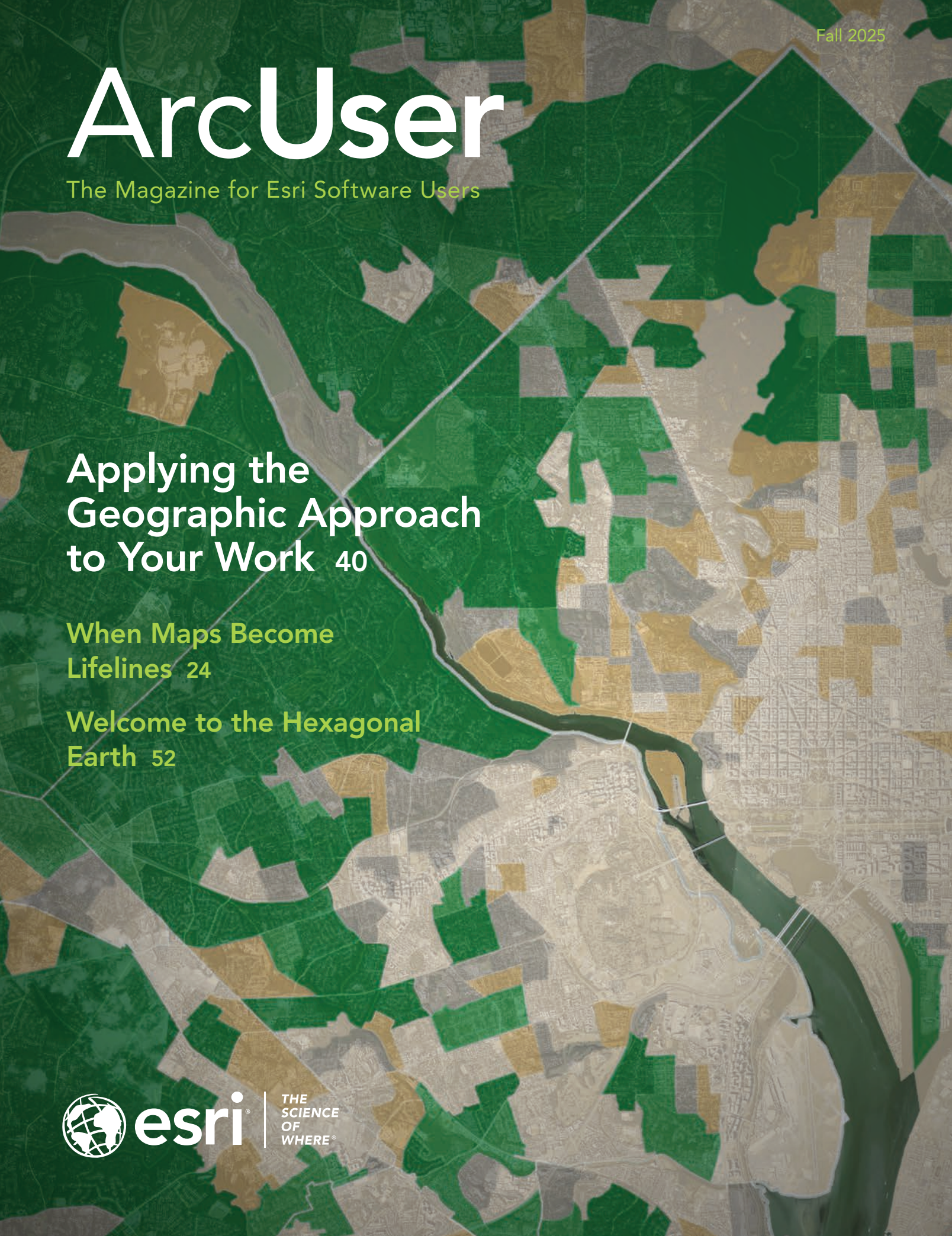
Fall 2025

ArcUser

The Magazine for Esri Software Users



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Mapping Out a Framework

Everybody starts somewhere. Maybe you have a degree in GIS or are in the process of getting one. Maybe you stumbled into GIS and learned it on the job. Maybe you got your start taking Esri web courses, poring over ArcGIS documentation, or asking questions on Esri Community. Lots of vibrant resources exist to get people started in the geospatial technology industry, and many of them continue to prove useful throughout the career of a GIS professional. You're always learning new workflows and tricks to simplify tasks and improve outcomes.

These workflows are important, but so is a framework: a way of looking at how any given task or piece of software fits into the broader scope of what you do. Often, our best work comes when we think in frameworks—when we plan not just where to start but also where we want to end up and how to get there.

The fall 2025 issue of *ArcUser* is brimming with frameworks designed to help improve your work. Take the cover story, "Applying the Geographic Approach to Your Work." This article starts with a concept familiar to many readers of *ArcUser* (the Geographic Approach) and lays it out, step by step, as a coherent, consistent methodology. Using a framework like this can help you understand where and why workflows fail and how to improve them. What exactly are you trying to achieve, and what are the steps necessary to achieve it?

The article "Welcome to the Hexagonal Earth" considers this framework idea more literally. Spatial tessellation, as the article notes, is not a new concept for GIS professionals. Nor, at this point, is the H3 hexagon. But this hexagonal framework is being used in increasingly creative and useful ways that can inspire the work that you do. Similarly, "Rethink Your Strategy for the AI Era" asks GIS professionals to more deeply consider the role of generative AI in their work, or at least the role they will need to occupy as generative AI continues to produce seismic shifts in the world of GIS.

This issue is also filled with stories of GIS professionals leveraging these frameworks to better their communities. Consider the nonprofit organization Trout Unlimited, which uses ArcGIS tools to reconnect stream networks that support vital ecosystems. Or the City of St. Louis, where digital twins are helping revitalize economically underserved areas. Or the YMCA, which uses ArcGIS Business Analyst to tailor its programming to the needs of individual member communities.

GIS allows us to make sense of relationships between places and how decisions made in one location affect another. But the work you do with it needs a map, too, so that you can understand not only where you want to end up but also the best way to get there.

Ben Van Voorhis
ArcUser Editor

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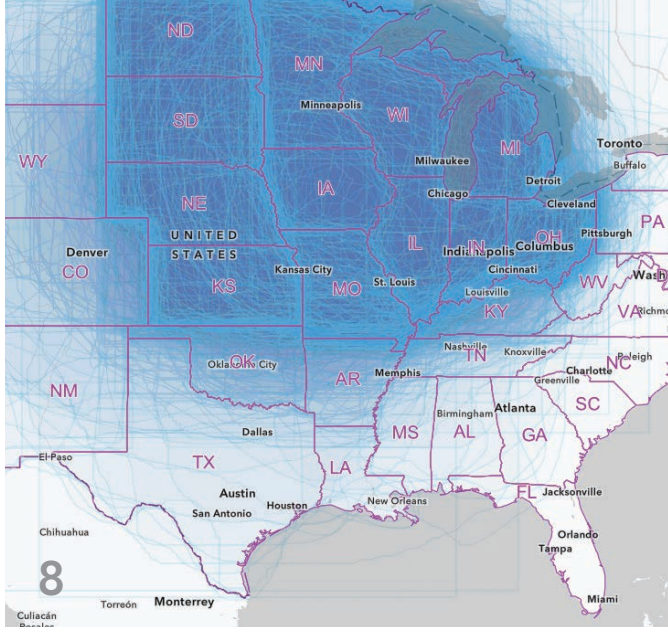

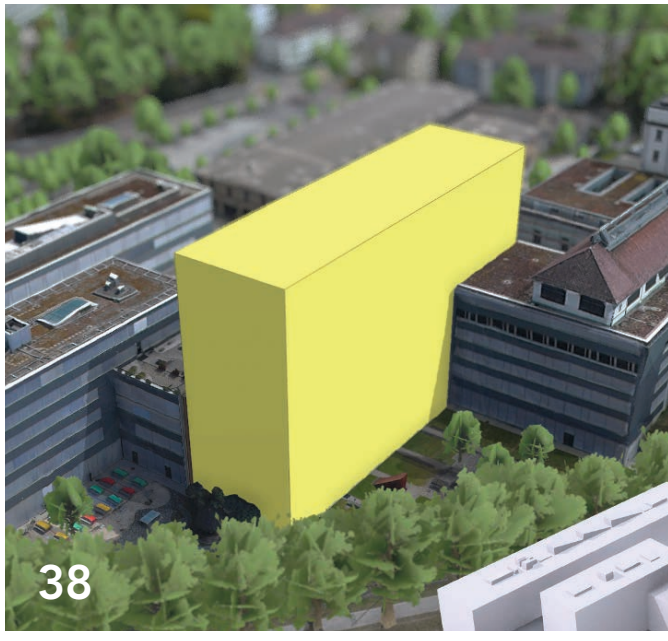

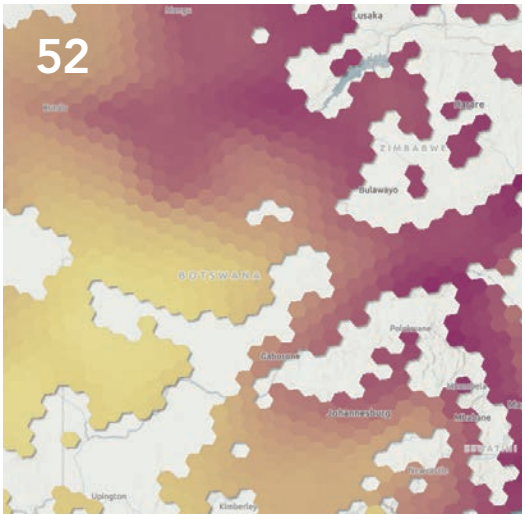

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Briefly Noted

Enter the 2025 ArcGIS StoryMaps Competition

This year, Esri's ArcGIS StoryMaps and ArcGIS Living Atlas of the World teams are cohosting the 2025 ArcGIS StoryMaps Competition to highlight best practices and innovation in storytelling, cartography, and data visualization—and to help you elevate awareness of the isssues that mean the most to you.

Individuals and organizations worldwide tell place-based stories about local communities, challenges, and innovative solutions—with common threads across people, the infrastructure we build, and the impacts on the natural world and environment. Whatever your story, the three 2025 ArcGIS StoryMaps Competition categories—People, Environment, and Infrastructure—offer an open space for all voices.

Entrants must be at least 18 years old and submit one story or collection built with ArcGIS StoryMaps. The story or collection must include ArcGIS Living Atlas content. Submissions will be accepted until December 12, 2025, and winners will be announced in April 2026.

To enter the competition, visit links.esri.com/stories25.

Help Shape the Future of Desktop GIS with the ArcGIS Pro Assistant

Esri is building the future of GIS workflows in ArcGIS Pro—and things are getting conversational. With the ArcGIS Pro assistant (currently in beta), Esri is beginning an exciting journey to transform how users interact with spatial data, tools, and documentation. With continued development and user feedback, Esri aims to create a tool that simplifies workflows and empowers users to solve problems more intuitively.

Currently, the ArcGIS Pro assistant can perform select AI-assisted actions, answer ArcGIS Pro help documentation questions in a conversational manner, generate openCypher queries based on a specified knowledge graph schema, and create query layers by generating SQL queries for a specified database connection and table schemas using natural language.

An endeavor as important as building an assistant doesn't happen overnight. It takes continual testing and iteration, which is why your feedback is crucial. Developing this assistant depends on the ArcGIS Pro user community joining the Early Adopter Community (EAC).

As an EAC member, you gain early access to new features and can provide feedback that directly shapes ongoing enhancements. You'll be among the first to test capabilities as they are developed, including an ever-expanding library of new actions and a powerful ArcPy coding assistant capability. Early access is available only to those with named user licenses in ArcGIS Online and ArcGIS Enterprise, within organizations that allow beta functionality and have the assistant enabled.

To participate and start shaping the future of ArcGIS Pro, visit links.esri.com/pro-assistant.

What Jane Goodall Saw

Dr. Jane Goodall is gone, and with her, a particular kind of seeing. Over the 65 years Goodall worked with chimpanzees, the rest of us came to see what she saw: creatures with personalities, families, grief, joy.

Goodall established the Jane Goodall Institute in 1977 to support work with chimps in Gombe, Tanzania, and to expand research, education, and conservation efforts worldwide.

In the late 1980s, Goodall flew over Gombe and saw her forest sanctuary had become an island surrounded by bare hills. Families had to cut down trees to survive. The choice was stark: either help find sustainable ways to live or watch everything—chimps and forests—disappear.

When Dr. Lilian Pintea came to Gombe in 2000 with his GIS expertise, Goodall saw the technology's potential. GIS combined satellite imagery with maps and ground truth to monitor change and show a path toward restoration.

The TACARE program grew from this approach. Forest monitors used smartphones to photograph illegal logging in real time. Village leaders visualized how protecting steep hillsides would prevent landslides. But the real power wasn't the data—it was that everyone was looking at the same picture, making decisions together.

Goodall's collaboration with Esri started in 2005 with the goal of democratizing a shared view for conservation. She saw the GIS community as essential partners in the work of ensuring that communities have agency over their future.

At 91, Goodall was still working to protect the planet's resources. Her Roots & Shoots program started with 12 Tanzanian high school students in 1991. Now it has grown to 75 countries.

Goodall showed us the way: Watch patiently. Listen first. Combine data with empathy. Give communities tools and respect—they will protect their lands better than outsiders ever could. Every person makes an impact on the planet every day. Find the best path forward. Then act on it.

Dr. Jane Goodall, DBE, Founder of the Jane Goodall Institute and UN Messenger of Peace

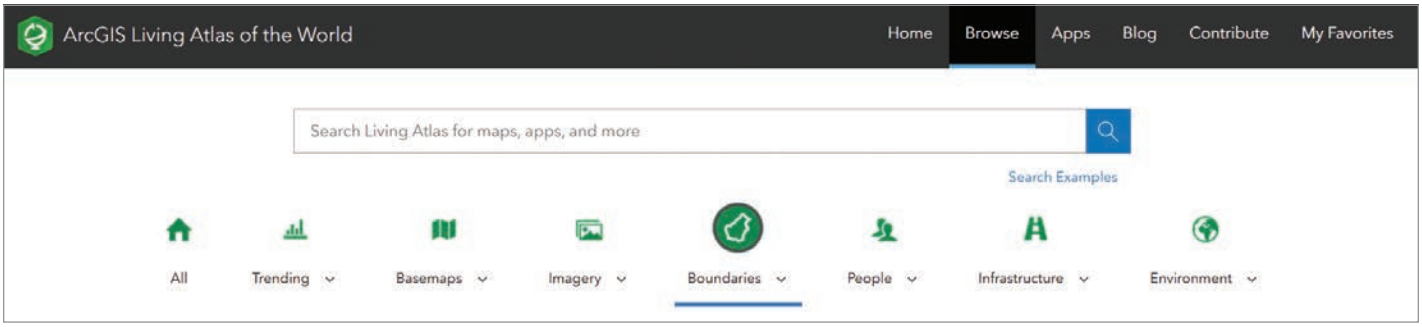
Jane Goodall spent her life proving that this is how change happens.

Photo by Stuart Clarke

How Boundaries in ArcGIS Living Atlas Can Support Your Work

By Diana Lavery

Many common GIS workflows involve boundaries. The boundaries themselves are often not the main focus of the map or the analysis, but are foundational content for GIS analysts, second only to basemaps.



↑ Use the Browse tab to find boundary layers in ArcGIS Living Atlas of the World.

Using Boundaries for Supporting Symbology

Here are some of the common workflows in which boundaries take on this supportive role:

- **Using boundaries for supporting symbology**
- **Joining tabular data to boundaries**
- **Using boundaries as a clipping layer**
- **Using boundaries in the Summarize Within tool**

Fortunately, ArcGIS Living Atlas of the World—which all ArcGIS users have access to—provides curated, high-quality boundaries to support your work.

Using Boundaries for Supporting Symbology

For the map on page 9, a survey asked respondents about the location of the Midwest region of the United States, with the polygons indicating survey responses in blue.

A state boundaries layer labels each state with its abbreviated name in a highly contrasting color. The polygon fill is set to hollow (no fill), and the state outlines are set to a bright pink. The labels for the state names are styled in the same pink.

Not only does this create a cohesive aesthetic, it also helps orient people reading and interpreting this map. Here, the polygons do not represent the only vital information being conveyed—the relationship between the data collected through the survey and the state boundaries is critical to answering the map's central question: Where is the Midwest? Without the high degree of contrast between the data and the boundary layer, this information is likely to be obscured.

Joining Tabular Data to Boundaries

Joining Tabular Data to Boundaries

Many thematic maps start off as data in spreadsheets. Boundaries for areas such as countries, states or provinces, or postal codes are just rows in the data table. To map that data, the table must be joined to boundaries first. To perform a join by attribute (a column in a table), or to join features in ArcGIS Online, you need a table of data as well as a target layer of boundaries. Many turn to the boundaries category in ArcGIS Living Atlas for their target layer.

For instance, see the table on page 10 showing the percentage of licensed California childcare providers that offer care during nontraditional hours by county. To display that information, you need a target layer of counties to use in your join. ArcGIS Living Atlas has a USA Counties Generalized Boundaries layer to add to the map.

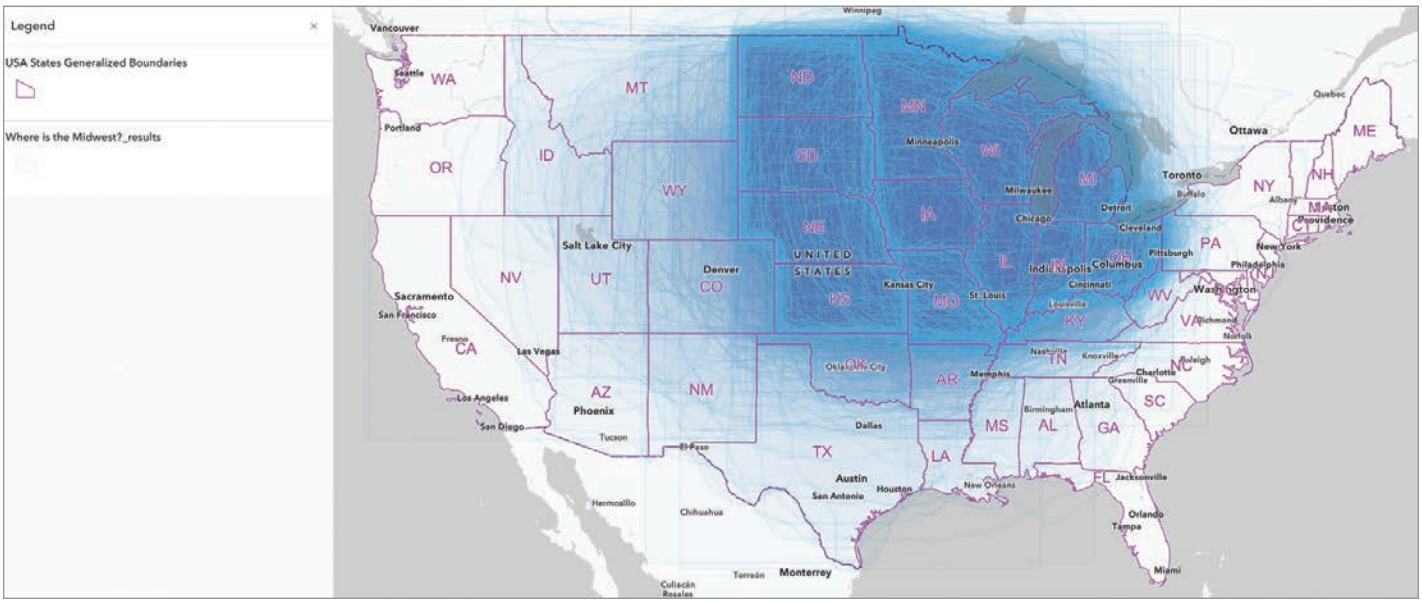
Real data is often messy. There is almost always a big tabular data transformation task to do first. Additionally, you may need to apply a filter or definition query to the target layer, or adjust the parameters in your join to get expected results. In this example, the original table downloaded from kidsdata.org needed to be pivoted from long to wide, and then the USA Counties layer needed to be set to just counties in California.

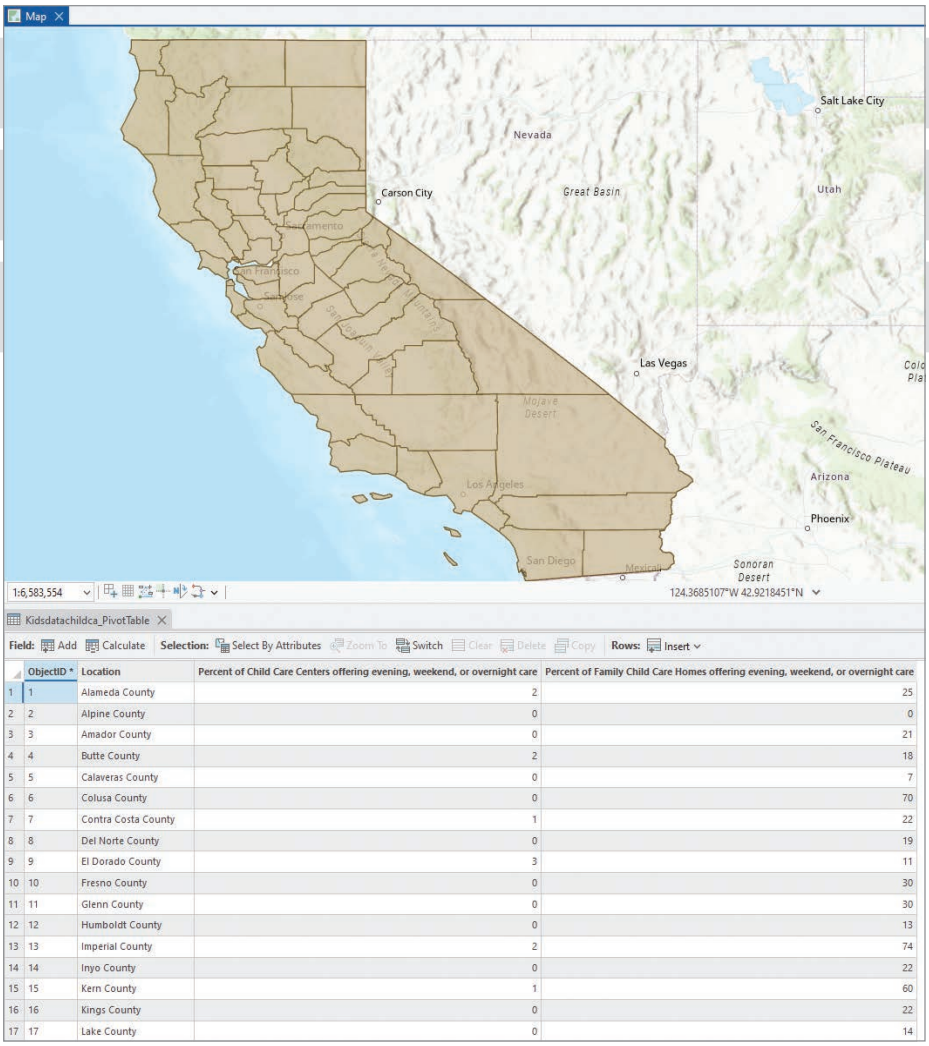
Once you perform the join, you are ready to symbolize your map.

Using Boundaries as a Clipping Layer

A common GIS workflow of extracting global or national data to a specific study area involves using the Clip tool. This enables you to set the larger dataset based on a clip feature. If your area of interest is

↓ State boundaries and labels are critical to this participatory map, but its design allows data collected through the survey to take the spotlight.





	ObjectID *	Location	Percent of Child Care Centers offering evening, weekend, or overnight care	Percent of Family Child Care Homes offering evening, weekend, or overnight care
1	1	Alameda County	2	25
2	2	Alpine County	0	0
3	3	Amador County	0	21
4	4	Butte County	2	18
5	5	Calaveras County	0	7
6	6	Colusa County	0	70
7	7	Contra Costa County	1	22
8	8	Del Norte County	0	19
9	9	El Dorado County	3	11
10	10	Fresno County	0	30
11	11	Glenn County	0	30
12	12	Humboldt County	0	13
13	13	Imperial County	2	74
14	14	Inyo County	0	22
15	15	Kern County	1	60
16	16	Kings County	0	22
17	17	Lake County	0	14

↑ In order to display tabular data on a map, you need a target layer to use in your join.

Using Boundaries as a Clipping Layer

a standard geography such as a country, state/province, or other popular designated area, check ArcGIS Living Atlas for a boundary layer you can use. Both feature layers and imagery layers can be clipped.

You can learn more about clipping through ArcGIS tutorials such as Clip a Layer in Map Viewer for ArcGIS Online and Clip Features to a Region for ArcGIS Pro.

Using Boundaries with the Summarize Within Tool

Many times, data starts off as dots on a map, such as crowdsourced data with photos and locations of graffiti, potholes, or wildlife sightings. To aggregate or summarize these points up to familiar geography levels (such as ZIP codes or census tracts), you first need a layer of these types of boundaries.

You can use boundary layers from ArcGIS Living Atlas in addition to your own data in the Summarize Within tool in either ArcGIS Pro or ArcGIS Online. This will yield counts (and maximum, minimum, average, and other summary stats) of your data.

Potential questions you can answer with this tool include:

- **How many dialysis centers are there in my ZIP code?** (Summarize points by ZIP code to get the count.)
- **How many miles of bike lanes are there in San Diego County?** (Summarize data from a line layer showing the ratio of bike lanes to counties.)
- **Which state has the most sightings of garden snails?** (Summarize the observations by state and sort from highest to lowest.)

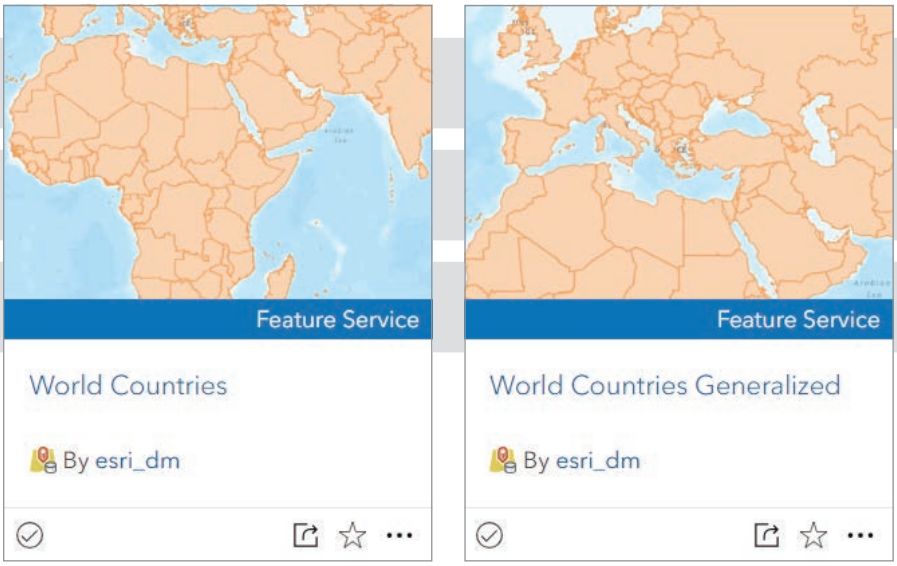
Both Generalized and Detailed

The most popular items in ArcGIS Living Atlas, including boundaries, have both a generalized version and a detailed version to support multiple needs. Using the generalized one is often advantageous since it is much less detailed. Fewer vertices mean faster performance.

You might need to use the detailed (non-generalized) version if having the detail on a coastline, river, or border is important to your visualization or analysis. If you are interested in a city-scale version of New Orleans, for example, you may be willing to deal with the slightly slower or heavier layer if it means having the detail you need in your map or in your analysis.

The Item Details page on the generalized layer has notes about the scale at which this layer is fit for use.

The Item Details page on the non-generalized layer has notes about using the fields Land_Type and Land_Rank, which separate polygons based on their



↑ Some of the most popular items in ArcGIS Living Atlas have both a generalized version and a detailed version to support multiple needs.

Using Boundaries in the Summarize Within Tool

↓ The detailed layer (left) may be slightly slower or heavier, but it can include the detail needed in your map or in your analysis.

size (1 = very small island, all the way to 5 = primary land). If you still want the detailed coastlines on the primary land but you don't need all the miniscule islands, filter out those with land rank values of 1 and 2, depending on your needs.

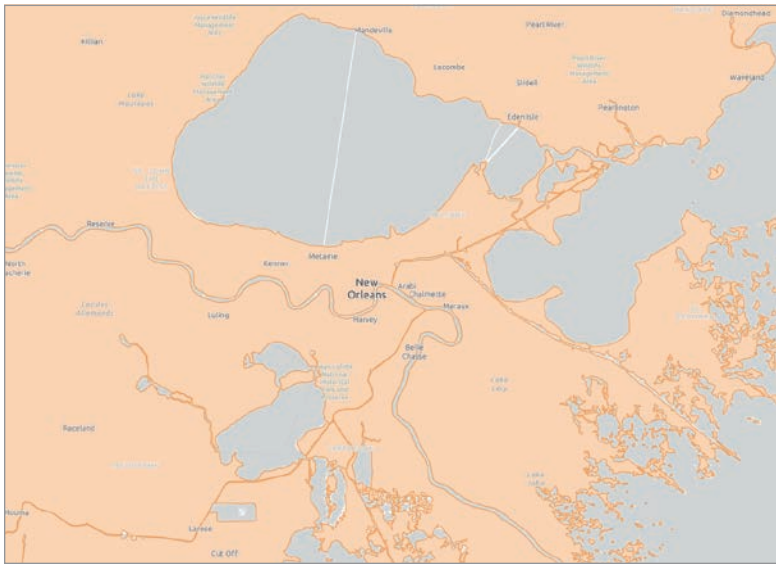
To find boundary layers in Map Viewer, open the Layers pane and click Browse Layers. Select From Living Atlas in the drop-down options, and search away. Items are updated regularly to ensure that you have the best available geographic information. Check the Item Details pages for item-specific information on the update cadence.

Here are some of the most frequently requested boundaries available today:

- **World Administrative Divisions** (commonly known as "Admin level 1")
- **World Countries** (both generalized and detailed)
- **World Regions**
- **World Continents**
- **USA Zip Codes**
- **USA Telephone Area Codes**
- **USA Counties**

About the Author

Diana Lavery loves working with data. She has over a decade of experience as a practitioner of demography, sociology, economics, policy analysis, and GIS, making her a true social science quantoid. Lavery holds a BA in quantitative economics and an MA in applied demography. She has been with Esri as a product engineer on Esri's ArcGIS Living Atlas and policy maps teams since 2017. Lavery enjoys strong coffee and clean datasets, usually simultaneously.



Exploring the Real-Time Data System Pattern

The ArcGIS Well-Architected Framework provides IT and GIS professionals with a comprehensive set of ArcGIS system patterns to assist in designing an ArcGIS deployment tailored to an organization's needs.

The real-time data system pattern is designed to facilitate real-time data streaming and analytics, enabling organizations to harness the power of live data for immediate insights and decision-making. This pattern serves as a foundational system that supports the continuous flow of data, processing, and analysis.

Industry Applications and Use Cases

The real-time data system pattern is highly versatile. Applications span various industries and use cases. Within financial services, real-time data analytics play a crucial role in fraud detection, risk management, and algorithmic trading. In smart cities, real-time data processing is instrumental in initiatives such as traffic monitoring, emergency response optimization, and efficient resource allocation. In Internet of Things (IoT) monitoring, organizations leverage real-time data to proactively maintain and optimize IoT devices and sensors.

These diverse applications showcase the broad utility and impact of the system pattern across different sectors, highlighting its significance in enhancing operational efficiency and decision-making processes.

Deployment Considerations and Options

This system pattern offers several benefits:

- **Continuous Data Processing:** The pattern enables the seamless processing of data streams as they are generated, allowing for instant analysis and response.
- **Real-Time Analytics:** Organizations can leverage real-time analytics to gain immediate insights, detect patterns, and make informed decisions promptly.
- **Scalability and Flexibility:** The system pattern is scalable, accommodating varying data volumes and processing requirements, and ensuring flexibility in handling dynamic data streams.
- **Integration Capabilities:** It offers integration with a wide range of systems and tools, allowing for seamless data flow and interoperability.

This system pattern can be deployed through software as a service (SaaS) or Windows/Linux. When considering deployment options, factors such as scalability, reliability, security, and the balance of responsibility between your organization and Esri play a significant role.

The SaaS deployment pattern using ArcGIS Online and ArcGIS Velocity provides quick time-to-market advantages, while the Windows/Linux deployment pattern, powered by ArcGIS GeoEvent Server, offers extensibility through custom input connectors and a gallery of add-on processors and connectors. Additionally, the use of big data analytics varies between deployment patterns, with the SaaS pattern incorporating big data analysis capabilities and the Windows/Linux pattern focusing on storing historical observations for batch analysis. Integrating real-time feeds and big data analytics results with a broader user base typically requires the use of multiple system patterns. The self-service mapping, analysis, and sharing system pattern or the enterprise application hosting and management system pattern can be combined with the real-time data streaming and analytics system pattern for comprehensive data management and analysis.

The real-time data system pattern within the ArcGIS Well-Architected Framework empowers organizations to leverage real-time data for enhanced decision-making, operational efficiency, and strategic insights. By embracing this pattern, organizations can stay ahead in today's data-driven landscape and unlock the full potential of real-time data analytics.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GIS Reconnects the Great Lakes Stream Networks

By Kyle Dankert

On a typical day of fieldwork in northern Michigan, an aquatic resource technician from the nonprofit Trout Unlimited (TU) will trek through the white cedar and hemlock woods of Huron-Manistee National Forests, lugging heavy survey gear along rugged hiking trails. It's difficult work. The forests are littered with treacherous two-track roads, and the weather can be especially hot and humid in the dead of summer.

After hiking through the tamarack bush, the technician comes to a stream that's cold to the touch, even in the heat. This is due to the strong groundwater influence and the shade of the canopy from the thick forests particular to this region.

However, the work site is impeded by a road crossing that blocks trout migration and increases temperatures downstream, damaging the ecosystem and the species that call this water home, like massive mayflies and mottled sculpin.

But the technician is here for the brook trout. This vibrant salmonid is a native indicator species, meaning that if its populations dwindle, it's a sign that something unnatural is affecting the health of the entire ecosystem. The trout's ecology requires habitat parameters like river substrate, dissolved oxygen levels, cold water, healthy surrounding forests, and connected stream networks for survival and reproduction.

The brook trout is also the mascot of TU, a conservation organization that operates throughout the United States. Its technicians survey streams like those in the Huron-Manistee National Forests to conserve and restore trout populations. TU is committed to identifying and removing barriers to aquatic organism passage by using GIS technology such as ArcGIS Survey123, ArcGIS Field Maps, and ArcGIS Experience Builder to reconnect stream networks for all the species that live there.

Site and Survey

Coldwater streams are defined by the Michigan Department of Natural Resources as streams capable of remaining below 63.5 degrees Fahrenheit year-round, even throughout the hot summer months. Coldwater is an ecosystem service made possible by groundwater influence, forests, and a well-connected stream network.

Although the Great Lakes region is rich in hundreds of these tiny stream networks, they are often blocked by road crossings throughout the area—a problem not only for the brook trout but for the entire ecosystem. TU is dedicated to reconnecting these networks and restoring habitat for brook trout with the help of GIS software. This focus also serves the needs of many other Great Lakes riverine species.

↑ Treks to survey sites are often executed by following directions through offline apps created with ArcGIS Field Maps.

→ A Trout Unlimited (TU) field technician inspects brook trout caught in a Claybank Creek fish survey.

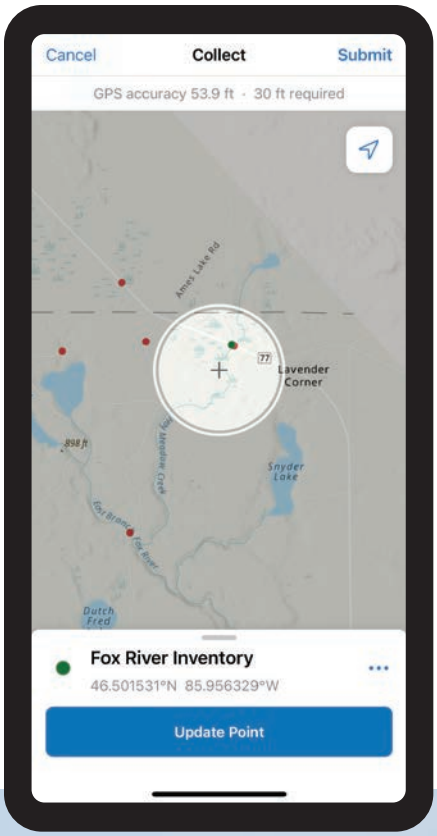
TU technicians restore miles of reconnected habitat by collecting data on barriers and removing the road crossings, culverts, and other human-made structures that inhibit aquatic organism passage.

Surveying these streams is the first step in the process. TU technicians complete the Aquatic Barrier Stream Crossing Survey on a daily basis to identify potential barriers to a stream network. This survey requires many fluvial, erosion, and habitat measurements, including flow rate, stream bank at full width, and structure width.

Technicians use the offline-compatible ArcGIS Field Maps. The app identifies work sites for the day and links the associated survey defining the style of fieldwork needed.

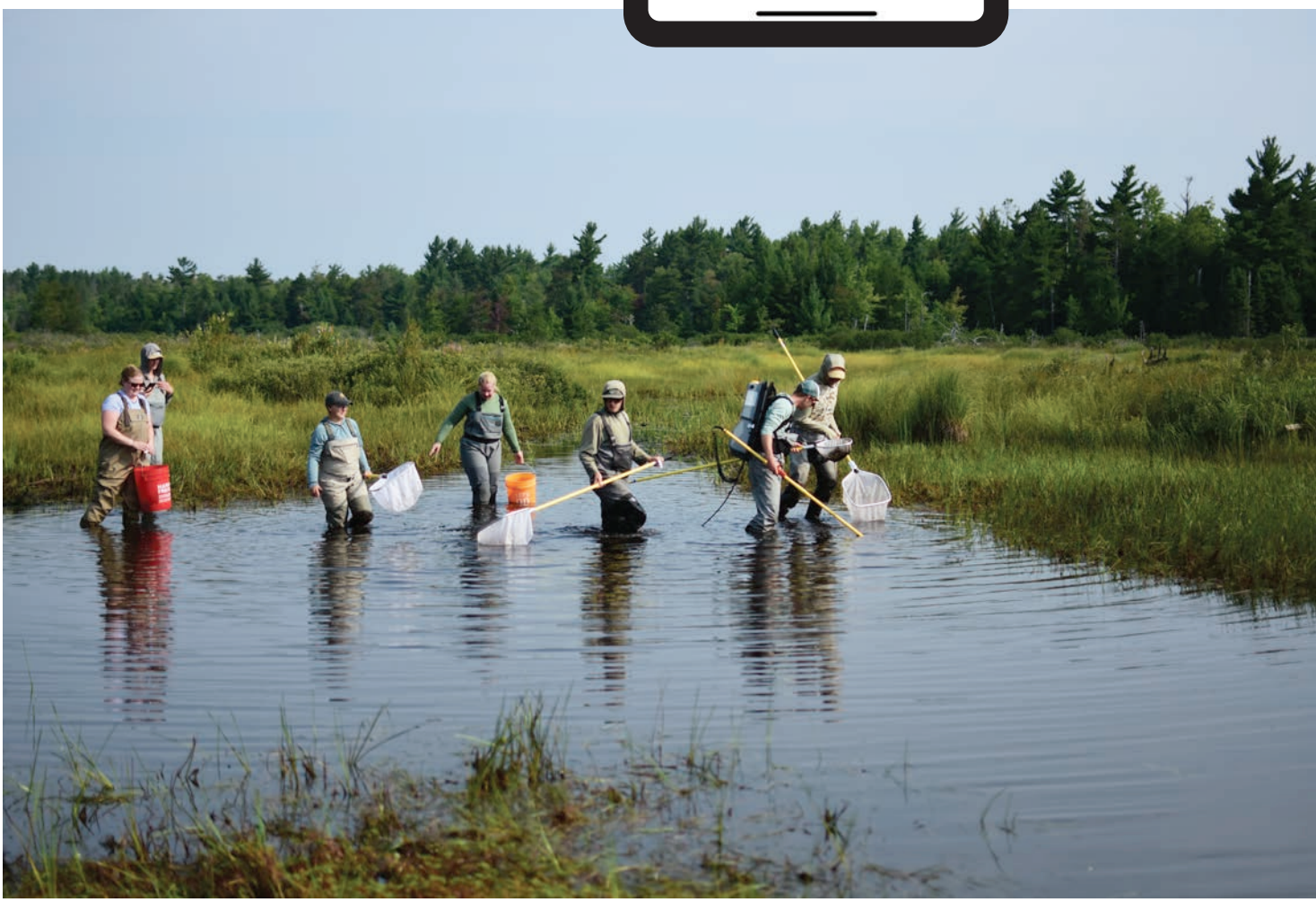
After surveying a site, the technician submits the completed survey using ArcGIS Survey123 with an immediate barrier score response characterizing the severity of the barrier's disruption to the stream network. This is then sent to an online database to prioritize sites for restoration potential.

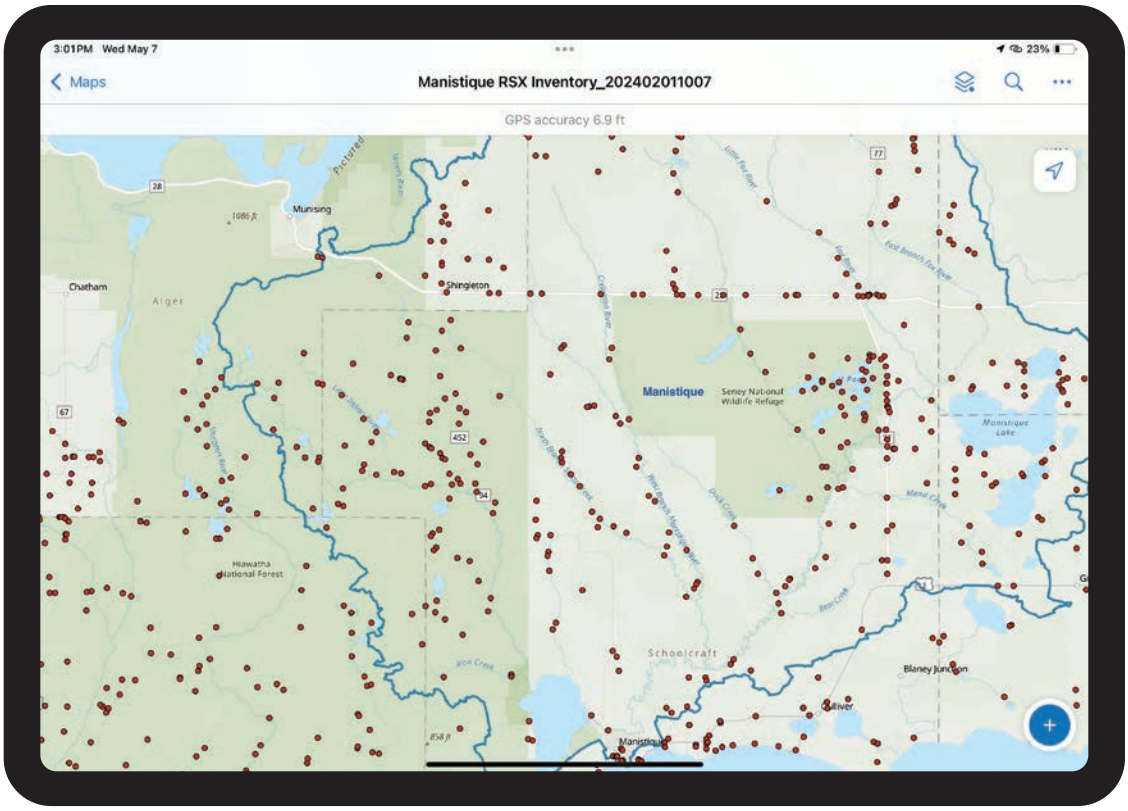
Prioritization considers habitat reconnection potential, cost of reconstruction, and landowner relationships, among other factors.



← ArcGIS Field Maps is used in all TU surveys for tracking completion of work at each site and getting directions offline.

↓ Collection time and effort are also measured through field apps when a survey commences.





→ ArcGIS Field Maps offers ease of data collection with the ability to update online layers on the fly. These layers and data are used for prioritizing restoration efforts and monitoring completed projects.

↘ Data is collected from biological samples like brook trout and then entered directly into ArcGIS Survey123 forms.

Once the construction phase is completed, TU staff can continue further up the stream network to find additional barriers and reconnect more segments of habitat.

TU staff then monitor these restored sites through recurring biological surveys focusing on fish and macroinvertebrate communities, using ArcGIS Field Maps to document fish populations and other variables before and after construction takes place. With a completed project, TU can calculate the connected stream mileage to the next barrier by updating its public *Stream Reconnection Map*.

Additionally, TU used ArcGIS Experience Builder to create the *Stream Reconnection Map*, which identifies sites that TU has identified as necessary for stream reconnection at any stage of the project. This includes information such as the particular watershed and stream location of the site, the year stream reconnection construction was completed, and the funding sources of the project.

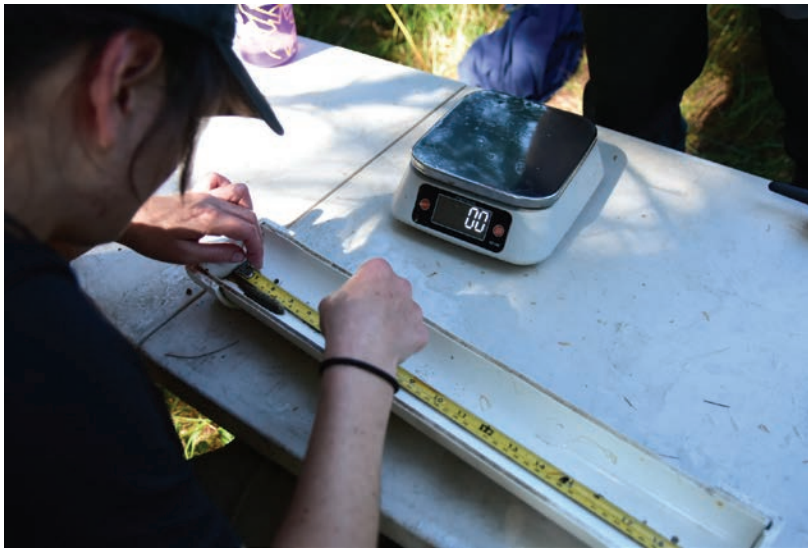
With these GIS applications, TU aims to continue monitoring the progress of stream reconnection for federal and private partners as well as for local chapters and TU members.

Putting the Pieces Together

TU collaborates with agencies and funding partners, including the USDA Forest Service, National Oceanic and Atmospheric Administration, US Fish & Wildlife Service, and National Fish and Wildlife Foundation, to reconnect hundreds of miles of upstream coldwater habitat for aquatic species like brook trout, providing climate resilience to freshwater resources.

This work is made possible through several ArcGIS field applications, especially data collection in ArcGIS Survey123. This app is essential for technicians to collect geomorphic data and determine if a stream location acts as a barrier for aquatic species at certain flows.

ArcGIS Field Maps is an essential tool for its offline capabilities and live tracking of progress. The effectiveness of restoration work is monitored through the uses of habitat and biological surveys—including macroinvertebrate surveys, stream temperature measurements, and electrofishing surveys that focus on native brook trout populations. Data collection efforts are designed and executed through ArcGIS Field Maps for both the office and the field.



Ideally, resources like the *Stream Reconnection Map* help present an ethical and sustainable perspective for aquatic ecosystems and human transportation in the Great Lakes region. By using and sharing these resources, TU can continue to grow its engagement with more people who live near these waters, as well as with others who collaborate, advocate, and hope for better stream health.

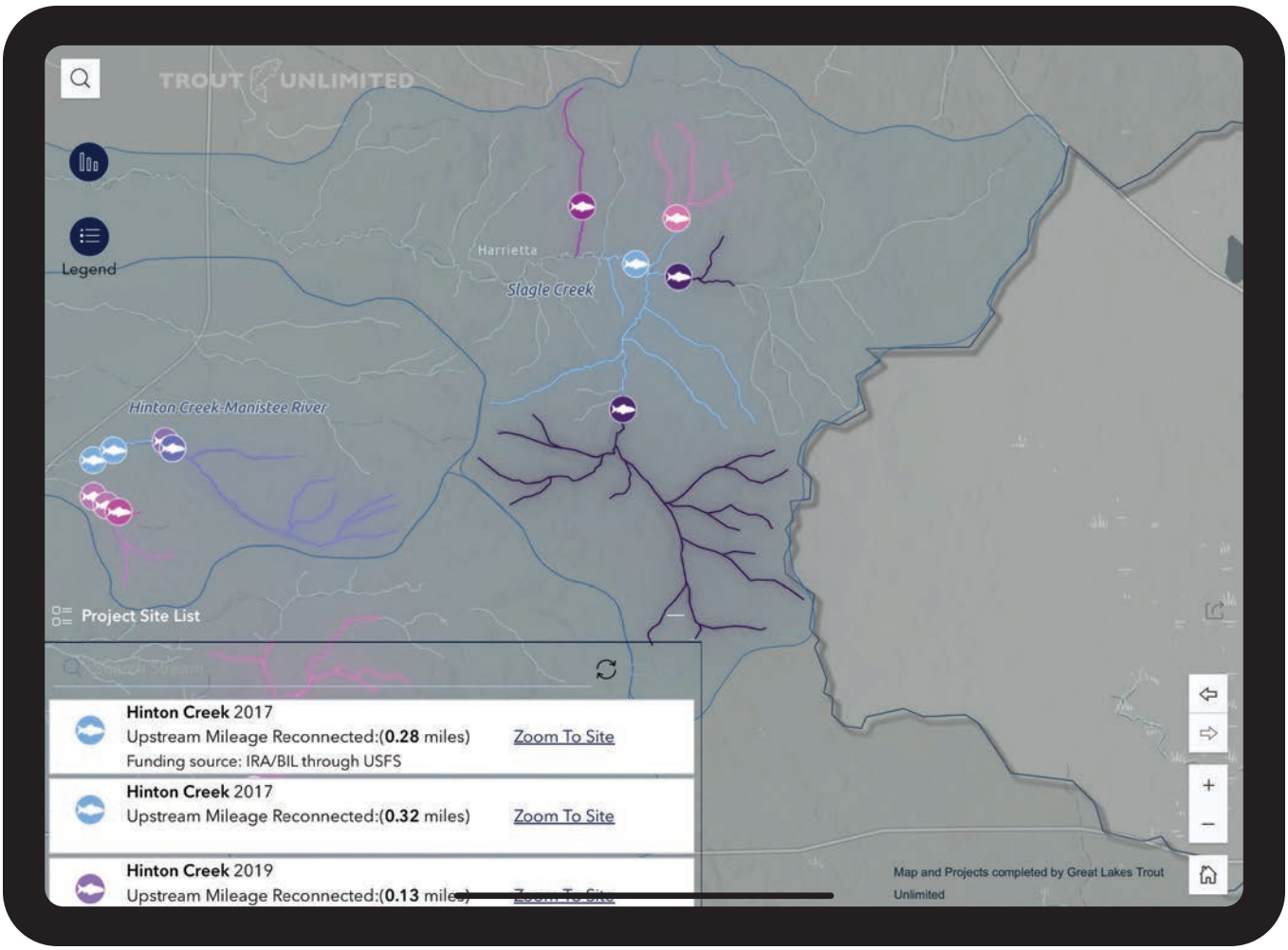
To follow the progress of the stream reconnection project, visit TU's *Stream Reconnection Map* at links.esri.com/tu.

About the Author

Kyle Dankert works for Trout Unlimited, focusing on freshwater stream ecology and restoration of coldwater stream habitat in the Great Lakes. Dankert has worked in watershed restoration for almost a decade. He has a bachelor's degree in environmental science and a master's degree in GIS from Calvin University. Dankert enjoys using spatial analyses and monitoring data to better understand how humans and climate impact coldwater resources.

← This restored crossing's design took into account the hydrology of this stream at many flow types as well as the rehabilitation of riparian and aquatic habitat.

↓ The *Stream Reconnection Map* shows reconnected stream segments by year completed.



Freight Operations Put Data First

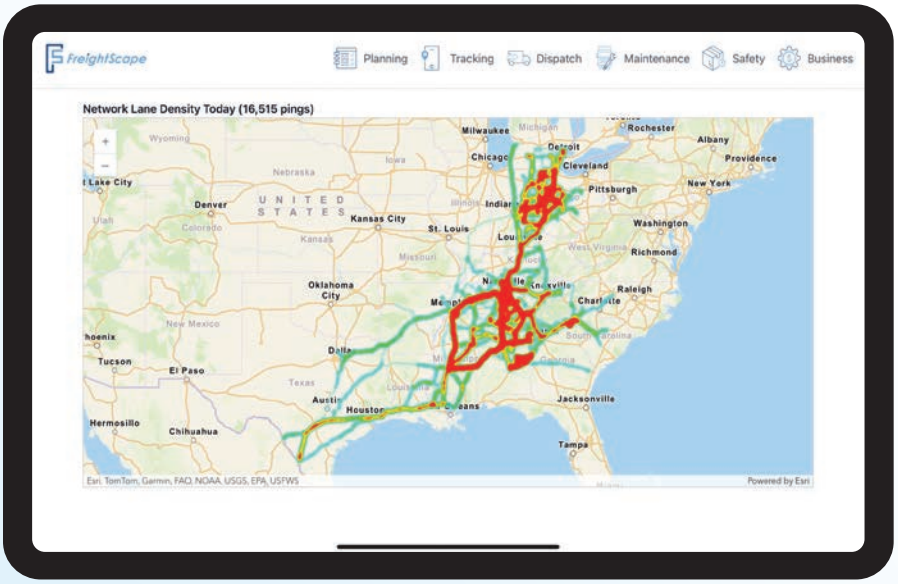
By Ryan Coleman

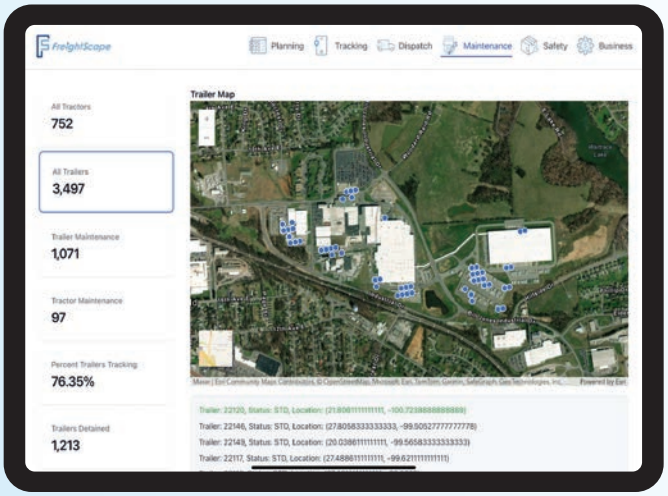
Since 1981, Murfreesboro, Tennessee-based Venture Express (VE) has been a premier freight hauler for the region's automotive manufacturing industry. The company's network of terminals, warehouses, and cross-docks allows it to cater to the just-in-time model that modern manufacturing requires. This means that VE receives the materials it ships exactly when they will meet customer demand—no sooner or later.

Because this management strategy requires precise logistics, VE has always emphasized the importance of technology. Having already embraced Electronic Data Interchange automation and solar trailer trackers, company management knew location-based automation was the next step in VE's technological evolution.

However, VE's fleet comprises 800 trucks and 3,700 trailers. The movement of these vehicles involves vast amounts of data that need to be organized visually to be useful in managing the company's operations. VE staff tried various display methods, but all came with processing, speed, and storage compromises. Finally, VE sought a solution that used ArcGIS software to display and analyze this extensive data pool.

In March 2024, VE teamed up with Esri partner Spatial Freight Solutions to implement and test a new fleet management platform called FreightScape. This web-based program joins disparate data sources—such as the transportation management system, electronic logging devices, trailer locations, and financial data—into a map-based display. Spatial and temporal data are then used to create metrics and automate dispatching. FreightScape has multiple displays to show real-time movements, data trends, and metrics.





↑ FreightScape needed a framework to meaningfully support the data generated by Venture Express's (VE) fleet.

→ The Maintenance page shows the status of VE's assets.

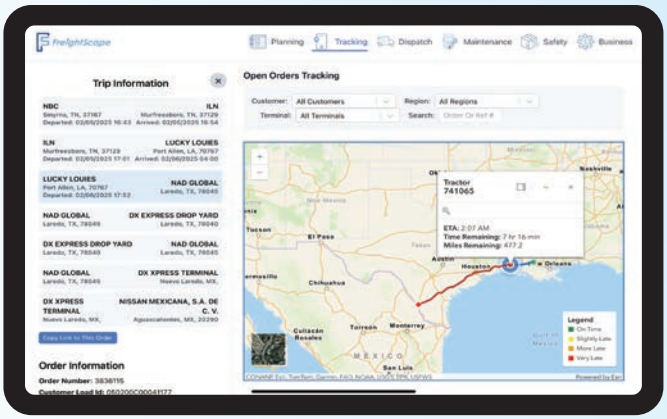
From Development to Execution

Before the development of FreightScape, VE used stand-alone applications designed by Freight Solutions developers, who spent nearly a year conceptualizing the different uses and functions of this software suite. The developers' experience with ArcGIS, however, led them to explore the transportation analysis solver in ArcGIS Network Analyst for VE.

With up to 20,000 location pings a day, ArcGIS Online was the only display choice fast enough to quickly load the location data VE was juggling. In addition, its truck route layers, open-source data layer (for real-time travel condition updates), and developer SDK made it the right choice for the project. ArcGIS Online was also useful for its cross-platform usability on tablets and mobile devices.

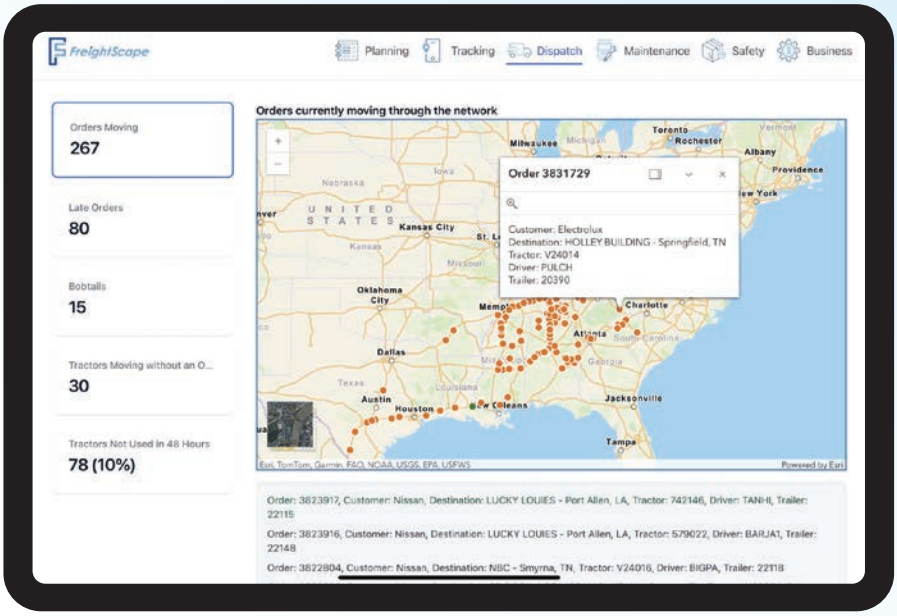
After deciding on the right software, coding and testing took six months. Some existing applications were converted from C# to Next.js, an open-source web development framework, and modified for use in the FreightScape UI.

Developers consolidated existing data in SQL, API, and CSV formats. VE's terminal



← The Tracking page shows the location and trip information for individual vehicles within VE's fleet.

↓ The Dispatch page shows all orders that are currently moving through VE's network.



locations, domiciles, and customer sites were geocoded and geofenced from existing records.

Data in Action

The goal of FreightScape was to empower every employee, from the CEO down, with the most detailed fleet data available. Because of users' varying degrees of expertise, the interface prioritizes ease of use. FreightScape's operation is intuitive, requiring little to no training, and features multiple data layers that are easily accessible. This data fusion makes previously unavailable tracking, dispatching, and analysis capabilities accessible to a wide variety of VE employees who can take advantage of the platform to leverage data to streamline their workflows. Order locations can be viewed in real time on customer-specific links. VE needed to use spatial relationships to reduce human error and noise, thus increasing revenue by using spatial data to match backhauls in real time.

VE data is displayed on various pages, along with metrics derived from real-time relationships. The Tracking page uses ArcGIS REST API to achieve near real-time visibility, updating each truck's remaining route and current ETA to the destination. Customers can view the status of their orders via a web portal.

The Geofencing page allows for quick updates to the customer database. This virtual business environment tracks daily fleet actions and triggers events—such as automatically closing a completed order or assigning a new one once a truck reaches its actual location.

Other pages include Dispatch (current orders), Safety (driver and safety-related information), Maintenance (asset status), and Business. The Business page shows trends over previous weeks or months, and its customizable key performance indicators (KPIs) can be shared in daily reports.

The software suite also leverages geolocation data in other ways. Specific cross-dock bays can be defined as inbound or outbound to analyze operational efficiency and throughput. A recruiting module examines local order volume and overall network flow to determine where drivers are needed most. Asset utilization metrics identify poorly managed sectors and provide a means to gauge improvements.

Since its launch, FreightScape has reduced manual dispatching by automating order assignments through geofencing, saving dispatchers hours each day and cutting down on costly routing errors. Trailer utilization has improved thanks to spatial backhaul matching, which has translated into fewer empty miles and lower fuel costs. Real-time visibility has allowed customers to proactively plan production schedules, reducing delays and improving service satisfaction. Internally, VE has been able to identify underused assets, rebalance its driver network, and forecast staffing needs more accurately. Together, these improvements have lowered operating costs and increased revenue opportunities.

All of this adds up to a tool that has saved time and money by transforming raw fleet data into actionable business intelligence, ensuring that everything ends up where it needs to go, exactly when it needs to be there.

Although the program originated as a tool for transportation companies, original equipment manufacturers—which require increased supply chain visibility—have also shown significant interest in adopting FreightScape. The modular design lets customers implement only the components relevant to their operation. With "track and trace" and "visibility" among the industry's current buzzwords, a platform like this has never been so valuable across multiple industries.

About the Author

Ryan Coleman is a cofounder of Spatial Freight Solutions, a transportation consulting company specializing in fleet visibility software and solutions. He holds an MS in supply chain management from the University of Tennessee, and is currently enrolled in Vanderbilt University's Owen Graduate School of Management. His background in ArcGIS includes real estate valuation data and drone mapping. Learn more at spatialfreightsolutions.com.

St. Louis Digital Twin Bridges Urban Divides

By Shimona Lahiri, Rex Hansen, and Mike Branscomb

In an effort to revitalize a historically underserved area, the St. Louis Development Corporation (SLDC) commissioned a project focused on revitalizing the Dr. Martin Luther King Drive corridor in St. Louis, Missouri, a priority for development in the city's Economic Justice Action Plan.

To bring this vision to life, SLDC collaborated with Esri partner Houseal Lavigne, an urban planning and geospatial design firm. Houseal Lavigne used ArcGIS Maps SDK for Unreal Engine to import real-world GIS data into an Unreal Engine application. The firm was able to create a lifelike, interactive digital twin that aims to support the revitalization efforts in the area.

By merging the geospatial accuracy of ArcGIS with the high-performance rendering, special effects, and animation capabilities of Unreal Engine, the project team was able to demonstrate potential urban transformations in a way that is both tangible and accessible to all residents, regardless of technical skill. The digital twin has been

↓ The former Marshall School on Dr. Martin Luther King Drive is a dynamic mixed-use development project aimed at revitalizing the neighborhood.

crucial in community engagement efforts, allowing residents to visualize potential improvements in their neighborhoods, thus fostering a sense of ownership and inclusion. The success of this project in enhancing urban planning and decision-making processes has set the stage for further expansion of digital twin technology across the city as it aims to improve infrastructure, transportation, emergency management, and overall urban and economic growth.

Urban Disparities and Community Engagement

St. Louis, a city of nearly 300,000 people, has a history marked by segregation and economic disparity, creating a cityscape where neighborhoods just blocks apart embody vastly different social and economic conditions. This division goes beyond just property values; it significantly affects residents' quality of life, access to essential services, and opportunities for economic advancement. The roots of these disparities lie in historical policies like redlining and racially restrictive covenants, which have had a lasting impact on the city's geographical and social structure, perpetuating a cycle of poverty and disinvestment in certain areas.

The city has faced significant challenges in engaging the community in urban development processes. Traditional methods of outreach and planning have often failed to capture the attention or earn the trust of the residents most affected by proposed changes. This has led to skepticism and a disconnect between the city's plans and communities' needs, making it difficult to implement projects that truly benefit the most vulnerable residents. There has long been a clear need for more effective engagement strategies that resonate with and include these communities in meaningful ways.

St. Louis's new approach to urban development addresses the physical aspects of development and fosters a sense of ownership and inclusion among all residents. This strategy involves leveraging innovative tools to visualize the impact of development projects and ensure that growth and investment benefits are equitably distributed across the city. St. Louis aims to use technology to bridge the gap between current realities and future possibilities by transforming the way the city plans and interacts with its residents, creating a more inclusive and equitable urban environment.

Urban Planning with ArcGIS Maps SDK for Unreal Engine

To address the deep-seated economic disparity and community disengagement, SLDC and Houseal Lavigne integrated ArcGIS Maps SDK for Unreal Engine into St. Louis's urban planning and community engagement processes. The primary deliverable for the project was a production-quality video showcasing the dynamic transformation of St. Louis neighborhoods, particularly focusing on historically underserved areas. The video depicts renovated structures, new buildings, and businesses rising from the ground. Additionally, the solution provided an interactive experience for city leaders and community members, fostering involvement and supporting informed decision-making. The digital twin of the city is not just a technological achievement but a new way to engage the community and drive positive change.

"The idea was to show the vision, before and after, of what the neighborhood could look like," said Steve Davis, vice president of SLDC.

The collection and provision of data for the St. Louis digital twin project, managed by Houseal Lavigne, was a comprehensive initiative that involved multiple city departments under the coordination of SLDC. Leveraging the city's extensive GIS databases, the project team gathered crucial data layers.

"We modeled using the data from the city—so, building polygons, parcels, road centerlines, and street furniture," said Devin Lavigne, principal and cofounder of Houseal Lavigne.

This rich collection of GIS data was pivotal for creating a realistic and interactive 3D model of St. Louis, enabling Houseal Lavigne to accurately replicate the physical characteristics of the city's neighborhoods.

Furthermore, the project did not just rely on current GIS data; it also incorporated historical data to provide a temporal dimension, showcasing the city's development over time and aiding users in understanding the long-term impacts of urban policies. Contributions from local businesses, community organizations, and residents provided additional layers of data, which enriched the digital twin model to reflect the lived experiences and realities of St. Louis's diverse population.

To ensure that the digital twin remained accurate and relevant, St. Louis

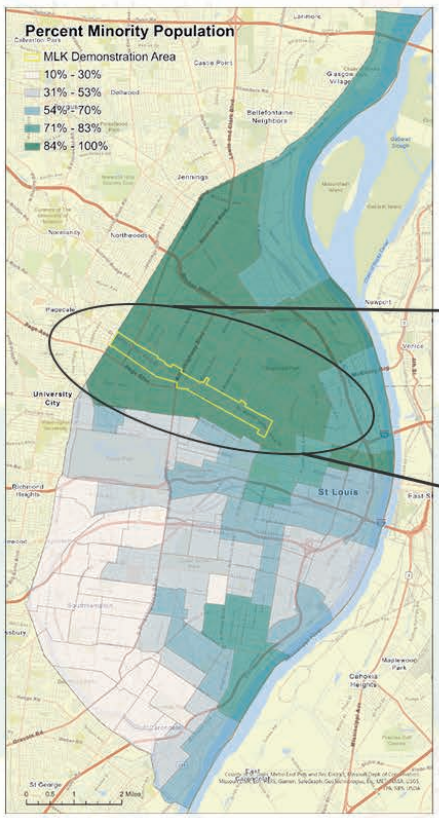
established protocols for ongoing data updates and management, adapting the model to reflect new developments and changes within the city. This approach not only facilitated the visualization of potential urban developments but also enhanced decision-making processes, providing a scalable and detailed model of the city's future.

Revitalization with Digital Twin Technology

The St. Louis digital twin project, integral to the Economic Justice Action Plan, focused on revitalizing historically underinvested areas, addressing issues such as crime and poverty. By creating a dynamic 3D visualization of potential urban developments, the digital twin has allowed stakeholders to visualize and engage with future changes, playing a crucial role in the mayor's state of the city speech and supporting economic revitalization efforts along key areas like Dr. Martin Luther King Drive.

Moreover, the digital twin was instrumental in enhancing decision-making processes. It enabled city planners and developers to simulate various development scenarios

↓ The area that SLDC commissioned Houseal Lavigne to help visualize by creating a digital twin using ArcGIS Maps SDK for Unreal Engine.



← The city's Dr. Martin Luther King Drive corridor area has undergone a lot of changes from the 1950s to the present day.

and assess potential impacts before any physical changes were made. This proactive approach minimized risks and optimized planning, setting a precedent for other cities dealing with similar challenges of economic disparity and community disengagement. The project not only demonstrated the power of technology in urban development but also emphasized the importance of collaboration and good data in crafting inclusive, transparent, and effective strategies for sustainable growth.

The successful implementation of the Dr. Martin Luther King Drive corridor project has paved the way for broader adoption of digital twin technology throughout St. Louis, powered by ArcGIS Maps SDK for Unreal Engine. The city plans to extend this technology to additional neighborhoods and sectors, enhancing simulations for infrastructure, transportation, and emergency management, which will increase community involvement.

Efforts to make the digital twin platform more user-friendly will include educational programs for residents as well as the integration of real-time data, improving transparency and interaction. By fostering a more connected and informed community, St. Louis aims to bridge urban divides and create a more resilient and inclusive city.

About the Authors

Shimona Lahiri is an Esri product marketer working with ArcGIS Maps SDKs for Game Engines and ArcGIS Maps SDKs for Native Apps. With an undergraduate degree in psychology and an MS in marketing, she is a digital marketing polymath and loves to craft interesting stories.

Rex Hansen is an Esri product manager for ArcGIS Maps SDKs for Native Apps and ArcGIS Maps SDKs for Game Engines. He has over 25 years of experience in GIS, spatial analytics, and computer mapping. Currently, he guides the development of native technologies in the GIS industry to use authoritative geospatial content and analysis in offline workflows; photorealistic experiences; and immersive, extended reality solutions.

Mike Branscomb is an Esri product manager for ArcGIS Maps SDKs for Native Apps and ArcGIS Maps SDKs for Game Engines. With over 20 years of experience working in the Esri ecosystem, he specializes in .NET, local server, and 3D scene layers. He is also a Scrum Product Owner with over 10 years of experience guiding teams through the product development life cycle.

When Maps Become Lifelines

By Ryan Lanclos

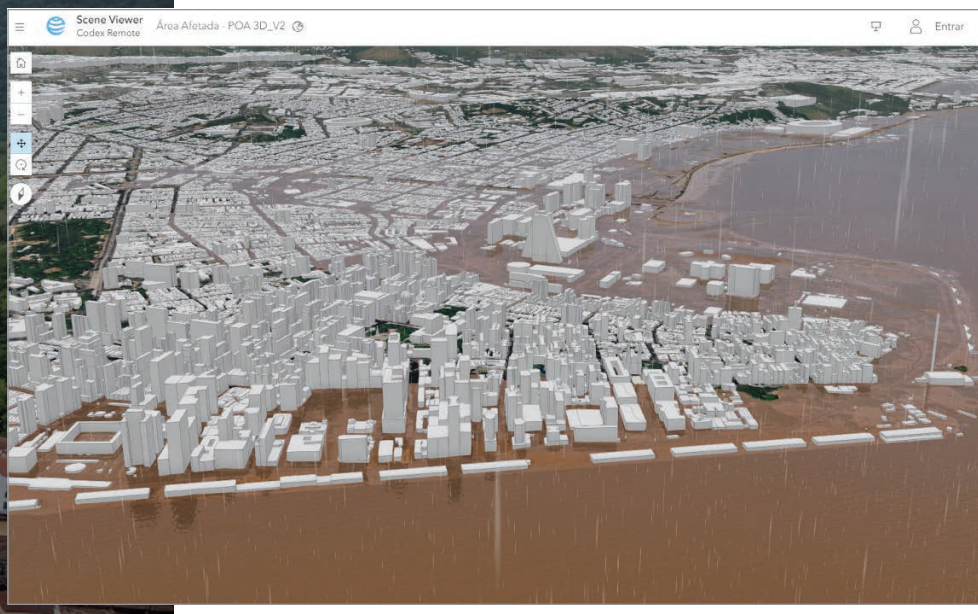
Luiz Marchiori stepped outside his apartment building in Porto Alegre one Sunday morning in May 2024, squinting into the bright sunshine. There was no sign of what was to come—of the fierce floods that would soon strike his Brazilian state of Rio Grande do Sul.

"I walked through the center of the city, and it was calm. But the water was rising," said Marchiori, a meteorologist-turned-founder and CEO of Codex—a company specializing in the GIS technology often used to prepare for and respond to this type of natural disaster.

Two hundred miles north, in the highlands, a year's worth of rain had fallen in just three days. Water in every river and stream was racing toward Marchiori's city—the state capital and regional home to 2.3 million people—carrying with it a force that would challenge everything he thought he knew about extreme weather.

Marchiori's mind was racing to think of ways he could help and the data that would be needed. He knew dashboards could give responders real-time awareness of the locations and conditions of people and resources. He considered all the ways that maps could become lifelines for residents who would need to find shelter and food. People and goods would need to be routed around broken roads and bridges. He expected calls from Codex's government customers to help them see clearly through the chaos.

What he didn't know was how many of his small team of technologists would be



↑ Codex's 3D flood simulation shows Porto Alegre's city center submerged, helping officials predict which buildings would be affected as water levels rose.

← Floodwaters escaped the banks of the Guaíba River in Porto Alegre, Brazil, where unprecedented rainfall in the highlands displaced 600,000 people in May 2024.

↓ Engineers assess flooded streets in Porto Alegre after Brazil's historic floods turned roads into rivers, forcing rapid infrastructure response.

displaced. When they lost everything, his office and their GIS skills would sustain and distract them from the anguish. They would work day and night, building real-time mapping apps to support rescue and response.

The Perfect Storm

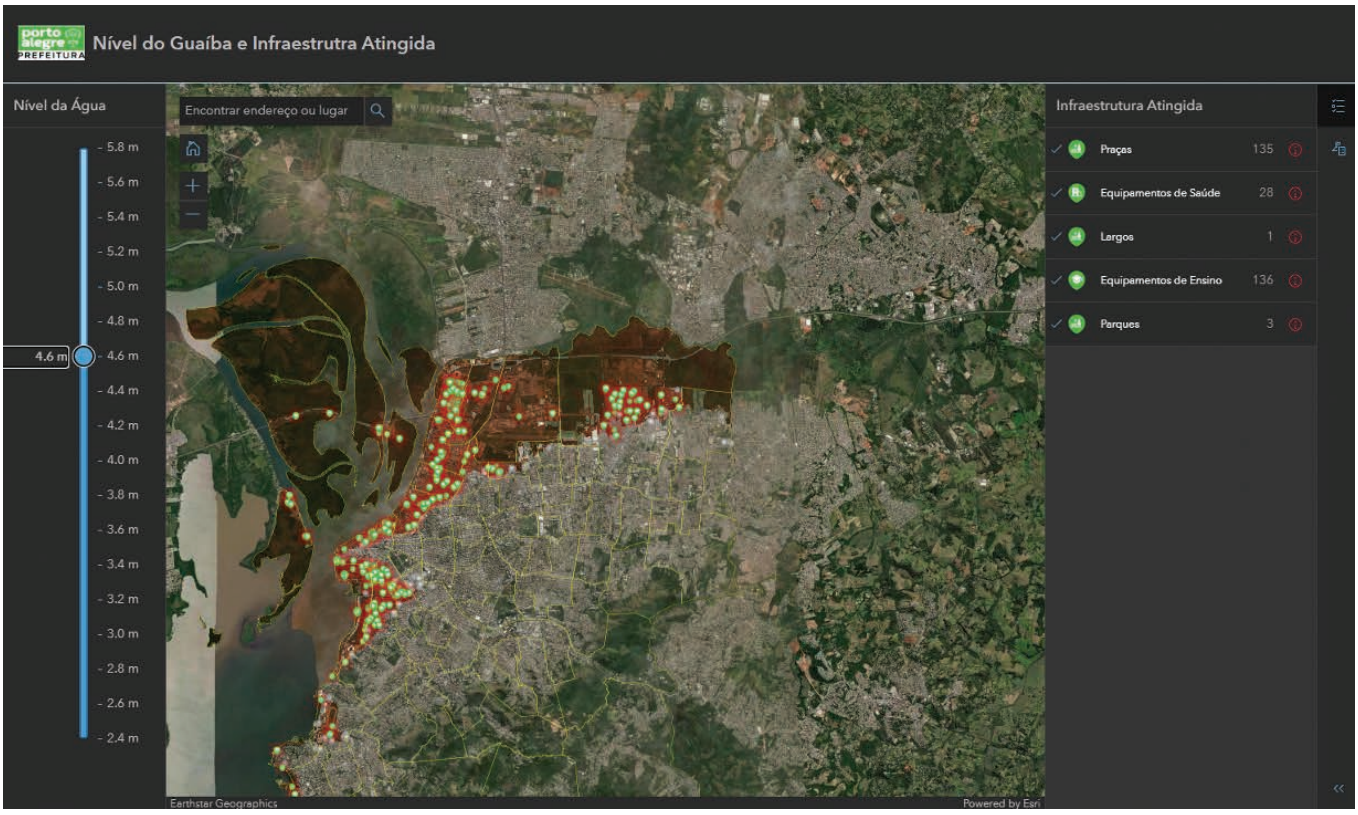
Statistically, such an event might occur once every 10,000 years. Even Marchiori, with his meteorological background, had never studied situations this extreme.

"There was never a scenario that could predict what happened," he said. "Everyone who works with these scenarios needs to re-think everything."

The geography of Rio Grande do Sul concentrated the power of the extreme rainfall. All the water from the highlands funneled toward the same place—the Porto Alegre region. Then, in a cruel twist of meteorology, south winds pushed brewing storm clouds against the highlands, bringing more rain as atmospheric pressure from the ongoing heat wave blocked the clouds' natural path to the ocean. A floodwater volume of 1.5 billion cubic meters descended on the city, causing water levels to rise at unprecedented speed and displacing 600,000 people.

Within 48 hours, rushing waters overwhelmed the city's Dutch-inspired pumping system that was designed to manage water in a region that sits below sea level. Pumps that normally push excess water into the ocean were knocked offline by inundated electrical systems. Water levels in downtown Porto Alegre reached nearly seven feet. The airport, 70 percent under water, would remain closed for six months.

For Marchiori and Codex's 70-person staff, the disaster was deeply personal. Four employees lost everything. Twelve had to evacuate their homes. Those who could make it to company headquarters brought mattresses and stayed for the duration of the event. The office never lost power or internet connection, so



↑ An interactive flood modeling tool highlights the infrastructure impacted by rising water levels in Porto Alegre. Red and green dots mark critical facilities like hospitals and schools, helping emergency responders prioritize rescues.

it became both an impromptu shelter for displaced staff and an emergency operations center to deal with the flooding event.

"When this kind of disaster happens in Brazil, it usually affects people with lower income, more vulnerable people," Marchiori said. "But in this case, it happened to everyone. People with mansions, people with shacks—everyone was affected."

When Infrastructure Fails

As the waters rose, traditional systems collapsed. The state's entire data infrastructure, located in low-lying areas, completely flooded. Government officials found themselves unable to access maps, databases, or even basic information about water levels. Bank systems went down for three days. People couldn't buy necessities because electronic payment systems had failed.

Codex received immediate aid through Esri's Disaster Response Program. Codex offered its services to Brazilian state and local governments free of charge. "We put ourselves in a position to help," Marchiori said. "We just said, let us do what we can."

Government officials set up emergency headquarters on higher ground and gave Codex a workspace. The team worked around the clock, often delivering applications within 24 hours of receiving requests.

"They would tell us what they needed for tomorrow, and we would work overnight to deliver it the next day," Marchiori said. "They needed it for planning, for rescuing people, for knowing where they had to go."

17 Applications in 30 Days

The Codex team created a suite of decision-support tools to convey the full scope

↓ This pre- and postdisaster slider app allowed responders to make sense of the damage. This view shows Porto Alegre's airport, with 70 percent of the runway submerged. Flood damage forced the closure of this vital link for six months, adding to the impact felt by residents and businesses in Brazil's fourth-largest city.

of the disaster. In 30 days, solution engineers made 17 different applications, each addressing critical needs that emergency planners in the city, the region, and the country had never anticipated.

The first application mapped road blockages in real time. Civil defense teams in the field sent coordinates via mobile phones. Within hours, Codex updated maps to show which routes remained passable for rescue operations. Red dots scattered across digital maps became the difference between dead ends and quick routes for emergency responders.

Another application identified vulnerable populations—people with mobility impairments, including residents who are blind and elderly people who needed assistance to evacuate. "They needed to know where the people who needed help were located to get them out of their homes," Marchiori said.

Drawing on Marchiori's meteorological expertise, Codex developed a flood forecasting tool that showed what would happen as water levels continued to rise. The application allowed officials to model different scenarios—if water rose another half meter, which schools would be affected? Which shelters would be flooded?

"We could see that the water was still rising, and it was still raining in the highlands," Marchiori said. "No one knew what the next morning would bring."

Innovation Under Pressure

Browsing Esri's Disaster Response Program solutions, the Codex team members adapted a flood simulation tool. Within hours, they had contacted an Esri solution engineer, obtained the code, and adapted it with local elevation data. Within two days, they had delivered a working application that could show exactly which areas would flood at different water levels.

"You can play with the water level," Marchiori said. "If it's going to rise another half meter the next day, you can see which areas are going to be affected. That was really helpful because it guided local authorities not to put a shelter in a place that was going to be flooded in the next two days."

The team also created detailed 3D models of flooded areas, damage assessment dashboards, and economic impact calculators. State officials needed to quantify losses to receive federal disaster funding. The GIS applications showed how many businesses would lose 50 percent of revenue if water reached one meter or face total loss if it went higher.

Codex found another way to help beyond the frenetic building of apps. UNHCR, the UN Refugee Agency, needed space to coordinate aid for displaced immigrants who had been living in low-lying neighborhoods. Codex staff offered them a room in their headquarters. The office became an impromptu humanitarian hub, with UNHCR officials working alongside GIS technicians to coordinate relief efforts.

Empowering Recovery

When disaster response shifted to recovery efforts, Codex developed a platform that empowered private companies to adopt

↓ The real-time dam monitoring dashboard tracks conditions and alerts for the 143 hydroelectric facilities across Rio Grande do Sul. The dashboard shows safety alerts in red where water levels caused structural integrity concerns during the May 2024 floods.

damaged infrastructure directly—schools, hospitals, parks—and offer funds and services to rebuild them.

One beverage company adopted the city's largest damaged school, rebuilding it with new equipment, furniture, and technology. "Private companies managed all the spending," Marchiori said. "It was much faster and more effective than traditional approaches."

The platform became a model for bypassing bureaucratic delays while ensuring accountability through transparency and corporate responsibility.

Lessons in the Debris

Cleanup work revealed the disaster's staggering scope. Mountains of debris—eclipsing the size of a football stadium—accumulated throughout the city. Every piece of wooden furniture touched by floodwater was ruined. The city estimated that three years would be needed to process all the debris through recycling programs.

Marchiori hopes to clear away outdated assumptions about meteorology and disaster preparedness. "Extreme weather is accelerating," he said. "All the studies, especially of risk areas, must be revisited and expanded."

Now, more than a year after the flood, progress has been made on some infrastructure improvements, including raising electrical panels for the pump stations. A new meteorological monitoring system is planned but is still in the bidding process. There is hope that this event will change how the country prepares for future events.

"Brazil has been a reactive country," Marchiori said. "We only do things after the disaster strikes."

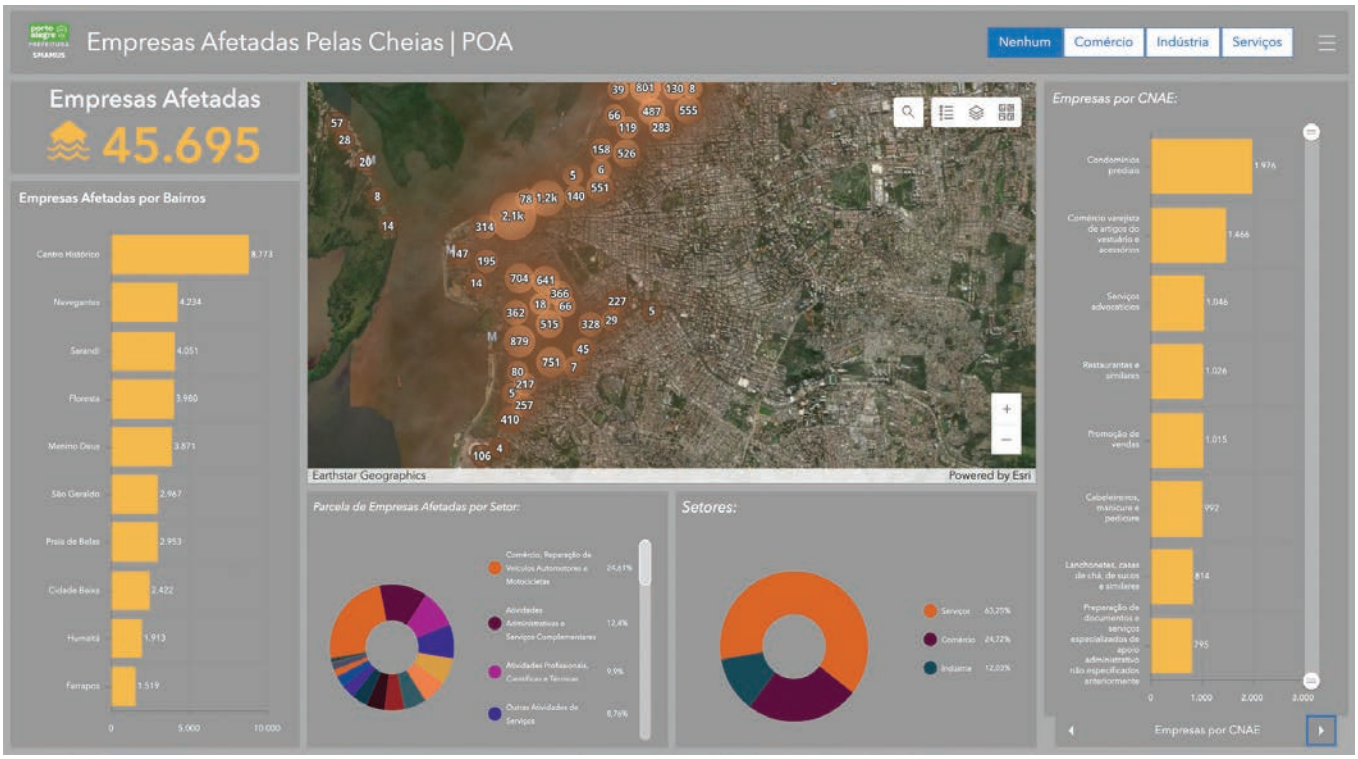
The View from Above

Today, Codex continues negotiations with other Brazilian states, knowing that similar disasters are inevitable. Parts of the team's flood response toolkit developed for the Rio Grande do Sul floods have been used in smaller emergencies, but the comprehensive system awaits the next major crisis.

"It's probably going to happen again," Marchiori predicted with the matter-of-fact certainty of a meteorologist. "And at that point, they're going to call us for an emergency contract, and everything will need to be ready for the next day."

Codex's response to the Rio Grande do Sul floods demonstrates how much people need clarity when traditional systems fail. When infrastructure collapsed and institutions stumbled, GIS provided a clear vision of the crisis to guide effective response. When extraordinary events defied all planning, GIS proved its worth—not just

↓ Cleanup workers in protective suits navigate through mud-covered streets and mountains of destroyed belongings, beginning the massive recovery effort that will take years to complete.



↑ An economic impact dashboard showed 45,695 businesses affected by flooding across Porto Alegre neighborhoods. This detail was essential for calculating tax revenue losses and justifying federal disaster relief funding requests.

as a technology, but as a means to strengthen human resilience. The small team of technologists at Codex showed how maps can become lifelines.

The Rio Grande do Sul floods of May 2024 may have been a once-in-10,000-year event for Brazil, but on our changing planet, the solutions developed will likely be needed somewhere else tomorrow.

About the Author

Ryan Lanclos is Esri's director of national government and public safety solutions and a subject matter expert on GIS technology for emergency management. He helps organizations deploy GIS to improve preparedness and leads the global Disaster Response Program, which provides GIS support during disasters. A former appointed member of the Federal Emergency Management Agency National Advisory Council in the US, Lanclos currently serves on the international advisory board of the Integrated Research on Disaster Risk program for Japan and the XPRIZE Wildfire advisory board. He has also served as Missouri's first geographic information officer, GIS adviser for the Governors Homeland Security Advisors Council, and director of state and local government program at the National Alliance for Public Safety GIS Foundation. Lanclos holds an MS in cartography and GIS from the University of Wisconsin–Madison, and a BA in geology from Centenary College of Louisiana.

↓ When the floodwaters receded, they left behind thousands of plastic bottles and tons of debris choking waterways, creating cleanup challenges that would persist long after the emergency response ended.

Dashboards Track Capital Improvement Projects in Schertz

By Alexa Venezia

A perennial hurdle for cities around the world is the task of ensuring infrastructure projects are planned, communicated, and monitored clearly. These projects are the bones of any well-functioning city, and having a framework for effective communication in place can only save time and money within departments and make life easier for city residents.

In Schertz, Texas, this issue was acute. To provide effective communication about capital improvement projects (CIPs) to stakeholders, city management would have to reach out to the engineering department directly for information. This meant requiring formal reports, waiting for scheduled meeting times, or communicating vital information with numerous phone calls. The team recognized the need for a solution that would streamline this communication.

The Schertz engineering department collaborated with the city's GIS team to address this challenge by using ArcGIS Dashboards to develop the Capital Improvement Projects dashboard. This dashboard has not only improved internal processes but also enhanced transparency between city management and residents. The dashboard's ability to provide real-time project updates reduced the need for countless inquiries and allowed users to view ongoing and upcoming projects on demand.

Elements of Design

While the dashboard prioritizes a user-friendly, intuitive design and filtering capabilities, many of its impacts lie behind the scenes. ArcGIS Arcade and HTML coding enhance the pop-ups with unique features, including a dynamic progress bar, which visually represents each project's stage along its timeline. The design for the progress bar is coded using HTML in the pop-up editor in Map Viewer by adding an Arcade expression under Add Content. The information needed to feed the progress bar is housed in the attribute expressions using conditional logic and ultimately referenced in the HTML script.

Another challenge addressed through coding involved the project's start and end dates. Definitive dates for CIPs are not always available due to the bidding process and contract variations with third-party companies. To accommodate this, Arcade conditional logic ensured dates were accurate and flexible. The dashboard dynamically defaults to showing the projected season and year (e.g., "Spring 2025") for projects without a finalized deadline. Once a contract is in place, the start and end dates update automatically to show the official timeline. These design features ensure that the dashboard is user-friendly and highly accurate, providing stakeholders with a clear picture of the project status when needed.

Development and Evolution

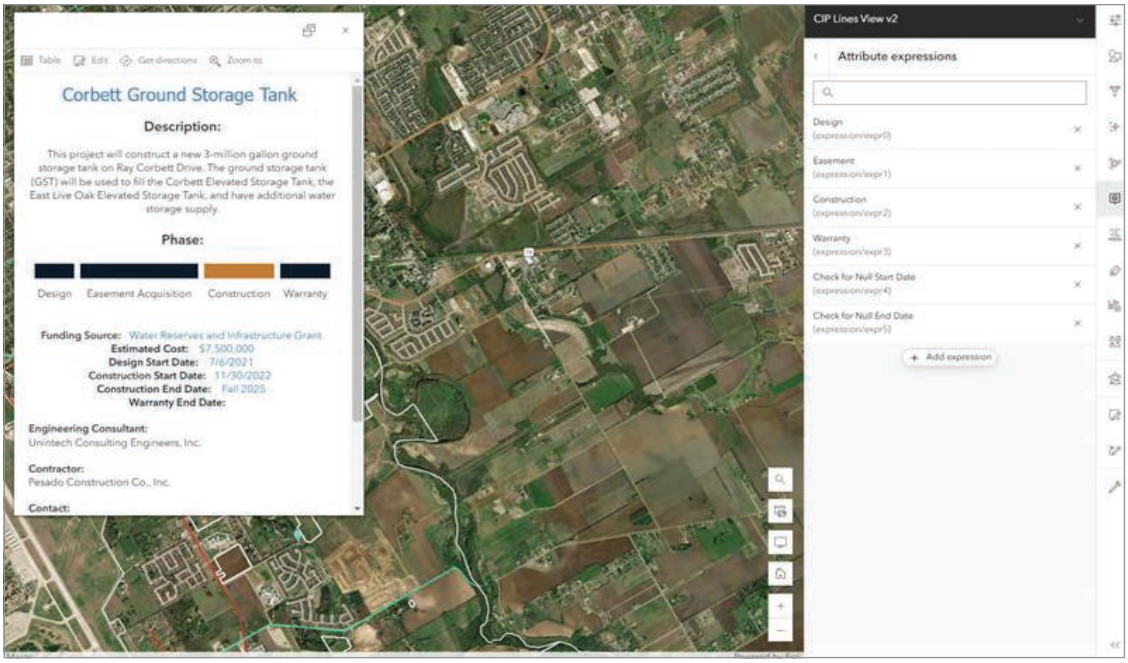
The development of the CIP dashboard was a collaborative effort that spanned almost a year. The GIS team and the engineering department met monthly to discuss revisions of the design, identify pertinent project details, and determine what was deemed public information. This iterative process allowed for continued improvements and feedback from stakeholders to ensure that the tool met both functional and aesthetic needs.

While continually evolving, the current version of the dashboard represents months of planning, coding, and testing. The result is a living, breathing application that can be updated regularly to reflect real-time data and developments.

"The customization and creation of our new dashboard is not only user-friendly but it also has the capability to display all the information we want," said John Nowak, assistant city engineer for Schertz and active collaborator for the CIP dashboard. "Since our dashboard has gone online, we have received many compliments from the public and our elected officials on how easy the information is to access and how helpful it is. The dashboard has been such a success that other departments are now working with GIS to develop similar dashboards for their needs."

The success of the current rendition of the dashboard has set the stage for future enhancements. Since the dashboard has gone live, the city has been actively working on collecting data for future projects

← The City of Schertz's Capital Improvement Projects dashboard prioritized an aesthetic design.



→ An example of the pop-up design and the attribute expressions affiliated with the project.

leading all the way out to 2050. One long-term goal is to give users the ability to query upcoming projects for the next five years without having to display the linework for all future projects. This will require at least a date field reflecting the fiscal year in which the project is planned. With the use of conditional logic, as each new year begins, projects scheduled for the sixth year will automatically transition into the five-year project list, ensuring that the dashboard remains current and relevant without having to manually update all its elements. By leveraging this automation and data management, the Schertz GIS team aims to further enhance the dashboard's functionality, making it an important asset for future planning and decision-making.

Schertz's Capital Improvement Projects dashboard is a straightforward, powerful example of how GIS can solve complex challenges, enhance workflows, and promote clear communication and transparency within municipalities. Combining ArcGIS Dashboards with additional coding techniques, Schertz's GIS team has developed a solution that supports communication across city management, the engineering department, and the public alike.

About the Author

Alexa Venezia is a GIS specialist with the City of Schertz, Texas. She holds an associate's degree in liberal arts, humanities, and social science; a BS in education and geography from SUNY New Paltz; and a certificate of achievement in geospatial information science and technology from Lake Michigan College. Venezia's work involves leveraging GIS to solve complex problems, developing innovative tools, and training staff on Esri products.

Check for Null Start Date

Run

```
//Define the primary and fallback fields
var primaryField = $feature["PlannedConstructionStart"];
var fallbackField = $feature["ProjectedStart"];

//Format the date fields (if they are not null)
var formattedPrimary = null;
if (!IsEmpty(primaryField)){
  formattedPrimary = Text(primaryField, "MM/DD/YYYY");
}

//Check if the primary field is null or empty
if (IsEmpty(primaryField)) {
  return fallbackField;
} else {
  return formattedPrimary;
}
```

← A conditional logic attribute expression designed to check for a null date and default to a projected start date otherwise.

Understanding the Who, What, and Where of the Y with ArcGIS Business Analyst

By Kimberly Hartley

There's a good chance that no matter where a person lives in the United States, they have a YMCA—or Y—nearby.

With nearly 2,600 locations across the country, the Y has been a popular destination for people looking to improve their health and wellness; build community; access free and nutritious meals; and participate in water safety, childcare, and youth development programs.

"Ys have a strong awareness of their members and need support in better understanding the broader communities they serve," said Andy Henry, senior analyst for GIS and data visualization with YMCA of the USA (Y-USA). Henry has helped provide that understanding. He uses ArcGIS Business Analyst to create infographics tailored to each location, showing data about the surrounding community. This information has become critical to crafting strategies and growing operations.

Knowing more about current and potential members, to identify the services and programming that might appeal to both, is essential to running a Y. So is being savvy at picking the best places to open or grow a location and being adept at advocacy when seeking support or grant funding.

"When Y staff see the infographics, it gives them the insights they need for helping with strategic planning, grant applications, and more," Henry said.

For one location in South Dakota, for example, the infographic shows details about the median household income, how many households have children, the largest population groups based on age and gender, and characteristics such as interest in exercising regularly and seeking information on healthy diets. It shows what jobs community members hold. It also shows how many people swim (24 percent), lift weights (20 percent), and do yoga (13 percent). The Y can then make decisions on what kind of programming to offer based on community interests and characteristics.

Transformational Data

For Rob Totaro, director of member advancement for the Alliance of New York State YMCAs, the information gained through ArcGIS Business Analyst has been transformational.

"Visualizing economic and health-related needs in specific neighborhoods has allowed Ys to expand into underserved communities, create new programs, and refine services to better meet demand," he said.

Totaro works with 38 independent Ys and more than 135 branches. In his role, he also advocates on their behalf, providing lawmakers with tailored, district-specific data to make more compelling cases for policies and funding that support YMCA programs across New York.

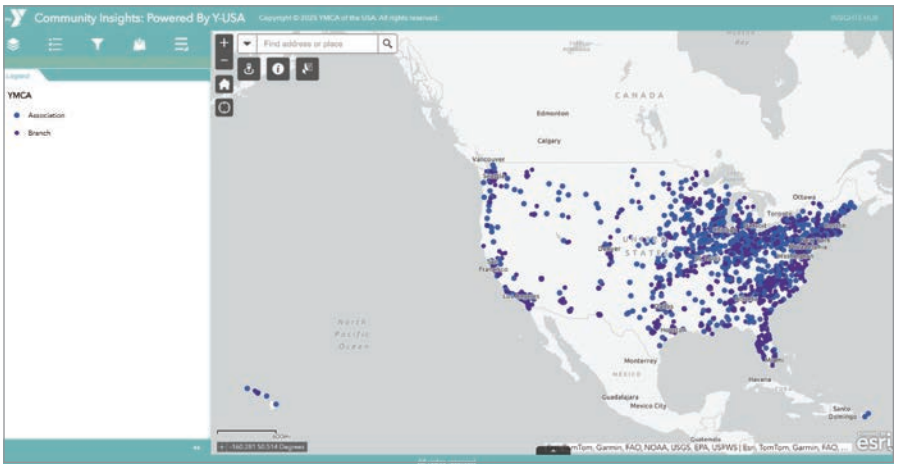
"At the statewide level, it has made our advocacy more precise and impactful," he said.

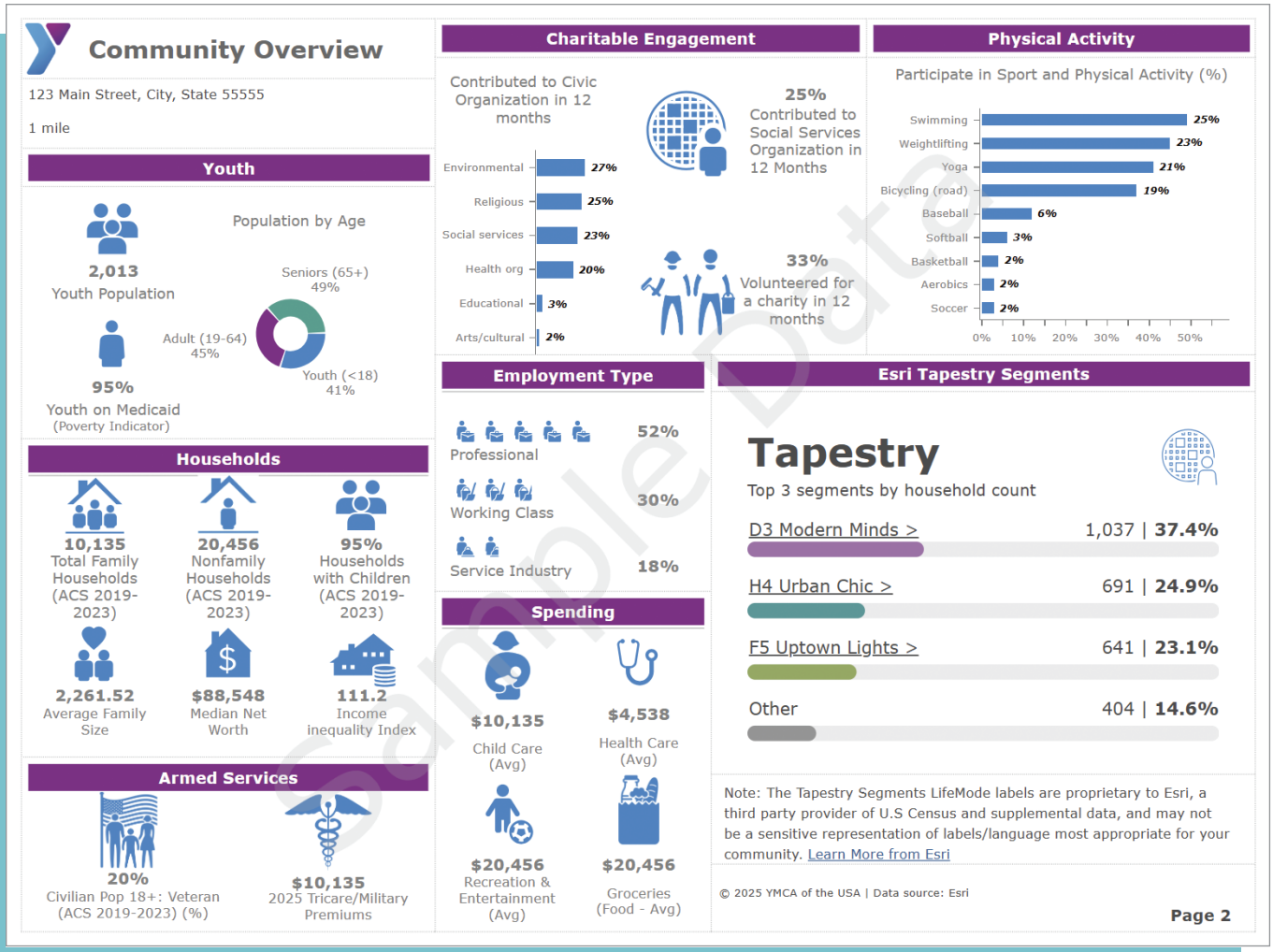
Access to rich data has been a departure from the limited data he often encountered throughout his 25-year career in marketing across multiple industries. The insights, often limited to basic demographics and surface-level information, weren't enough to drive meaningful strategy. Now, as he supports YMCAs through strategic planning and board governance processes, he can analyze membership trends, comprehensive demographic data, and socioeconomic profiles to lead change management initiatives that challenge assumptions and preconceived ideas.

"With these tools, I can show YMCA boards where their members actually are and highlight community needs they may not have considered," he said. "Ultimately, the reports have helped demonstrate both accountability and vision. They show that we understand our communities deeply and that we are making thoughtful, data-driven choices to improve health, strengthen families, and build stronger communities."

Sometimes the data confirms what YMCA boards already knew, but other

↓ ArcGIS Business Analyst is used to generate reports for each of the more than 700 YMCA associations across the US.





↑ Infographics created with ArcGIS Business Analyst help the YCMA make decisions on what kind of programming to offer.

times, it reveals blind spots. "In both cases, it ensures that choices are grounded in evidence rather than guesswork," he said.

Custom Reports, No Additional Cost

Henry generates each infographic report in ArcGIS Pro using a Python script to update it automatically. He includes Esri's latest demographic data, the ArcGIS Tapestry segment profile, which is updated once a year. Every YMCA branch location gets an infographic showing data within a 12-minute drive time, or a three- to five-mile radius. There are also reports for each of the more than 700 YMCA associations across the 50 US states, the District of Columbia, and Puerto Rico.

What made Business Analyst particularly appealing to Henry was the ability to integrate Y-USA's own internal, proprietary datasets with Esri's available datasets to create custom infographics and reports.

Previously, individual YMCAs would have had to pay for a third party to do a special analysis of their communities and members. Now, they can request reports directly through the national resource office, Y-USA, at no additional cost. They can also access the data on their own, in a self-serve capacity, to make their own reports.

Henry has also used Business Analyst to run sustainability assessments for site selection of new locations or expansions; quickly produce reports on demand (including demographics profiles, market potential, and consumer segmentation); and compare locations against key benchmarks for further analysis.

"Data isn't the final answer, but it's a good starting point," Henry said. "These tools make it easier for Ys to visualize who lives in their communities and begin asking the right questions."

For Totaro, the tools have done even more than that.

"The reports have fundamentally elevated the Y's ability to plan strategically, serve effectively, and advocate persuasively," he said. "By grounding decisions in credible, visualized data, they help Ys move beyond intuition and anecdote to a more objective, evidence-based approach."

About the Author

Kimberly Hartley had been a journalist for 15 years before joining Esri's writing team in early 2021. She worked as a reporter for *The Virginian-Pilot* in Virginia, *The Associated Press* in Las Vegas, and both *The Orange County Register* and *The Press-Enterprise* in Southern California under her byline Kimberly Pierceall.

Rethink Your GIS Strategy for the AI Era

By Matthew Lewin

If there's any field where expertise was once a significant barrier to entry, it's GIS. Collecting, analyzing, and visualizing spatial data has traditionally been complex, technical work that only trained specialists could do. Today, generative AI tools are at the brink of knocking those barriers down. **Fast.**

This raises some tough but necessary questions: What happens to GIS departments when users can do the basics themselves? What skills do GIS practitioners need to cultivate to keep up? And what can GIS departments build that AI can't easily replace?

Which GIS tasks will users handle themselves with AI?

Traditionally, GIS departments and organizations have been responsible for a broad range of services: managing spatial data, running analyses, producing maps, and supporting decision-making processes. In the past, these services depended heavily on specialized software and deep technical knowledge, which, to a degree, protected a GIS team's role in an organization.

Today, those barriers are rapidly falling.

Across the geospatial technology spectrum, AI is already supplanting human expertise. Generative models can automatically discover and organize datasets from public and private sources, a task that once took analysts hours of searching and cleaning. Data preparation—historically one of the most time-consuming aspects of any GIS project—is now being accelerated by AI that can identify errors, harmonize datasets, and even predict missing values with minimal human oversight.

For instance, when an analyst needs to update a city's land-cover map, they might spend days sifting through data portals, downloading files, fixing projects, and preparing data. With an AI agent, that analyst can search cloud repositories like ArcGIS Living Atlas of the World, on-demand Earth observation data from AWS, or Microsoft's Planetary Computer to select the best imagery based on the project's area and specific criteria, such as cloud cover and resolution. Once it identifies the appropriate data, it could manage all the tedious preprocessing steps, including cloud masking, band normalization, clipping, and projection alignment.

Another example: conducting a site suitability analysis. Traditionally, an analyst gathers data layers such as zoning maps, traffic flows, demographic data, and environmental constraints, then manually weigh these factors according to project priorities.

After building weighted overlays and running spatial models, the analyst produces a suitability map. Instead of doing this manually, an AI agent developed with a tool like LangChain could handle much of the data planning and organization. It could then trigger a tool like PyLUSAT to run the suitability model. A user simply prompts the agent with a natural language request, such as, "Find the best location for housing based on proximity to transit and low flood risk." And just like that, a suitability map is generated!

In other words, the services that users once relied on GIS teams to perform are increasingly available on demand, often at the click of a button. This means that, in the future, the real value won't come from performing standard tasks faster. It will come from tackling the complex, strategic, and ambiguous problems that AI tools aren't equipped to solve—challenges that require human judgment, contextual understanding, and nuanced decision-making.

Which skills does a GIS team need to evolve to stay ahead?

The shift in cognitive workload driven by generative AI doesn't mean GIS expertise is becoming obsolete. It means the nature of that expertise is evolving, and quickly.

A useful way to understand this evolution is through the DIKW model: **Data → Information → Knowledge → Wisdom**.

At the base level, data is raw and unprocessed—coordinates, satellite imagery, and survey points. A step up, data is organized into information, like a shapefile showing flood zones. Knowledge builds on information by adding context, experience, and interpretation—for example, understanding not just where the flood zones are but why they matter to vulnerable communities. At the top is wisdom—that is, the ability to make sound judgments; anticipate consequences; and act ethically in complex, real-world situations.

Stage	Past Focus	Future Focus (with AI)	Type of Human Expertise
Data and Information	Manually discovering, collecting, and preparing data	Curating, validating, and quality-checking AI outputs	Data and information management
Knowledge	Designing models, manually analyzing patterns	Framing better questions, interpreting complex outputs	Domain knowledge and critical thinking
Wisdom	Building visualizations, reporting results	Making strategic decisions, guiding ethical and responsible use	Wisdom and judgment

For much of GIS history, professionals have operated primarily at the data and information levels. Finding, preparing, and analyzing spatial data has been where much of the value is created.

Now, AI is rapidly taking over those lower layers.

This means the future of GIS expertise lies in the more advanced stages, with knowledge and wisdom. GIS professionals will need to curate data, not just collect it. They'll need to validate and question AI-generated outputs, not accept them at face value. They'll need to frame problems more clearly; guide organizations through uncertainty; and connect spatial insights to real-world decisions that balance economic, environmental, and social priorities.

In practical terms, this means investing in higher-order skills:

- **Critical thinking:** Ask smart, strategic questions that AI can't anticipate.
- **Solution conceptualization:** Develop use cases that address complex business uses centered around a geographic approach.
- **Interpretation:** Look beyond the patterns in the data to understand what they mean in context.
- **Ethical judgment:** Lead conversations about privacy, fairness, bias, and the responsible use of spatial data.
- **Strategic communication:** Tell compelling, clear stories that move decision-makers to act.

GIS departments that focus on higher-order skill sets will go from service provider to trusted partner. Instead of merely being asked to create maps and runs models, you'll have the opportunity to engage in discussions earlier in the process. This engagement will help leaders understand which spatial questions are truly relevant.

Rather than just producing outputs for others to interpret, you will take on the role of guiding interpretation, challenging assumptions, and framing decisions through a spatial lens. As a consultant myself, I am often asked how to elevate GIS on senior leadership's radar.

Perhaps AI will be the catalyst that makes this happen.

What assets can you build to enhance your ability to remain relevant?

As AI gets more sophisticated, GIS managers face a tough reality: Skill and expertise alone won't protect your team's relevance. To stay essential, GIS programs need to build assets that AI can't easily replicate. Think of these assets as intellectual moats—durable advantages that protect your team's value over time:

- **Authoritative data:** Most AI systems are trained on open, generic datasets, the kind of data that is readily available but often lacks depth, specificity, or context. These models are excellent at recognizing broad patterns, but they struggle when nuance matters—when small local differences, historical subtleties, or regulatory complexities change the meaning of spatial information. That's why owning or curating high-quality, authoritative spatial data is one of the strongest moats a GIS department can build. It's not just about collecting more data. It's about creating datasets that are richer, more accurate, more timely, and more deeply connected to the realities of the organization or community you serve. For a city, for example, data reflects the local ground truth—not just current zoning maps but political forces that shaped urban boundaries. It weaves in domain-specific insights like how soil composition affects land valuation or how informal transit networks operate in a city. When GIS teams build and maintain these specialized datasets, they create a strategic asset that AI can't easily copy or replace.
- **Organizational fluency:** Every organization operates within a web of political dynamics, cultural norms, legacy systems, and informal networks that aren't written down in any dataset. They're invisible, but they often matter more than the technical solution itself. AI might be able to suggest a supposedly optimal solution on paper, but it won't understand the undocumented realities that determine if it succeeds or fails in an organization. GIS managers who know how to navigate those realities and understand where GIS can create real impact bring a kind of wisdom that AI can't replicate. It's not just technical expertise; it's knowing how to make GIS matter in your specific environment.

- **Creating and brokering GIS-AI agents and ecosystems:** GIS managers who develop the skills to design, train, and orchestrate specialized AI agents (lightweight AI assistants built for specific geospatial tasks) will put their organizations on a very different footing. Instead of relying on off-the-shelf models that treat every organization the same, they'll build bespoke AI ecosystems that reflect the unique goals, constraints, and realities of their environment. Imagine having agents trained on your spatial data and becoming the orchestrator of those agents to the extent that your team's primary job becomes brokering an agent ecosystem—essentially a fleet of AI agents built to serve your business. And because these agents are trained on your organization's own data, they get smarter and more aligned over time, evolving in a way that generic AI tools can't.

The Risk of Standing Still

There's a real risk here, and it's not just about falling behind. If GIS departments don't examine their strategy, they risk becoming irrelevant.

When users can generate their own maps, run their own analyses, and produce their own spatial insights without our help, the old service provider model simply doesn't hold up. If the value you offer is limited to technical outputs, it's only a matter of time before someone asks, "Do we even need a GIS team for this?" Staying focused on technical execution could result in a missed opportunity to lead and shape how AI is used.

The rise of AI marks a fundamental shift for GIS. It automates tasks across the entire geospatial data life cycle. It democratizes access to powerful analysis and visualization tools. It also changes users' expectations about what GIS can and should deliver.

However, it doesn't diminish the importance of GIS. It makes human GIS expertise more important than ever, as long as that expertise evolves.

The future belongs to the GIS programs that move beyond technical execution to strategic leadership. It belongs to the teams that invest in human skills, durable assets, and deep relationships. It belongs to those who are willing to ask themselves the hard questions now and act boldly on the answers.

About the Author

Matthew Lewin is the director of management consulting for Esri Canada. His efforts are focused on helping management teams optimize and transform their businesses through GIS and location-based strategies. As a seasoned consultant, Lewin has provided organizations in the public and private sectors with practical strategies that enable GIS as an enterprise business capability. His interests lie at the intersection of business and technology, and he thrives on helping organizations bridge the gap between the two to achieve their most challenging GIS ambitions.

FROM GIS TO CAD

By Arno Fiva

↑ The City Download Portal allows you to use 3D models to visualize and design new projects within existing urban environments.

Architects, urban planners, and civil engineers often require accurate and accessible 3D context to visualize and design new projects within existing urban environments. A new open-source showcase app built with ArcGIS Maps SDK for JavaScript, called the City Download Portal, enables you to do exactly that. By drawing an extent, you can download selected buildings and terrain as one single 3D model. Open the file to import GIS context into your favorite modeling software, whether it be Blender, Rhino, or SketchUp.

The 3D Object Layer

Uploading and manipulating 3D models on the web is enabled by a layer type called 3D object layer. It can be created through ArcGIS Pro or directly in ArcGIS Online and ArcGIS Enterprise.

A 3D object layer consists of a 3D object scene layer and a 3D object feature layer. The scene layer facilitates efficient display and loading, while the associated feature layer stores the data for editing and querying. This 3D functionality is integrated within the SceneLayer class, allowing you to use SceneLayer.queryFeatures() to retrieve results directly from the associated feature layer. This means you can run spatial or attribute-based queries that return the 3D geometry, the same way you can with point, line, and polygon features.

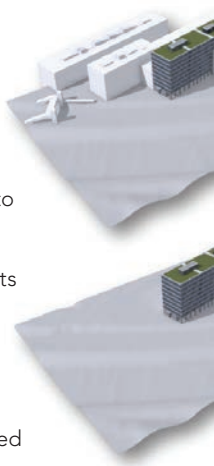
Manipulating 3D models such as buildings directly in the browser requires having the 3D geometry in an interoperable format. For web applications, the common format is GLB, also known as binary glTF.

The team at Esri R&D Center Zurich has made 3D data manipulation and access available as a public API. This means you can use JavaScript Maps SDK to implement custom workflows and applications using your 3D data, ultimately empowering authoritative data providers to increase interoperability and accessibility of their 3D system of record.

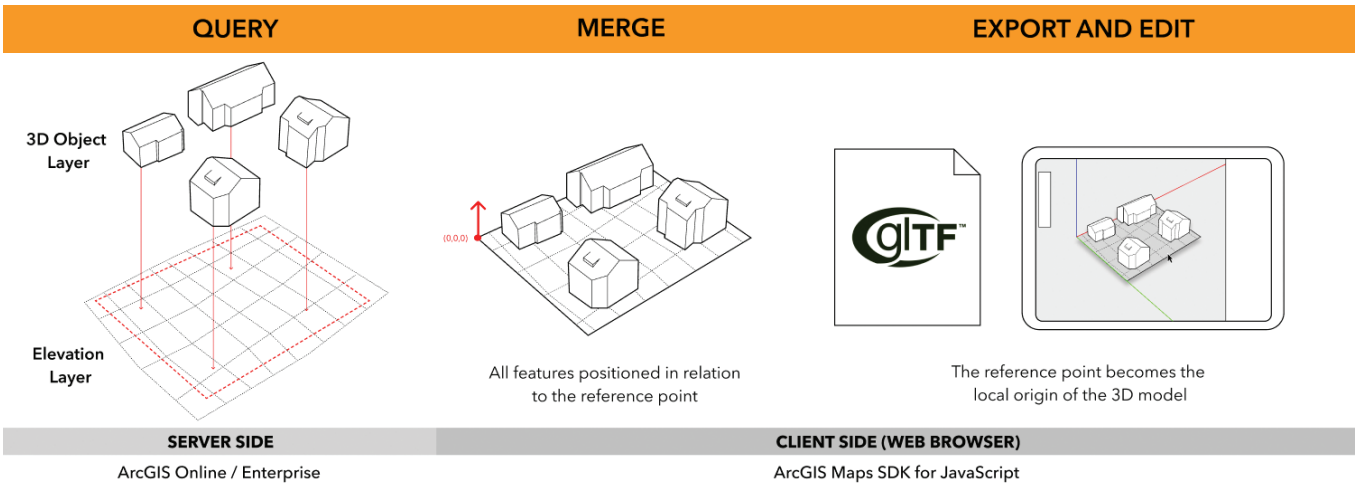
3D Geometry Workflow

In the City Download Portal, you can leverage these new possibilities in the following way:

- **Query 3D building features:** Use the SceneLayer.queryFeatures method to select and retrieve mesh geometries for specific buildings.
- **Create terrain geometry:** Generate a detailed mesh geometry for the terrain from elevation data using meshUtils.createFromElevation.
- **Merge features into a single mesh:** Create a single 3D model using meshUtils.merge.
- **Convert to Cartesian coordinates:** Establish a real-world reference point as the local model origin using meshUtils.convertVertexSpace.
- **Export and download:** Convert the mesh geometry to binary glTF (GLB) with Mesh.toBinaryGLTF for download.



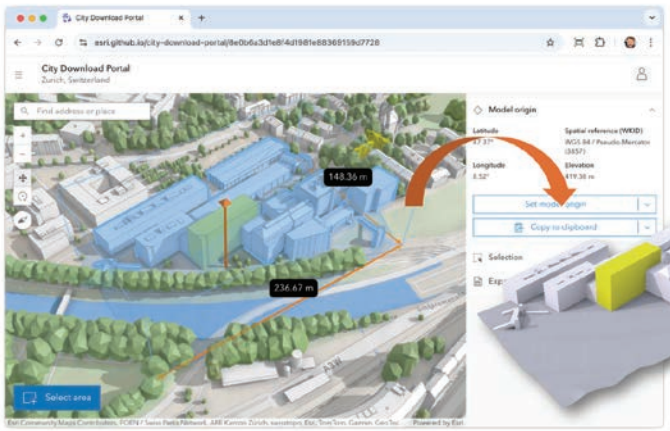
In this workflow, the mesh geometry class represents GLB models in JavaScript Maps SDK and provides conversion methods between the two. Queries are based on extents defined by the user and performed directly on the SceneLayer class. While textures are ignored in this example, individual features or parts of the exported model can be colored to enhance visualization.

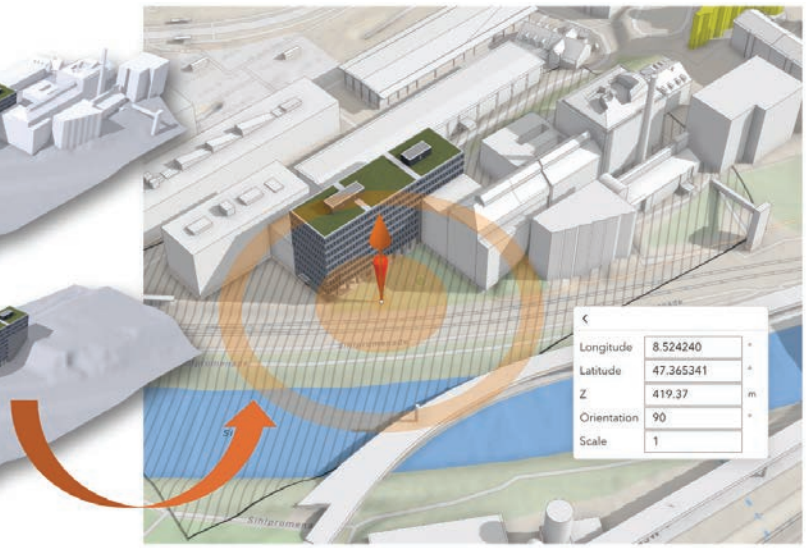


↑ The 3D geometry workflow allows for the integration of additional layers into your 3D models.

↓ Manipulating 3D models directly in a browser requires having the 3D geometry in an interoperable format.

↓↓ ArcGIS Maps SDK for JavaScript provides tool tips with exact coordinate data, ensuring accuracy during manual input.





Generally, this client-side approach allows for the integration of additional layers such as vegetation, street furniture, or infrastructure into your 3D models. The possibilities are as vast as your imagination—or the web browser's memory, eventually.

Interoperability and Georeferencing

When moving 3D data between a GIS and 3D modeling software, maintaining consistency in coordinate systems and origins across tools is crucial. By keeping a fixed reference point and orientation, newly modeled 3D data will align perfectly when reimported into ArcGIS. While this is outside the scope of the City Download Portal showcase, it can be achieved with a 3D object layer in Scene Viewer or any other editing app powered by JavaScript Maps SDK.

While some 3D formats store georeferencing metadata directly, others—like glTF—require manual referencing. JavaScript Maps SDK provides tool tips with exact coordinate data, ensuring accuracy during manual input. Support for file-based georeferencing is on the horizon in upcoming JavaScript Maps SDK releases, further simplifying the integration process across different platforms.

Accessing your 3D data in the browser opens up a whole range of opportunities to build custom workflows. The City Download Portal is one example showing what's possible. You can fork and redeploy a version in your own GitHub organization, or simply replace the web scene ID in the URL to use it with your own data. The app will use any 3D object layer you have in your scene.

While client-side processing offers flexibility, it's essential to monitor memory usage. For larger datasets, consider shifting the 3D data manipulation to a server-side implementation.

The City Download Portal is open source and publicly available. (Credit to the cities of St. Gallen, Switzerland, and Vigo, Spain, for providing their 3D buildings as open data for the demo application.) Access the live showcase app at links.esri.com/citydownload, and the source code at links.esri.com/sourcecode.

About the Author

Arno Fiva is a developer evangelist at the Esri R&D Center Zurich, creating 3D web apps using the ArcGIS Maps SDK for JavaScript.

Applying THE GEOGRAPHIC APPROACH to Your Work

By Julia Cowing
and Jamie Sherman

CHANCES ARE, if you're a user of geospatial technology, you're familiar with the Geographic Approach. At its most basic, it's a simple idea: that many of the most complex challenges around the world can be solved through the lens of *where*, and that geography is a crucial component in most problem-solving measures.

But in practice, GIS can feel overwhelming. So many tools, data sources, and decisions can go into any given task. Beneath that complexity is a shared goal: people using geography to make smarter decisions that improve how we work and live.

More than anything, the Geographic Approach is about framing GIS work through a lens of user intent and outcomes, not just tools or features. It's a human-centered framework that aligns with how people naturally think and work. In fact, if you're using GIS tools, you're probably already following this process, even if you're not aware of it.

The following stages in this workflow apply more or less across the board. GIS professionals can and will iterate within each step, but presenting the Geographic Approach in a discrete, linear shape makes it easier to align, test, and improve your processes and outcomes, no matter the industry. These stages provide a common language—whether you're a product manager, designer, analyst, or field operator—to spot friction, uncover needs, and design for meaningful progress:

ASK: Clarify the question and define success.
ACQUIRE: Gather the right, usable data.
EXAMINE: Validate data integrity and readiness.
ANALYZE: Generate insights through spatial reasoning.
MONITOR: Track and optimize processes to improve outcomes.
ACT: Share findings and drive informed decisions.

GIS tools are evolving faster than ever. New features, data integrations, and user types emerge constantly. But user goals remain surprisingly stable. By focusing on user intent—what users are trying to achieve at each stage—the Geographic Approach helps teams spot usability gaps where tasks break down, design smarter tests around real user goals, and track the right metrics for achieving those goals.

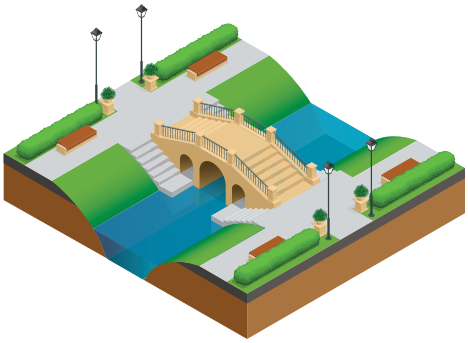
Mapping Workflows to Real-World Contexts

Of course, even if this approach is universal, applying it looks different across roles and industries. When you layer factors such as time pressure onto varying needs for visual context (maps versus tables), new stories emerge.

Broadly speaking, GIS usage tends to fit into four distinct modes:

- **OPEN-ENDED:** Low-urgency, long-range planning with historical data needs
- **ALWAYS-ON:** High-pressure, map-driven, real-time decision-making with livestream data needs
- **GOVERNANCE:** Attribute-heavy data maintenance with authoritative dataset needs
- **QUICK LOOKUP:** Fast, focused answers with key stats needs for non-GIS work

The useful thing about the Geographic Approach is that it can be applied to each of these modes to help you achieve specific outcomes in each phase of your workflows.



The OPEN-ENDED Mode

SAY you are part of an urban planning team that wants to explore how to improve access to green spaces in a city. One thing you could do is analyze where parks or gardens are missing and which communities lack access, in order to plan new green space investments. This scenario involves compiling various types of data (population, land use, transit, etc.) and evaluating different development scenarios over a 20-year plan.

Open-ended scenarios need tools that emphasize clarity, flexibility, and iterative thinking. The interface should enable pattern-finding and scenario testing (e.g., toggling layers, adjusting parameters). In practice, that means providing rich analytical capabilities, allowing users to experiment, refine their questions, and explore what-if scenarios seamlessly. Supporting a long-term, exploratory workflow involves features like scenario comparison, easy backtracking, and clear visualization of historical data to facilitate insight.

ASK: Clearly define the core question and desired outcome. Where are gardens or parks missing in the city? Success at this stage means articulating a focused question and applying filters or criteria on the map to home in on the relevant issue.

ACQUIRE: Gather all relevant data needed to answer the question. Here, that might mean compiling datasets like zoning maps, transit lines, and population demographics. Success means you can easily find, import, and trust data sources.

EXAMINE: Inspect and prepare the data to ensure that it's useful and accurate. Customize map views by layering green space data with demographic layers. Verify data integrity. Layers should be easy to adjust and validate so that you can spot any data gaps or quality issues before analysis.

ANALYZE: Perform in-depth spatial analysis to generate insights. Compare park access by neighborhood or demographic group to identify disparities. The GIS tools used should make analysis intuitive. After running geoprocessing tools or models (like accessibility analysis), you should be able to easily interpret the results.

MONITOR: Set up methods to track changes or trends over time. Track when new parks are added and establish metrics for access to these spaces. If the system allows defining these ongoing indicators and you can clearly observe updates or changes in the data over the project's duration, that's success.

ACT: Share the findings and take action based on insights. In this example, you would compile results into reports or interactive maps for stakeholders, answering the question and guiding policy. Success means you can easily export or present the analysis in a clear, compelling format, enabling data-driven decisions.

STAGE	PROMPT	WHAT TO OBSERVE
ASK	"Where are gardens missing?"	Can users filter maps clearly?
ACQUIRE	"Bring in zoning & transit data"	Can they find and trust sources?
EXAMINE	"Customize map views"	Are layers easy to adjust?
ANALYZE	"Compare access by demographics"	Can users use the overlay tool to intersect demographic and park access data?
MONITOR	"Track access over time"	Is the tracking setup clear?
ACT	"Share report with stakeholders"	Can they export results easily?

The ALWAYS-ON Mode

CONSIDER an emergency management situation like a flash flood. Roads are closing fast and crews en route need new directions in real time. If you are a dispatcher or GIS operator, you must quickly identify flooded areas, see which roads are closing, and reroute mobile crews on the fly. The Always-On user's task is to use the live map to find a safe alternative route and communicate it immediately to teams in the field.

For Always-On scenarios, users are under time pressure and benefit from prominently displayed alerts or notification on status changes. The system should be designed for *now*—meaning it handles real-time data smoothly, updates fast, and allows you to act in the moment. Features like autorefreshing maps, prominent warning symbols, and quick buttons for common actions (e.g., sending an alert) are critical. In short, in an Always-On mode, users need support for split-second decision-making and communication.

ASK: Instantly recognize and frame the problem in geographic terms. In a crisis, this might mean asking, "Where's the flooding right now?" Success means you can spot the danger zones immediately and without confusion. The system should allow quick identification of the issue's location and scope.

ACQUIRE: Incorporate real-time data feeds relevant to the situation. In this case, you would load live road closure data, weather radar, or sensor feeds. Success at this stage is the ability to quickly load and trust these real-time data sources, ensuring that they update reliably and are easily added to the map.

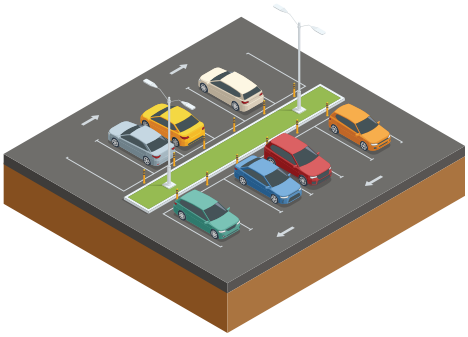
EXAMINE: Check the current operational picture by viewing critical layers. Examine where crews are at any given moment by overlaying the live GPS locations of field teams on the flood map. Success means the map display is clear and up-to-the-minute, and all relevant layers (e.g., crew positions, flood extent, road status) are easy to interpret at a glance and reflect the current situation.

ANALYZE: Rapidly determine the best action or solution. In our scenario, this could mean using the map to find a new route for crews around closures. You might use a routing tool or simple visual analysis. Success is defined by your ability to get a confident answer fast. Either the system suggests an alternate route or you can identify one without hesitation. Analysis functions must work quickly and be straightforward under pressure.

MONITOR: Continuously watch for new developments after taking initial action. Keep an eye on the map for any new road closures or flood spread as the event unfolds. Success means the platform supports ongoing tracking with live updates. Not only can you see changes in real time, but also you can trust that the data is updating consistently. This could also include alerts or visual cues for changes.

ACT: Immediately communicate the decision or information to those who need it. In this case, you would push out an update with the new route to all mobile crews and other stakeholders if necessary. Success is achieved if the system makes it easy to broadcast or share updates instantly (e.g., one-click team notifications or dashboard updates). Any output (maps, directions, alerts) must be delivered in real time so that teams can act on it without delay.

STAGE	PROMPT	WHAT TO OBSERVE
ASK	"Where's the flooding?"	Can users spot danger zones quickly?
ACQUIRE	"Load live road data"	Can they trust real-time feeds?
EXAMINE	"Where are crews now?"	Are map layers clear and relevant?
ANALYZE	"Find new route"	Can they reroute with confidence?
MONITOR	"Watch for new closures"	Is ongoing tracking reliable?
ACT	"Push update to teams"	Can they communicate instantly?



The GOVERNANCE Mode

IMAGINE you are a GIS data manager responsible for a city's infrastructure database. A typical governance task might be incorporating a contractor's new streetlight updates and ensuring the data meets the city's schema and quality requirements. After a contractor surveys streetlights and submits changes, you must verify those updates (correct locations, attributes like wattage) and publish the updated, clean layer to the enterprise system.

In the Governance mode, trust is everything. The system should support precision, repeatability, and traceability—for example, show how many records were updated or provide an easy way to roll back changes. A clean, table-centric view (for attribute-heavy tasks) and forms or wizards for data input can help reduce errors. Ultimately, the system should make your job easier by catching mistakes early and ensuring that maintaining data quality is as straightforward as possible. Therefore, it should also support rigorous data validation, easy repetition of routine tasks, and clear audit trails. In practice, this means that features like bulk editing with safeguards, validation rules and prompts, and version control are critical.

ASK: Determine the data requirements and objectives before making changes. What data is required for the streetlights and what are the standards? Success at this stage means you can clearly define the schema/fields needed and the validation rules (e.g., knowing that every streetlight must have a lamp type, location, wattage, etc.). The system might support this by providing templates or data dictionaries, allowing you to easily configure or recall the expected schema.

ACQUIRE: Load or input the new data to be governed. Import the contractor's streetlight data into the GIS. Success means the data can be loaded efficiently and you can immediately verify that the import succeeded. The platform should help catch any import errors and ensure that the dataset is ready for review.

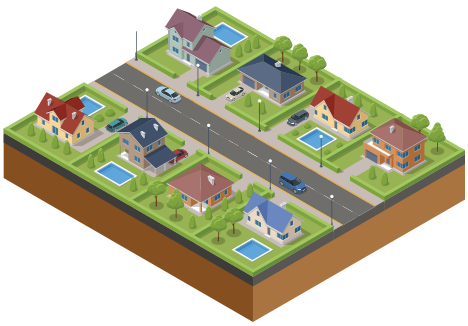
EXAMINE: Rigorously inspect the data for errors, omissions, or mismatches. Examine the streetlight data to find outdated information or incorrect entries, such as streetlight records that haven't been updated or that violate quality rules. This stage requires effective quality control tools (validation reports, highlighting errors, filtering for null values) to efficiently spot and fix data issues. The interface should make it easy to scan attributes (often in tabular form) and flag problems.

ANALYZE: Apply necessary data transformations or updates safely. For instance, you might need to globally update an attribute (say, convert all streetlights to a new standard code or adjust LED wattage values). Success means you can perform bulk edits or run geoprocessing tools with confidence that you won't corrupt the data. The system should support batch operations with preview or undo capabilities, ensuring changes can be reviewed and are applied consistently.

MONITOR: Review change history and track edits over time. After updating, check the edit logs or version history to ensure every change is recorded and traceable. You should easily be able to confirm what was changed, when, and by whom. This stage is about ongoing monitoring of data health. The system might offer dashboards for data quality or notifications if certain data values fall out of compliance in the future.

ACT: Publish or finalize the clean data so that others can use it. Here, this means publishing the updated streetlight layer to the enterprise GIS or sharing it with relevant stakeholders once verified. Success means the data layer is successfully exported or published with correct settings (coordinate system, format, permissions, etc.). The end result is an updated, reliable dataset that is available for use in maps and analyses. The organization should trust it to reflect the true state of the infrastructure.

STAGE	PROMPT	WHAT TO OBSERVE
ASK	"What data is required?"	Can users define the schema easily?
ACQUIRE	"Load contractor data"	Can they import and verify datasets?
EXAMINE	"Find outdated info"	Are QA tools efficient?
ANALYZE	"Update LED wattage"	Can they batch edit safely?
MONITOR	"Review change history"	Is version tracking accessible?
ACT	"Publish clean layer"	Can they export with correct settings?



The QUICK LOOKUP Mode

THINK of a real estate agent helping a homebuyer looking for a place near good schools and public transit. The agent performs a quick lookup by searching for homes for sale near schools and transit lines in the client's desired area. In this scenario, the agent doesn't need to perform deep analysis or create complex maps—they just need to quickly find suitable listings and perhaps share a map of these listings with the client.

Quick Lookup scenarios need tools that prioritize speed, simplicity, and shareability. Because users in these scenarios are often not GIS experts, the system should allow fast access to key information. Think of features like a prominent search bar and simple lookup tools, auto-suggestions, and one-tap filter or sorting tools.

Essentially, the system should let them get in, get answers, and get out with confidence. This could mean providing default map configurations for common queries, and ensuring that any output (maps or single number/metric reports) can be quickly produced and shared. By streamlining the experience, you can accommodate users who only use GIS in brief spurts and care most about transactional tasks.

ASK: Formulate a simple spatial query or search. The agent might start by looking for the nearest homes for sale around a particular school, or entering a location and criteria. Success means the search function is fast and forgiving. You can type a place or keywords and get immediate, relevant results even if the query isn't perfectly structured. The system should handle plain-language queries or partial info quickly and gracefully.

ACQUIRE: Access the relevant map or data instantly. In a Quick Lookup scenario, this could be clicking on a saved web map or opening an app that shows listings. Success is being able to open the data with one click. The platform might pre-package the necessary layers (e.g., listings and school locations) so that you don't have to manually add anything.

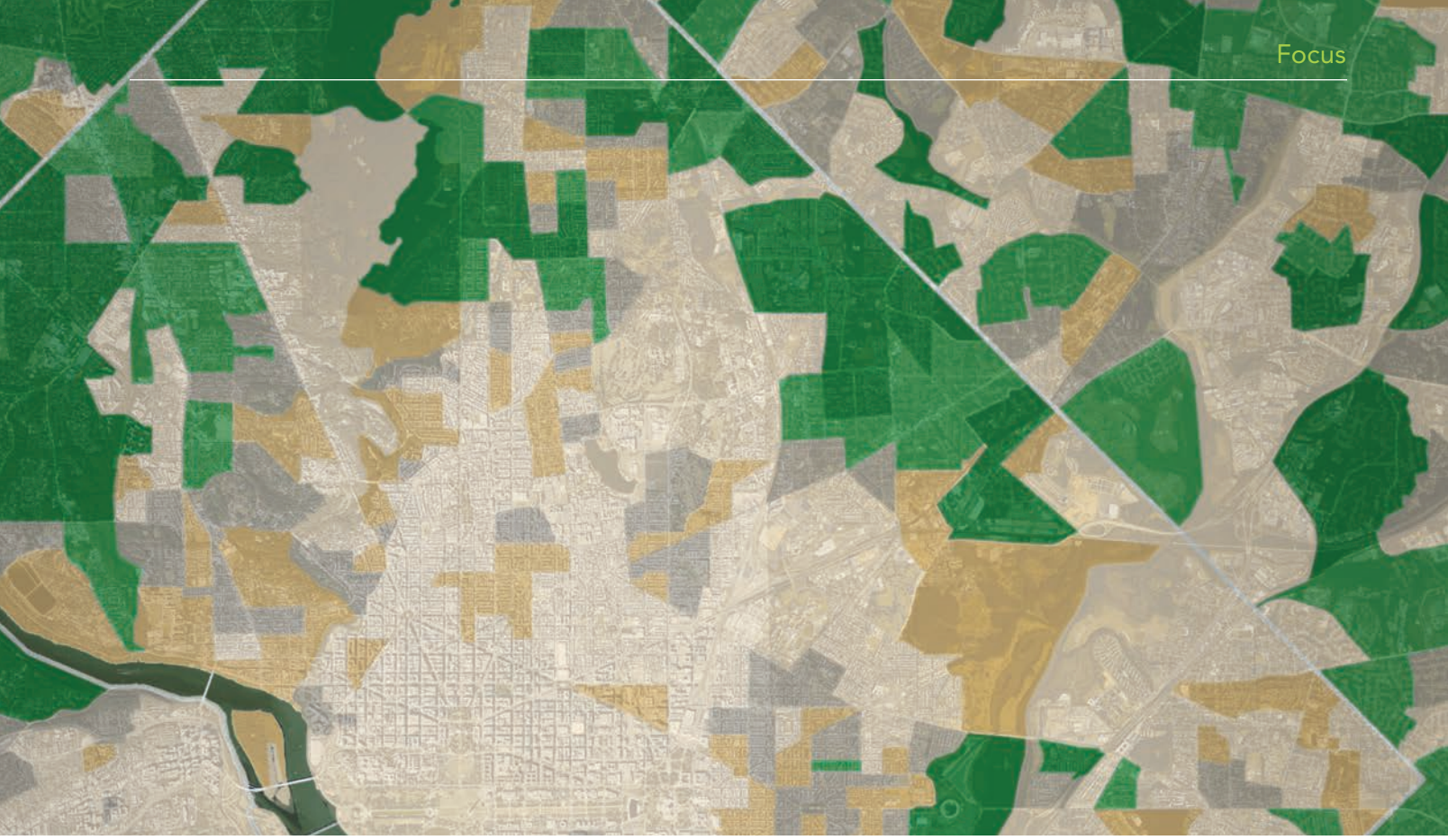
EXAMINE: View the results and context on the map. The agent would check the map to see how close each listing is to a school or transit stop. Success at this stage means the key details are clear at a glance. The map or list should highlight important information (distances, ratings, prices, etc.) without requiring further analysis. The user should be able to quickly interpret whether a given result meets the criteria.

ANALYZE: Make a quick comparison or decision using minimal analysis. In this mode, analysis might mean comparing a few options side by side or using a basic filter/sort capability (for example, seeing which of the found listings has the shortest commute). Success means the user can spot key differences quickly between options. The interface might allow a simple compare view or sorting by a key metric. Importantly, this stage for the Quick Lookup mode should not require running complex tools, just straightforward comparisons or visual judgments.

MONITOR: Set up an alert or watch for new information if needed. If the user's question is recurring (e.g., they want to know when new listings appear in that area), they might use a notification feature. Success here means any alerts or filters are intuitive to configure. For instance, the agent can easily save a search that automatically notifies them of new matching listings. A well-designed system will offer effortless updates.

ACT: Share the information or apply it immediately. For our example, the agent would want to send the results to their client, possibly as a brief report or a link to a map. Success is defined by the ease of sharing fast and polished outputs. The user should be able to generate an email, PDF, or shareable map link in one or two clicks. For the Quick Lookup mode, this stage often means using the output right away.

STAGE	PROMPT	WHAT TO OBSERVE
ASK	"Search for nearby homes"	Is the search function fast and forgiving?
ACQUIRE	"Open relevant map"	Can users access data quickly?
EXAMINE	"Check proximity"	Are key metrics clear at a glance?
ANALYZE	"Compare areas"	Can users spot key differences quickly?
MONITOR	"Watch new listings"	Are alerts or filters intuitive to set up?
ACT	"Send results to client"	Is sharing fast and easy?



Benefits of THE GEOGRAPHIC APPROACH

APPLYING the Geographic Approach with this kind of intention offers clear benefits. For one thing, with a linear, systematic approach, it's easy to understand where and why workflows fail, and to improve them going forward. It can also give teams a shared model to think through individual projects and improve cross-team focus and collaboration. Testing and iteration, too, become simpler and more consistent.

GIS will only grow more powerful, the tools more advanced, the datasets more vast. But the Geographic Approach is a grounding force. It's a reminder that at the end of every dataset is a decision. Behind every map is a person trying to act.

By applying the Geographic Approach deliberately across usage modes, GIS managers and professionals can think with more intention and cohesion about what exactly they are trying to achieve, and the steps necessary to achieve it.

About the Authors

Julia Cowing is a technology strategist specializing in user-centered processes. She helps organizations develop solutions that start with user needs and end with measurable business impact. She is currently an individual contributor in research operations at Esri.

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Allen Carroll's Quiet Cartographic Revolution

First published in *GoGeomatics*

By Anusuya Datta

↑ Allen Carroll (center), with his grandmother, his brother, and the world.

Before the software platforms, before the glossy atlases, there's a photo. A little boy in pajamas sits between his grandmother and brother. Behind them, pinned to the wall: a world map. Allen Carroll remembers staring at it from his bunk bed, nudging continents together in his mind. He was four or five.

The picture opens Carroll's book *Telling Stories with Maps: Lessons from a Lifetime of Creating Place-Based Narratives*, and it tells you everything you need to know. This is a book that begins with wonder, not code.

Carroll would go on to become chief cartographer at *National Geographic* and later, the creator of ArcGIS StoryMaps. He's spent a lifetime shaping how people see places.

And while the maps have evolved—from airbrush to interactive layers—the instinct behind them hasn't. Clarity. Connection. A sense of where we stand.

The way Carroll organizes his book feels deliberate, almost architectural. He starts with questions about how humans respond to stories, how memory and location are tied together in the brain, and why maps command attention.

"Maps pack huge amounts of information into a form that most people find easy to interpret. The human mind has a remarkable ability to mentally project patterns on a page or screen onto the real world," Carroll told me. "As long as maps are carefully designed and not overloaded with detail (and that's a pretty important qualifier!), they speak a visual language that's almost universal."

The early chapters are personal. He recalls going on childhood road trips, sketching floor plans, drawing his own neighborhood maps by hand, and later designing infographics for *The Washington Post Magazine*.

Once he pitched an idea to them: What lies beneath Dupont Circle, that tangled roundabout in Washington, DC? The result was a six-panel vertical excavation, moving from the asphalt to the streetcar tunnels to the Metro system to the geologic provinces under the city—and, finally, to the exact point on the Earth's surface opposite DC, somewhere in the Indian Ocean.

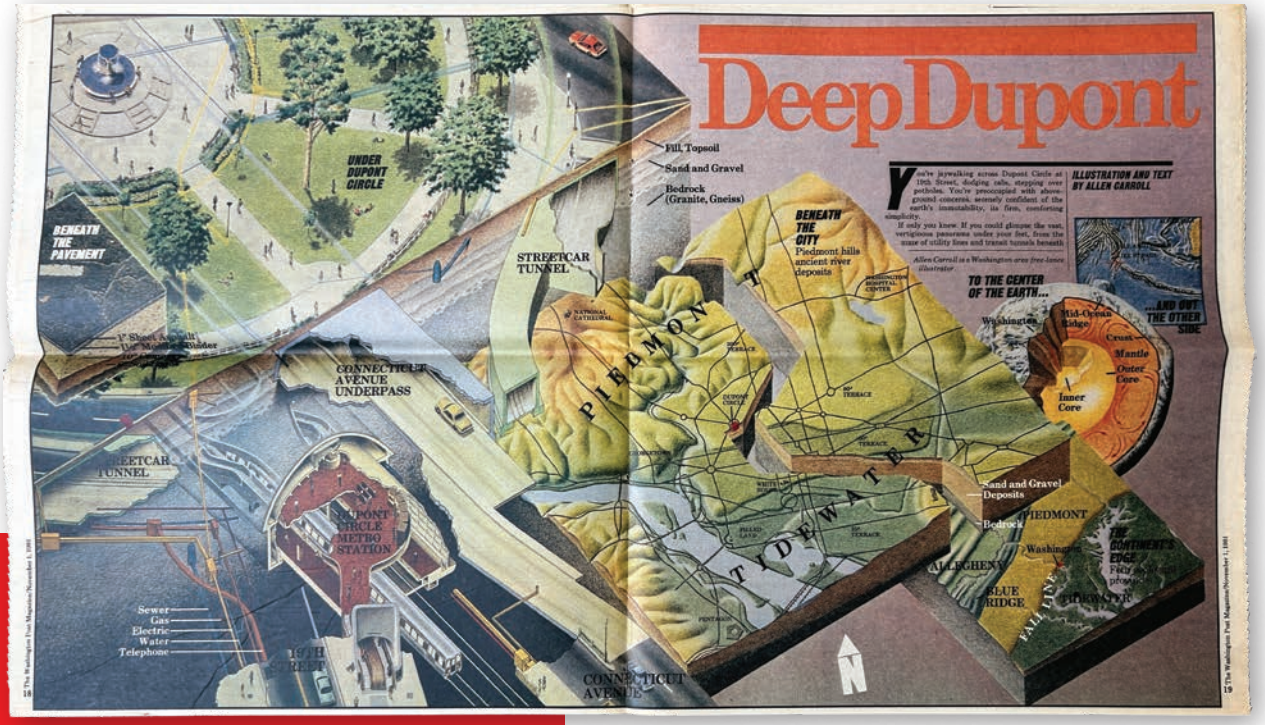
He used airbrush and colored pencil to draw the entire thing, manually researching and sketching out spatial layers. The story caught the attention of *National Geographic* staff, who called him in. According to Carroll, he spent too long on that piece for what it paid. But it bought him something else: a job that would change his life.

This anecdote is one of the first moments where we see how design, research, and storytelling can sit inside a single visual. From there, the book expands into science, education, and technology. Carroll traces the emergence of digital storytelling tools, the development of ArcGIS StoryMaps as a platform, and the editorial choices that shaped its direction. You see someone carefully considering each layer—how a map is built, and how it connects with the person reading it.

A Platform That Almost Didn't Happen

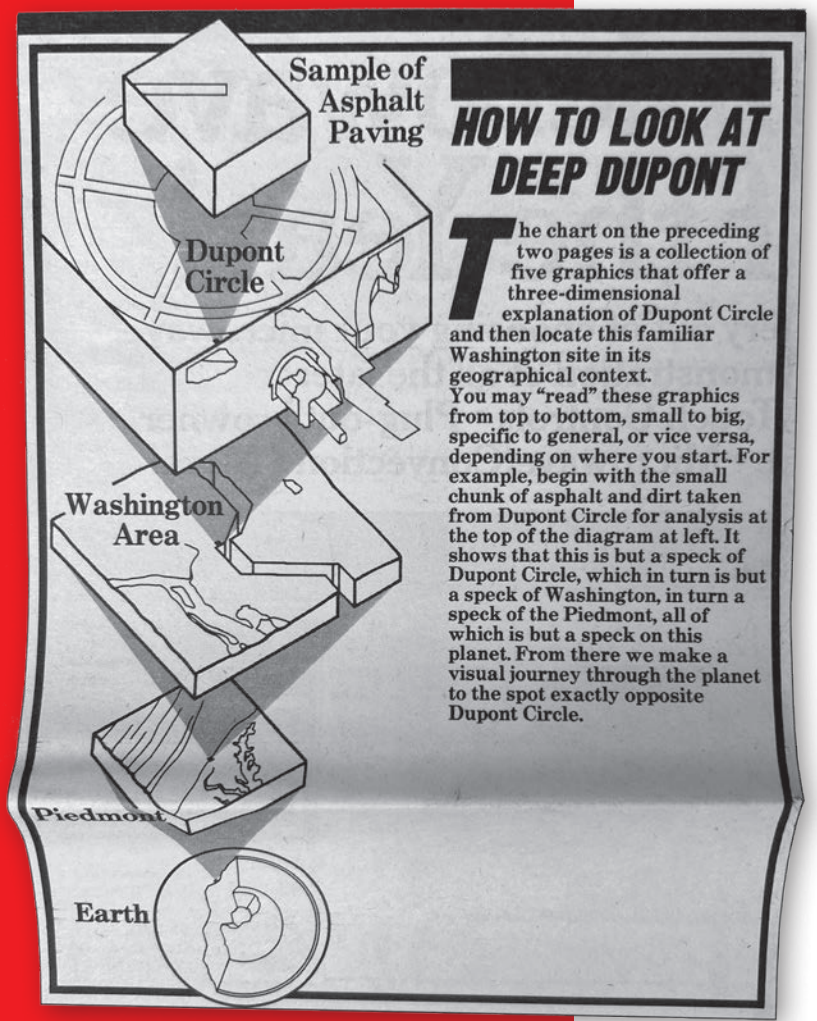
When Carroll left print and moved to Esri, he was stepping into the digital unknown.

He describes the winding road to building ArcGIS StoryMaps. Early trials were clunky web experiments, mock-ups, weekend hacks, custom scripts. One of his team's first successful stories



↖ "Deep Dupont" was Carroll's depiction of the infrastructure, soil, and geology beneath a Washington, DC, landmark. Published in *The Washington Post Magazine*, November 1, 1981.

↙ This diagram deciphers Carroll's illustration for the Dupont Circle story. "How to Look at Deep Dupont" by Allen Carroll was first published in *The Washington Post Magazine* on November 1, 1981.



involved mapping tornadoes across four decades. Not a flashy subject, but the way the data moved and updated with every zoom level gave readers a sense of both scale and detail.

These early prototypes—be it a story on bird migration or the *Titanic*'s passenger map—weren't meant to become a global storytelling tool.

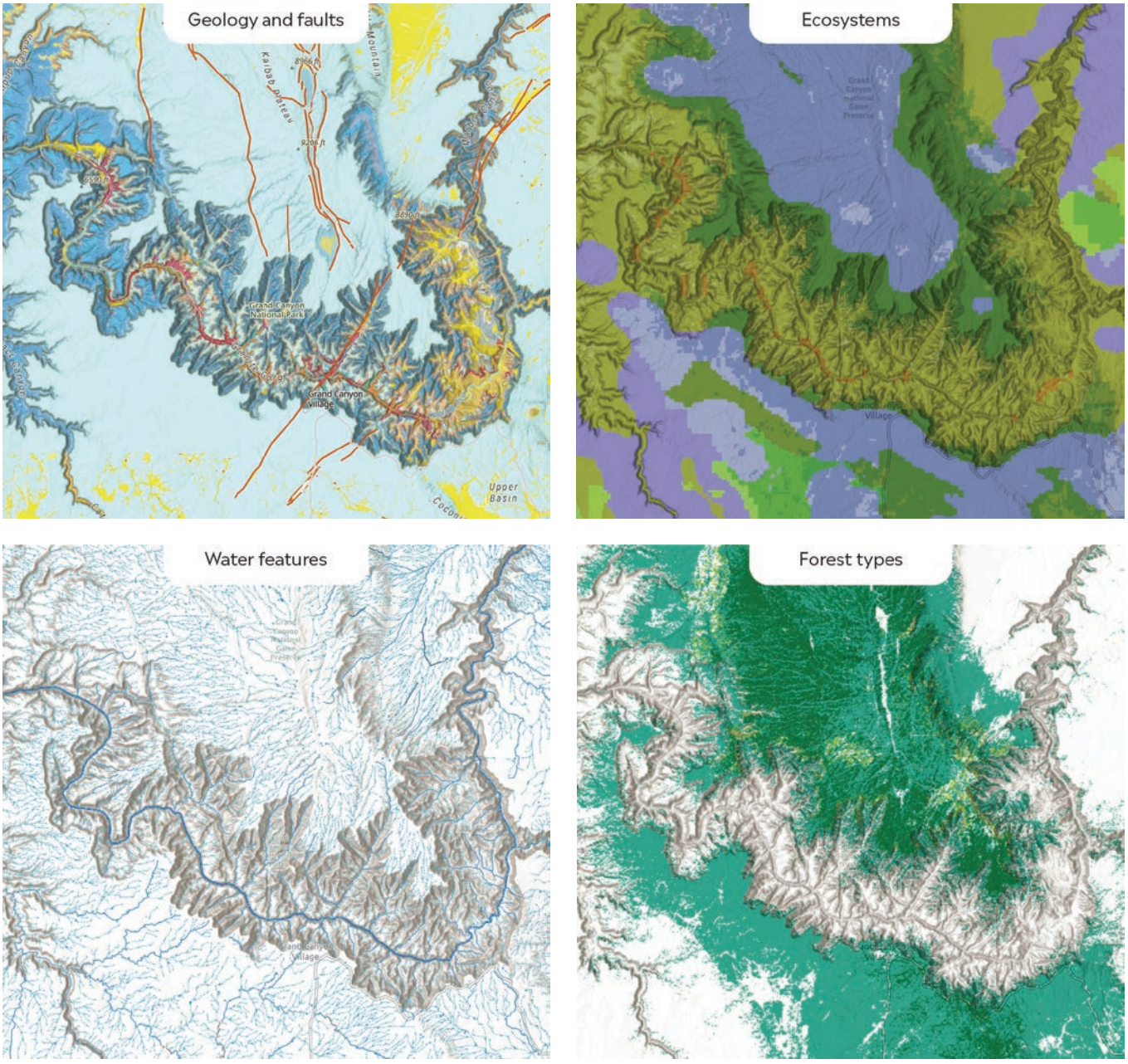
But slowly, the pieces came together. A platform emerged that was designed to let people create place-based stories using maps, media, and narrative structure. Teachers used it in classrooms. Scientists used it to explain ecosystems. Communities used it to document histories that wouldn't make it into official archives. Even governments started using it to publish public dashboards.

Today, there are more than 3.5 million stories created using Esri's tool. Carroll doesn't hype this. He presents it the way he presents everything else: through examples that explain themselves.

Carroll walks the reader through different kinds of mapping narratives: Some begin with small details and expand outward, others frame a problem and lead the viewer toward resolution. In one especially effective structure, he shows how maps can serve as narrators—anchoring the story while shaping its emotional rhythm.

Take the story *The Two Koreas*. Carroll first worked on this project in 2003 as a print map for *National Geographic*. It was a typical foldout—carefully designed but limited by the static nature of the print medium. Years later, he retold the story digitally with his Esri team. This time, readers could scroll through a changing map that showed territorial control during the Korean War, frame by frame. Each scroll step unlocked a new phase of the war—no arrow diagrams, just visual motion through time and geography.

The effect was different. No overload, no wall of data. Just a spatial story told in rhythm. That's the kind of map Carroll argues for: not flashy, not drowning in interactivity, but constructed with a sense of timing.



↑ *Thirteen Ways of Looking at the Grand Canyon* by the Esri ArcGIS StoryMaps team explores multiple facets of the iconic national park by displaying a series of thematic maps at identical scales.

Where the Story Lives

The book's most compelling sections focus on how spatial stories are built. Carroll explains how a map can act like a narrator or a setting or a protagonist. The role changes depending on the story.

One of Carroll's personal favorites is *World's Longest Mule Deer Migration*, created by the University of Oregon Geography Department and the Wyoming Migration Initiative. It tracks Deer 55 as she navigates a 150-mile journey across Wyoming's fragmented landscapes. The story reveals how roads and fences have fragmented migration routes, cutting herds off from one another.

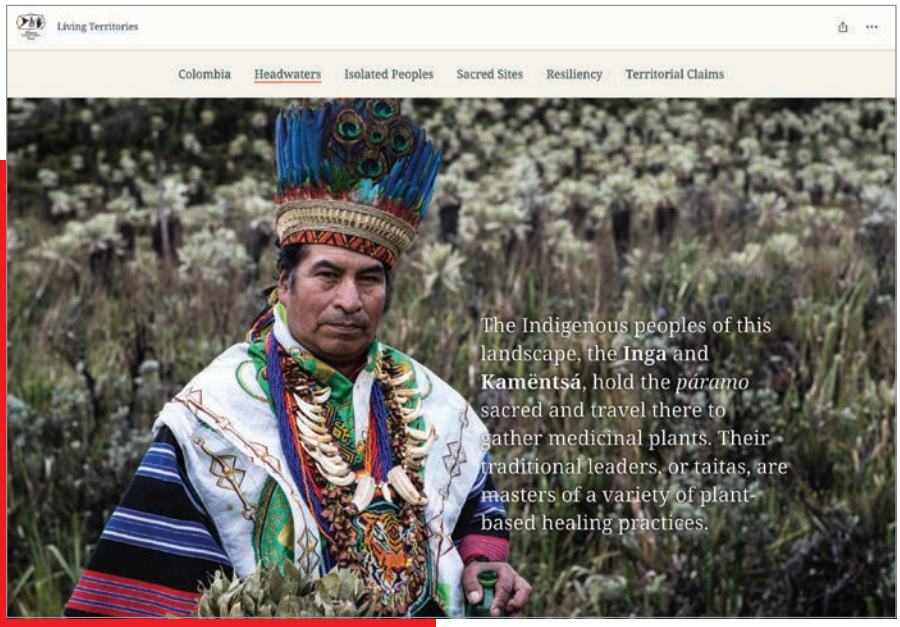
"It combines tracking data, which I always find spellbinding," Carroll notes in the book, "with land-use and land management data to show that, even in the nation's least populous state, wildlife must navigate a series of subdivisions, fence lines, roads, and other hazards." By focusing on a single animal, the story personalizes a broader environmental challenge—turning movement data into something compelling and urgent.

Carroll emphasizes that many of the best stories are built around people. One memorable example in the book follows a couple—Dorothy and Nathan—who drive to the beach in an electric vehicle and try to find a place to charge. What sounds like a product demo becomes documentary: failed chargers, broken maps, delays. The reader sees a real-time gap between infrastructure and expectation. It's the kind of storytelling that makes policy feel lived-in.

The book quietly insists on cartographic responsibility. Carroll returns often to questions of representation: Who is included? Whose perspective does the map reflect? What choices shape what we see? He describes how Indigenous communities in the Amazon cocreated stories with ArcGIS StoryMaps that blended oral history with geography, drawing territorial lines shaped by memory, ecology, and cultural meaning rather than legal boundaries.

In one of the book's most revealing chapters, Carroll explores the neuroscience of storytelling. He explains how place, memory, and emotion are physically linked in the brain—how grid cells and place cells activate when we remember where something happened. This connection explains why stories rooted in geography resonate.

This is where his argument takes shape: Maps are not just explanatory tools. They are memory engines. They help us remember where stories took place and how we felt when we heard them.

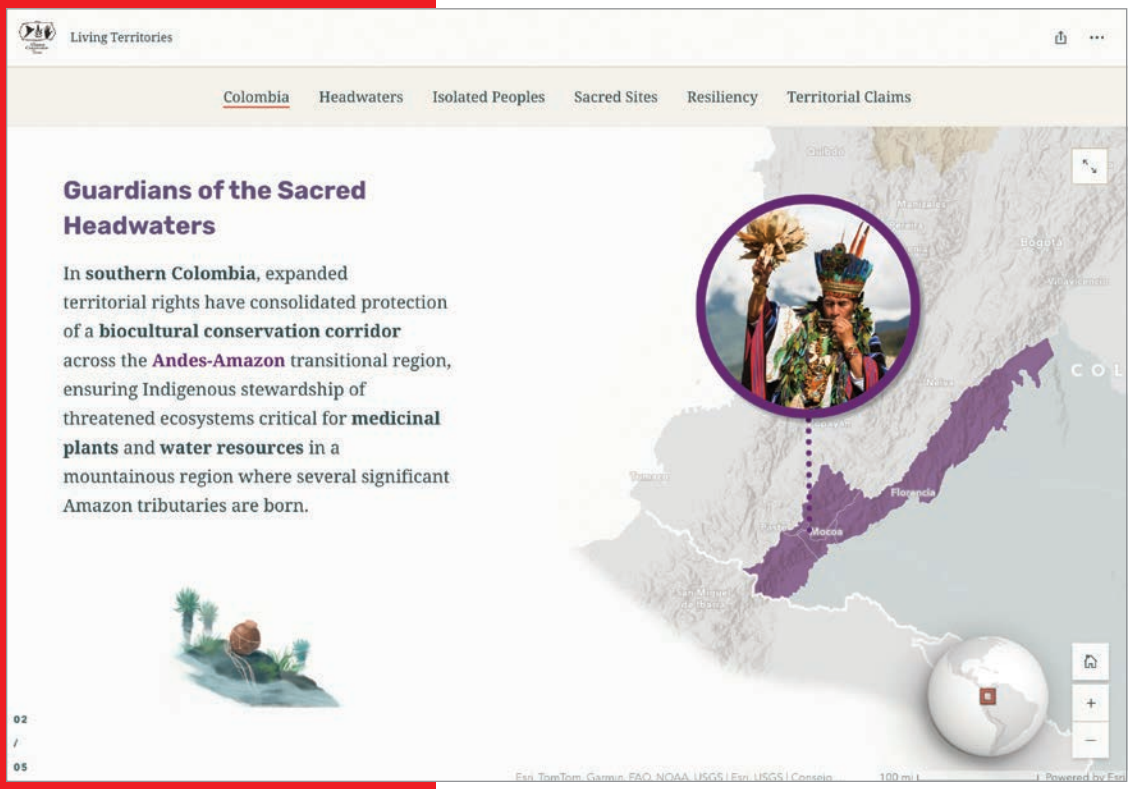


A Book Meant to Be Moved Through, Not Rushed

The pace of *Telling Stories with Maps* is unhurried. Carroll lays out examples the way a curator might lay out a gallery—step by step, layer by layer. Some sections outline narrative structures or story types, but they don't read like instruction manuals. They read like field notes from someone who's been refining his approach for decades.

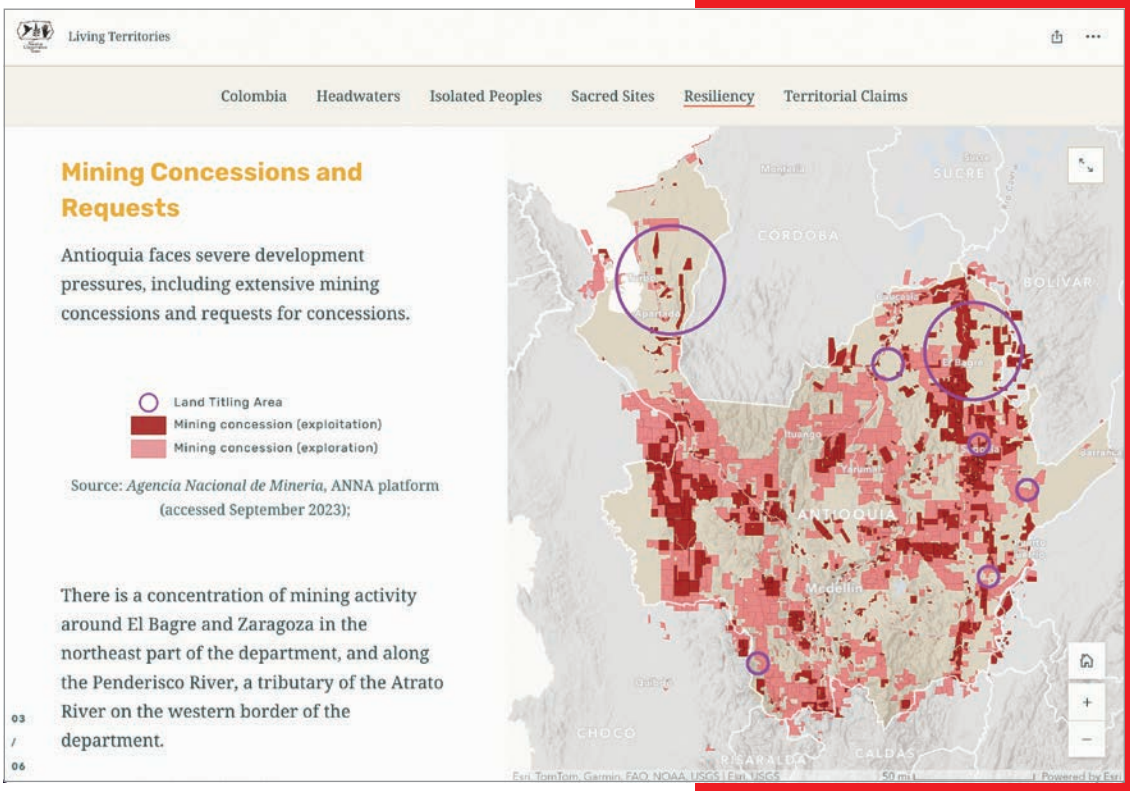
Carroll isn't trying to dazzle. He is trying to equip. And he does it by showing what thoughtful storytelling can look like when it's grounded in place.

"I'd love to think that the book might inspire GIS professionals to tell more stories



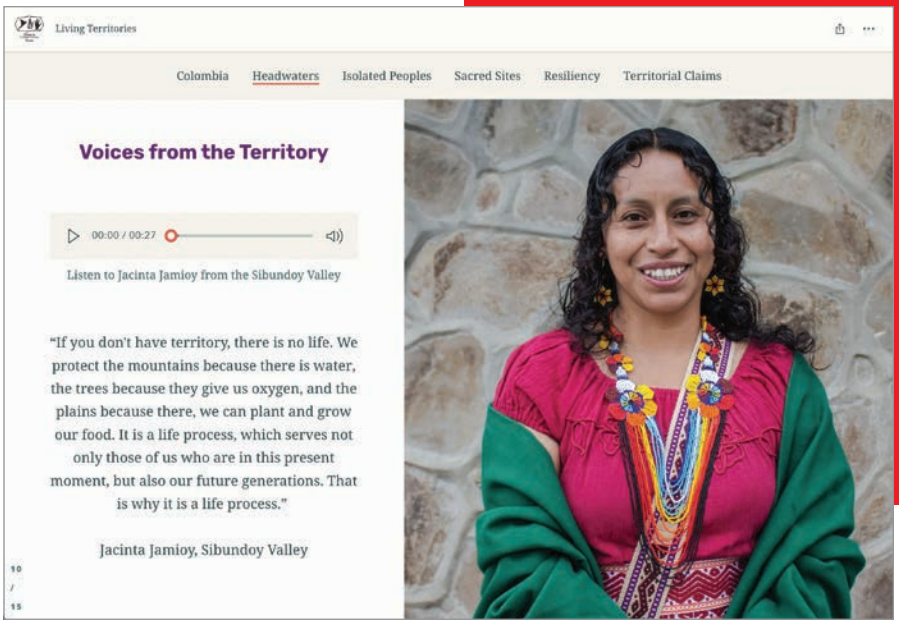
↖ *Living Territories* by Amazon Conservation Team is one of the many illustrative stories created with ArcGIS StoryMaps that Carroll uses in his book. Each chapter of the story opens with a photo essay and accompanying text.

↙ Maps and media layers blend art and cartography.



↗ Map choreography locates Indigenous territories and portrays development pressures.

↘ Portrait photos, text, and audio clips integrate Indigenous voices into the story.



about their work—the data they use, the insights they gain—to broad audiences," he told me. "I hope the book makes people appreciate the peculiar power of maps: how dense they are with information, how they provide an additional dimension to storytelling, how they add richness and context to narratives. And I hope they'll use this potent mix of maps and multimedia to positive ends—to inform and inspire people about the interconnectedness of our planet, nature, and human culture."

In the end, *Telling Stories with Maps* isn't about promoting maps. It's about telling stories with care—stories that embrace detail, hold complexity, and reveal the patterns that shape the way we live and understand place.

It's a quiet book, full of carefully chosen examples and hard-won lessons. Like the best maps, it lingers, less for what it shows than for how it changes the way you see.

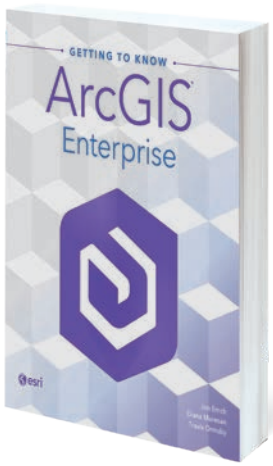
If you think maps are merely tools for directions or spatial data, Carroll wants you to pause. He invites us to consider the map as something else altogether—narrator, interpreter, witness, advocate. What unfolds is more than a professional retrospective. It's a generous offering from someone who has spent decades observing how storytelling evolves through technology, visuals, and the ways we make meaning from place.

About the Author

Anusuya Datta is a contributing editor at *GoGeomatics*. A writer and journalist based in the Canadian Prairies, Datta has a keen interest in connecting technology with sustainability and social causes. She serves on the board of EO4SDG, and earlier worked as the executive editor of *Geospatial World*. A regular contributor to platforms such as *SpaceNews*, CBC, and *AgriBusiness Global*, Datta has also delivered guest lectures at the University of British Columbia's school of journalism on the use of satellite imagery in storytelling.

Bookshelf

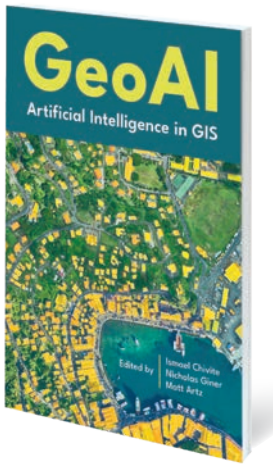
Getting to Know ArcGIS Enterprise



By Jon Emch, Diana Muresan, Travis Ormsby

ArcGIS Enterprise is the foundational software system for GIS, powering mapping and visualization, analytics, and data management. Collaboration and flexibility are central to ArcGIS Enterprise, allowing you to organize and share your work on any device, anywhere, at any time. A thorough knowledge and understanding of ArcGIS Enterprise is essential to increasing the ability to work with others and remain responsive and resilient in today's increasingly demanding and changing business environment. *Getting to Know ArcGIS Enterprise* covers the essential skills of planning, deploying, administering, using, and maintaining ArcGIS Enterprise. It addresses the most common and vital workflows ArcGIS Enterprise administrators need to understand. November 2025, 300 pp. Ebook ISBN: 9781589487918 and print ISBN: 9781589487932.

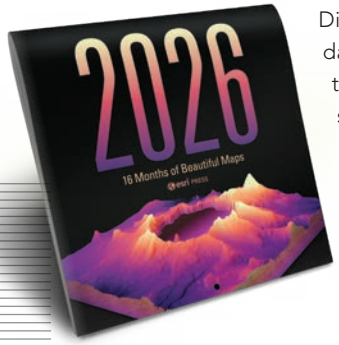
GeoAI: Artificial Intelligence in GIS



By Ismael Chivite, Nicholas Giner, Matt Artz

Organizations across the globe have long relied on GIS technology to manage and analyze data through the powerful lens of location, helping them tackle some of the toughest business and societal challenges. The emergence of AI-enhanced GIS has opened new opportunities to these groups to automate complex spatial analyses and harness the full power of spatial analysis. This democratization of GIS can help everyone make better decisions faster, from city planners and policymakers to businesses, research groups, and constituents. *GeoAI: Artificial Intelligence in GIS* explores a collection of real-life stories about public and private sector organizations as well as nongovernmental organizations (NGOs) and nonprofits successfully using GeoAI to manage processes, workflows, policies, and communication. The book also includes a technology showcase that provides ideas, strategies, tools, and actions to help jump-start your own use of GeoAI. September 2025, 120 pp. Ebook ISBN: 9781589488458 and print ISBN: 9781589488441.

2026 Esri Press Wall Calendar: 16 Months of Beautiful Maps

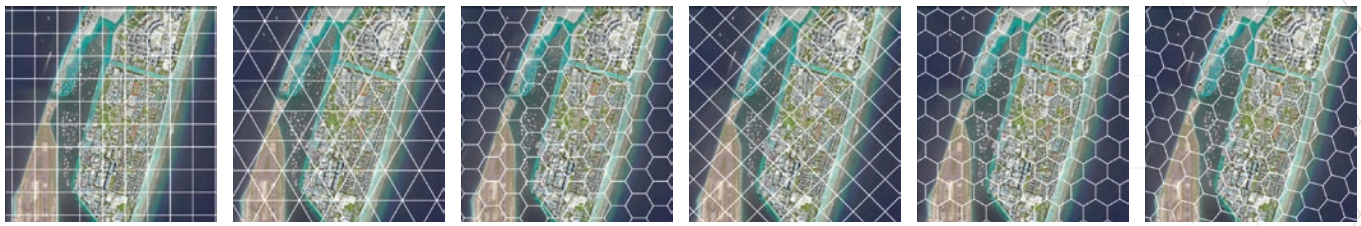


Discover the beauty of geography and maps with this stunning 2026 wall calendar. Perfect for anyone with a passion for maps and the powerful stories they tell, this calendar will inspire you to see the art in cartography. Each month showcases a visually captivating map created by cartographers from Esri, the global leader GIS technology. Includes full-color cartographic maps printed on high-quality, glossy paper; generous writing space for appointments and reminders; and US holidays and religious observances, plus fun GIS facts and history. August 2025, 26 pp. ISBN: 9781589488182.

Scan this code to buy the calendar.

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

Welcome to the Hexagonal Earth



↑ Shapes available in the Generate Tessellation tool in ArcGIS Pro. From left to right: Square, Triangle, Hexagon, Diamond, Transverse Hexagon, H3 Hexagon. Each shape is ~0.1 square kilometer.

Creating

regular tessellations to summarize spatial data isn't a new workflow in the world of GIS. Geoprocessing tools like Generate Tessellation and Generate Grids and Hexagons have supported this need for years. Specify your desired tessellation shape, area, and extent and go to town. So, with all the shape options available, why do people gravitate to the hexagon?

- Among all shape types, hexagons have a low perimeter-to-area ratio, reducing sampling bias due to edge effects. Circles have the lowest perimeter-to-area ratio of any shape, but can't tessellate (i.e., fit closely together with no gaps or overlaps).
- A hexagonal grid's inherent circularity captures curved patterns in spatial distributions.
- If the grid is being used for hot spot or outlier analysis, hexagons have more neighboring cells that share an edge (6) than square (4) or triangular (3) grids.

Unfortunately, one of the drawbacks to most tessellations is that these grids often have ad hoc sizes or alignments. It's not easy to create a multiscale grid template that nests neatly through different defined scales—and no universal grid ID to synthesize work from multiple organizations.

Generating these spatial summaries can consume a lot of time and resources, especially at a global scale. To avoid one-off siloed data products, there was a need for a smarter tessellation approach.

Why do people gravitate to the hexagon?

↓ The smallest H3 hexagon, Level 15, is only about one meter wide, with grid IDs shown.

H3 Hexagonal Hierarchical Spatial Index

Enter the H3 hexagon. Created by Uber to analyze and optimize ride-sharing pricing and dispatch at the city scale, it solved a lot of the limitations of previous tessellated grids.

First, H3 is hierarchical, meaning that it was designed so that each hexagon has seven smaller "child" hexagons nested neatly inside it. They range from Level 0, about the same land area as the European Union, down to Level 15, which is roughly a meter wide.

Second, H3 is spatially indexed. Each hexagon index is used for identifying the grid cell, as well as knowing its resolution and any spatially related parent or child hexagons, along with other geospatial manipulations.

In 2018, Uber made H3 open source and available to other organizations. H3 has been part of ArcGIS Pro since version 3.1, where H3 hexagons were added as an output option to the Generate Tessellation and Generate Grids and Hexagons geoprocessing tools.

The availability of a hierarchical, spatially indexed hexagonal grid system has opened the door to combining and summarizing geospatial data using a standardized methodology at the global scale.

Take the Global Environmental Hexagon Atlas. This collection of layers in ArcGIS Living Atlas of the World applies the geographic approach to datasets contributed by organizations from around the globe. Each of these layers provides critical information on different aspects of biodiversity, conservation, and sustainability, whether on land or in the ocean.

The Global Environmental Hexagon Atlas

The Global Environmental Hexagon Atlas combines different biodiversity and conservation summaries to help users discover patterns and explore the relationships that emerge. These biodiversity and conservation indicators include human activities and footprints, land-use types, protected areas, biomass assessments, and future projections of ecosystem change, among many others.

Using filtering and multivariate symbology, each of the 13 maps included in the atlas is a useful example of how these individual source datasets can benefit from—and gain context through—their comparison with others. Spanning land and sea, these maps use a combination of multivariate symbology, layer effects, and filters to explore specific challenges our planet faces, today and in the future.

Hexagons have a low perimeter-to-area ratio

Where does high population density coexist with high biodiversity intactness?

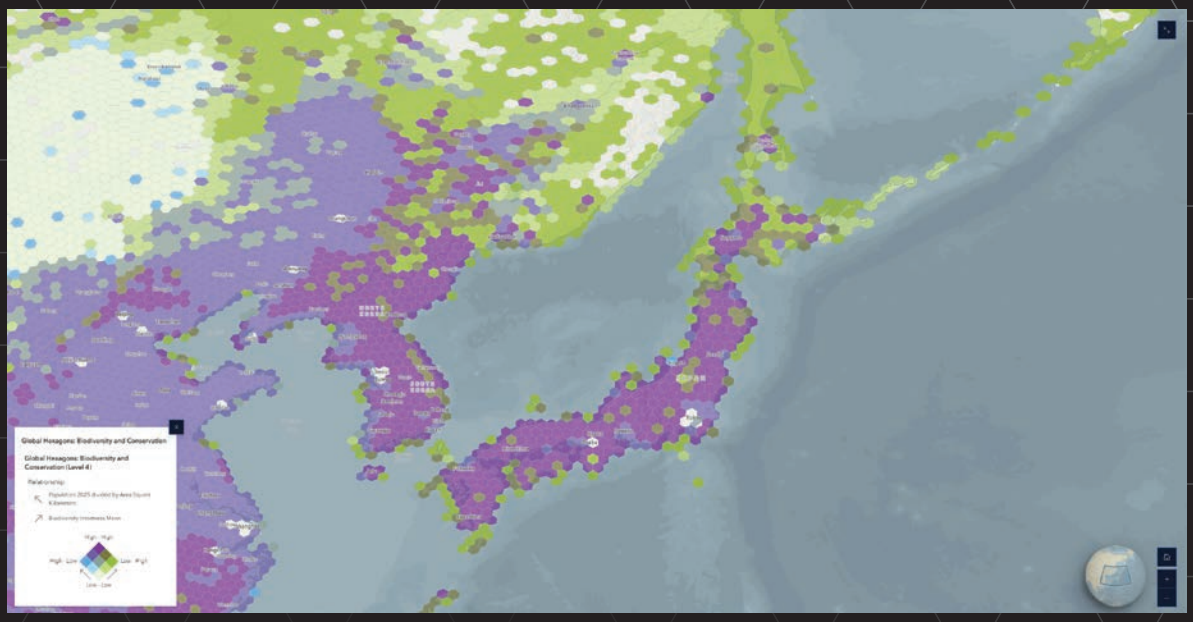
Map A combines one-kilometer resolution WorldPop 2025 population estimates with the Biodiversity Intactness dataset, which uses a 1970 baseline and future projections to determine the expected biodiversity loss in 2050.

Areas with high population density are colored blue; areas with high biodiversity intactness are colored green. If both are high, the color is purple. Dark purple areas may represent the regions of greatest sustainable development.

Where are areas of high species richness and irrecoverable carbon but low protection?

Map B combines 30-kilometer resolution International Union for Conservation of Nature (IUCN) species richness data with 300-meter resolution irrecoverable carbon data from Conservation International, using a drop-shadow layer effect to elevate the hexagons above the basemap. Human activity is the primary threat to the richness of local native species and to the vast stores of irrecoverable carbon that are vulnerable to release.

Areas with high irrecoverable carbon are colored yellow; areas with high species richness are colored blue. If both values are high, the color is black. Areas that have greater than 25 percent protection are filtered out of the map. The black hexagons represent areas that should be considered for greater protection to prevent irrecoverable carbon loss.

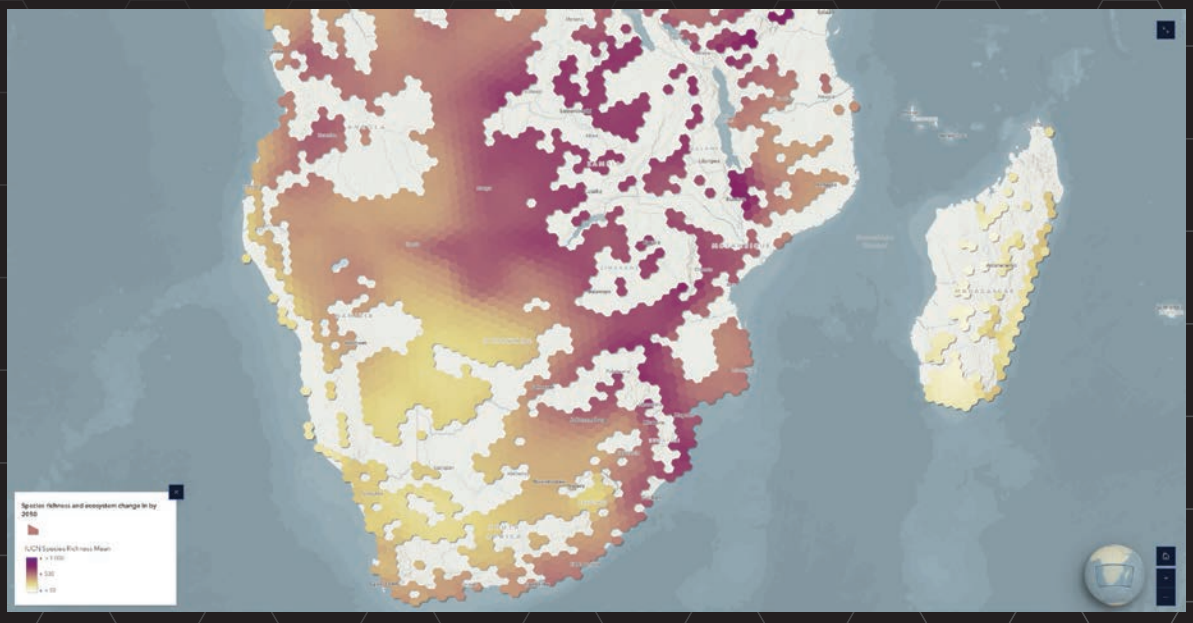


→ This map shows where high population density coexists with high biodiversity intactness. Dark purple areas may represent regions of greatest sustainable development, as seen here in Japan and South Korea.

a

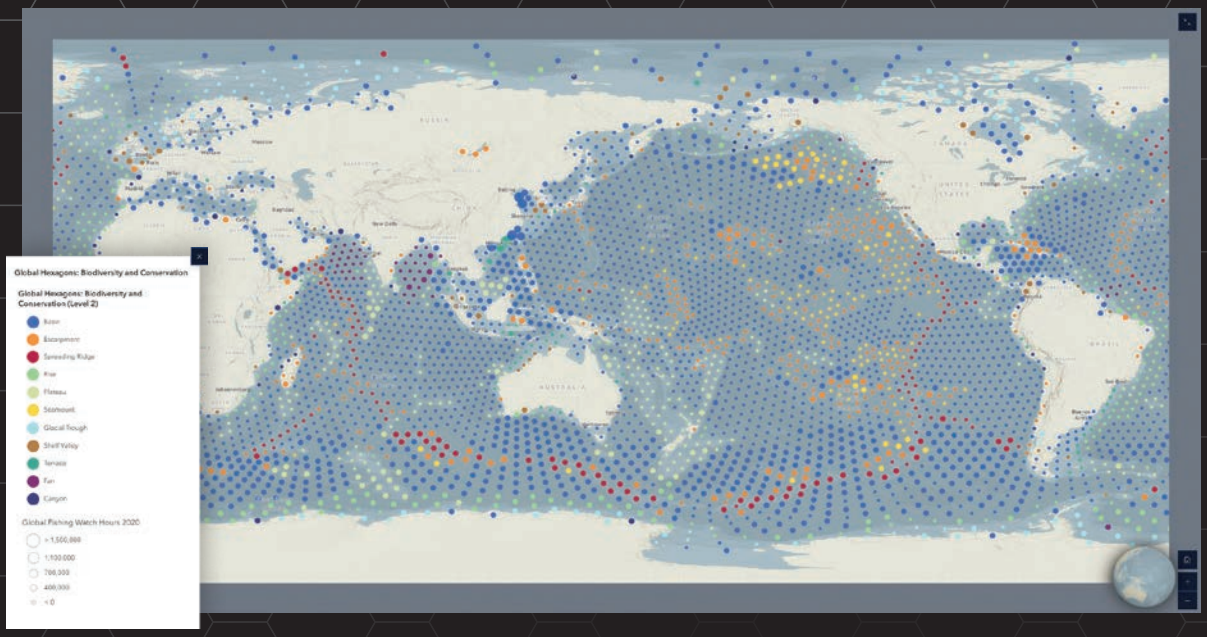
→ This map shows how areas of high species richness and irrecoverable carbon interact.

b

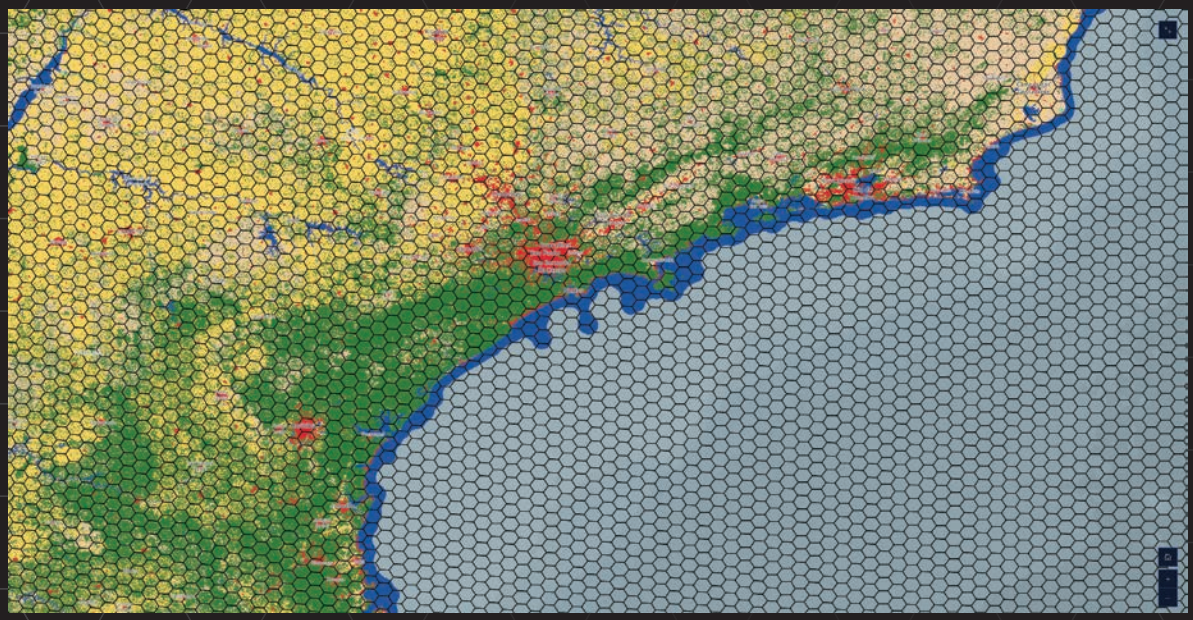


→ This map shows where ecosystem changes have the greatest impact on species richness.

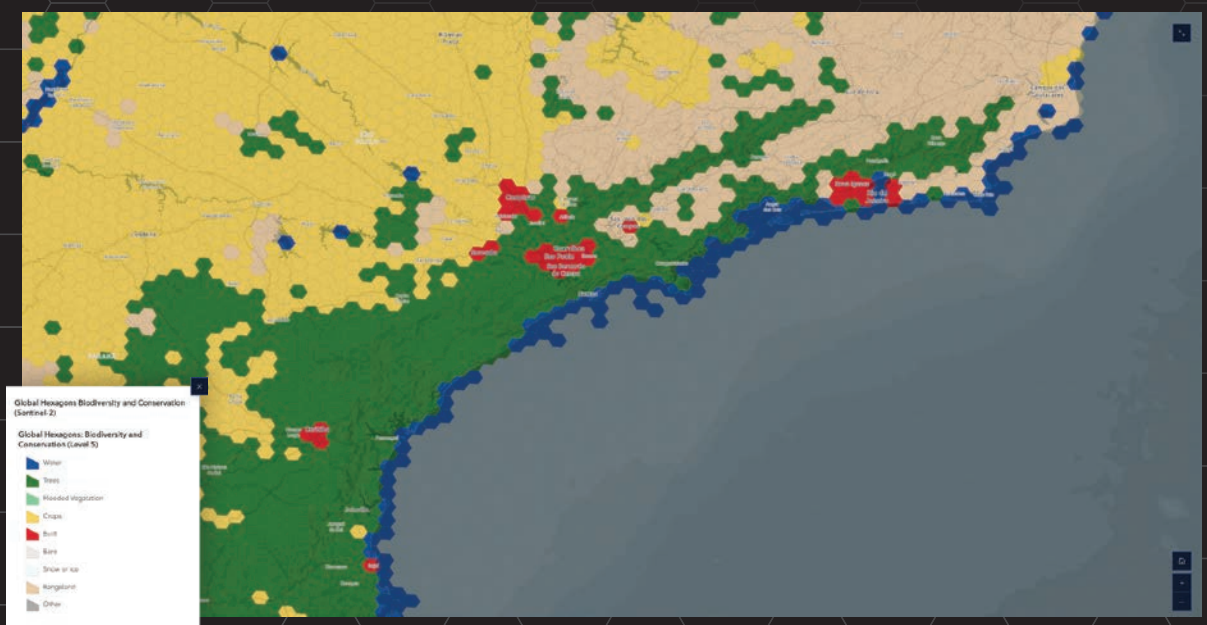
c



← This map shows relative global fishing intensity as it relates to seafloor geomorphology.



← The Zonal Statistics tool can create basic summary statistics or categorical breakdowns like area percent or predominant class within each hexagon.



← The Summarize Within tool summarizes vector features like points or polygons to determine feature counts or areas within each hexagon.

Where might ecosystem change have the greatest impact on species richness?

Map C looks to the future and uses IUCN species richness data again, this time filtered by the predominant Terrestrial Ecosystem Change driver for that hexagon in the year 2050.

The World Terrestrial Ecosystems 2050 data identifies how bioclimate and land cover may change. In this map, we see the average species richness for an area, with purples indicating more amphibians, reptiles, birds, and mammals. The data is filtered by areas with expected ecosystem shifts.

Which parts of the ocean are subject to the greatest fishing intensity?

Map D looks to the oceans, showing the relative global fishing intensity in vessel hours for 2020, compared to the local predominant seafloor geomorphology, combining raster fishing intensity with vector ocean morphology polygons.

Seafloor geomorphology features influence currents, nutrients, and habitat that create productive fishing grounds. This map displays the relationship between the predominant seafloor geomorphology and the annual total of commercial fishing hours for each hexagon. Larger circles indicate higher numbers of fishing hours.

Creating the Hexagonal Earth

There are two main analysis workflows for summarizing spatial data within defined areas, depending on its format. To tackle a wide variety of global biodiversity datasets for the Global Environmental Hexagon Atlas, two geoprocessing tools were applied for raster- or vector-based sources:

- **Raster:** *Zonal Statistics* (**Map E**) creates summary statistics, such as minimum/maximum/mean, sum, or categorical breakdowns like area percent or predominant class within each hexagon.
- **Vector:** *Summarize Within* (**Map F**) summarizes vector features, primarily points or polygons, to determine feature counts or areas within each hexagon.

Given the diversity of authoritative datasets available in ArcGIS Living Atlas, summaries were focused on those with global extents to serve the broadest audience possible.

For instance, how is a layer like Sentinel-2 10m Land Use/Land Cover converted from a categorical raster to H3 hexagons?

Creating a global hexagon grid starts with a H3 hexagon template for Level 2 through Level 5.

(To create your own global H3 hexagon grids, use the Generate Tessellation tool and set the extent to latitude -90°/+90° and longitude -180°/+180° in WGS84, then repeat for each level. Analysis-ready global H3 hexagon grids can also be copied from an ArcGIS Online service that includes Level 0 through Level 6.)

Next, the Sentinel-2 10-meter raster is downsampled to 30 meters to reduce processing time. Even the smallest Level 5 hexagon is still hundreds of square kilometers, so this resolution reduction has little impact on the statistical summaries.

Next, Zonal Statistics is used to determine the relative contributions of the different land-cover types in each cell, by area percent, along with the predominant/majority type.

The result is a single land-use/land-cover type for each hexagon, at each level, symbolized in the same manner as the Sentinel-2 raster classes.

Explored individually, these hexagonal maps distill noisy spatial data into simple cellular summaries. However, the real power of the analysis comes from the combination of these layers—including a total of 55 individual metrics—into a single, multiscale biodiversity atlas.

Using Hexagons with Your Own Data

One benefit of using H3 hexagons is the ability to combine summaries from a variety of sources. If you've created your global or local tessellations using the H3 option, each level will always be coincident and have the same hexagon grid IDs. This is great news for collaboration—and for building your own maps and mashups. For instance, you can take a H3 hexagon summary table for your own dataset and join it to the Global Environment Hexagons for fresh new bivariate insights.

This collection of biodiversity summaries represents a new pattern for synthesizing spatial data globally or locally. Having dozens of biodiversity indicators at your fingertips at multiple scales and geographies is an incredibly powerful concept. What makes this particular location unique? What will it look like in 25 years? Can you show other locations like it? These are the questions the geographic approach helps us answer.

Hexagonal grids have an inherent circularity

EDITING IN ArcGIS Instant Apps

By Sarah McDonald

ArcGIS Instant Apps offers ready-to-use web applications that are fast to set up and simple to use. Among its many templates, five are designed with data editing capabilities in mind:

- Manager
- Sidebar
- Web Editor (beta)
- Attachment Viewer
- Reporter

Each of these templates supports an editing experience tailored to specific workflows and user needs. Different editing tools are available for each template, and align well with various common use cases. It's important that you choose the right app for your data editing tasks.

Before creating your application, ensure that the data used in your web map is properly configured for editing. Here are a few key checks to perform on your layers:

- **Ensure that layers are editable.** On the Settings tab of the hosted feature layer's item page, confirm that editing is enabled for each layer.
- **Configure editing level.** Choose what type of editing abilities are allowed on each layer like add, update geometry, update geometry and attributes, or delete.
- **Confirm layer sharing.** Review that layers are shared with the intended audience or groups.
- **Consider using layer views.** Control who can view and edit certain features within the layer by using a view of the layer.

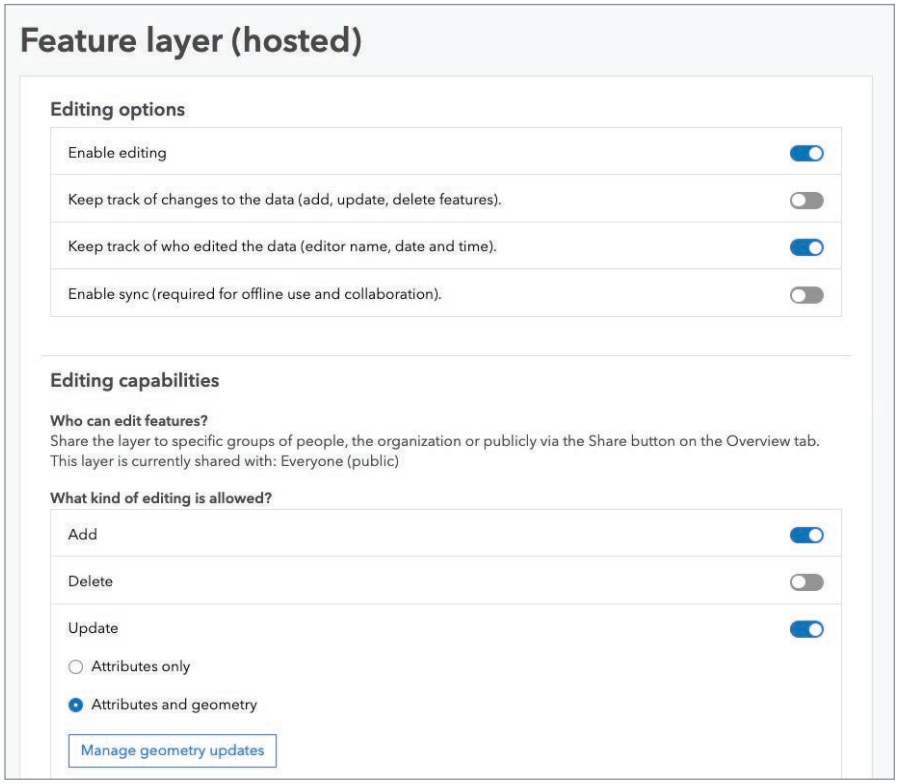
The next step is to add your layers to a web map. While building your map in Map Viewer, consider key configurations to simplify the editing experience, like smart forms and feature templates.

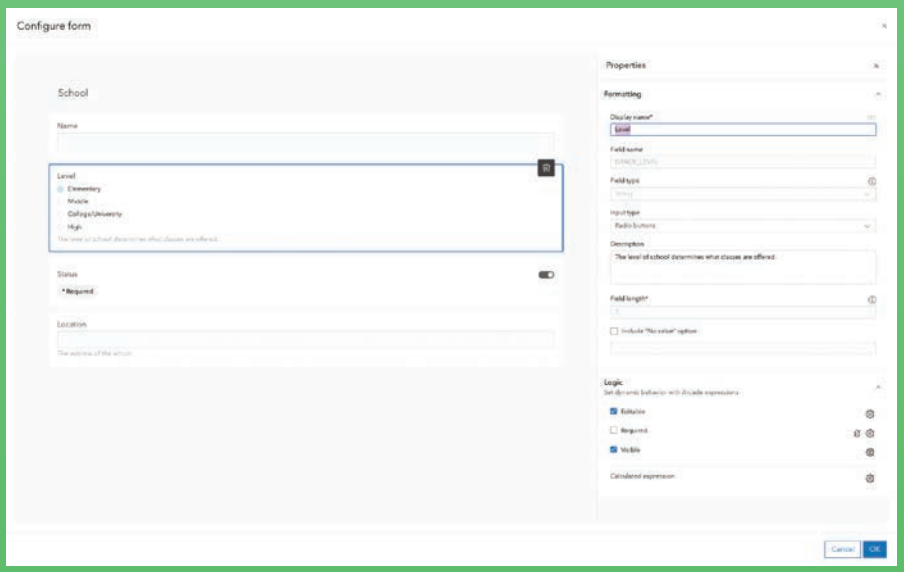
Smart forms streamline the editing process by presenting editors with a curated list of relevant fields and predefined, valid attribute values for each editable field. Forms help reduce errors and guide users through the editing process.

Feature templates are defined categories based on attributes that editors use when adding a new feature on the map. They assist with giving users a clear starting point when adding a new feature.

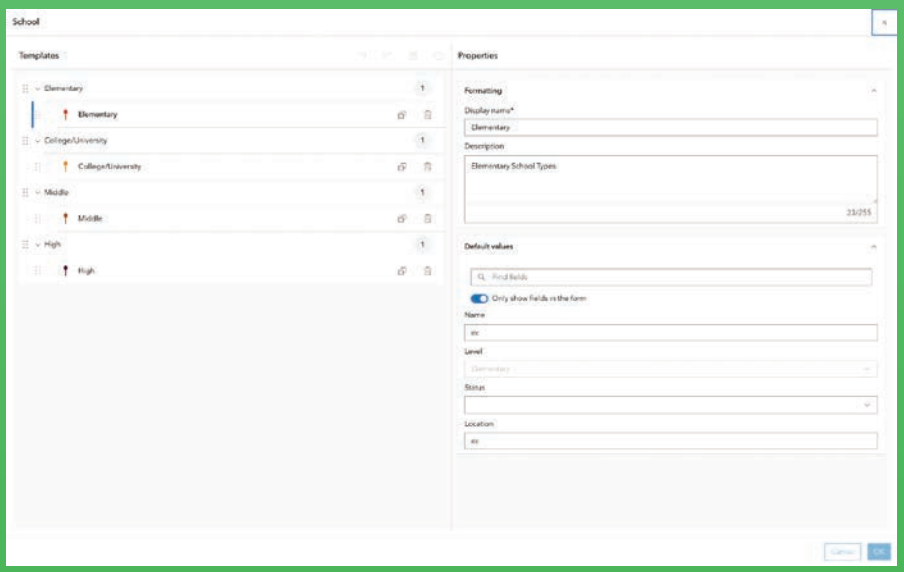
Editing features in Instant Apps can be broken into two categories: full capabilities and limited capabilities. Full capabilities allow users to add new features, update existing features, and delete features—offering a complete editing experience directly within the app. Limited capabilities are designed for more guided, workflow-specific editing tasks. These apps support only certain types of edits, focusing on streamlined interactions that align with specific use cases.

↓ It's important make sure the data used in your web map is properly configured for editing.

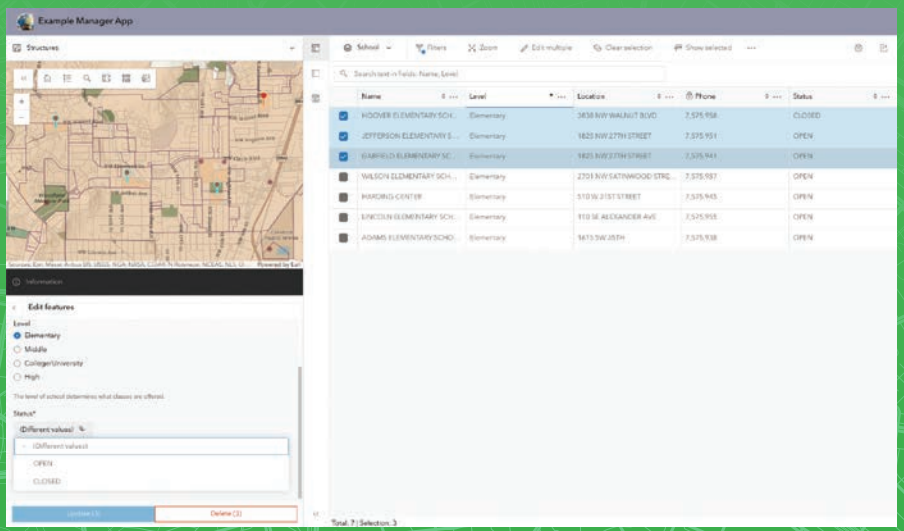




↑ Smart forms streamline the editing process and reduce errors.



↑ Feature templates give you a clear starting point when adding new features.



↑ An example app created with the Manager template.

Apps with Full Editing Capabilities

Manager

The Manager template is ideal for reviewing and editing features across multiple web maps, offering a flexible interface that combines map and table views. Users can add, update, or delete features directly within the app. A key feature of Manager is its integrated table, displayed prominently in the main stage, allowing for quick and efficient attribute updates.

In addition to basic editing, users can access and update related records through either the table or the information panel, which also displays pop-ups for selected features. Manager supports updating multiple features at once.

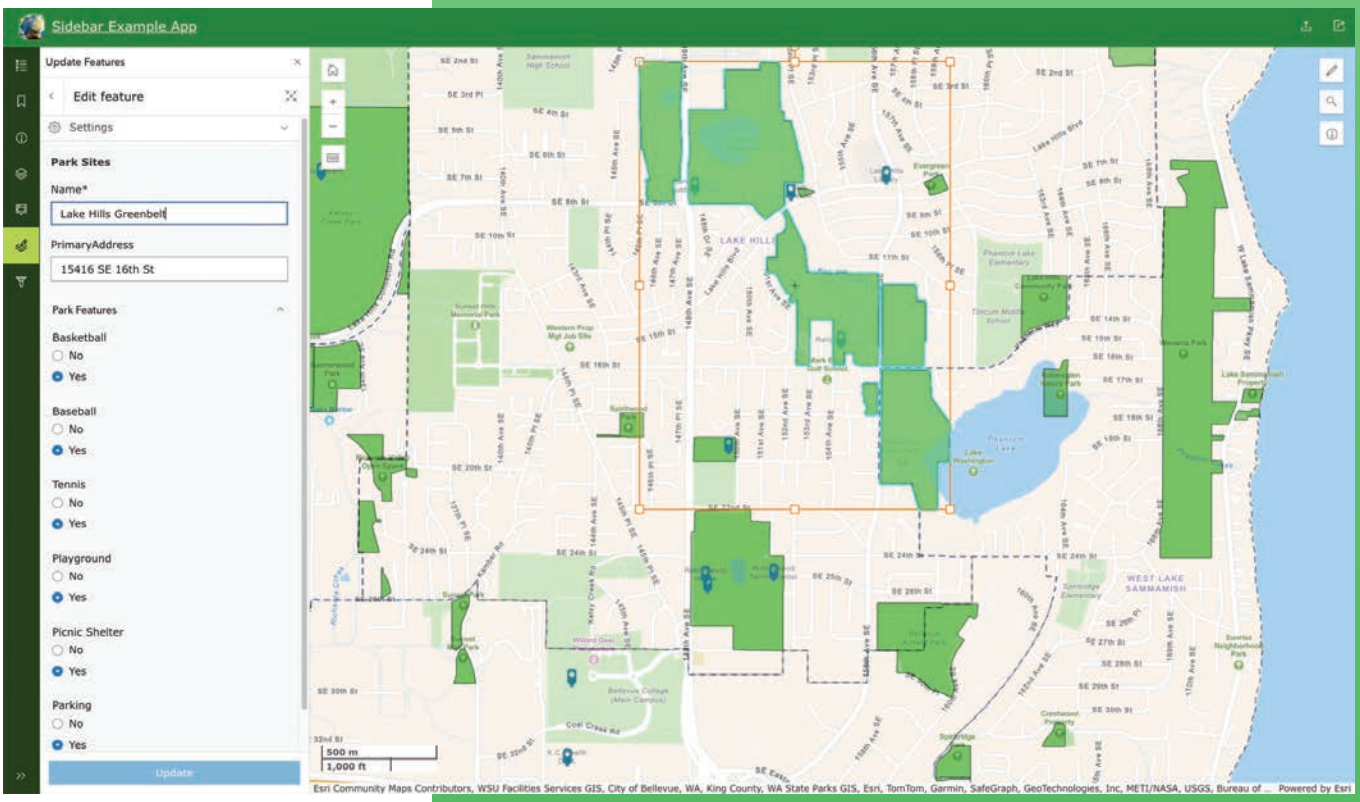
Sidebar

Use the Sidebar template to display a map alongside tools to edit, filter, and interact with data. With the built-in editing tool, you can add, update, and delete features directly within the app. For more efficient workflows, Sidebar also supports updating multiple features at once.

Additionally, you can enable a table view through the layer list tool, making it easy to edit attributes directly in a tabular format. This combination of map, tools, and table provides a streamlined and flexible editing experience tailored to a variety of use cases.

Web Editor (beta)

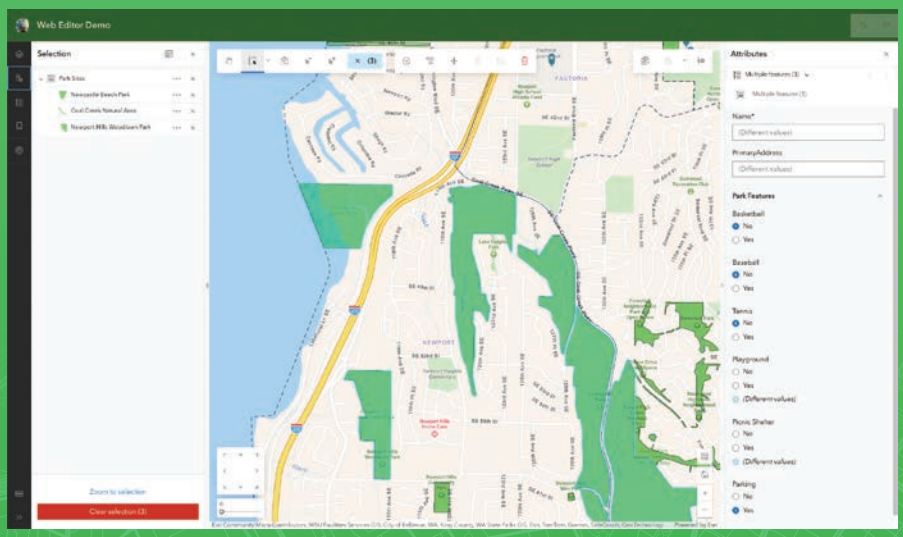
Use the Web Editor (beta) template to create a customized version of the Web Editor application that is tailored to your editing needs. It includes a full suite of editing tools—you can add, update, and delete features, as well as perform advanced geometry edits such as editing vertices as well as splitting, merging, moving, and reshaping features.



↑ An example app created with the Sidebar template.

Like the other full-capability apps, Web Editor supports updating multiple features at once. It also offers tools to copy and paste features within the same layer or across different layers, enhancing flexibility in data management.

App authors have control over which map layers are selectable or editable, allowing for a more focused and intuitive editing experience for specific use cases.

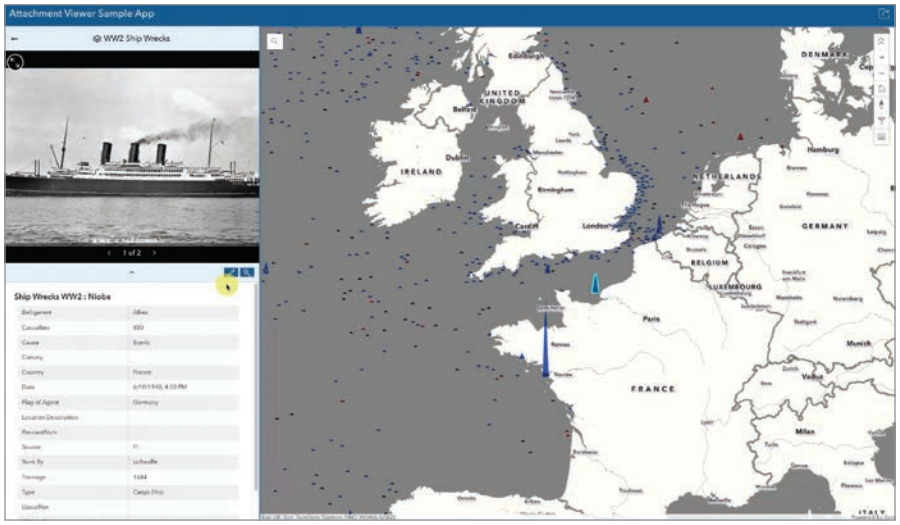


↑ An example app created with the Web Editor template.

Apps with Limited Editing Capabilities

Attachment Viewer

Use the Attachment Viewer template to display photos, videos, and PDF files stored as attachments alongside your map. While its editing capabilities are limited, it does allow users to update attribute information directly within the app. Attribute edits can be made through the pop-up panel that appears next to the attachment and map displays. This template is ideal for



← An example app created with the Attachment Viewer template.

↓ An example app created with the Reporter template.

workflows that involve reviewing data and making simple attribute updates.

Reporter

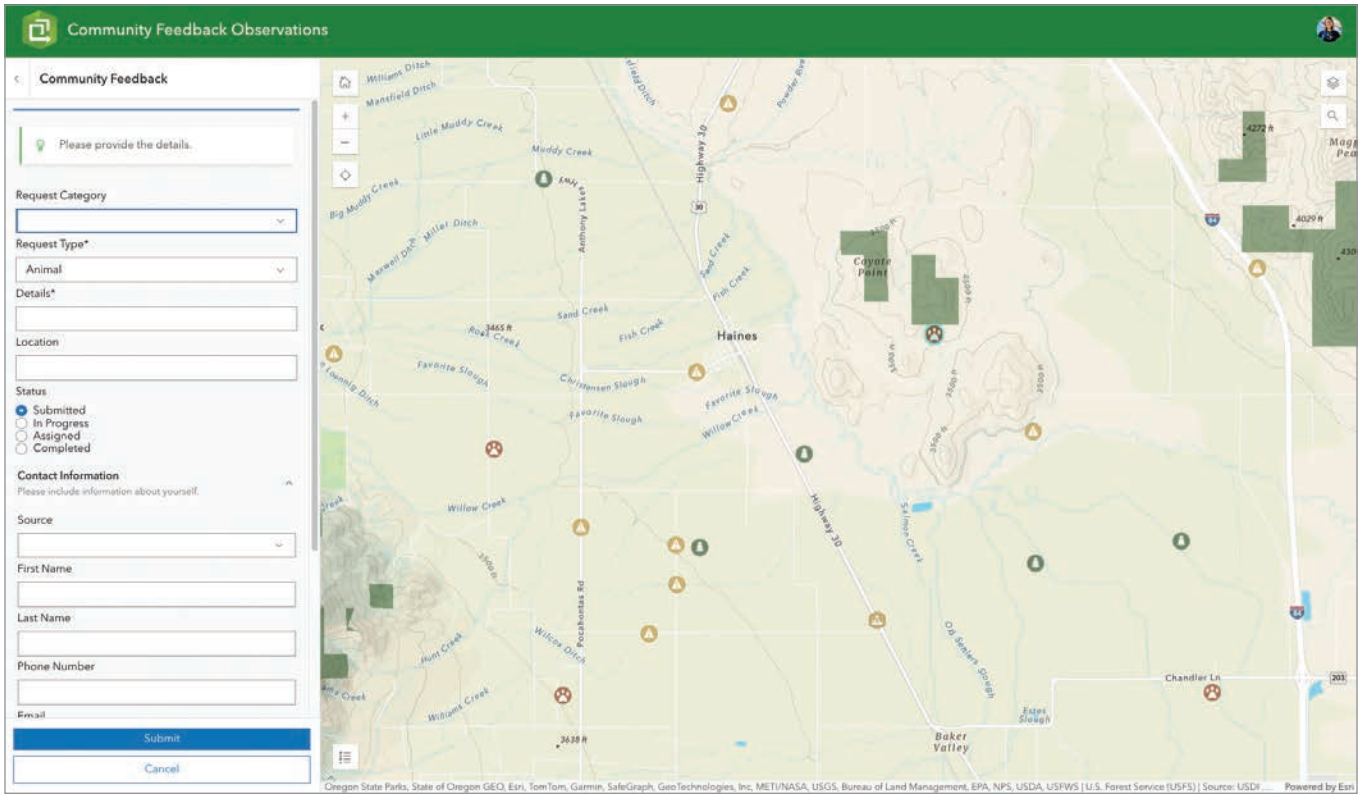
The Reporter template is designed for collecting and sharing information about new or existing issues within a specific area. Users can submit new reports, comment on existing ones, and express feedback through voting features with likes and dislikes.

The app allows users to add new features, and while editing capabilities are basic, these capabilities are designed to work with the specific needs of the Reporter template. To enable voting functionality, numeric fields must be configured to store like and dislike counts. Additionally, a related table is required on the reporting layer to capture and store user comments.

This template is ideal for community engagement and crowdsourced reporting, offering a structured yet interactive way to gather input from users.

About the Author

Sarah McDonald is a product engineer for ArcGIS Online who works on Instant Apps. She's been with Esri since 2016 and enjoys cycling, ceramics, and hanging with her dog.



How to Move ArcGIS Content Between Organizations

By Noah Paravicini and Sara Sanchez

One frequently asked question about ArcGIS content is this:

How do I move my published content from one organization to another?

It sounds straightforward, but the answer may not be as simple as it looks, and depends on several factors:

- Is the content moving across tiers?
- What types of content must be moved?
- What types of infrastructure, hardware, or operating systems are involved?
- Is the administrator who is conducting the workflow most comfortable using out-of-the-box tools for the migration, or do they prefer a programmatic workflow?
- Does the administrator who is conducting the workflow have experience using scripting tools to do the migration?

If you've explored a migration workflow before, you've likely found that some solutions provide only partial migrations for a subset of content, and others are more comprehensive.

But which one is the right one to use for your case? Which one is easiest? Are there caveats that you need to be aware of?

With those questions front and center, let's dive into the various migration tools and strategies available in ArcGIS: what they are, how to use them, and when each one is most appropriate for the task at hand.

ArcGIS API for Python: clone_items()

ArcGIS API for Python has multiple tools oriented around programmatically transferring content from one organization to another. Perhaps the most used of these tools is clone_items().

Part of the ContentManager class, this function takes in a list of item objects from one ArcGIS organization and re-creates that list elsewhere, in another ArcGIS organization. It has the ability to re-create almost any item type, with the main exception being ArcGIS Hub sites/pages.

The clone_items() function essentially disassembles items internally to determine

all their dependencies, and clones the sources for all required items in the new organization, where they are reassembled from the ground up.

The function has numerous features, such as the ability to search a target organization for existent cloned items, the ability to copy service data or rereference the original service, and the option to re-create services from scratch versus having them exported via a file format.

The clone_items() function has been around for a while and, as such, brings some legacy overhead with it. This means that, despite having perhaps the most extensive range of compatible content, there are some incompatibilities that may arise from the evolution of different components and item types in any ArcGIS system.

It is a popular first option for users looking to directly migrate a subset of items, though there are cases where other migration tools may function more effectively. It works for both ArcGIS Online and ArcGIS Enterprise organizations.

- **Experience level:** Some scripting experience required
- **Supported environments:** ArcGIS Online and ArcGIS Enterprise
- **Accessible via:** ArcGIS API for Python, ArcGIS Pro, and ArcGIS Notebooks (through Python)
- **Strengths:** Great for cloning almost any kind of item, including underlying services and data
- **Caveats:** Incompatibilities may arise with certain edge cases, often pertaining to feature services

ArcGIS API for Python: OfflineContentManager

Another, much newer migration tool in ArcGIS API for Python is the set of functions found in the OfflineContentManager module.

This module functions similarly to clone_items(), but with some key distinctions. Most notably, it allows you to create offline backups of your migration items, in addition to all their dependencies.

This means that a user trying to migrate items to multiple different organizations can avoid repeated calls to clone_items(), and that users can create backups of their items to use for restoration in the event that something goes wrong.

Another distinction from clone_items() is that OfflineContentManager gives users the option to avoid a rollback on failure. For example, if clone_items() fails in cloning any item in the process, every item from the call will be deleted. However, OfflineContentManager allows users to skip over failed items and carry on migrating the rest of the items.

One final difference is that, by default, this function must copy services by exporting them to a file geodatabase or shapefile and then reuploading and publishing them to the destination organization.

As opposed to clone_items(), the functions in this class are new, so not every item type is covered.

However, these functions do a great job of circumventing some of the pain points of clone_items(), such as incompatibilities when reconstructing services, repeated calls to the same function, and the all-or-nothing nature of clone_items().

This is a great option for users looking for a programmatic solution when clone_items() can't sufficiently accommodate the workflow. Users who would benefit from this option can use it to create backups and migrate to multiple different new organizations. It is supported for both ArcGIS Online and ArcGIS Enterprise organizations.

- **Experience level:** Some scripting experience may be required
- **Supported environments:** ArcGIS Online and ArcGIS Enterprise
- **Accessible via:** ArcGIS API for Python, ArcGIS Pro, and ArcGIS Notebooks (through Python)
- **Strengths:** Can create backups; can help when either the clone_items() function or GroupMigrationManager is not compatible
- **Caveats:** May be time-consuming; not all item types are supported yet

Group Export and Import

Group export and import is another handy option that allows users to export/import offline packages of items, oriented around the migration of a group's items. This tool is available to migrate content between ArcGIS Enterprise organizations and is extremely user-friendly: Users can use the interface in their ArcGIS Enterprise organization to export and import group content.

As an alternative, this workflow can be done programmatically using ArcGIS REST API endpoints for the export/import functions, in addition to a GroupMigrationManager module in ArcGIS API for Python.

One distinct advantage this tool has over the two previously mentioned functions is the ability to overwrite extant items with the same ID, allowing users to update items based on changes in a different organization without making duplicates in a new organization.

There are some caveats to consider with this option. For example, to migrate content using this method, the staging (import) environment must be on a version of ArcGIS Enterprise that is the same as or later than the development (export) environment.

In addition, item dependencies aren't automatically handled in the same way that they are with the prior two options. However, if all item dependencies are accounted for, and the migration is between two eligible ArcGIS Enterprise organizations, then export and import through the organization may be the easiest way to migrate content. As mentioned earlier, it's also great for users looking to overwrite or update their items.

- **Experience level:** No scripting experience required
- **Supported environments:** ArcGIS Enterprise
- **Accessible via:** GUI in ArcGIS Enterprise, ArcGIS REST API, ArcGIS API for Python, ArcGIS Pro, and ArcGIS Notebooks (through Python)
- **Strengths:** Easily accessible through the organization; can create backups
- **Caveats:** Not available for ArcGIS Online; not all item types supported

Distributed and Partnered Collaborations

Distributed collaboration and partnered collaboration are two disparate types of content-sharing mechanisms that are very different from those covered thus far. Distributed collaboration enables organizations to share content between ArcGIS Enterprise and ArcGIS Online or between multiple ArcGIS Enterprise deployments. Partnered collaboration, on the other hand, is specific to ArcGIS Online, as it supports the workflow to share content across ArcGIS Online organizations.

Collaborations are not designed to transfer the ownership of content from one organization to another; instead, as the name implies, they allow one organization to maintain ownership of items while sharing them with another organization to view or edit. Collaborations are a great choice to share content in a professional capacity, such as in a provider-client scenario, or to privately share owned apps and data for public consumption.

The terms of a collaboration are defined by the host to specify who the guests are; how many there are; whether guests can send content, receive content, or do both; and more. Collaboration does require a reasonably involved setup process. Administrators can do this through the organization's settings, or through a script such as one that leverages ArcGIS API for Python.

This workflow is truly a unique way to share, receive, and discover content while preserving ownership in a single organization. It also allows for the opportunity to share private items outside an organization, though the organization must carefully consider what content qualifies for this level of access.

- **Experience level:** No scripting experience required
- **Supported environments:** ArcGIS Online and ArcGIS Enterprise
- **Accessible via:** ArcGIS Online and ArcGIS Enterprise organization settings, ArcGIS REST API, ArcGIS API for Python, ArcGIS Pro, and ArcGIS Notebooks (through Python)
- **Strengths:** Unique method of sharing and level of accessibility; high level of customization
- **Caveats:** Geared toward sharing content as opposed to migrating it

WebGIS Disaster Recovery Tool

The WebGIS Disaster Recovery tool, while not specifically designed for content migration or sharing items, is intended as a large-scale option used to protect content within an entire ArcGIS Enterprise organization. This tool enables an administrator to create a backup of an ArcGIS Enterprise organization so that in the unforeseen event of a failure, the backup can be used to restore the organization.

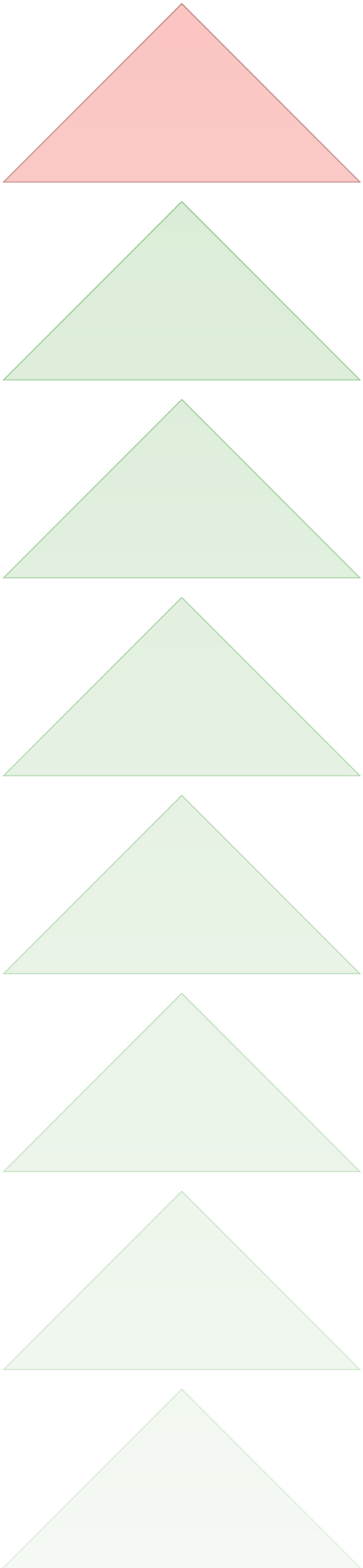
For content migration, this option is different from other technologies covered, though the core concept and goal remains the same: to maximize access and availability of data in ArcGIS. Because this tool was designed to ensure that the data in a specific organization remains available, it is often used to replicate content across environments. This is particularly useful for organizations that want to migrate all organization content to a new operating system, tier, or data center. It may also be used to ensure backups are available for critical apps and data when they are continuously accessed by numerous users or customers.

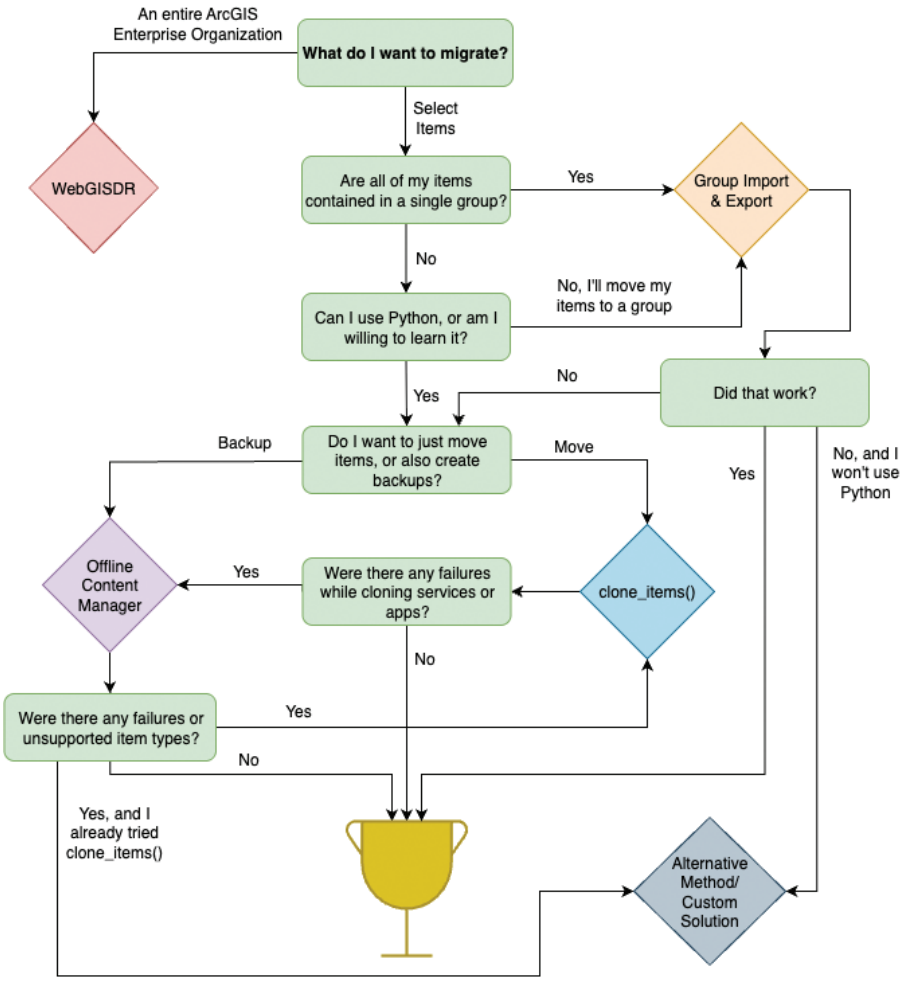
- **Experience level:** No scripting experience required
- **Supported environments:** ArcGIS Enterprise on Windows and Linux
- **Available via:** Built-in ArcGIS Enterprise tools
- **Strengths:** Can back up and migrate an entire organization; provides unmatched capability and level of completeness
- **Caveats:** May require more extensive knowledge of the full ArcGIS Enterprise deployment than other options

Other Tools

The migration tools covered thus far are all oriented around migration of various item types or even entire organizations. However, there are also a handful of assorted item-specific and situation-specific migration tools.

Some of these solve specific problems, while others provide a convenient way to migrate content given a limited scope.





- **Export Service and Publish Service Definition:** This pair of functions provide a highly convenient way to migrate services while retaining total parity in data and configuration in a new organization. Using the publishing tools in ArcGIS REST API in ArcGIS Enterprise, an administrator can export services as service definition (.sd) files and then republish them in another organization. This maintains the highest level of accuracy with data and configuration relative to any other method of exporting and importing feature services. Note: This feature is available in ArcGIS Enterprise 11.4 and later.
- **Migration with ArcGIS Experience Builder** (and ArcGIS API for Python): One specific but popular question is: How can I migrate the web experiences from my locally deployed Experience Builder app to my ArcGIS Online or ArcGIS Enterprise organization? ArcGIS API for Python provides a workflow to automate this process. Locally deployed applications may not directly communicate with a portal, so this workflow essentially bridges that gap.
- **Sharing API Functions:** ArcGIS REST API includes a sharing API to support all portal operations, including exporting, downloading, uploading, and publishing items. These functions work behind the scenes for other migration tools, such as the ArcGIS API for Python methods. These tools provide the most simplified building blocks for migration solutions, for those who wish to build their own custom solution.

Migration Options at a Glance

To help illustrate these options, the flowchart provided covers different scenarios and recommendations to migrate your content across ArcGIS Enterprise organizations. For migrations involving an ArcGIS Online organization, ArcGIS API for Python must be used. To follow the options available for ArcGIS Online, start near the center of the flowchart, in the box that says, "Do I want to just move items, or also create backups?" Note that collaborations aren't included as a workflow in the flowchart, as it is intended to highlight migration options (re-creating content) as opposed to sharing content.

About the Authors

Noah Paravicini is a developer on the ArcGIS API for Python team. Paravicini grew up in the Bay Area before going to Dartmouth, where he graduated in 2019 with a degree in computer science and environmental studies. He joined Esri in June 2022 and now resides in San Diego.

Sara Sanchez is a lead product engineer on the ArcGIS Enterprise team. She enjoys spending time at the lake, reading nonfiction, and cooking.

By Jesse Cloutier

Community Engagement Drives City Success in Arlington

The City of Arlington's Virtual Map is an internal application designed to be a central data repository for the city's GIS database. The app is available to all of the Texas city's roughly 3,000 employees, and about 200 of them use it every day.

According to Jeffrey Thompson, GIS applications developer for the City of Arlington, the availability of Virtual Map saves Arlington residents roughly $2 million a year while improving the customer service experience.

An application like Virtual Map relieves pressure on the city by reducing the need for additional resources, including more staff and added training costs. Virtual Map supports many different city functions, with its heaviest users relying on it for providing answers to questions from the public. And because most users of the application have no formal GIS training, simplicity of use is a must.

At the heart of this app is code Thompson developed that registers data from a REST endpoint as an ArcGIS Experience Builder data source.

"That's something that I think I might have been the first person to figure out how to do,"

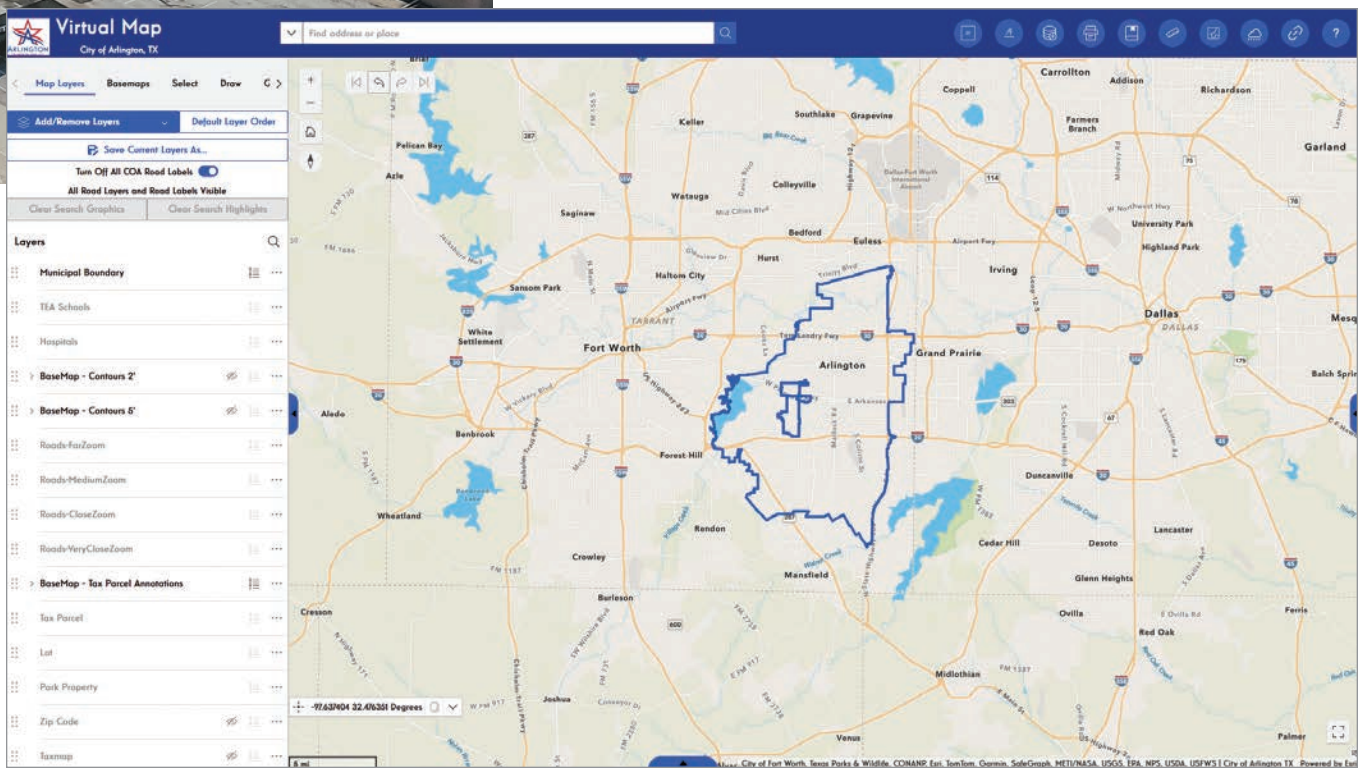
said Thompson. "It's opened up a lot of doors for us in Experience Builder."

Thompson was able to overcome limitations he'd run up against when using the typical method of adding data to maps in ArcGIS Experience Builder via ArcGIS Maps SDK for JavaScript. Data added through his alternate method is fully compatible with all the features in ArcGIS Experience Builder.

But getting to the bottom of this wasn't a solo effort. Thompson is a regular participant in Esri Community—Esri's free online platform for connecting users from around the world—and routinely relies on shared resources to help develop apps like Virtual Map.

"Esri Community was vital to figuring out how to do this," Thompson said. "I knew it must be technically possible because the Add Data widget can do it, but the functions were buried deep in the Experience Builder code, and I could not find them on my own. I asked this as a question on the boards and got a vital piece of code

> "That's something that I think I might have been the first person to figure out how to do."
>
> **Jeffrey Thompson**
> City of Arlington



↓ The default view of Virtual Map created in ArcGIS Experience Builder, featuring the Add/Remove Layers widget.

↑ This Virtual Map screenshot displays the custom Draw widget built in collaboration with other Esri Community members.

> "Esri Community was vital to figuring out how to do this."

from the developers. I know at least three members of the build team personally looked at and contributed to the answer."

A Community Contributor

Within the first hour of every workday, Thompson signs in to Esri Community to hunt down questions that need answers.

"I use Esri Community partly as a warm-up to my day by answering a few questions," he said. "That gets my brain started and helps me get on to my real work."

By "real work," Thompson means tasks like developing custom widgets, scripting for geoprocessing applications, and migrating data that the City of Arlington had in ArcGIS Web AppBuilder over to ArcGIS Experience Builder.

Even after he's turned to the day-to-day needs of his role, Thompson keeps tabs on Esri Community by periodically returning to check on conversations or by reviewing email notifications for new activity on posts he's following. Since he began using Esri Community in 2023, he's answered hundreds of other users' questions.

Thompson's employer is supportive of the time he spends in Esri Community. His involvement is an investment that has translated into efficiency gains and saved resources for the city.

"There have been a number of times where I've solved problems before they came up because I'd been out reading things that other people had posted," said Thompson. "Seeing the answers to those questions and knowing what problems could arise has been hugely beneficial in getting me past issues before they even show up."

Despite his growing presence in Esri Community, Thompson doesn't think of himself as a typical GIS person, having manifested this relatively new career trajectory out of a geology background. It was only after a manager pointed him toward Esri Community as a helpful resource for his then-new role that he began using the platform and contributing at a pace rarely seen among new members.

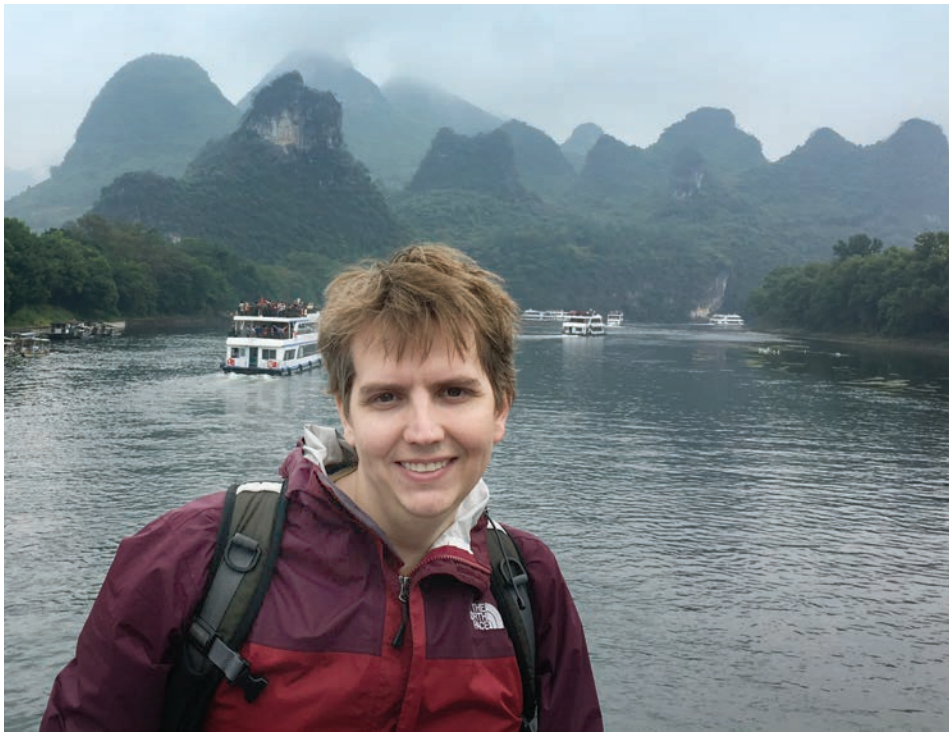
That involvement and the benefits to the City of Arlington have garnered appreciation from Thompson's higher-ups, some of whom have commended the relationships he's developed within the broader GIS community and how it reflects on the city.

Expanding Peer Support Through User Groups

Of Thompson's many touchpoints in the Esri Community, his coleadership in the Experience Builder Tips and Tricks user group and the Experience Builder Custom Widgets group are among his most prominent. In both open user groups, visitors can find helpful guidance, workarounds, and custom widgets specific to

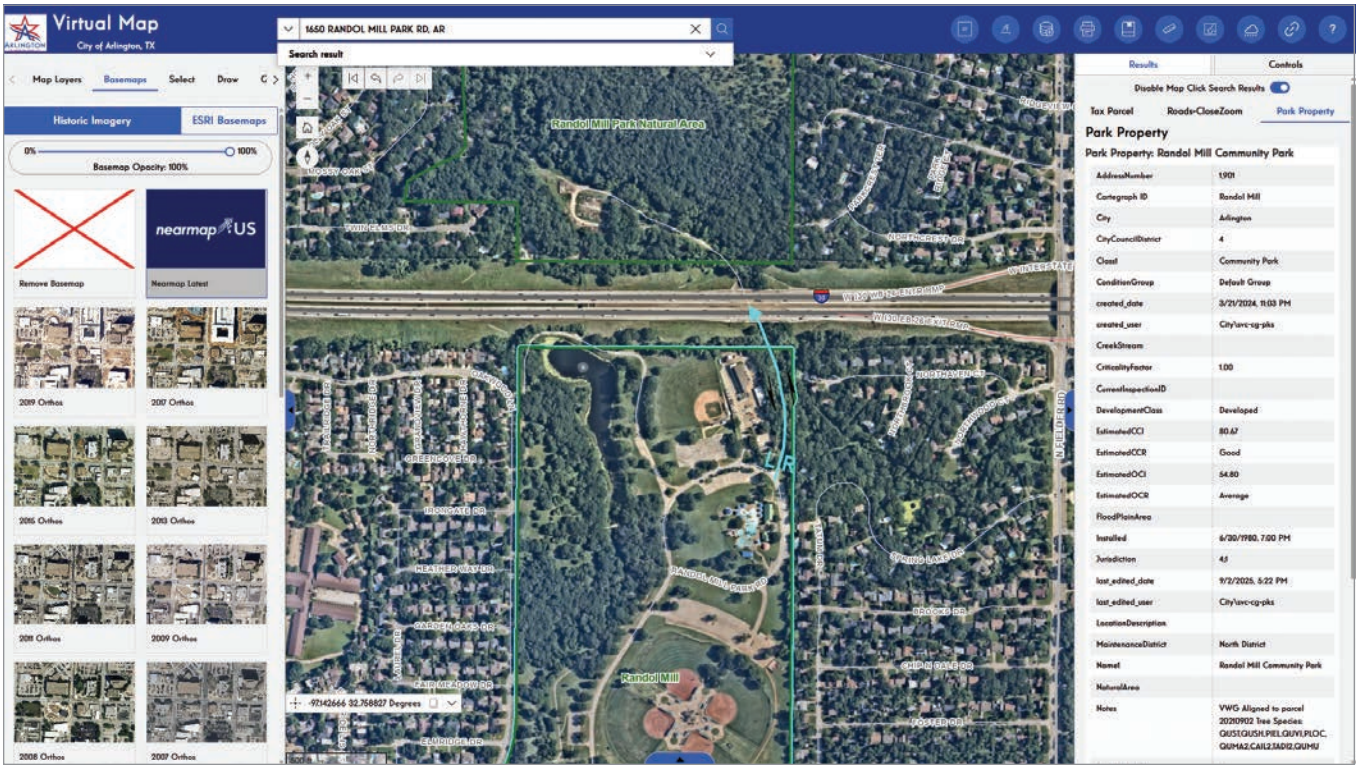
ArcGIS Experience Builder, a product in which Thompson has carved out a special niche for himself over the course of his migration duties.

After contributing to the Experience Builder Custom Widgets group, Thompson saw the need to expand the scope of knowledge to include more than user-made widgets. Finding that he was regularly repeating answers to the same questions from different Esri Community members, he created the Experience Builder Tips and Tricks group as a dedicated location for information from the customer side of product use. This could help other users find already-existing answers to their questions more easily. He also viewed it as an opportunity to constructively draw Esri staff attention to feature requests and improvements he wished to champion.



→ Jeffrey Thompson on the Li River in southeast China.

↓ This Virtual Map screenshot displays customization to the Search widget and the custom Identify widget.



> “You’ll solve problems before you even come across them yourself.”

In 2025, Experience Builder Tips and Tricks became the second-most frequented user group in Esri Community, with over 22,000 visits and more than 13,000 unique visitors. Messages of thanks from other users are common, which lets Thompson and other contributors know that their efforts are making a meaningful difference.

Thompson has always wanted the group to be a collaborative space and is constantly looking for more contributions from other contributors, especially when it comes to adding new content to the blog. For Esri Community as a whole, Thompson recommends new members start by subscribing to Question Boards.

“You’ll get so much information just by reading those questions and the answers,” Thompson said. “You’ll solve problems before you even come across them yourself.”

About the Author

Jesse Cloutier is an Esri Community manager who is focused on engagement and content. His guiding ethos is that community—people coming together around shared purpose, demonstrating collective support, and collaborating in mutually beneficial ways—is the most powerful source of progress in the world.

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