomes critical during major wildfires, which spread at rapid rates.

In a wildfire situation, Overwatch Aero's sensor operators and pilots fly UAS aircraft a few thousand feet above the ground along opposing ridgelines to capture highly accurate full motion video (FMV) feeds along the fire's boundaries. These FMV feeds are georeferenced live and streamed to the UAS ground control station in real time. Data specialists then use the Full Motion Video capability in ArcGIS Image Analyst to interpret the infrared data and update the fire perimeter hosted in the NIFC's ArcGIS Online organization. By eliminating delays among imagery acquisition, interpretation, transmission, and production, fire personnel can receive updates in near real time, enabling informed decision-making when it matters most.

Overwatch Aero has also developed a custom web app using ArcGIS Experience Builder that combines the FMV feeds with the geospatial data generated by UAS data specialists. This allows any credentialed official to see live video footage of progressing fire activity, using an accurate map for context.

Making Timely Decisions and Reducing Risk

With the systems and processes developed by Overwatch Aero, incident management teams can make strategic decisions with the most up-to-date and accurate information possible. This enables them to more effectively deploy resources and conduct safer operations. Additionally, using UAS and Esri technology together offers an added measure of safety, since both systems can be administered and controlled remotely.

During one 2022 wildfire, for example, the incident commander was able to pull more than 400 firefighters off an overnight shift while the UAS was airborne. This enabled the firefighters to rest safely and reduced their risk of injury while the UAS engaged in a remotely controlled data-gathering operation.

"It's a win-win for the agencies to operate under an umbrella of this type of aircraft," said Crotty. "It can provide precise and timely *[information]* to firefighters and incident management teams. And, most importantly, we can do it safely."


↑ Overwatch Aero's FVR-90 UAS—a fixed-wing, vertical take-off and landing, rotary drone—is equipped with a thermal, full-motion video (FMV) camera and gimbal to ensure steady imagery.

About the Authors

Heidi Ogle is a GIS specialist with the National Park Service and a qualified UAS data specialist. She supports 87 national park units across eight states along the Colorado Plateau, from Montana to Texas. Ogle has a master's degree in geography from California State University, Chico, and is a certified GIS professional. Jordan Hahn is the cofounder and chief executive officer of Overwatch Aero, LLC. He manages data collection and dissemination activities and generates many of Overwatch Aero's GIS workflows. Hahn has a degree in aerospace engineering from Texas A&M University.

Learn more about the Esri Startup program at **developers.arcgis.com/startups**.
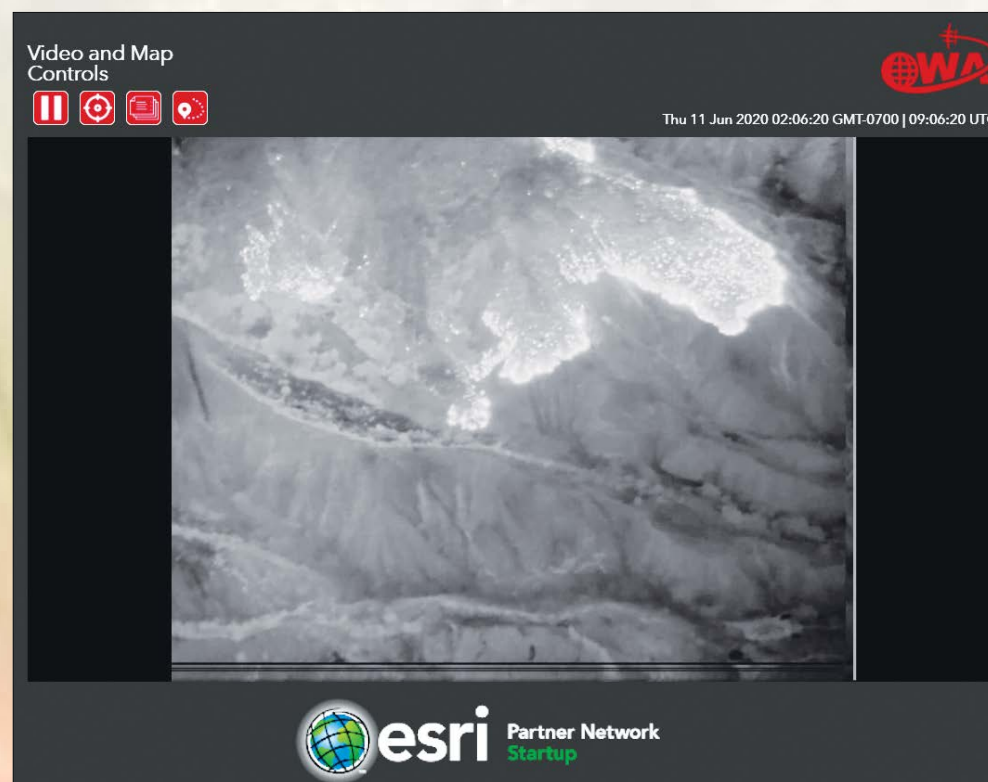
↑ Live video and geospatial data are streamed directly to the end user's mobile device using a web app built with ArcGIS Experience Builder.

Esri Partners Meet Organizations' Changing Needs

When organizations need to make swift or long-term changes to how they use, gather, store, and manage spatial and nonspatial data, it can be advantageous to work with outside experts that know how to build, integrate, and maintain new systems. That's exactly what Esri partners are equipped to do.

Find out how Esri partners Safe Software, DCSE, and HDR helped three organizations develop new and innovative GIS implementations that meet their changing needs, from gathering data in a war zone to extending GIS throughout the enterprise.

Using Open Data to Clear Land Mines in Ukraine

Since 2016, The HALO Trust—the world's largest land mine clearance charity—has been embedded in communities in eastern Ukraine to clear mines from the armed conflict between Russian-backed separatists and Ukrainian forces that began in 2014. When Russia launched a full-scale invasion of Ukraine in February 2022, HALO had to halt those operations and move to the capital of Kyiv, where fighting was less intense, to better respond to the urgent and expanding need to clear mines around the country.

Gathering data in the field on land mines was now out of the question, so HALO needed to quickly change its approach to focus on digital data collection. Staff members suddenly needed to augment the organization's existing ArcGIS technology-based web maps with live, open-source data.

To make this work, the HALO team wanted to use a data integration tool that could automatically extract, transform, and load (ETL) large amounts of data. HALO staff were aware of **Safe Software (safe.com)** and its FME Platform, which automates ETL operations for diverse data types, including open data—no coding required. So the team reached out to Safe Software and got the system up and running.

Today, HALO uses FME Platform to collect information about different types of incidents around Ukraine that involve explosive ordnance. The software scrapes social media sites and data aggregators, processes and geolocates the data, and publishes the data on HALO's ArcGIS technology-based web maps. Every few hours, APIs automatically pull new open-source data and process and publish it on the interactive web maps. This allows field

operations teams, HALO executives, government donors, and international stakeholders to use the maps to find out where there are threats, contaminations, and confirmed munitions throughout Ukraine.

While HALO has been able to resume field-based operations in Ukraine in areas where fighting has ceased, the organization still employs these automated data workflows to reduce manual work, eliminate duplicate assignments, reduce human errors, and save time. HALO now plans to integrate this new data management system in the 25 countries it works with that have national mine action databases. The organization will use FME Platform in these environments to connect and automate the flow of data between ArcGIS Survey123, ArcGIS Enterprise, and the PostgreSQL database management system.
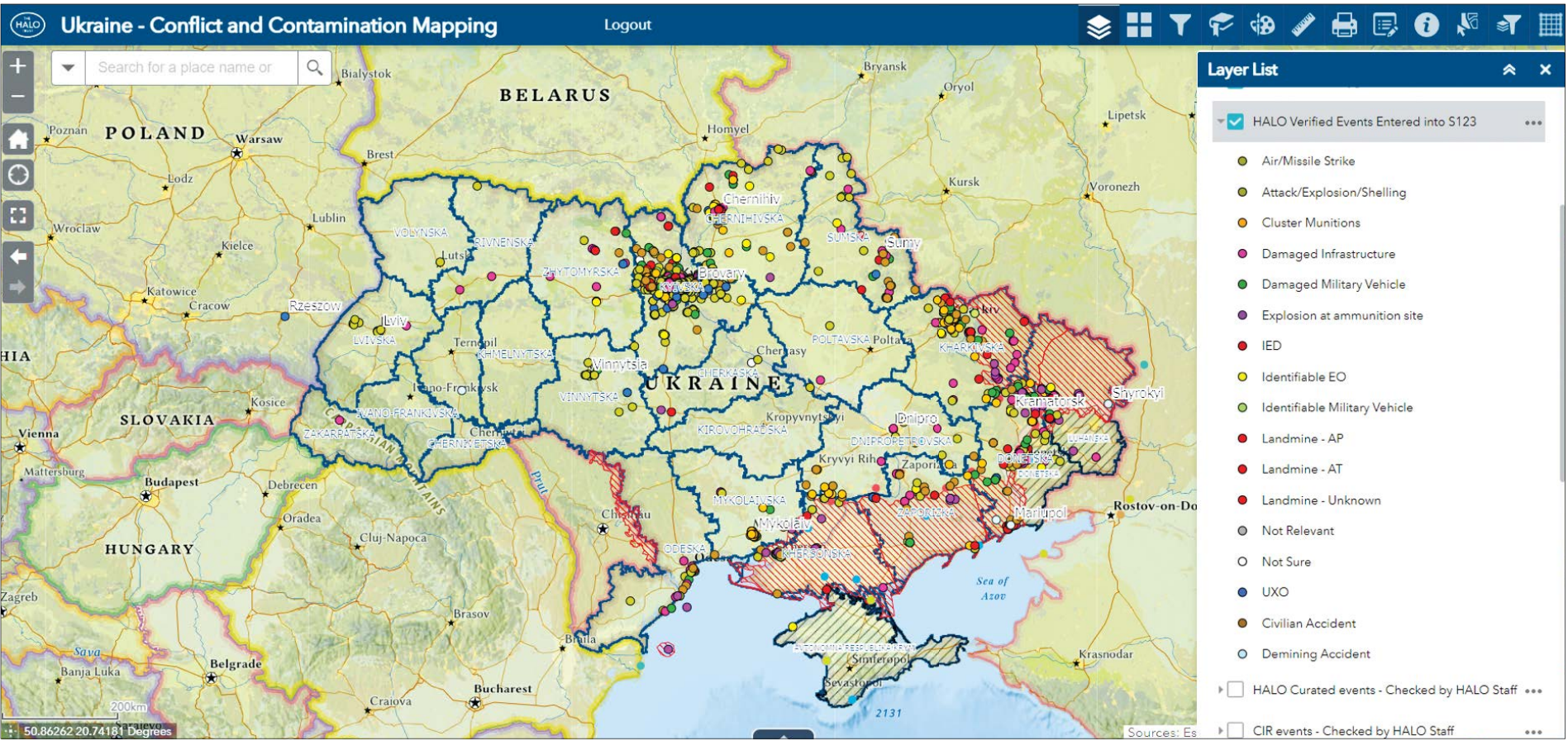
↑ Safe Software's FME Platform pushes data from the Live Universal Awareness Map (Liveuamap) API into a PostgreSQL database to populate The HALO Trust's conflict and contamination map.

Streamlining Mobile Data Collection to Mitigate Risk

The San Bernardino Municipal Water Department (SBMWD) has operated and maintained the sewer collection infrastructure in San Bernardino, California, since it took that over from the city's public works department in 2017. For years, the SBMWD sewer collection team, which maintains sewer lines, struggled to track its work using an outdated paper- and spreadsheet-based system. Having to manually fill out paperwork to show which areas had been cleaned and where future cleanings needed to take place made it difficult for the team to meet its line cleaning and sewer spill avoidance goals.

To improve the planning, data capture, and reporting processes for this work, SBMWD sought a GIS-based solution that would allow a range of staff members from diverse backgrounds and with varying levels of computer proficiency to visualize their progress and plans. Collaborating with **DCSE (dcse.com)** and its partner, Spatial Wave, SBMWD implemented an ArcGIS technology-enabled Mobile Asset Management System (MAMS) that allows users to better plan, schedule, assign, and perform sewer line maintenance while tracking the resources that get used.

The MAMS has access to SBMWD's GIS data, associated engineering documents, and the sewer lines' closed-circuit television (CCTV) feeds. It links data collected in the field with the department's GIS and publishes that in ArcGIS Enterprise. Employees in both the field and the office can then use a dashboard, built with ArcGIS Dashboards, to monitor progress on sewer line cleaning, and supervisors can use it to plan future operations.

A significant benefit for SBMWD is that the MAMS uses ArcGIS Runtime SDKs for .NET and iOS to publish the GIS data for mobile use. This enables the sewer collection team to display digitized field data using symbology that's similar to what mobile crews saw on old hard-copy maps generated in ArcGIS Desktop. It also helps seamlessly publish the data in ArcGIS Enterprise and display real-time progress via the dashboard.

Although it was a significant change to switch from a paper-based system to a GIS-centric solution, employees adapted quickly after taking part in training sessions. With all its sewer line cleaning data centralized and accessible in ArcGIS Enterprise, SBMWD has improved communication among departments. Now, supervisors and mobile crews can visualize critical information—including as-builts, cleaning history, and CCTV data—all in one digitized, geospatially focused system.

SBMWD estimates that the MAMS has saved staff members hundreds of hours each year in looking for the history of sewer line cleaning data and communicating their work progress with colleagues and supervisors. Ultimately, the system supports SBMWD's goal of conducting timely sewer line cleanings and avoiding environmentally damaging and costly sewer spills.
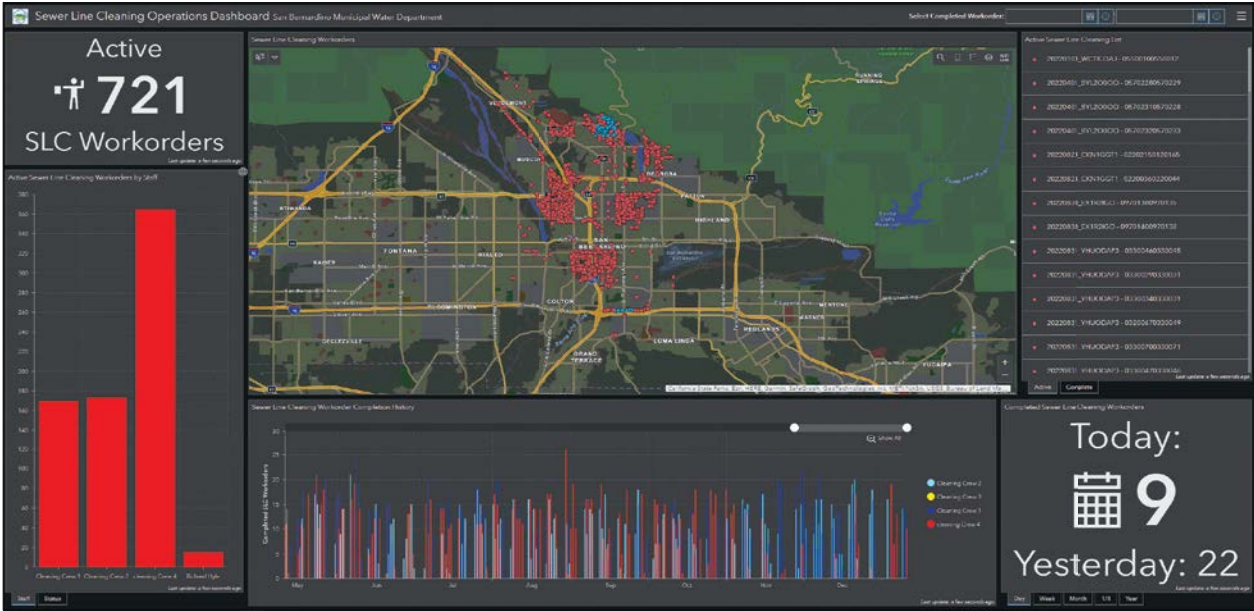
↑ Employees now use a dashboard to monitor progress on sewer line cleaning to plan future operations.

Implementing a Future-Oriented GIS Plan

The City of Billings, Montana, has a vision for developing a connected, data-driven community. This vision relies on being able to accurately collect and manage live data.

For the last 20 years, Billings has had a relationship with engineering firm **HDR (hdrinc.com)**. Billings recently relied on HDR to build basemaps and create hundreds of asset management layers in ArcGIS Pro, ArcGIS Enterprise, and ArcGIS Online to improve service delivery to residents. So when the city created its new Billings GIS Plan, staff members asked a team at HDR to assess and implement the plan.

The HDR team started by doing a systems and data review of the public works department's production GIS environment. This review included evaluating the city's current GIS data and IT infrastructure in relation to map performance, data access, workflows, and third-party software integrations. The team also carried out a detailed review of the public works department's GIS data, looking for gaps in completeness, accuracy, and consistency. The results of the assessment were summarized in an ArcGIS StoryMaps story, with data gaps, potential issues, and recommendations presented in maps and as key takeaways.

Next, the team from HDR worked with staff from the Billings public works department and GIS professionals at the city to prioritize its recommendations in a GIS road map and begin implementing them. Projects outlined in the road map included foundational priorities, such as improving GIS governance, updating data schemas, making database upgrades, and deploying ArcGIS Enterprise. Once these foundational improvements were in place, the team implemented a suite of updated ArcGIS Online apps, such as ArcGIS Dashboards and ArcGIS Hub; conducted an ArcGIS Utility Network pilot project that used feature manipulation engine workflows for
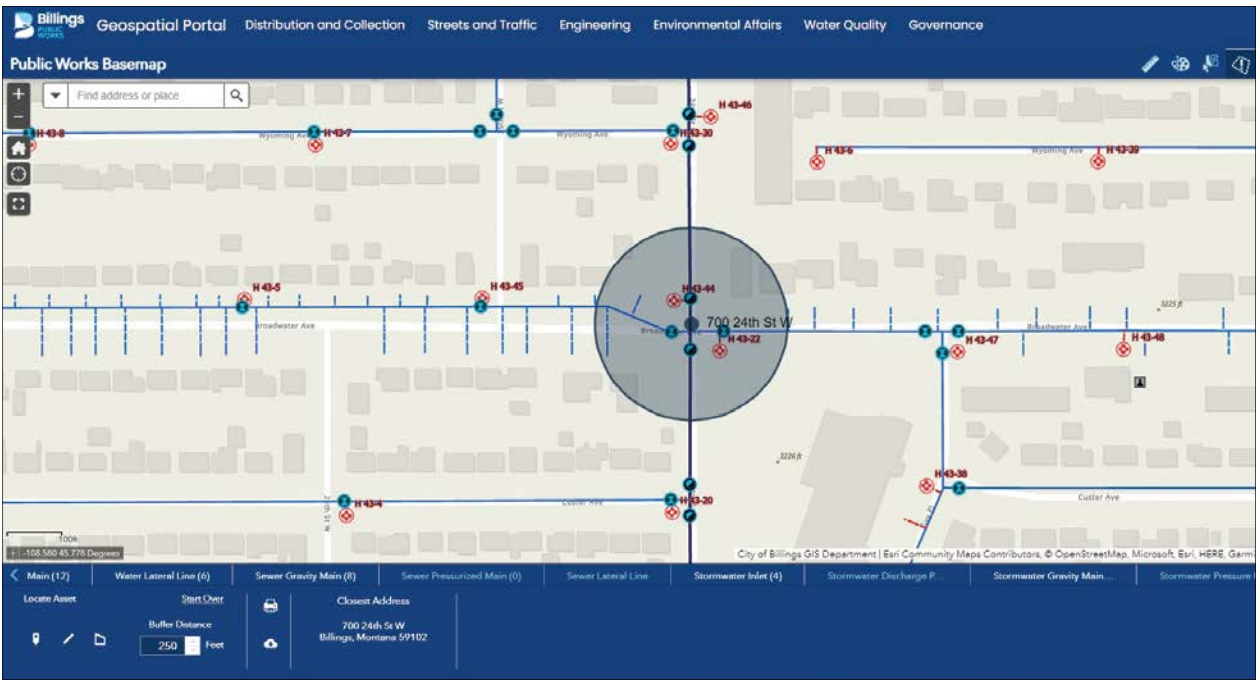
↑ HDR helped the City of Billings, Montana, assess and implement its Billings GIS Plan to foster a connected, data-driven community.

data migration; and modernized the city's technology from Esri partner Cityworks. The team also implemented automatic vehicle location tracking for the city's snowplows and integrated Montana's Call Before You Dig program with ArcGIS and Cityworks.

Now that the Billings GIS Plan is going strong, teams from HDR host GIS training workshops for city staff. These initiatives amplify the city's use of GIS and help streamline business operations across all divisions within the public works department.

At the 2022 Esri User Conference, the City of Billings received a Special Achievement in GIS (SAG) Award for this ongoing project.

For New Stadium Build, Drone Technology Keeps Sustainability On Track

At San Diego State University in San Diego, California, the football team, called the Aztecs, plays the best of the best in Division I of the National Collegiate Athletic Association (NCAA) at Snapdragon Stadium, which opened at the start of the 2022 football season. For the university, the 35,000-seat outdoor college arena—which hosts football games, professional soccer matches, and other public events—offered an opportunity to engage in sustainable building practices.

The construction of Snapdragon Stadium involved recycling all the concrete from the stadium that San Diego's former professional football team, the Chargers, used to play in and redistributing it as the subbase material for the roads that service the university's new stadium and 132-acre Mission Valley campus. This entailed processing more than a million cubic yards of materials from the demolished arena at an on-site batching plant and moving it to the adjacent construction site.

OCMI, Inc., a California-based firm that provides estimating, scheduling, and project and construction management services, oversees capital projects at the university. The firm needed a solution to help track the movement of materials around the construction site and provide progress reports to stakeholders.

"We needed a way to track and understand how those materials were being moved in conjunction with the schedule and be able to validate *[the information that contractors]* were giving us," said Justin Dorsey, project executive and preconstruction manager for OCMI.

Dorsey and his team elected to use drones to fly around the project site, along with Site Scan for ArcGIS to collect, process, and analyze imagery. This would allow them to not only keep tabs on materials but also monitor construction and provide progress reports and metrics to stakeholders at the university.

This was a high-profile project for the community and part of a larger, multimillion-dollar construction venture, so Dorsey was determined to do the best job possible.

"*[The old stadium]* was a relic to San Diego residents. So that was quite a big deal that the stadium where so many memories were made was going away," he said. "Knowing the gravity of that project...we had to knock it out of the park for the community."

A Flexible, Scalable Drone Solution

In searching for the right software to use with drones, Dorsey found the scalability of cloud-based Site Scan to be a defining factor. He also liked the tools that came with it.

"Site Scan fit the bill for what we were looking for, and it gave me the flexibility to scale," he said. "My goal is not for me only to fly but for me to grow *[drone use]* as a business line within my organization and run it from the enterprise level."
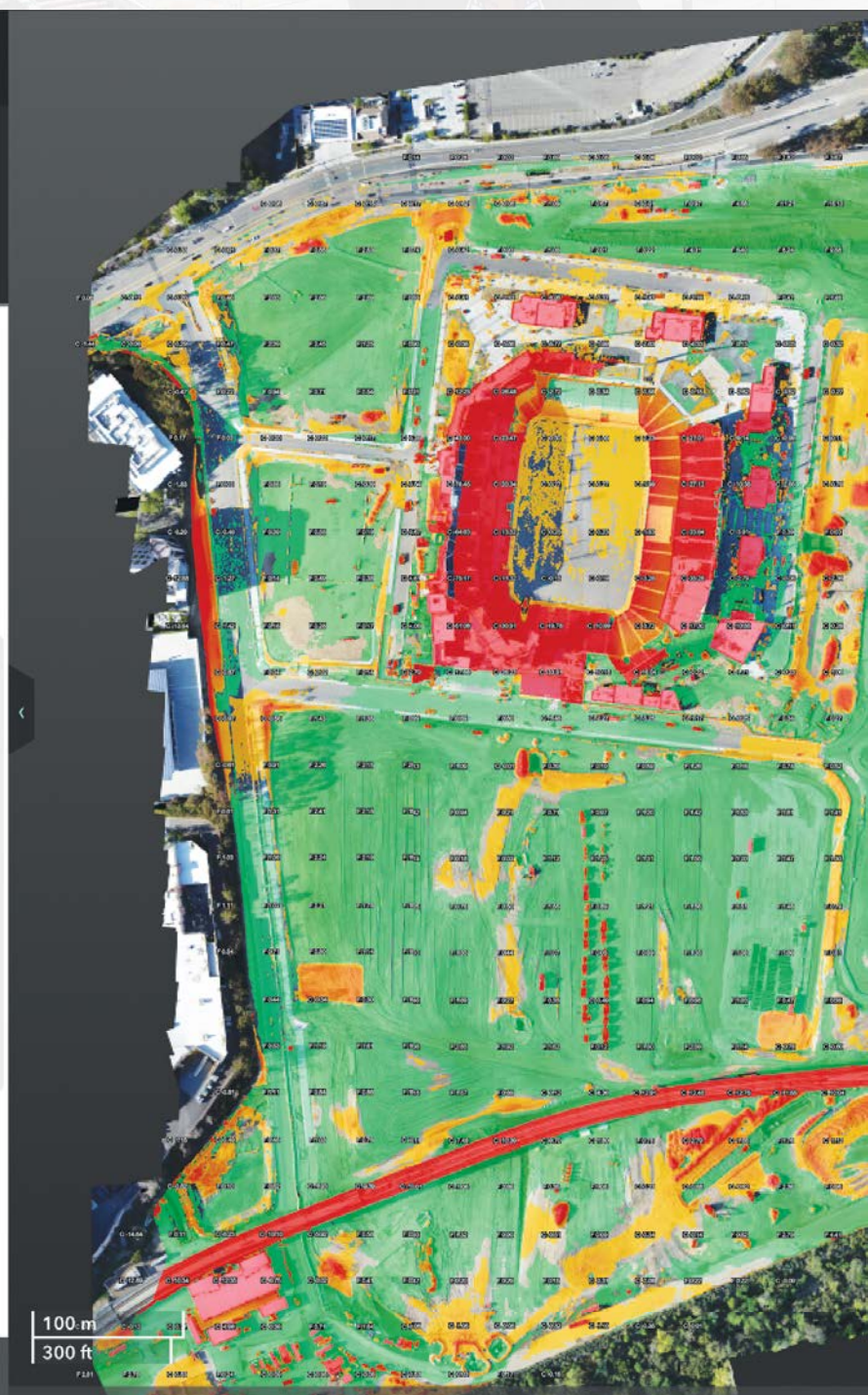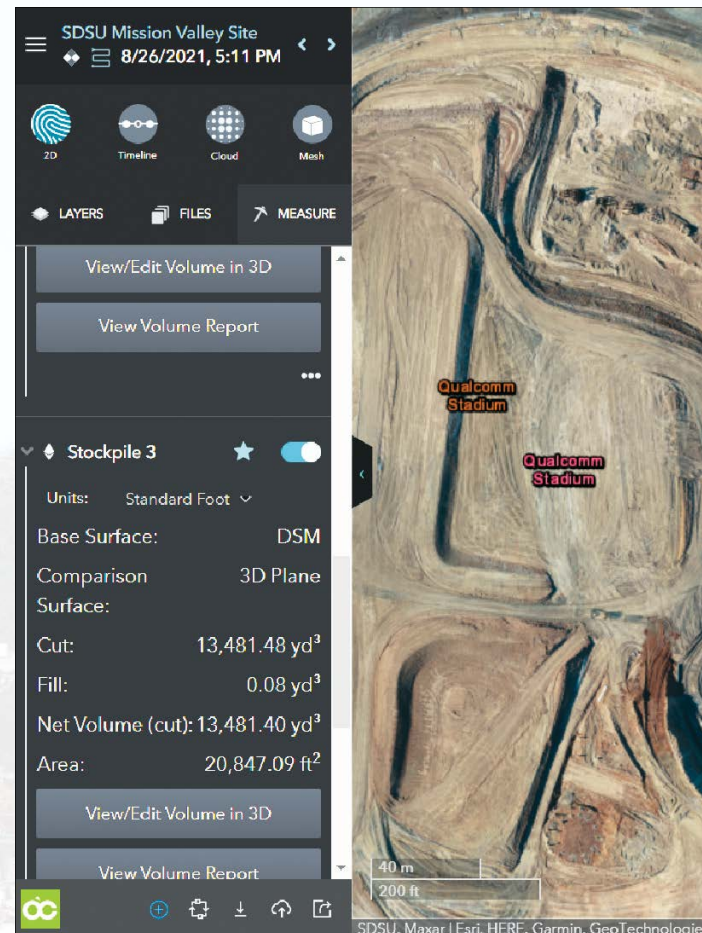
Another benefit of using Site Scan was that it was "drone agnostic," according to Dorsey. Other solutions he researched required users to purchase the drone along with ground control points and other proprietary hardware, which would lock OCMI into using one company's products. Site Scan, however, is compatible with a range of drone technology. Recently, when one of his organization's drones required maintenance, Dorsey was able to continue flying weekly missions using his personal drone.

Dorsey was also able to learn how to use Site Scan quickly and easily because it is user-friendly and intuitive. After receiving airspace authorization at the project site, Dorsey began flying his drone every Thursday to take images of the construction.

"I went out, and I took my drone out and flew it, and I tried to reverse engineer how I thought the software would work," Dorsey said. "The datasets were pretty large—about 700 to 900 photos per mission."

For the stadium construction project, which began in 2020, Dorsey said his typical workflow was to fly over the site with a drone, upload the images to Site Scan, and then process the imagery. He shared a weekly distribution report with stakeholders that showed the site plan and included a link to a 2D orthomosaic and a 3D mesh model that let users walk around the site remotely. Dorsey also included videos from his flights.
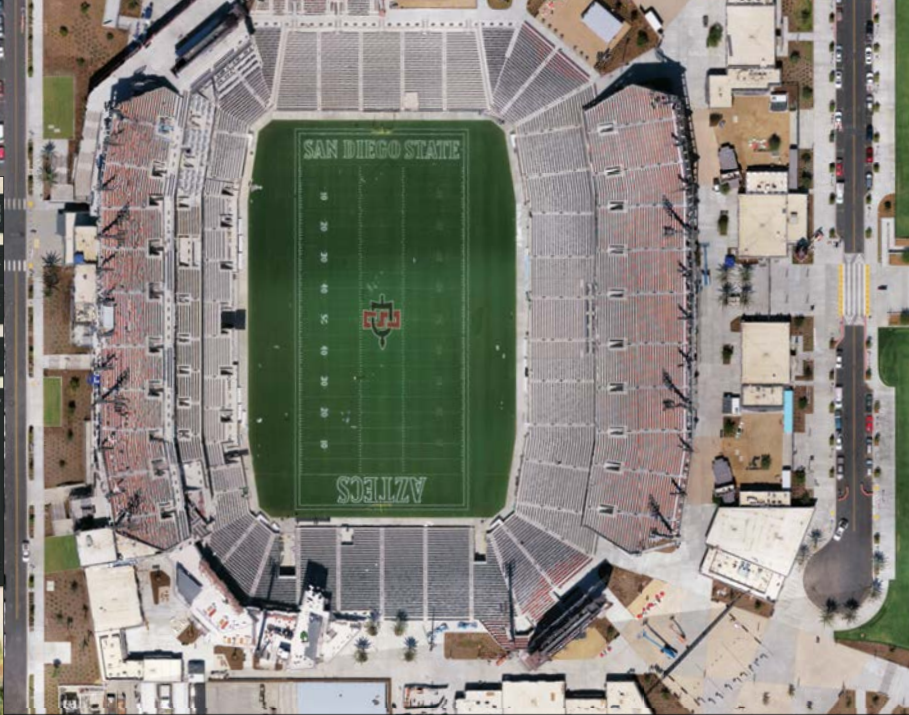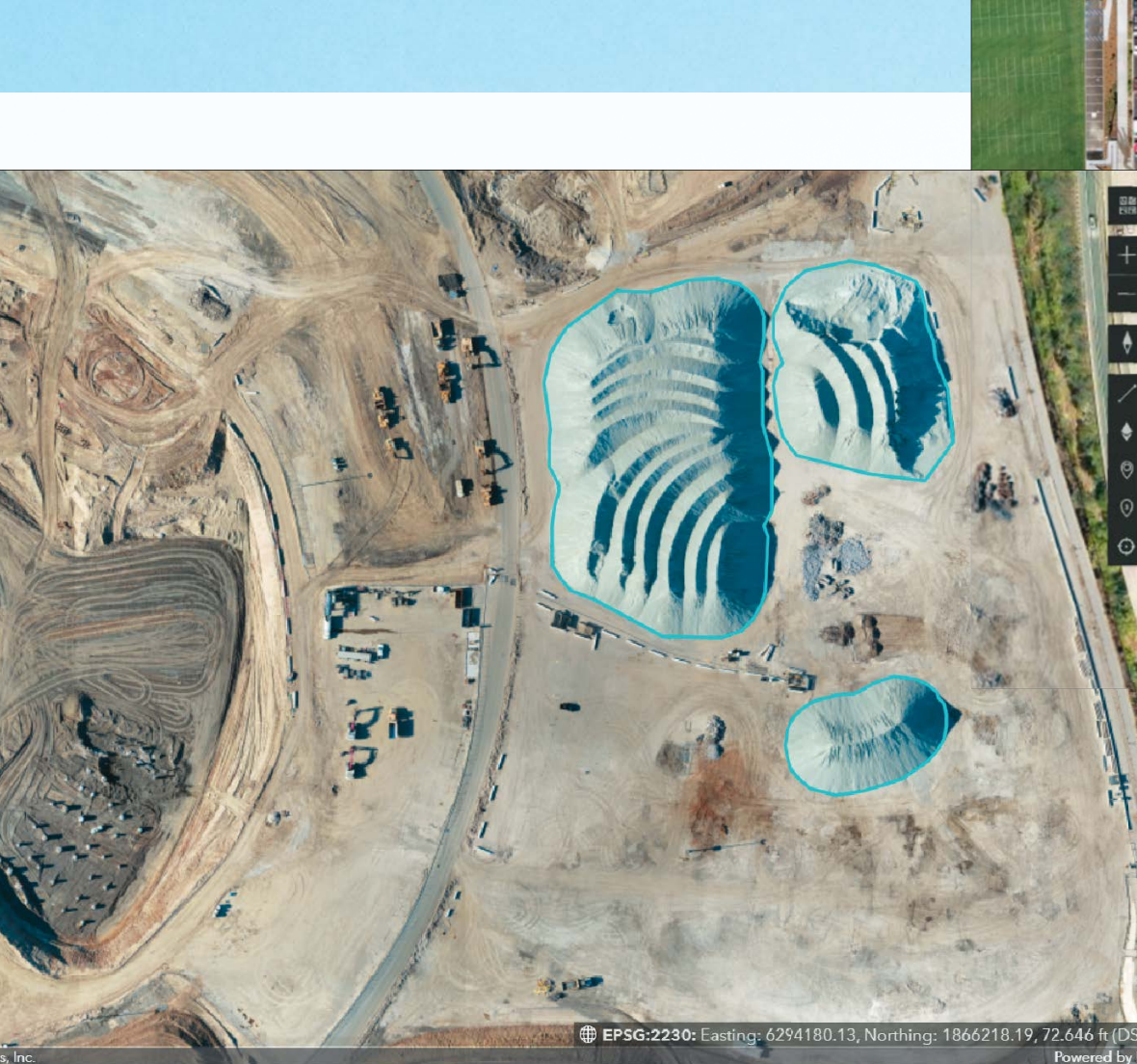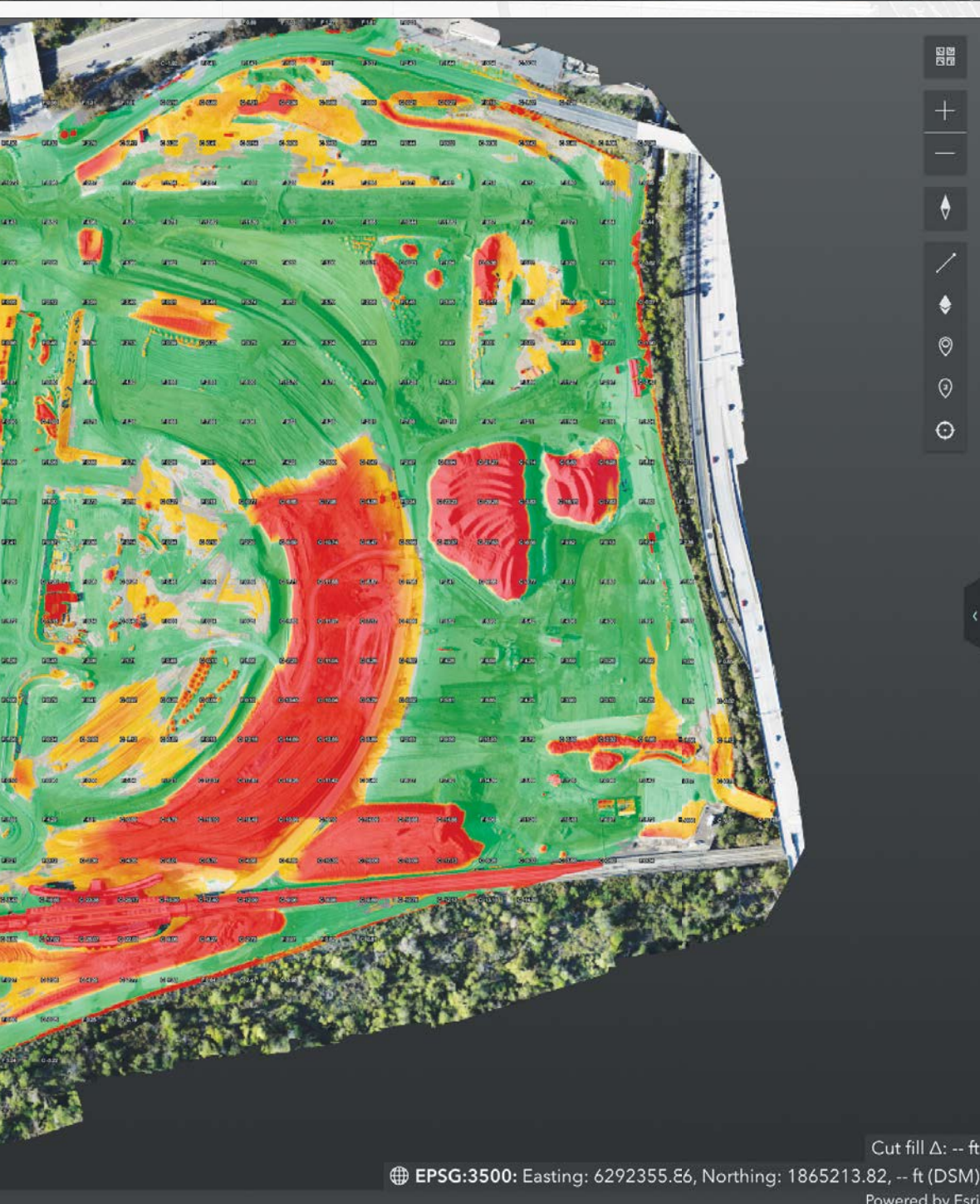

→ Processing and analyzing imagery with Site Scan for ArcGIS allowed project stakeholders to compare the original grade of the construction site to the final design of the stadium.

Capturing the Right Metrics

Because site construction began at the height of the COVID-19 pandemic, using Site Scan was key for Dorsey and his team to keep stakeholders up-to-date on the project.

"I *[would]* get requests from clients *[that said]*, 'Hey, can I get that new plan? *[…]* It created a sense of awareness of *[the]* project site from a visual aspect," Dorsey said. "People do like the 3D mesh model. That does give them visibility on the project site."

Dorsey was pleased that Site Scan gave him the ability to create models. He and his team recently used the software to complete a topographic survey of the new women's lacrosse field at San Diego State University. Using ground control points of the field, he said he completed a drone flight in 15–20 minutes and was able to immediately process the data to create the survey. Getting a plane or helicopter to fly the same mission could cost $8,000 to $10,000, so the use of a drone and Site Scan led to significant cost savings.

"Back when I was flying a drone as a photographer, I was just taking artistic photos or getting to spots that I wanted to capture. But you couldn't create models," Dorsey said. "So I see the value of how this is going to start to weed out some of those big-dollar costs on projects if you have the right tools in place to do so."

On the Snapdragon Stadium construction project, using Site Scan enabled OCMI team members to obtain the metrics they needed for their client. When the original stadium was being taken down, construction personnel created large stockpiles of concrete, and an on-site batching plant was set up to reprocess it. OCMI was asked to get quantity takeoffs on the stockpiles—that is, to estimate materials—and Dorsey and his team were able to use Site Scan to run volume calculations that told grading subcontractors exactly how much material was excavated.

"When we were faced with a change order request, we were able to quantify exactly how much material was in the various three stockpiles on-site, which then we were able to *[use to]* thwart the claim that there wasn't enough material to fulfill the base *[of the stadium]*," Dorsey said. "So that was a big win for having *[Site Scan]*."

Knowledge Sharing for Continued Returns

Despite the challenges of constructing a new stadium with recycled materials during a global pandemic, Snapdragon Stadium was built on time and came in under budget.

The successful deployment of Site Scan for the stadium project has led Dorsey and the OCMI team to use it for other construction projects as well. And Dorsey's end goal is to pass on the knowledge he's gained and teach other pilots how to employ the technology.

"I'm thinking, how do I scale it?" Dorsey mused. "It's just something that I'm really passionate about and want to invest in. I think there are a lot of returns when it comes to where *[Site Scan]* is going."

Captivated by Imagery, a Pioneering Radar Expert Builds a Legacy in Education

↑ Dr. Christiane Schmullius (Photo courtesy of Anne Günther, Friedrich Schiller University Jena.)

The first time Dr. Christiane Schmullius saw an infrared Landsat image, she was astonished.

"I was touched by the colors and the heterogeneity of the surface I was looking at," she said. "Being able to see something that my own remote sensing sensors—my eyes—cannot see because they're limited to the visible wavelengths was just amazing. I was in awe."

That was the moment Schmullius knew that she wanted to work in remote sensing. Now, she is a leading expert in the use of radar and global satellite monitoring to perform land surface analysis.

Schmullius, an ebullient professor and chair of the Department for Earth Observation at Friedrich Schiller University Jena in Germany, grew up in Frankfurt as part of a hiking family.

"My father used to hike every Saturday in the forest, and as a hobby, we also visited old castles," she recalled. "I grew up driving and walking through the landscape. And obviously, I was looking at maps."

Her love of nature influenced her to study physical geography as an undergraduate. One of her required courses was on air photo interpretation.

"This was in 1982, and at our institute, we didn't have computer pools," she recalled. "So we looked at air photos and stereo photogrammetry using stereoscopes."

Her professor was a geologist who also owned a company that analyzed air photos from all over the world. Schmullius was so captivated by the images she saw in class that she decided to intern at his company.

"They had computers, and for the first time in my life, I saw a near-infrared false color composite of the Brazilian rain forest," she said. "That was it; I was hooked."

To continue working in this field, however, Schmullius realized that she would need to study in the United States.

"The company I interned for used Landsat images, and seeing what you could do with them on a computer, I realized that in Germany, we were not at that standard," she said.

Schmullius applied for a Fulbright scholarship to study at the University of California, Santa Barbara (UCSB). She centered her application on the need to use remote sensing technology to protect the environment, which was becoming a big focus in the United States.

"They loved my application so much that they encouraged me to apply for a two-year, fully funded ITT scholarship," Schmullius said, referring to the ITT International Fellowship Program, which was sponsored by the International Telephone & Telegraph (ITT) Corporation. "That is what gave me the chance of a lifetime to do my master's at UCSB. It was one of the best places to study earth observation."

She took a class on radar taught by visiting professor John Richards, who is now a professor emeritus at Australian National University.

"I didn't understand much at the time. What he talked about seemed like miracles to me. But that really hooked me on radar," she said. "That is what great teachers can do."

Upon completing her master's degree, Schmullius returned to Germany to look for a job in remote sensing.

"I got the opportunity to work at a very well-known photogrammetry school at the Karlsruhe Institute of Technology," she said. "They had a project using Landsat data to map land cover, and that is exactly what I had done my master's thesis on. There were not many people in Germany around 1986 who had that kind of experience, and I really have to say, my training at UCSB had been excellent."

She worked there for a year and a half before moving to Berlin, where she pursued her PhD at the prestigious Free University of Berlin while working at its Institute for Space Sciences.

"One of Germany's first astronauts was looking for a PhD student to use an airplane, a little Cessna, as an airborne laboratory for conducting interesting research," she said.

Because the former astronaut had trained with the National Aeronautics and Space Administration (NASA), he liked that Schmullius had studied in the United States, she said.

"I got accepted as his PhD student, and so another adventure started," she recalled. "My idea was to bring a radar antenna up in the Cessna to fly over agricultural fields and investigate how those fields looked in different radar wavelengths."

Similar to how microwaves in kitchens work—heating up food by bringing water molecules into rotation to create warmth—radar transmits pulses of microwave radiation toward the earth's surface. When these pulses encounter water molecules in soils, vegetation, or snow, for example, parts of these signals bounce back to the radar sensor, denoting (in simplified terms) how much water is present on the observed surface. Taking these measurements over and over, across space and time, shows changes in surface moisture, vegetation structure, or snow volume.

"I got in touch with oceanographers at the University of Hamburg who owned a multifrequency radar antenna for ocean platforms, and my astronaut PhD adviser was crazy enough to say, 'Okay, let's do it. Let's put that radar antenna in the Cessna!'" Schmullius said. "He flew the airplane himself because our setup was a little dangerous. And it worked out. I loved it."

The dataset they put together was valuable and formed the basis of her PhD dissertation. Because of that experiment, the German Aerospace Center, known by its German acronym DLR, got in touch with Schmullius and offered her a postdoc position exploiting imagery taken by Europe's first radar satellite, ERS-1, for agricultural monitoring. She accepted.

At the time, DLR was also working with NASA's Jet Propulsion Laboratory (JPL) and the Italian Space Agency to launch a radar space shuttle mission called SIR-C/X-SAR.

"My boss said, 'Wouldn't you be interested in becoming a member of the German payload operations team that's planning the radar acquisitions in the space shuttle *Endeavour*?'" Schmullius recalled. "And I said, 'Well, of course!'"

As part of DLR's team, Schmullius got to go back to California and work with JPL and a lot of her former UCSB classmates. She was also eventually part of the mission control team at NASA's Johnson Space Center in Houston, Texas.

"The second shuttle mission in 1994 performed an extremely successful experiment called radar interferometry, which is a very powerful technique used to map topography and changes in topography," Schmullius said. "The lessons learned paved the way for the Shuttle Radar Topography Mission in 2000, which produced one of the most successful earth observation products: a global digital elevation model."

The shuttle campaigns ended in 2000, and Schmullius moved into academia as a professor of remote sensing.

"I always loved teaching," she said.

She was also ready to explore her own interests. Since joining the faculty at Jena, Schmullius has collaborated with scientists all over the world on projects such as producing biomass maps of the Siberian taiga and forests in Mexico, helping Kruger National Park in South Africa map its vegetation structure to analyze the sustainability of elephant populations, developing tools to assess land degradation in southern Africa, and improving crop and surface moisture monitoring in Germany.

Schmullius and her team have also built a radar teaching web tool called EO College (eo-college.org) that's used around the world. It is a repository of massive open online courses (MOOCs) on earth observation that range from simple to complex.

"We have 2.5 million page views, 25,000 registered users, and 4,000 course completions, which is a lot in the radar remote sensing world," she said.

Schmullius believes that transforming her enthusiasm for radar remote sensing into approachable educational material is her greatest legacy. And as the GIS and remote sensing fields continue to unify, she is excited to see what comes next.

"With Sentinel-1 and Sentinel-2, we now have a fleet of earth observation satellites that let students and scientists bring together radar and optical data to explore changing land surface phenomena. For example, we can acquire images at 6:00 a.m. and 6:00 p.m. and see how the water content of forests and crops has changed. That's marvelous," she exclaimed. "With the Copernicus Sentinel fleet, we have reached a new era of how we monitor our earth's surface in every realm, whether for sustainable land use, necessary infrastructure, climate change impacts, or health care. The data is there, and it's wonderful, and it's free. There will be more and more automatic exploitation of these big datasets, but they are useless if they are not brought together with GIS. So both worlds need each other."

↓ A synergistic combination of Sentinel-1 radar (left) and Sentinel-2 optical (right) imagery shows land surface dynamics in Northern Cape, South Africa. (Image courtesy of the SALDi Project.)

GIS Hero

High Precision Data Capture

Inside Esri® ArcGIS® Field Maps

Trimble® GNSS hardware, apps, and services integrate with ArcGIS Field Maps to precision-enable your workflow and drive confidence in your spatial data.

Confidence.
Delivered.

geospatial.trimble.com/esri

Trimble. esri Partner Network Silver

There's Hope for Achieving New Biodiversity Targets

Scientific Currents

By Guest Columnists **Dr. Walter Jetz** and **Tamara Rudic**
Yale Center for Biodiversity and Global Change

The end of 2022 brought about a long-delayed but pivotal moment for global biodiversity: the adoption of the Kunming-Montreal Global Biodiversity Framework (GBF) at the United Nations (UN) Biodiversity Conference.

At what was formally known as the 15th meeting of the Conference of the Parties to the Convention on Biological Diversity, or COP15, leaders from around the world committed to new goals for safeguarding biodiversity and its contributions to people. These replace the previous Aichi Biodiversity Targets that were set in 2010. The new framework sets ambitious goals to enhance ecosystem integrity, prevent extinctions and loss of genetic diversity, and support inclusive and equitable conservation approaches.

What was achieved includes the following:

- Nearly 200 nations made a global and measurable commitment to halt and reverse biodiversity loss by 2030.
- They adopted a target to protect 30 percent of land, inland waters, and the ocean by 2030. This target recognizes the rights and leadership of Indigenous peoples and local communities while more than doubling and quadrupling the current levels of protection for land and sea, respectively. (This target was inspired by Edward O. Wilson's call to protect "half" of nature for global biodiversity.)
- The agreeing nations consented to creating a monitoring framework to track progress toward reaching their shared commitments.
- $200 billion a year will be mobilized for safeguarding biodiversity by 2030, doubling the previous Aichi baseline.

The Aichi Biodiversity Targets called on nations to protect at least 17 percent of terrestrial and inland water and 10 percent of coastal and marine areas, as well as to meet 19 other objectives. These goals remained largely unachieved by their target date of 2020.

We must ensure that this new, more ambitious agreement does not reach the same fate. To do that, we need to use established metrics and the latest geospatial technology to rigorously monitor progress.

Achieving Targets by Measuring Progress

There is hope that the key beneficiaries of past losses of nature now recognize their responsibility for the problems that the world's ecosystems currently face. In the GBF, parties have made greater (yet still insufficient) resource commitments in support of countries with the strongest conservation burden—that is, those where high biodiversity coincides with the critical need for economic growth.

Perhaps the most significant sign that leaders are committed to achieving the 2030 goals might be the adoption of a monitoring framework that formally recognizes the importance of measuring progress toward these shared commitments. Specifically, the GBF Monitoring Framework requires countries to use standardized indicators of biodiversity change to quantitatively track the status and trends of ecosystems and species.

Unlike with the previous agreement from 13 years ago, it is now possible to take comparative and increasingly robust measurements of biodiversity change at the global scale. This is thanks to

rapidly growing biodiversity data, vast flows of information from ever more sophisticated earth-orbiting satellites, and the immense advances that those within the GIS community have made—all of which have enabled the global biodiversity monitoring and science community to take major steps forward.

Much of this progress has been facilitated by the Group on Earth Observations' Biodiversity Observation Network (GEO BON). This group has encouraged the use of Essential Biodiversity Variables (EBVs)—such as genetic differentiation or species population sizes measured over time—as core spatiotemporally explicit variables supporting the development of high-level biodiversity indicators.

A New Generation of Biodiversity Indicators

A good case in point consists of three GEO BON biodiversity indicators based on EBVs and developed by Yale University's Map of Life, a global platform for assessing species distributions and their changes. They are the Species Habitat Index (SHI), the Species Protection
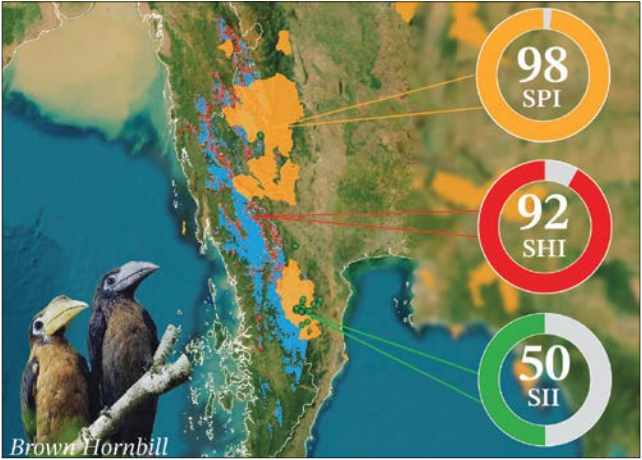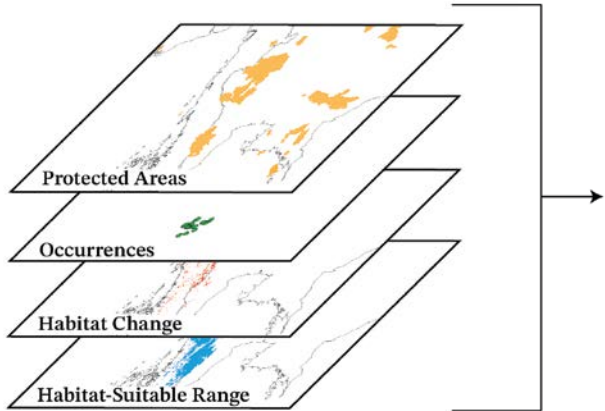
↑ The brown hornbill has lost 8 percent of its habitat area and connectivity since 2001 (red), but it has near-adequate protection in conservation areas (orange). Monitoring efforts for the species need to be improved (green).

Index (SPI), and the Species Information Index (SII). These indexes were produced in partnership with Esri; the E. O. Wilson Biodiversity Foundation; and other technology and funding partners including Google, the National Aeronautics and Space Administration (NASA), and the National Geographic Society. All three indexes were formally adopted in the GBF Monitoring Framework.

The indicators are geospatial metrics that track the population health and conservation status of species, plus the adequacy of monitoring efforts for those species, based on measurements taken for tens of thousands of single species. The metrics can be calculated at any level with available information, but particularly powerful insight arises when they are developed and standardized globally.

These calculations start with employing top-of-the-line species distribution models to derive best-possible estimates of species' geographic ranges—an effort at the heart of Map of Life. Available at mol.org, Map of Life integrates a range of distribution data types and resources with remotely sensed environmental layers in spatial models to derive 1 kilometer- and finer-resolution predictions of their occurrences.

From there, each indicator uses additional data on remotely sensed land-cover change (from the SHI), expansions of the protected area network (from the SPI), and data on growth in species occurrence (from the SII). The SHI scores the sizes, connectivity, and genetic diversity of species populations relative to a reference period. The SPI measures how adequately species are represented in conservation areas. And the SII captures how well field observations represent the distribution of species.

Combining Measurement with Decision Support

More than offering measurement, the indicators provide support for decision-making. Thanks to their detailed, map-based nature, researchers can identify the exact areas where a species is losing habitat, where additional protected areas would be most effective, and where further data collection efforts are needed.

In addition, the three indicators are even more powerful when used together. Using the SII to advance targeted data collection improves the information available on the distribution of species, which leads to more accurate calculations of the SHI and SPI. When the SHI gains timely insight into habitat change, this can help inform protected area planning. And combining the habitat and protection scores provided by the SHI and SPI, respectively, can help researchers identify protected areas
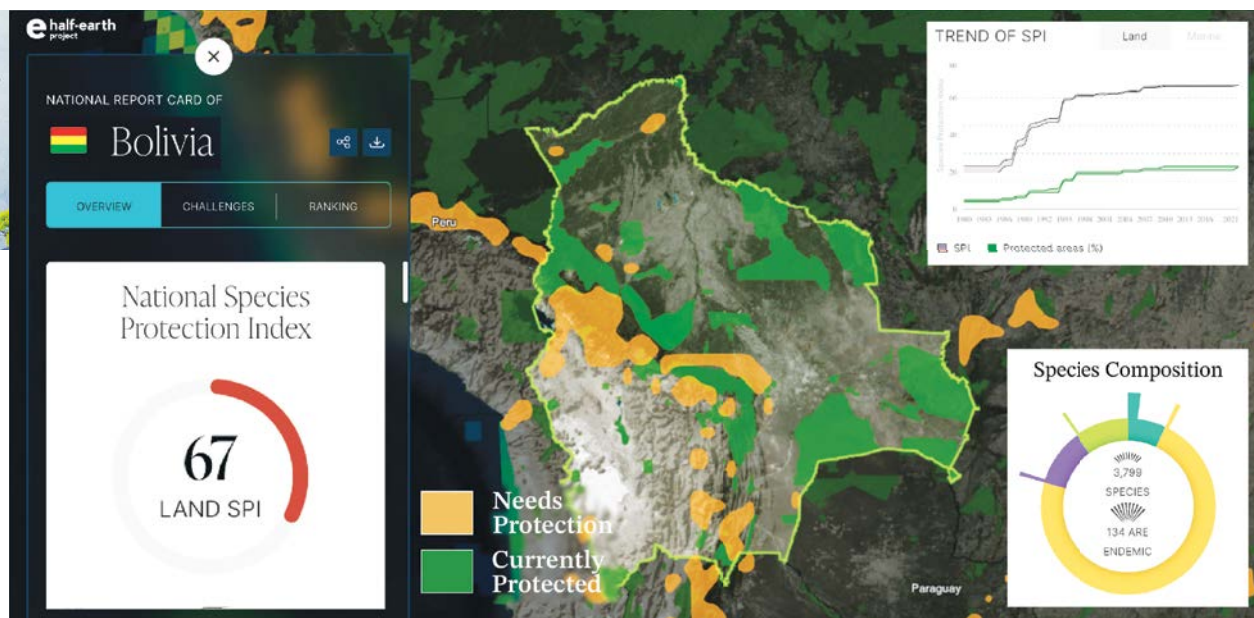
that continue to face habitat loss, as well as potential areas to target for restoration and subsequent protection.

On the Map of Life website, anyone can explore detailed information for tens of thousands of species across all countries. For example, people can see where the brown hornbill has faced the most severe habitat loss. Or they can examine the countries in which the zebra duiker's habitat is sufficiently covered by protected area networks. Or they can see the regions in Bolivia where biodiversity is critically undersampled.

This array of information can greatly help countries track their progress toward attaining the GBF goals and initiate effective, data-driven conservation actions.

The Half-Earth Project Map

For the most comprehensive information on the priorities of and progress in area-based conservation, head to the Half-Earth Project Map at map.half-earthproject.org. E. O. Wilson's research on island biogeography and his subsequent book, *Half-Earth: Our Planet's Fight for Life*, inspired the 30x30 target that's part of the GBF. This is the initiative to protect 30 percent of land, sea, and freshwater by 2030 to safeguard biodiversity. The central metric

for measuring progress around 30x30 is the SPI, which gauges how well existing protected area networks cover species' habitats and where new additions to networks have the greatest potential to conserve biodiversity.

Open and accessible to all, the Half-Earth Project Map, which was developed in close partnership with Esri, also offers National Report Cards for each nation. These include statistics on the composition of species in the country, temporal gains in protection, and areas that are being prioritized for future conservation. Additionally, site visitors can explore the unique challenges each country faces on the road to achieving a high SPI and compare various countries in global rankings.
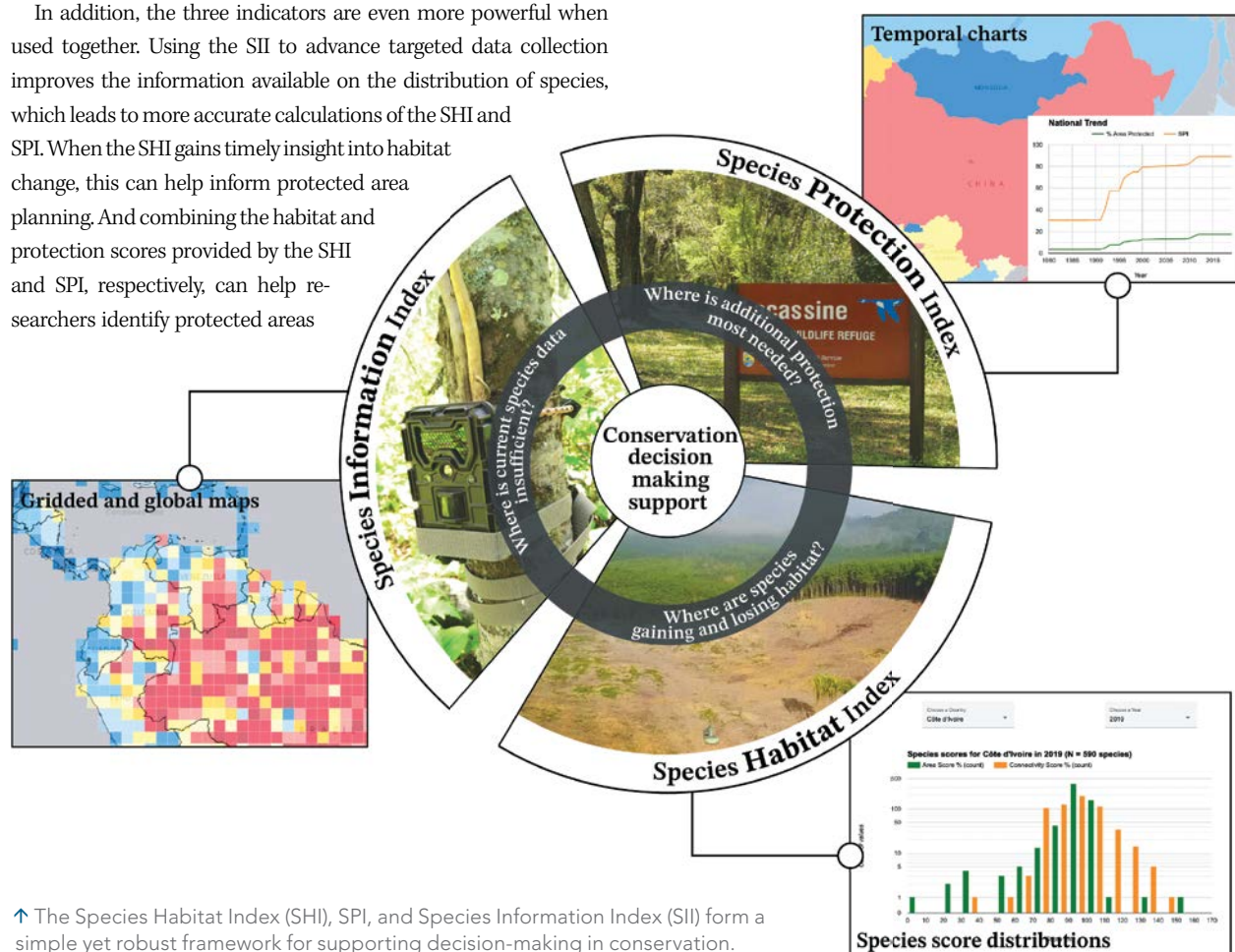
Another feature of the Half-Earth Project Map is the Area of Interest tool, which lets users get similar biodiversity reports for any location of interest, such as a potential new park or construction site. For each species, users can explore a region's relative importance to and protection adequacy for that species, its threat status, and more. Drawing from the species data at Map of Life, this tool supports spatial conservation assessment and planning through an easy-to-use, interactive interface. Anyone who is armed with both local knowledge and these globally relevant indicators will be better equipped to contribute to the conversations around and actions that affect various species.

Now, Go Explore

The biodiversity conservation equation is multilayered. It doesn't just involve one species and geospatial data—it also takes into consideration the needs and rights of human communities; the assurance of continued ecosystem services; and other economic, social, and cultural concerns. Biodiversity indicators form one crucial part of this equation. When humans weave these biodiversity indicators into their decision-making processes alongside other factors, the world will inevitably achieve the greatest results for biodiversity, people, and the planet.

To get engaged with these projects, head to mol.org/indicators and map.half-earthproject.org. There, you can investigate the three biodiversity indicators and explore ways to get involved with GBF efforts.

For more information, email Dr. Walter Jetz of Yale University at walter.jetz@yale.edu.

About the Authors

Dr. Walter Jetz is a professor of ecology and evolutionary biology and of the environment at Yale University. He leads Map of Life and directs the Yale Center for Biodiversity and Global Change, which creates knowledge and tools for understanding biodiversity dynamics and guiding conservation decisions. Tamara Rudic is the science communication specialist for the Yale Center for Biodiversity and Global Change.

↑ The Half-Earth Project's National Report Card for Bolivia shows which areas of the country are protected and which parts need to be conserved, plus the composition of species there and trends in the national Species Protection Index (SPI).

↑ The Species Habitat Index (SHI), SPI, and Species Information Index (SII) form a simple yet robust framework for supporting decision-making in conservation.

Managing Bathymetric Data Just Got Easier

Hydrographic surveyors, cartographers at national mapping agencies, and others who collect and aggregate bathymetric data often end up managing large, overlapping datasets that ultimately get trapped in desktop-based, bathymetric-specific data processing systems. This can make it difficult to perform data analysis and share the results.

The latest release of ArcGIS Bathymetry enables users to catalog vast amounts of bathymetric data and make the data easier to identify, extract, analyze, and visualize and leverage in web and mobile apps.

ArcGIS Bathymetry is an extension for ArcGIS Pro that provides tools and workflows for exploring and modeling bathymetric data and its metadata in a GIS environment. After users collect and process their raw data, ArcGIS Bathymetry catalogs finalized data products in the Bathymetric Information System (BIS) database.

The BIS is an efficient and lightweight database for archiving survey data and its associated metadata. It creates references to where the data products are located, allowing users to access and visualize them on the fly without having to move, copy, or otherwise duplicate the data. Moreover, the BIS framework enables users to create their own metadata and leverage those attributes and values to quickly discover, filter, and sort across vast data archives.

With the release of ArcGIS Pro 3.1, ArcGIS Bathymetry offers a simple, end-to-end workflow that allows users to do the following:
- Create a BIS database
- Add data to the BIS
- Publish the BIS database as an image service
- Sort and filter survey data archives in an intuitive web app
- Create custom mosaic datasets

Different Roles for Different Users
ArcGIS Bathymetry gives a small number of users the ability to enter new survey data into the BIS database via ArcGIS Pro. That data can then be shared across the organization or with a community of specified users via ArcGIS Image Server. Additional users can then access the disseminated data through an intuitive and easy-to-use web app. This gives key stakeholders the ability to sort and filter archived survey data to find what they need.

Metadata Can Be Customized
The BIS that's delivered with ArcGIS Bathymetry allows users to create their own custom metadata attributes. When the BIS is shared with other users, they use those metadata attributes to sort and filter datasets. For instance, they can filter the data according to the name of the agency or company that captured the survey so that they're evaluating only those datasets.

Spatial Data Gets Archived Together
In ArcGIS Pro, ArcGIS Bathymetry allows users to archive bathymetric data together with any other type of spatial data. This makes it easier to collect information and make decisions based on all the spatial data that's available for a particular area of interest. Hydrographic survey planners, for example, can leverage and visualize the polygons, contours, and lidar data from a survey taken of a harbor to help prioritize additional survey operations when monitoring changing sedimentation.

An Easy Way to Disseminate Data
The Bathymetry web app offers a simple way for users to disseminate their BIS database to a wide audience. The web app is configurable, which enables users to decide which attributes of the BIS to expose and whether to share them publicly or with a select user group. When additional users then employ the filter and sort tools to limit the data to what they want to see, they can generate custom mosaic datasets that can be used in ArcGIS Pro to perform further analysis. For instance, after conducting a survey, staff at a port agency may want to calculate the volumetric difference between the surfaces recorded in a previous survey versus the most recent one to determine how much the port will need to pay a dredging company to keep waterways clear.
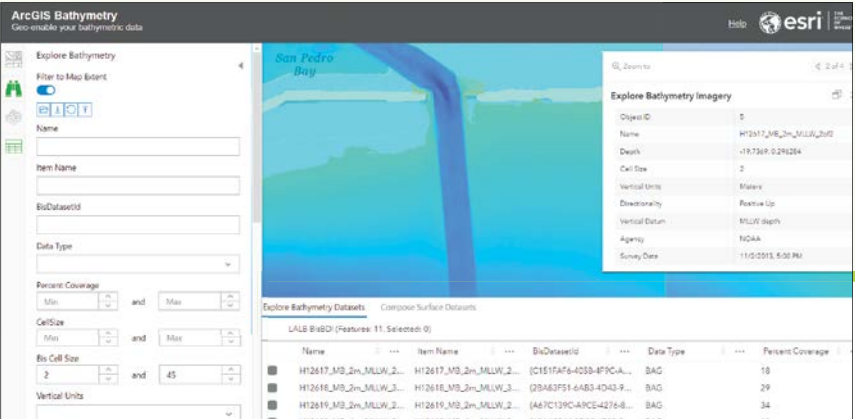
Geoenable Your Bathymetric Data
For more information about ArcGIS Bathymetry, visit go.esri.com/bathymetry. Current Esri users can reach out to their Esri representatives.

To see an example of the Bathymetry web app and other ArcGIS Maritime maps and apps, visit go.esri.com/maritimedemosite. A webinar on ArcGIS Bathymetry in ArcGIS Pro 3.1 is available at go.esri.com/BathymetryWebinar2022.
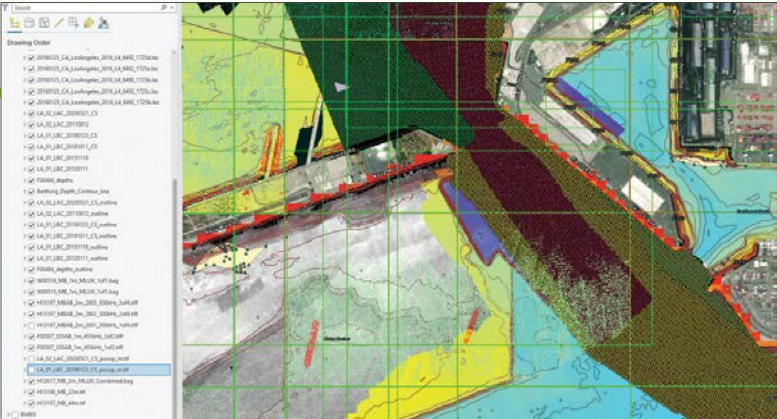
← ArcGIS Bathymetry allows users to visualize polygons, contours, and lidar data alongside single-beam and multibeam sonar data.

→ The ArcGIS Bathymetry web app provides an easy way for users to share their Bathymetric Information System (BIS) data.

Improve Daily Operations with ArcGIS Mission

During strategic events and incidents, such as a major sporting tournament or a natural disaster—when command and control of a situation are paramount—ArcGIS Mission provides real-time data visualization and communication between the command post and field personnel. By facilitating situational awareness, Mission helps tactical teams get critical resources where they need to be, when they need to be there. The software also stores mission-critical data behind the scenes so that it is ready to use for analysis and reviews.

Cobb County, Georgia, for example, leveraged ArcGIS Mission when the Atlanta Braves made a Major League Baseball playoffs run in 2021. Before, during, and after the postseason games that were held at the team's home field, Truist Park, county staff used Mission to visualize critical information, such as the location of every traffic light and camera near the stadium; track resources, including plainclothes officers patrolling the area; and provide real-time communication between the command post, mobile crews, and other agencies working the event. This allowed incident commanders to make tactical, data-driven decisions in the moment and ensure that everyone had an enjoyable and safe experience.

What is perhaps less known about ArcGIS Mission is that it can be just as beneficial when used for daily operations. Security service providers can employ it to keep facilities; schools; and key people, such as business and community leaders, safe. Law enforcement agencies can leverage Mission to enact crime control strategies. And national, state, or local park service organizations can use it to maintain trails and ensure visitor well-being.

Here is how daily use of ArcGIS Mission works.

One Solution for Daily Planning and Operations

With Mission, users benefit from having one solution to plan events, assign resources, share information, communicate with team members, and review incidents. The software dynamically integrates organizational data, such as basemaps and asset details; intelligence from external sources, such as live weather data and maps of landmarks; and new information that comes in during a mission, such as photos and field reports, into a common operating picture. By layering imagery, live weather and traffic data, and other dynamic information

feeds onto a mission map, users add context to their operations, enhancing situational awareness and decision support.

The ArcGIS Mission Manager web app allows safety and security managers to build and organize the events that make up a typical day at an organization, such as monitoring campus security patrol routes or briefing private security personnel on where executives will be holding and attending meetings. Within Mission Manager, users generate mission maps, complete with graphics, overlays, and other reference layers; build teams and add members to them; create and leverage mission reports; manage materials such as documents and photos; and oversee the activities of field-based personnel. Once the day's activities are underway, Mission Manager users can see mobile crews' past and current locations in relation to the operational picture presented on the mission map. They can also track all teams' communication to stay abreast of new events and findings.

Concurrently, field personnel use the ArcGIS Mission Responder mobile app to conduct their day-to-day duties. For instance, campus security officers can use the app to mark themselves inactive when they take a break, or park rangers who need to close a trailhead can employ the app to report the status of the task and add notes or photos to help with reporting. Within the app, the mission map—which contains dynamic and static layers—helps mobile workers orient and locate themselves in relation to in-progress events and other field-based responders. So law enforcement officers can view traffic data to modify their patrol routes, or those park rangers can monitor weather trajectory to see if they need to close additional trails. The app also enables users to monitor chat feeds and browse any completed mission reports for increased awareness.

Working with Other ArcGIS Technology

One key advantage of deploying ArcGIS Mission for daily operations is that it integrates with other ArcGIS apps and software.
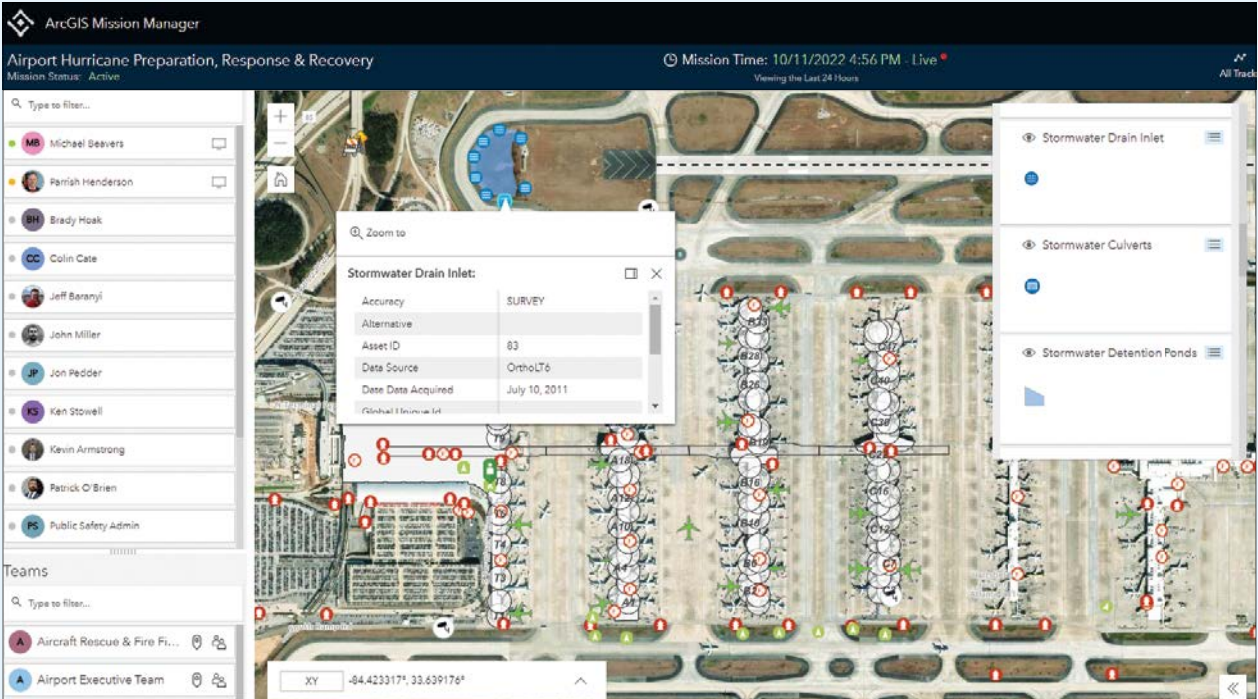
Leveraging ArcGIS Dashboards, for example, to create an interactive, single-screen view of an organization's day-to-day operations brings the whole picture to life. Dashboard users can see incident reports, field personnel tracks, chat feeds, and other data to pinpoint areas of concern, hold their teams accountable, and replicate mission success in future operations.

Mission is also compatible with ArcGIS StoryMaps, which is useful for compiling narrative-based briefs that combine text, multimedia, and interactive maps. Stories can be used to foster operational transparency by reviewing events that occurred within a specific time frame or at a particular location.

Additionally, ArcGIS Mission can be used in conjunction with ArcGIS Pro and ArcGIS AllSource, Esri's new intelligence analysis app, to gain a deeper understanding of patterns and trends in an organization's daily operations. This can help mitigate security vulnerabilities and improve future events and activities.

For more information about ArcGIS Mission, head to go.esri.com/mission.

↑ The ArcGIS Mission Manager web app allows managers to generate mission maps, build teams, and organize events.

← Dashboards let users see incident reports, field personnel tracks, chat feeds, and other data.
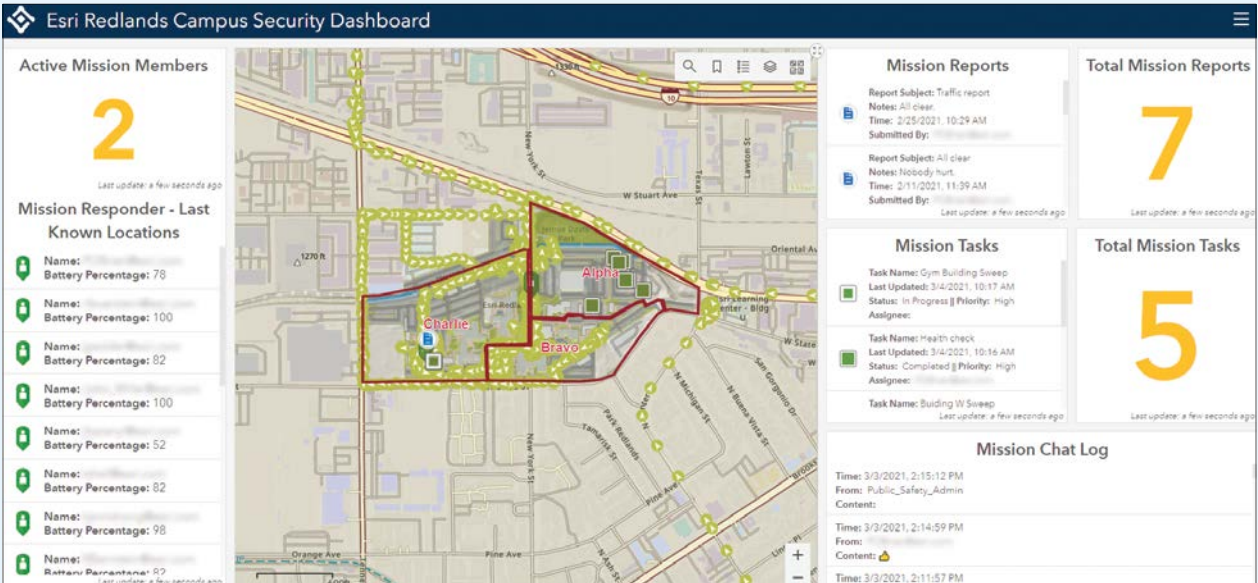
Adopt-a-Drain App
Turns Residents into Environmental Stewards

In January 2018, Jayne Jenks, a conservation specialist with the Waukesha County, Wisconsin, Land Resources Division, approached the county's land information systems team about using GIS to help develop an adopt-a-drain program. The program would allow county residents to choose a storm drain near their homes to keep free from debris. The idea was to give residents a sense of ownership over a small part of their stormwater infrastructure, resulting in greater community stewardship of the county's waterways.

The adopt-a-drain program had two goals. First, the county wanted to improve the quality of water in regional waterways by reducing the flow of trash, debris, plastics, and organic matter into the stormwater system, which drains directly into local rivers, streams, lakes, and ponds. By encouraging residents to keep drains clear of detritus, the county would be able to naturally improve the area's water quality.

Second, Waukesha County aimed to reduce the number of storm drains that get backed up during heavy rainfall. If left unchecked in a deluge, storm drains can become clogged with organic matter and trash, causing stormwater to pool in intersections and creating traffic hazards and other issues. With the recent increase of strong storms and 100-year flood events in the region, it is critical that stormwater runoff systems work at peak efficiency to quickly move water downstream or into retention ponds.

Jenks wanted the adopt-a-drain system to be easy for residents to use; supply the county with key metrics, such as which drains have been adopted and how much waste gets cleared from them; and inform future actions that cities and the county could take to ensure good water quality throughout the region. Relying on Waukesha County's already existing ArcGIS Enterprise deployment, along with technology from Esri partner VertiGIS and a dashboard built with ArcGIS Dashboards, Jenks and Jim Landwehr, the supervisor of Waukesha County's land information systems team, created an adopt-a-drain program that's proving popular with residents and a good example for other local government organizations.

### A Data-Rich App Achieves Several Goals

From a geographic standpoint, Jenks decided to start small with the adopt-a-drain program by developing a pilot project in a single city. She wanted to see if residents would embrace the initiative and give the county a chance to work out any issues before broadening it to other areas.

The city of Waukesha was chosen as the pilot area—in part because it has a mature GIS, including a complete and spatially accurate inventory of storm drain assets, and in part because the city and Waukesha County have a long history of collaborating with GIS. They share data, work together on parcel mapping, and jointly participate in the Southeastern Wisconsin Esri Technical Users Group.

To get residents of the city of Waukesha (and eventually the whole county) involved with the

↑ Custom forms, built with Geocortex Essentials, prompt users for information and provide relevant feedback based on their responses.
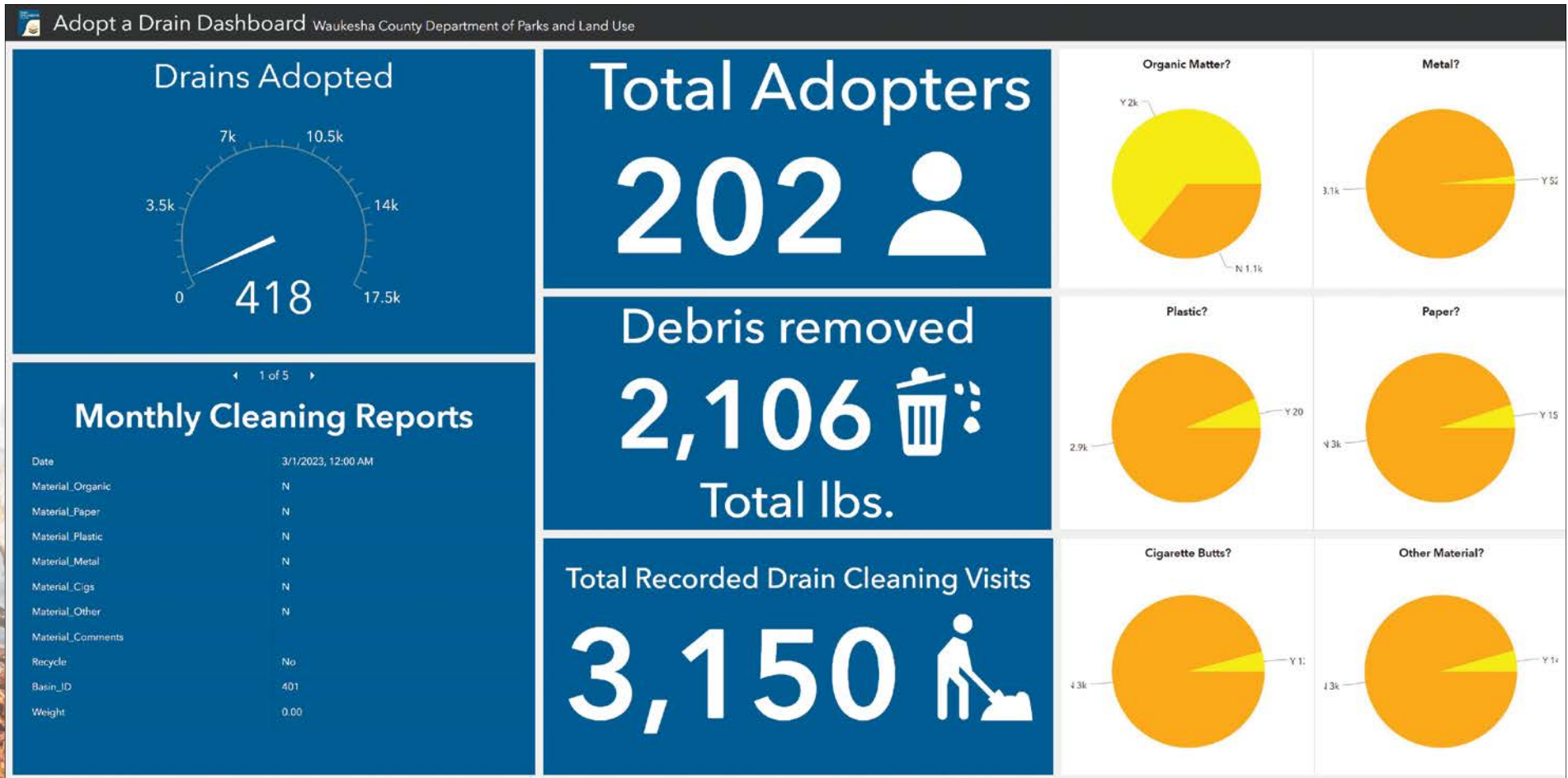
↑ A public-facing dashboard gives viewers a quick overview of storm drain inspection data from Waukesha County's adopt-a-drain program.

↑ Users log their visits each time they clean their drains and record the materials that get removed from them.
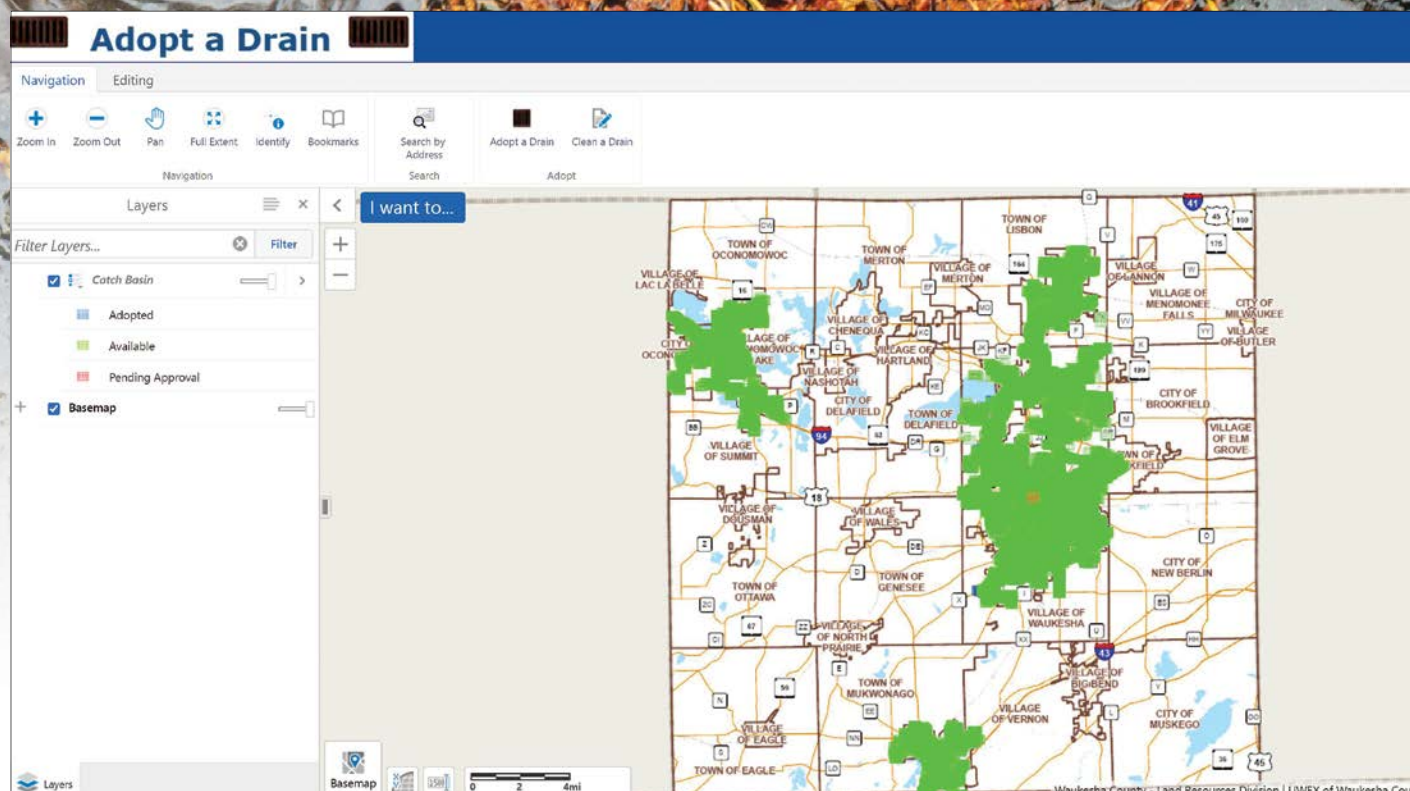
↑ The adopt-a-drain web app lets residents adopt drains near their homes.

program, Jenks wanted to develop a public-facing web app. She thought it should have a simple, map-based interface that would allow users to easily find and select drains to adopt before entering a minimal amount of address data that the county would use to mail them an adoption kit. The kit includes instructions for how to clear a drain, an adhesive storm drain sign that reminds people that these catch basins drain into local waterways, and a reflective vest to wear when cleaning a drain in high-traffic areas.

Landwehr designed the app using Geocortex Essentials from VertiGIS. The product's Workflow Designer allowed him to develop custom forms that prompt users for information and carry out related tasks based on their responses. The web app is powered by feature services in ArcGIS Enterprise that display storm drain locations on a map. Editing tools within the app's interface enable users to select a drain to adopt and enter their contact details so that the county can mail them educational materials and small promotional rewards if they become frequent cleaners.

The drain adoption form also allows users to have a little fun by giving their chosen drain a nickname. This has resulted in drains throughout the city of Waukesha acquiring creative monikers, including Drainy McDrainface,

Clown Lookout, Purple Drain, and Drain Dead Easy. In addition, the form ensures that drain adopters acknowledge and accept the terms of agreement that absolve the county of liability.

Once residents start cleaning their drains, the app allows them to record data about their drain visits, including the type and estimated weight of the materials they remove. This data collection feature is what makes Waukesha's adopt-a-drain program a little different from standard asset adoption programs in which participants simply choose a piece of infrastructure to keep clean and the government-resident interaction ends there. The debris statistics that drain adopters submit through the app help Waukesha County's Land Resources Division understand the general composition of materials that find their way into these inlets. Users can also check a box to indicate whether they recycled any recyclable materials after removing them from the drain.

To help county staff members and the public monitor the drain adoption program and related cleaning statistics, Jenks asked Landwehr to create a public-facing dashboard. He used ArcGIS Dashboards to build a dashboard that presents the information in easy-to-interpret charts, graphs, and information boxes. The dashboard includes specifics on what types of materials drain adopters collect, which provides Land Resources Division staff with data to support cleanup priorities and develop targeted educational campaigns.

Success with Residents and Beyond

As of March 2023, more than 200 residents of Waukesha County have adopted nearly 420 storm drains. Those stewards have paid more than 3,100 visits to their drains to inspect and clean them and have removed an estimated 2,100 pounds of debris from the local stormwater system. County staff have received some great feedback from residents as well.

"Helping to keep the Fox River clean by removing debris from the drains is very rewarding," said one Waukesha resident named Susan. "I find that if I clean the drains right after either a wind or rainstorm, I am likely to find organic matter that would otherwise go straight into the river. It isn't often that you find something that takes only a few minutes per month with such immediate impact!"

Another resident, named Josh, said that his nephew took an interest in helping clear drains over the summer. "Every time he's visited since, he always tells his dad to drive slowly as they enter the neighborhood so that he can scope out the status of the drains," Josh wrote.

After the pilot project in the city of Waukesha showed success, the county broadened the geographic extent of the adopt-a-drain program to five other communities, including the cities of Pewaukee and Oconomowoc and the villages of Mukwonago, Pewaukee, and Sussex. Two additional communities are slated to join the program in 2023, and eventually residents will be able to adopt stormwater drains all over urban areas of the county.

Waukesha County's adopt-a-drain initiative also caught the attention of the Dane County Land Information Office, located in Wisconsin's state capital, Madison. The GIS team there sought advice from Waukesha County staff on the functionality, back-end development, and rollout of the web app. Dane County has since introduced a similar program to its residents, since it is evident that people will take action if asked and given the right tools.

As Waukesha County continues to urbanize, efforts to keep its waterways, parks, and natural areas clean need to keep pace. While encouraging residents to adopt storm drains might seem like a small undertaking for a large problem, it is an attempt to empower people to take more responsibility for their surroundings by becoming environmental stewards. It is through programs like this—along with the Waukesha County Recycle Right and adopt-a-trail initiatives—that small changes can lead to big solutions.

Over the years, staff in Waukesha County's Land Resources Division have realized that GIS technology can be used for education, mitigation, and collaboration to help keep the natural environment healthy. With that comes the realization that GIS is making Waukesha County a better place to live and play.

For more information on Waukesha County's adopt-a-drain program or web app, email Landwehr at jlandwehr@waukeshacounty.gov.

Single Interface Gives Water Utility a Comprehensive View of Operations, Assets

By Raj Patil, Novotx

Sunriver, Oregon, has been a popular vacation destination in central Oregon since the 1960s. Nestled in the foothills of the Cascade mountains, the area is known for its natural beauty and snow- and sun-friendly recreation activities.

The main source of fresh water for Sunriver is the Upper Deschutes Basin Aquifer, which supplies three primary wells that are connected to the region's water distribution system via 81 miles of water main. Sunriver Utilities manages water and wastewater operations in the area, currently serving a steadily growing customer base of 4,700 accounts. The utility has its own wastewater treatment plant that treats an average of 500,000 gallons of wastewater per day. In addition to providing reclaimed water to irrigate

an 18-hole golf course, the treatment plant supplies byproducts that are used to create compost that Sunriver Utilities sells to the community.

Six years ago, leaders at Sunriver Utilities realized that, to keep up with growth in the area, their manual, paper-based systems for managing work operations needed to be digitized. They wanted to start tracking work and asset management activities in an electronic system that could leverage the utility's existing ArcGIS technology, which served as the enterprise-wide system of record for all assets. Leaders also wanted to integrate customer billing workflows into the solution.

To do this, Sunriver Utilities implemented Elements XS, a GIS-centric, web-based asset management app for utilities and government

organizations from Esri partner Novotx. Elements XS interacts directly, in real time, with published map services in ArcGIS Enterprise and ArcGIS Online. This allows Sunriver Utilities to manage workflows and assets; track inventory and labor; and generate comprehensive, GIS-based reports all in one place.

In the four years since implementing the system, employees at Sunriver Utilities have gained a better understanding of the utility's assets. According to Erik Nelson, the GIS manager at Sunriver Utilities, this allows everyone at the organization to make more informed, data-driven decisions.

"Since implementing Elements XS…we not only have increased productivity in daily operations, but [we have also] substantially boosted company

↑ Elements XS offers one interface for a variety of maps and geospatial apps.

revenues," Nelson said. "The robust platform has allowed us to integrate our enterprise [GIS], asset and work management, inventory, and utility billing into a single, seamless system."

A Way to Reinvest in Existing Technology

Elements XS is designed specifically for utilities and governments. It is an all-inclusive, web-based app that integrates with the ArcGIS system, as well as billing, financial, and enterprise resource planning (ERP) software—enabling utilities to take full advantage of their existing technology investments.

Employees at Sunriver Utilities can access Elements XS from anywhere and on any device, meaning staff in every department can manage

↑ Within the Elements XS interface, a dashboard displays all installed backflow devices on a map along with the test results for each device.

↑ Sunriver Utilities uses Elements XS and ArcGIS technology for hydrant inspections, backflow testing, valve exercising, capital construction projects, and work order tracking.
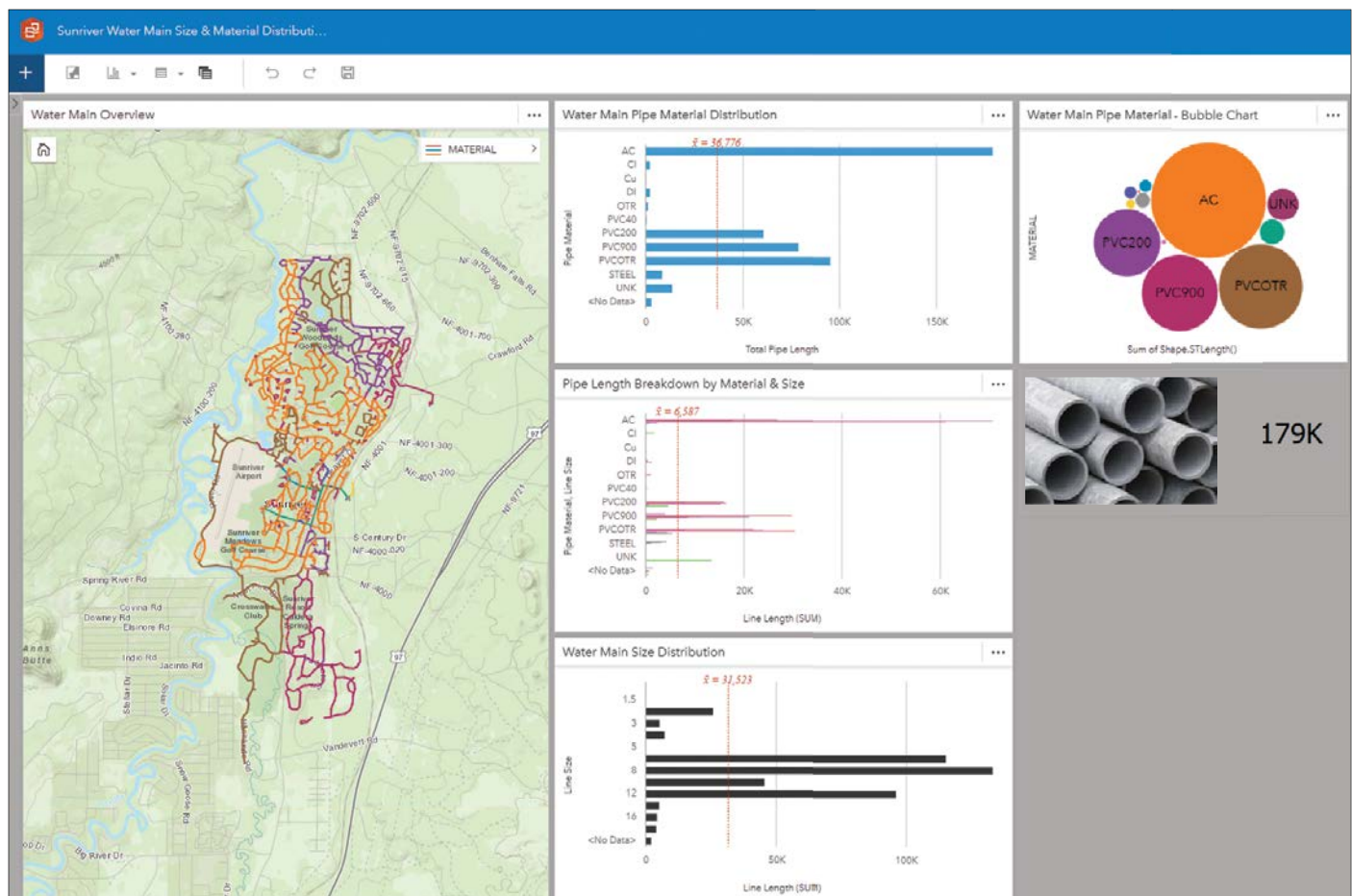
↑ ArcGIS Insights workbooks provide information and analysis on assets such as water and sewer mains, hydrants, and lift stations.

assets without having to work in separate modules. Elements XS is built on a live, real-time connection to ArcGIS, so an organization's geodatabase is the single, authoritative repository for asset data. Employees can seamlessly access ArcGIS Dashboards, ArcGIS Insights, ArcGIS Survey123, ArcGIS Field Maps, and more, from within the Elements XS interface, meaning they don't have to switch from app to app. They also no longer need to bring paper to the field.

"Field workers can complete their service orders on mobile devices rather than having a stack of papers that could easily become misplaced, wet, and muddy in our line of work," said Sunriver Utilities water supervisor Steve Yeoman.

Currently, the utility uses Elements XS for backflow testing (inspections of devices that prevent water from flowing the wrong way), hydrant inspection, valve exercising (the process of physically moving valves to prevent them from corroding), and work order tracking, as well as capital construction projects.

Major Improvements in Backflow Testing

Since Sunriver Utilities deployed Elements XS in 2018, the utility has significantly boosted productivity and revenue in its backflow testing program.

Backflow testing involves sending a crew—from either the utility or a contractor—to test backflow devices that are placed on pipes to prevent water in a customer pipe from flowing back into the water main. For example, when a fire hydrant is turned on, the water should only flow out through the fire hydrant, not backward because it could cause an imbalance in water pressure.

Within Elements XS, employees at Sunriver Utilities now view all installed backflow devices on a map and use a dashboard, built with ArcGIS Dashboards, to see the test results of each device. Mobile crews also use Survey123

and Field Maps within Elements XS to create and fill in test reports; automatically report test failures; request device changes; and, if discrepancies are found between what's in the GIS and what's happening on the ground, make or request changes to an asset's metadata.

This new process has helped Sunriver Utilities increase the number of backflow devices tested each year by 29 percent, to an all-time high. What's more, the time between Sunriver Utilities finding a defective device and notifying the appropriate party to get the issue resolved has decreased. This has contributed to a 20 percent increase in revenues related to backflow testing.

Managers and Mobile Crews Monitor and Share

Sunriver Utilities now employs a comprehensive map- and analytics-based process for all its water asset inspections.

"Being able to interact with our GIS maps and dashboards within Elements *[XS]* has been extremely valuable for work management, project tracking, and managing asset life cycles," said Yeoman.

A dashboard allows mobile crews, managers, and supervisors to track the progress of projects without leaving the Elements XS user interface. It also enables employees to easily share critical data with both internal and external stakeholders.

Additionally, the availability of ArcGIS Insights within Elements XS allows everyone from managers to mobile crew members to quickly review and analyze asset data, so they can approach asset life cycle management and maintenance tactically and strategically. Insights workbooks provide valuable information on assets such as water and sewer mains, hydrants, and lift stations. The app's interactive maps, data cards, charts, and graphs let

employees analyze asset conditions, performance levels, maintenance history, and life cycle trends in a holistic way. Employees also use Insights to review data from the utility's billing database to better understand and manage meter-based activities, including determining customers' water usage and service needs and when their assets need to be repaired or replaced.

Plans for the Future

Now that leaders at Sunriver Utilities see the benefits of capturing comprehensive water asset data in ArcGIS within the Elements XS interface, they are working on implementing the system for the utility's wastewater assets and operations as well.

Having all available data about an asset—from its physical condition and maintenance details to where it is located and how much it costs to operate—together in one GIS-centric interface makes it simpler to plan maintenance and repairs; helps staff decide when an asset needs to be serviced, rehabilitated, or replaced; and aids in end-of-life decision-making, such as when to decommission an asset and how to dispose of it.

Looking to the future, Sunriver Utilities plans to add other geospatial details to its asset records—by mapping all the individual components of a pump or wastewater lift station, for example—to make them easier to visualize and interact with on a map. The utility is also exploring how to integrate Oregon's call-before-you-dig program into the system.

About the Author

Raj Patil is the director of strategic alliances and international business at Novotx.

To Be a Geospatial Leader, Go Beyond the Technical

By Kevin Haynes, South Carolina Army National Guard, and Tim Nolan, Collin County, Texas

The 21st century is bearing witness to massive advances in the scope, complexity, and impact of geospatial technology. Some might even call today the golden age of GIS.

To keep pace with the demands now put on geospatial industry professionals to come up with solutions to the world's most pressing problems, many GIS programs need to revamp their management structures, systems, and procedures. The Urban and Regional Information Systems Association (URISA)—a nonprofit organization that provides education and training to a vibrant and connected community of geospatial practitioners in all phases of their careers—is doing just that.

URISA takes a holistic approach to the geospatial profession. The organization's philosophy goes beyond teaching the technical components of GIS and takes seriously the need to develop well-rounded geospatial professionals who can have a tangible impact on the world.

The URISA GIS Leadership Academy, a first-of-its-kind program, addresses the increasing need for leadership in GIS by introducing participants to cutting-edge management practices. As one recent graduate, Micah Williamson, the engineering manager at i3 Broadband, noted, "After 20 years in the GIS business, this is the only training that I want."

A Whole New Geospatial Learning Experience

The URISA GIS Leadership Academy—or GLA, as it is affectionately referred to—is a unique course that digs deep into the particulars of geospatial leadership. Over five days, participants learn management techniques related to GIS strategic planning, team development, organizational capacity building, financial sustainability, program investment and justification, resource allocation, change management, situational assessment, organizational performance evaluation, ethics, and problem-solving. Experienced GIS leaders teach GLA workshops that center on engaging, interactive discussions and team-building exercises.

The whole experience offers opportunities to delve into topics in a way that can't be done at large conferences. It also gives participants the chance to critically evaluate their management practices. This rarely happens during the day-to-day grind of geospatial work since it tends to center on the technical aspects of the profession.

"Spending a week focusing on leadership and management that is just as critical as technical training *[is]* to your job, to your performance, to your ability to succeed at work—whether you are a manager or not—was *[one]* thing that really made it a valuable use of time," said Aaron Cole, GIS analyst II for the City of Watsonville, California, who attended the GLA in Minneapolis, Minnesota, in December 2021.

Most GIS professionals haven't formally studied management and leadership, so they typically learn on the job through trial and error. But when geospatial professionals lack strong leadership and management aptitudes, the quality, productivity, and impact of the technical parts of the field suffer.

The GLA educates participants—who range from GIS technicians to team managers—on the most current best practices in management, including crucial nontechnical skills, such as project management, strategic planning, and how to supervise people. Experienced instructors teach industry-standard methods, provide real-world examples, and conduct collaborative sessions that engage participants as they work through the challenges related to each topic.

Important Lessons That Affect Management Practices

In November 2021, the South Carolina Army National Guard GIS leadership team attended the GLA in St. Petersburg, Florida. The organization's GIS program manager, Christy Jacobs, was astounded at how different her GLA experience was from other trainings she had participated in.

"At all the GIS conferences, you mostly learn technical skills—you learn how to use the new apps. But I *[needed]* to learn how to manage my people and projects better," she said. "I *[needed]* to learn new ways of management and project tasking, how to interview people, *[and]* how to deal with difficult personalities and the generational divide."

That's what she explored at the GLA. And GLA alumni like her continually voice how important the course has been to their management practices.

Kaitlin Schrup, a GIS analyst for the Puyallup Tribe of Indians in Tacoma, Washington, attended the GLA in Minneapolis in 2021. Schrup was grateful for the deep conversations she got to have with the other experienced professionals in attendance—all of whom hail from vastly different sectors—about geospatial leadership and management challenges.

"My biggest surprise—and probably the biggest benefit of doing the GLA—was the amount of knowledge that I gained from my fellow participants," she said.

Cole echoed Schrup's appreciation of the networking and learning opportunities afforded by other participants.

"The attendees were...super engaged and really motivated," he said. "*[They]* brought a lot of content and experience to the conversation."

Alumni Feel Empowered to Try New Things

Time and again, GLA alumni reflect on how the workshop gave them the confidence they needed to change how their organizations operate.

The South Carolina Army National Guard, for example, was implementing pieces of project management best practices, but there were significant gaps. By encouraging South Carolina Army National Guard attendees to think critically about their organization's management practices, processes, and procedures, the GLA helped them feel empowered to try new things and, eventually, fill those gaps.

A core component of the workshop focuses on how to better communicate with decision-makers.

"The aha moment for me...*[was realizing]* that GIS will continually need to be promoted—and to accept that," said Schrup.

"Right off the bat, *[the GLA]* gave me some language to use that I really didn't have at my fingertips before," recalled Sara Hopkins, a senior GIS analyst for the City of Gresham, Oregon, who attended the Minneapolis GLA in December 2021.

The course content is geared toward giving participants real tools in areas such team building, conflict resolution, gap analysis, and change management that they can implement right away. Yet the GLA is more than the course content. It is an experience that gives attendees an opportunity to engage with peers from around the world, ranging from GIS technicians, analysts, and specialists to cartographers, program managers, and directors. The GLA empowers GIS professionals to go beyond technology and think about people. After all, at its core, GIS is about people.

Attend a GIS Leadership Academy

In 2023, URISA will hold two GIS Leadership Academy events. The first one will take place in Charlotte, North Carolina, June 12–16, and the second one will be held in Denver, Colorado, November 27–December 1.

For more information on the academies, visit links.esri.com/urisa-gla. To join URISA, go to links.esri.com/join-urisa.

> ### About the Authors
>
> Kevin Haynes is the environmental GIS manager for the South Carolina Army National Guard. He is also president of Carolina URISA, the North Carolina and South Carolina chapter of the organization. Tim Nolan is the senior IT manager for Collin County, Texas. He is a URISA board member and an instructor at the GLA.

↓ The GIS Leadership Academy was held in Raleigh, North Carolina, in 2019.

Managing GIS

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

URISA
Fostering Excellence in GIS
www.URISA.org

Interactive Web App Showcases Museum's Sprawling Sculpture Collection

The Patricia and Phillip Frost Art Museum at Florida International University (FIU) in Miami, Florida, is a 46,000-square-foot facility that houses 6,500 works of art. With a focus on contemporary art from the United States and international regions such as the Caribbean, the museum's curatorial team, led by chief curator Amy Galpin, organizes 10–12 exhibits each year to provide the community with free access to world-class art.

As part of its collection, the Frost Art Museum has what's known as Sculpture Park, which consists of about 30 sculptures scattered around FIU's 344-acre main campus. To help students and visitors navigate the sprawling Sculpture Park and learn more about the works of art, Galpin recently worked with Diana Ter-Ghazaryan, who, at the time, was a research associate at FIU Libraries' GIS Center, to develop a virtual guide.

Ter-Ghazaryan, now an associate professor at the Spatial Sciences Institute at the University of Southern California, worked with a student assistant, Dan Frome, to collect data about the sculptures. They then used ArcGIS Experience Builder to transform the data into an interactive web app.

"Leaning into the art and leaning into the visual component of this project were easily accomplished with Experience Builder," Ter-Ghazaryan said. "It allowed us to build a customized site with strong visuals without being developers."

A Geography Lesson Yields a Solution

The FIU Sculpture Park app was inspired by GeoMuse, an app resulting from collaboration between Ter-Ghazaryan and her colleague Lien Tran when they were both at the University of Miami.

While working in the University of Miami's Department of Geography, Ter-Ghazaryan had students collect the latitudes and longitudes of sculptures on campus for a lesson in using GPS. As her students completed the assignment, Ter-Ghazaryan realized that the university's printed maps of the on-campus museum's sculptures were out-of-date. To help people explore this sculpture collection virtually, Ter-Ghazaryan and Tran, who is now an assistant professor at DePaul University, applied for internal funding and assembled a group of students to build GeoMuse, an interactive web app.

The success of GeoMuse inspired Ter-Ghazaryan to propose a similar project to Galpin at FIU. Galpin was enthusiastic about the proposal because, she said, there was no central way for students and visitors to explore the outdoor collection of the Frost Art Museum's sculptures. There also wasn't much information available about the public art on campus.

"I definitely value the significance [of the digital space] and its opportunity to reach larger audiences," said Galpin. "This was an opportunity to create a map that people could use to find out more about the work on campus."

A Quick, Intuitive Experience

For the GeoMuse app, Ter-Ghazaryan and her students worked with a developer to create a custom-built solution. At FIU, she wanted something that would be easy to deploy and maintain. So Ter-Ghazaryan and Frome, who is now a GIS specialist for Miami-Dade County, decided to use ArcGIS Experience Builder, an app builder that supports flexible layouts, content, and widgets.

Frome said he knew that Experience Builder was the right choice for this project because the FIU app needed to have a strong visual component to showcase the art while also displaying descriptions of the work.

"[We wanted] something that [we] could customize to make as simple for everybody as possible but [that would also] look good and be intuitive," Frome said. Additionally, the duo wanted whoever was going to build the app to be able to do so "without… spending a year learning how to be a web developer," he added.

For both Ter-Ghazaryan and Frome, who ended up creating the app themselves, using Experience Builder was intuitive. They built the app pretty quickly.
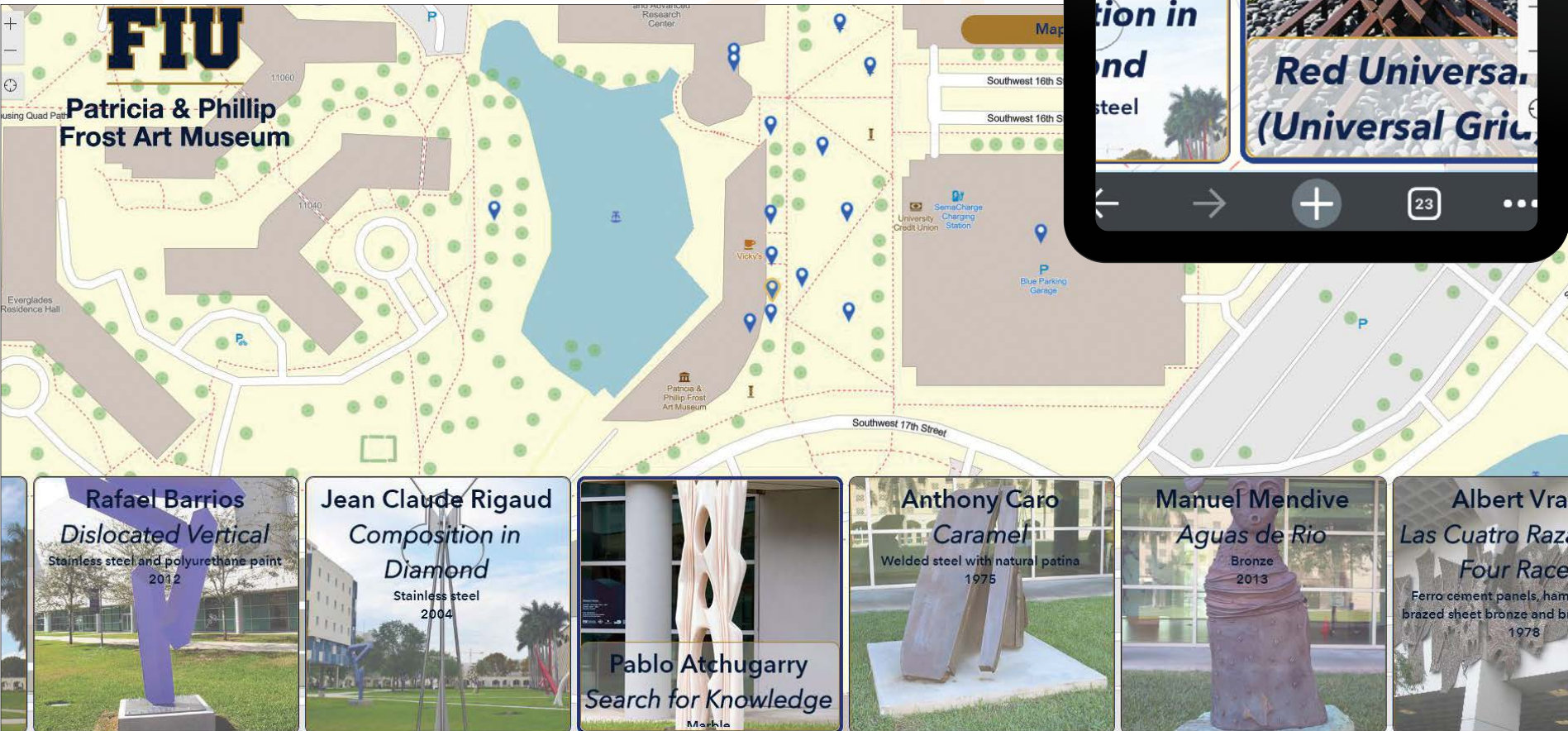
→ The web app functions on mobile devices, helping viewers navigate around the campus.

↓ Florida International University's (FIU) Sculpture Park web app uses the locations of the pieces as the basis for exploring art.

"It was a lot of jumping in and tinkering around," said Frome. "[The app] kind of came together [with us] just learning about different widgets and different tools and how to implement them… and learning what various functions would be helpful."
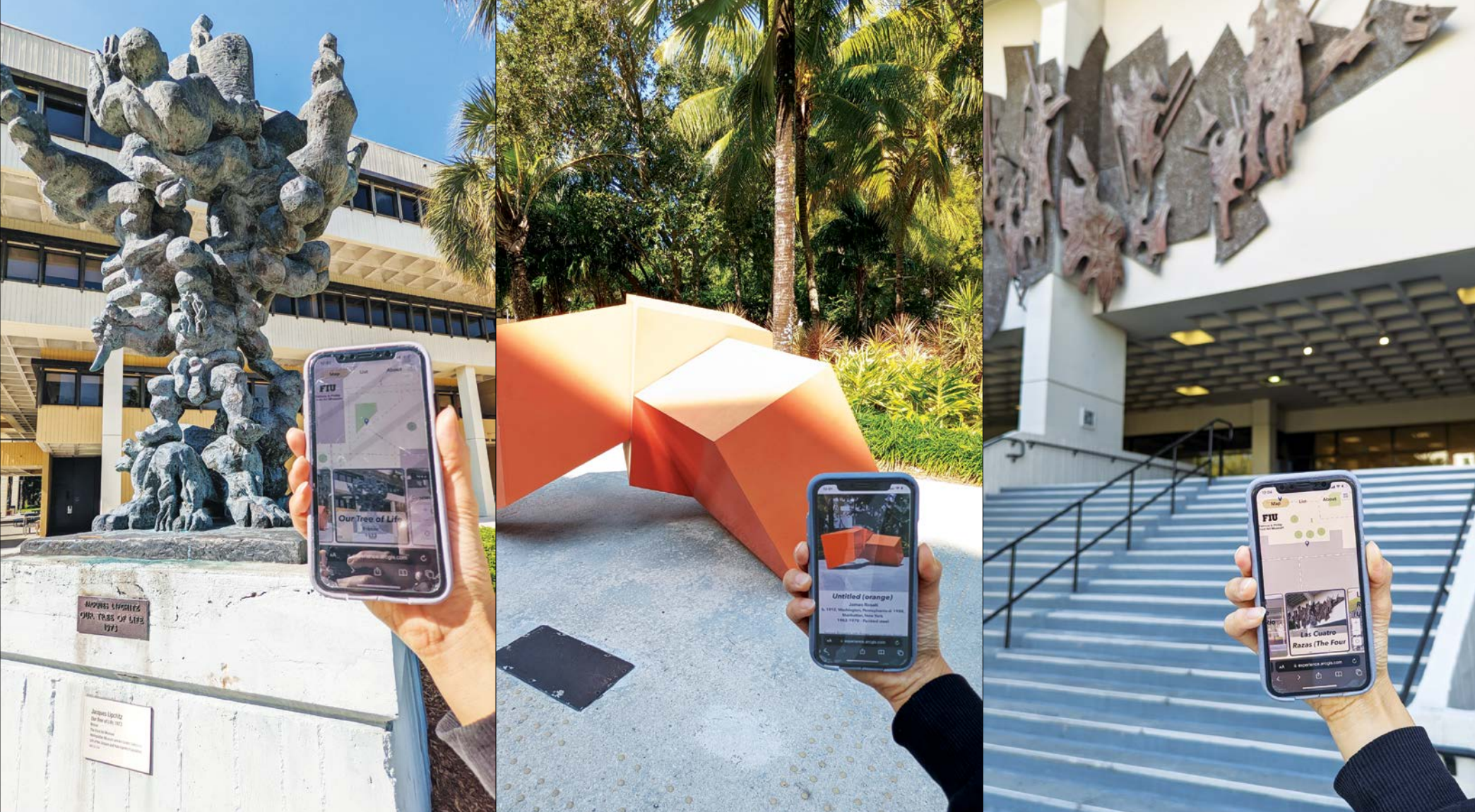
A Smooth Development Process

Ter-Ghazaryan and Frome began the development process by getting a spreadsheet from Galpin that listed all the works she wanted to be included in the app, along with their locations. Frome then walked the FIU campus to collect the latitude and longitude of each sculpture, using ArcGIS Survey123 on his smartphone. He also took photos of the artwork.

↑ The Sculpture Park web app includes the location of each sculpture, a photo of it, the artist's name, and the year the piece was produced. (Images courtesy of Luis Garcia Falcon.)

Once all the information was gathered, Ter-Ghazaryan and Frome used Experience Builder to create a custom web app that functions on mobile and desktop devices. They experimented with different displays and buttons to ensure that the two versions were consistent and worked well.

Throughout the data collection and app setup process, Ter-Ghazaryan and Frome had check-in meetings with Galpin and the museum team to update them on progress and ensure that they were creatively on the right track.

"The visual component of this is really the most important. Being able to see things, being able to take a good picture and have [the app] display…all that kind of stuff is really what made [Experience Builder] the obvious choice for us," Frome said. "[We were] able to have something workable finished quickly without coding it from scratch."

Ter-Ghazaryan appreciated that Experience Builder allowed her and Frome to easily work within the cloud and connect different systems. Frome said he had to travel for several weeks during the project and yet was able to continue working on the app, which was helpful.

"The connection of Experience Builder to Survey123 and the seamless connection through ArcGIS Online made it really easy and quick for us to be able to collect the data [and] bring it right in and then just deploy that web map right [in] Experience Builder," said Ter-Ghazaryan. "I think that was a really important benefit of working on the cloud platform."

The final web app includes the location of each sculpture, a photo of it, and curatorial information such as the artist's name and the year the piece was produced. A map is available as well to help users with navigation.

A New Way for People to Engage with Art

With the goal of engaging the student community and the public, FIU launched the virtual Sculpture Park web app in the summer of 2021. Galpin thinks that being able to read descriptive text about each work and view large images of the sculptures are important features of the app. She also likes that it offers different views of the map, contributing to a user-friendly experience.

Ter-Ghazaryan pointed out that while museums often have video tours or 360-degree videos of their collections, they don't typically use maps or locations as the basis for exploring art. She thinks that FIU's Sculpture Park app provides a great way to spotlight the Frost Art Museum's outdoor sculpture collection and connect the physical and virtual realms. Moreover, Galpin stresses that the app will bring more attention to the creative works in the museum.

"I see this map as a holistic way in which we are realizing our mission and caring for the art in our collection and offering opportunities for the public to engage with it in different ways," she said.

↑ Key features of the app include how users can read descriptions about each work of art and view large images of the sculptures.

"Leaning into the art and leaning into the visual component of this project were easily accomplished with Experience Builder. It allowed us to build a customized site with strong visuals without being developers."

Diana Ter-Ghazaryan
University of Southern California

The Relevance of Cartography

A Cartographer's Perspective

By Tim Trainor
President, International Cartographic Association

Cartographers, Cape Town Is Calling

The International Cartographic Association (ICA) is on the move again. After holding the 2021 International Cartographic Conference (ICC) in Florence, Italy, the ICC will lure cartographers and geographic information science (GIScience) professionals to Cape Town, South Africa, August 13–18, 2023. (The conference will then head to Vancouver, Canada, in 2025.) The executive committee of the ICA encourages a global footprint for these important conclaves.

This year, the Cape Town event will be special. It has been 20 years since the ICC has been held in Africa. In 2003, it took place in Durban, South Africa, and the theme was Cartographic Renaissance. Cape Town seeks to go beyond this year's theme, Smart Cartography for Sustainable Development, by making an effort to have as many representatives from African countries as possible attend the event to make the most of the conference's diverse programming and networking opportunities. Cartographers and GIScience specialists from all over the world will share their knowledge, expertise, and experiences and bring what they learn back to their home organizations.

Other meetings will be held in alignment with the conference as well. The Africa division of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) will assemble. And the SDG Data Alliance will meet to continue its work in assisting several countries in Africa and other regions in using geospatial information to achieve the Sustainable Development Goals (SDGs). The SDG Data Alliance is dedicated to helping countries share their important geospatial information via SDG Data Hubs, which are built using Esri technology including the Sustainable Development Goals solution and ArcGIS Hub.

Who should make plans to travel to Cape Town in August? Anyone who is interested in the three open and interconnected events—the 31st ICC, the UN-GGIM: Africa meetings, and the SDG Data Alliance program.

For cartographers and GIScience professionals, the ICC will present opportunities to learn from fellow practitioners and researchers about current trends in cartography, see creative cartographic products and diverse visualizations, and participate in many of the interesting presentations being given under the 47 different conference topics. Government leaders, policy makers, business executives, and other specialists who attend the

UN-GGIM: Africa meetings will be able to engage with country representatives and learn about the geospatial plans and accomplishments of African countries and other nations in the region. Finally, anyone who participates in the SDG Data Alliance gathering will discover how the organization's methodology—which is based on the UN's model of fostering a country-led approach for managing and sharing geospatial information in support of achieving the SDGs—is bringing together stakeholders, partners, technology, and data to help advance progress on sustainability.

The venue for the conference is the world-class Cape Town International Convention Centre, located along the waterfront and within walking distance of several hotels. More details about the venue, the program, and the International Map Exhibition being presented at the ICC—along with travel information, accommodation recommendations, and general tourist information for Cape Town and other destinations in South Africa—are available on the conference website at icc2023.org.

One of the hallmarks of the current ICA Executive Committee is its commitment to offering scholarships. Financial support is available to early career scientists and professionals in cartography and GIScience to participate in official ICA events, such as the ICC in Cape Town. For details on the scholarships, visit icaci.org/scholarship.

While it is most beneficial to experience the ICC and the beauty of Cape Town in person, the ICA has made accommodations, based on the influences of the COVID-19 pandemic, for those who cannot travel to South Africa. There will be opportunities for people to participate virtually in the scientific program of the conference, though not all events will offer virtual attendance options.

The International Map Exhibition being presented at this year's ICC promises conferencegoers a unique experience. For the first time, most of the cartographic products that will be on display in common areas of the conference center will also be exhibited in various virtual ways. Some will be presented via digital technology on shelves or tables set up throughout the conference center, while others will be exhibited at kiosks. Many will also be available to see on the ICC website, including some maps and charts, ArcGIS StoryMaps narratives, and other digital cartographic products and services that will be shown there exclusively. Atlases and educational cartographic products will be viewable in hard copy or as virtual productions

at the conference center. Physical cartographic products, such as globes, tactile maps, and relief maps, will only be available in the conference center for exhibition participants.

Each ICC also features the Barbara Petchenik Children's Map Competition, which invites children in various age groups to submit their best maps for display and judging. The theme for the 2023 competition is A Map of My Future World. Information on how representatives from ICA member nations and affiliates can organize the competition and encourage children to enter is available at icaci.org/petchenik.

The ICC offers an excellent opportunity for commercial enterprises to learn about current trends and developments in the geospatial and cartography realms. Attendees get to engage with professionals and presenters and even potentially influence future cartographic and geospatial research. Commercial companies can display their products and services in the Commercial and Technical Exhibition. And there are openings to sponsor various aspects of the ICC experience. A detailed sponsorship and exhibitor prospectus is available on the conference website.

Another highlight of the conference is the conferring of special awards on distinguished cartographers and geographic information scientists. It is important and exciting to recognize individuals for their exemplary contributions to their profession and the ICA.

There is much to see and do in and around Cape Town as well. Tours of nature reserves, botanical gardens, and other sites will be available to give attendees and their families amazing, customized experiences. The expansive V&A Waterfront, located near the convention center, is filled with restaurants and shops, and visitors can get a view of the port or Table Mountain from their hotel rooms. Additionally, ICC attendees are encouraged to visit nearby South African wineries and historical sites during their extended stays in Cape Town. The local organizing committee has also arranged for local vendors to make cuisine reflecting the cultures in and around Cape Town available inside the convention center.

The host of the event, the South African National Committee for the ICA, is thrilled to welcome professionals, experts, scholars, and map enthusiasts from around the world to participate in this exceptional opportunity to convene, learn, teach, and grow. On behalf of the ICA Executive Committee, we can't wait to meet you in South Africa.

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.

Esri Press

Designing Map Interfaces: Patterns for Building Effective Map Apps
By Michael Gaigg

Designing Map Interfaces: Patterns for Building Effective Map Apps is the essential guide to creating geospatial app interfaces that are usable, efficient, and stunning. Whether configuring an out-of-the-box solution, building an app with an app builder, or working on a custom app project, readers can employ the book's practical tips to assemble a meaningful user interface (UI). Intended for GIS professionals, solution engineers, developers, and designers, *Designing Map Interfaces* identifies several recurring problems in UI design and outlines specific UI patterns to employ to fix them. December 2022/March 2023, 173 pp. Ebook ISBN: 9781589487260 and paperback ISBN: 9781589487253.

Preserving Our Planet: GIS for Conservation
Edited by David Gadsden and Matt Artz

By employing maps and apps, conservation professionals can more easily observe what's happening on the ground, analyze and organize their data, and collaborate with other organizations and members of the public to harness opportunities and address threats. *Preserving Our Planet: GIS for Conservation* showcases how several conservation organizations have successfully used GIS to help preserve biodiversity. The book provides ideas, strategies, and tools to help readers jump-start their own uses of GIS for conservation. It also comes with a collection of online resources, including stories, videos, and downloadable content. September 2022/January 2023, 130 pp. Ebook ISBN: 9781589487222 and paperback ISBN: 9781589487215.

## Managing Our World: GIS for Natural Resources
Edited by Geoff Wade and Matt Artz

In *Managing Our World: GIS for Natural Resources*, readers can explore how applying a geographic approach to managing natural resources boosts efficiency and advances sustainability. The book spotlights real organizations in the agriculture, forestry, mining, energy, pipeline, and renewable energy sectors that are successfully using GIS to streamline workflows, gain competitive insight, improve their sustainability efforts, and more. It shows how these organizations are equitably balancing current demands for earth's natural resources with preserving those resources for future generations. Examples in the book demonstrate how to increase profitability, improve environmental protections, and expand societal benefits while improving organizational efficiency. January/April 2023, 184 pp. Ebook ISBN: 9781589486898 and paperback ISBN: 9781589486881.

Winn and Doug the Waterdrops: A Water Cycle and Wastewater Story
By Tim Olson and Rick Lohmann

Written for children in grades 1–5, *Winn and Doug the Waterdrops: A Water Cycle and Wastewater Story* shows kids where water comes from and what happens once it gets used. Part of a career-themed science, technology, engineering, arts, and mathematics (STEAM) picture book series, the book invites young readers to explore the different phases of Winn the Raindrop's life through the water cycle, from vapor to runoff, before following Doug the Waterdrop to see how water gets cleaned after it is used. Perfect for encouraging critical and creative thinking and spatial analysis skills, *Winn and Doug the Waterdrops* highlights the incredibly important jobs that water resource engineers and wastewater operators have and how they make the world a better place. In-book activities and a glossary are included. April 2023, 56 pages. Ebook ISBN: 9781589487208 and paperback ISBN: 9781589487192.
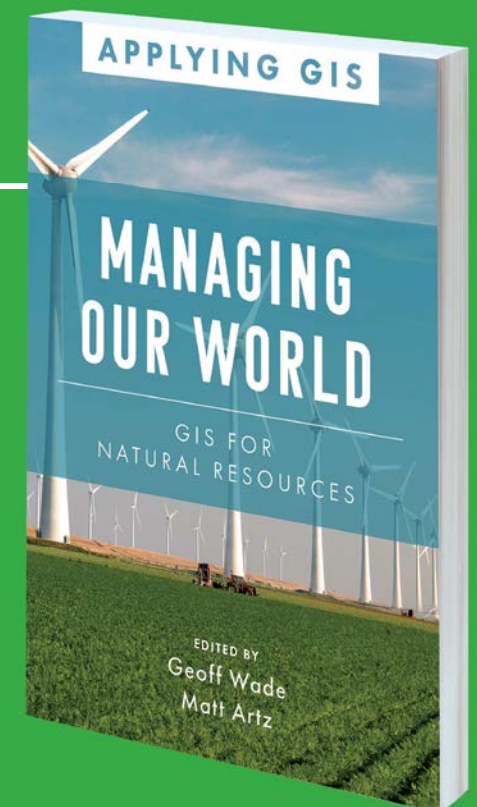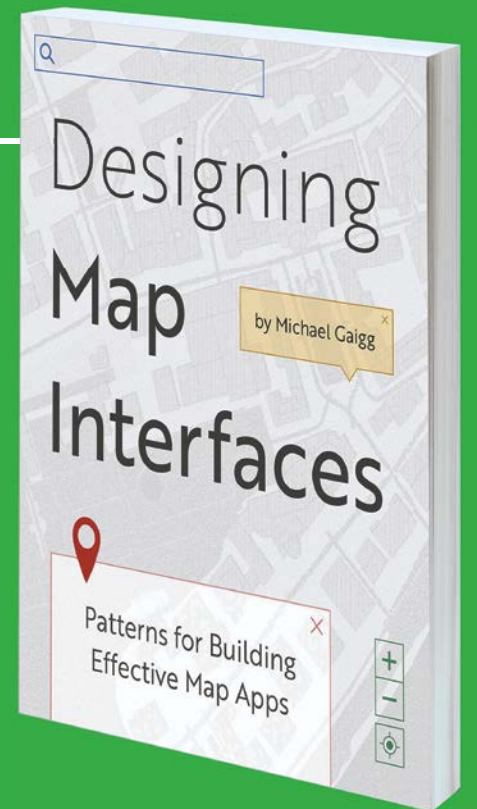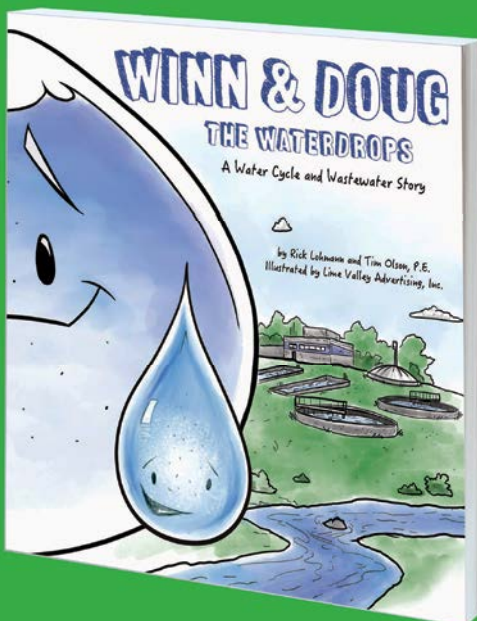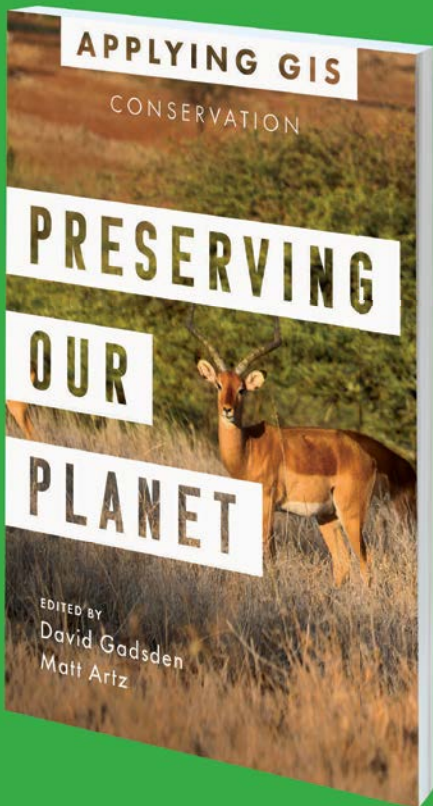
New **Training** and **Certification** Offerings

Training

Manage GIS Data with Confidence

Instructor-led classes provide an ideal way for GIS practitioners to gain hands-on experience with the latest ArcGIS tools and build skills that they can apply immediately to their own projects. To learn how to maintain an organization's authoritative GIS data or ensure efficient multiuser workflows, attend one of the following courses:

- **Managing Geospatial Data in ArcGIS:** Participants gain a thorough understanding of file and enterprise geodatabase capabilities. They learn how to create a geodatabase and configure features that ensure data integrity and accuracy over time. View upcoming classes at go.esri.com/manage-data.
- **Implementing Versioned Workflows in a Multiuser Geodatabase:** This course teaches geodatabase administrators and GIS data managers a traditional versioning workflow that minimizes disruptions to editors, ensures the integrity of GIS data, and integrates with existing business workflows. Find course details and register at go.esri.com/versioning-class.

Explore the Intersection of AEC and GIS

Esri's massive open online courses (MOOCs) provide a fun, no-cost way to explore new topics, practice with the latest ArcGIS software, and earn certificates of completion.

Registration is open now for the second offering of **Transform AEC Projects with GIS and BIM**, which received positive reviews after its 2022 debut.

"The hands-on sections of the course were most enjoyable—they were well structured and easy to follow, and a great introduction to tools and workflows from start to finish," wrote attendee Zack MacDonald.

The MOOC runs for four weeks, May 3–31. Participants learn how to combine GIS, computer-aided design (CAD), building information modeling (BIM), and drone-captured imagery data to gain a holistic view of an architecture, engineering, and construction (AEC) project in its real-world setting. Working with ArcGIS Pro, ArcGIS Drone2Map, and other popular products, attendees apply location-based insight to their decision-making.

Participants spend two to three hours each week watching videos, completing software exercises, and taking quizzes. Registration for the course is available through May 10 at go.esri.com/aec-mooc.

Gain Support for GIS Initiatives

When organizations modernize their GIS infrastructure, expand GIS access, or deploy new ArcGIS capabilities, they need to consider how that will affect the way their employees work. Deploying a people-focused plan alongside a technology plan helps build enthusiasm and achieve faster adoption of new tools and workflows.

Adoption strategy experts from Esri put together a series of short videos that illuminate common challenges and give real-life examples of organizations that have successfully applied an adoption strategy. Watch the series at go.esri.com/adoption-videos.

Certification

The Esri Technical Certification Program supports professionals and students who want to validate their experience with ArcGIS Pro, ArcGIS Enterprise, ArcGIS Online, and other ArcGIS technologies. Certifications can be obtained at four levels: foundation, associate, professional, and specialty.

Foundation-level certifications are for people who have up to two years of experience working with ArcGIS technology. The following foundation-level exams are available:

- **GIS Fundamentals Foundation** is for individuals who do entry-level mapping and data visualization, sharing, and analysis in ArcGIS Online and ArcGIS Pro.
- **ArcGIS Pro Foundation** is for people who use ArcGIS Pro to do entry-level mapping and data visualization, sharing, analysis, and management.
- **ArcGIS Developer Foundation** is for those who create and deliver apps that interact with the ArcGIS system and its APIs and manage content, user roles, authentication, and services.

For anyone thinking about pursuing a certification, consider what Edwin Solis Garita, a certified infrastructure technical support analyst, said about his experience.

"As part of my daily tasks…I need to prove that I have the skills to help our customers reach their goals," he explained. "As an Esri-certified professional, I have a medium to validate my ArcGIS knowledge and skills and prove I know how to deploy, maintain, and teach about its use."

Read the rest of Solis's certification success story at go.esri.com/certification-success.

Explore all Esri technical certification exams at esri.com/training/certification. To get help choosing one, watch *Preparing for an Esri Technical Certification* at go.esri.com/cert-prep-video.

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* blog (**go.esri.com/trainingblog**), connecting with the Esri Training community on Esri Community (**go.esri.com/training-community**), and following **@EsriTraining** on Twitter.

location
intelligence
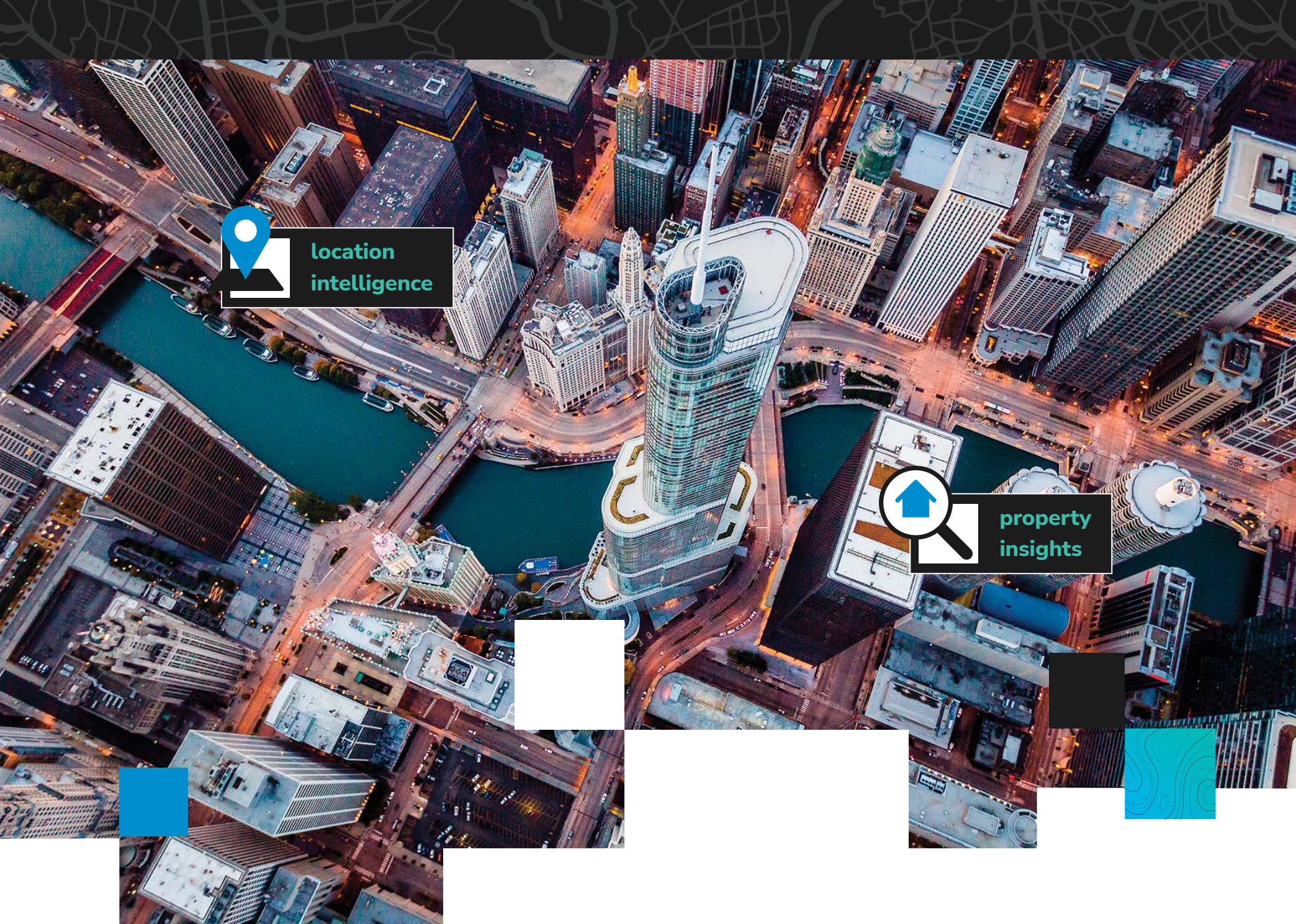
property
insights

SmartFabric.™ Where location intelligence intersects with property insights

Where can you find all of this meaningful geospatial data — parcel, building footprints, addresses and sub-addresses, property characteristics, tax and deed information, zoning, broadband serviceable locations, business and residential property indicators and more — on one easily accessible platform?

We continue to regularly expand our comprehensive connected data assets to give you access to the most current, accurate, reliable location data possible. And we integrate that data to provide the valuable insights that you need to make even smarter business decisions.

FIND OUT MORE TODAY.
Visit lightboxre.com/Smart for more information.

LIGHTBOX

esri 380 New York Street
Redlands, CA 92373-8100

185408