ArcNews

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Briefly Noted

Esri and UNFPA Collaborate on 2030 Census Round
Esri and the United Nations Population Fund (UNFPA) extended their strategic partnership in support of the 2030 census round. Building on a successful collaboration in 2020, the partnership aims to embed GIS technology in all phases of census work. The renewed partnership is significant for countries facing challenges in conducting their censuses. By providing national statistics and census offices with tools and financial support, Esri and UNFPA will help these nations achieve accurate and timely census data—essential for effective planning and development.

New Session Usage Pricing for Basemaps
Session usage pricing for basemaps, available through ArcGIS Location Platform, gives developers and organizations a more predictable and cost-effective way to integrate Esri basemaps into apps and business systems by aligning pricing with user interactions like panning, zooming, and searching. This is especially valuable for high-traffic apps or those with extended user sessions, such as real estate search portals, rideshare apps, or delivery tracking systems. It complements the existing tile usage pricing, which customers can still choose based on their needs.

A GeoPortal for Nature
In a partnership with the International Union for Conservation of Nature (IUCN), Esri is making a $10 million in-kind donation to expand access to data, maps, and GIS technology in support of Nature-based Education (NbE). The donation will help IUCN stand up the new NbE GeoPortal, which will allow students, teachers, and conservationists worldwide to collaborate, explore maps, and develop technical skills.

Iraq Counts Its People

After 37 Years of War and Waiting

For two days in November 2024, Iraq shut down almost entirely to conduct its first full census since 1987. Some 125,000 census workers with tablets went door to door to count every resident in a nation that spent nearly four decades consumed by war, occupation, and sectarian violence.

The shutdown was controlled. People could visit shops for essentials but couldn't travel between districts. Movement between cities was banned. Streets that had emptied so many times during conflict were now cleared by design rather than fear. Families stayed home and waited for census workers to arrive.

"An accurate census is essential for ensuring equitable representation and informing critical decisions regarding investments in health care, education, and housing that affect all residents," said Linda Peters, global director of official statistics

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← When Iraqi prime minister Mohammed Shia al-Sudani visited the Commission of Statistics and GIS (CSGIS), census officials demonstrated how the geospatial framework delivers clear, data-driven insights to government leaders.

Building the Geospatial Nervous System

Jack Dangermond's Vision for the Future

By *xyHt* staff

This article was originally published in xyHt *magazine. It has been lightly edited for style.*

The geospatial industry is moving through a period of profound transformation. Advances in reality capture, artificial intelligence, and cloud integration are converging with urgent global challenges, from climate resilience to urbanization. In this moment, few figures are as influential as Jack Dangermond, founder and president of Esri. For more than 50 years, he has guided the evolution of geographic information systems from a specialized tool to a global platform shaping decisions across governments, businesses, and communities.

In an extended conversation with *xyHt*, Dangermond shared not just technical observations but a sweeping vision for the future of GIS. He spoke of digital twins as living systems, of a distributed geospatial infrastructure that functions like a planetary nervous system, of intelligent agents augmenting professional expertise, and of

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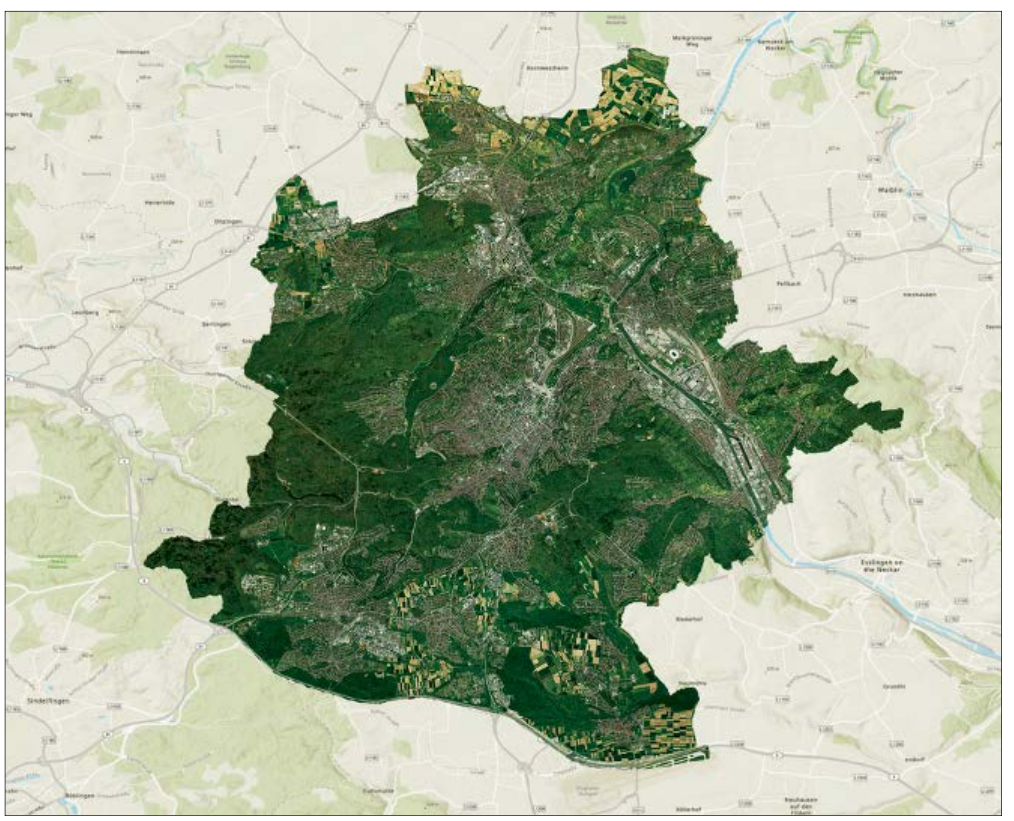

↑ Maps create a common language for decision-making. (Image courtesy of GeoFly GmbH.)

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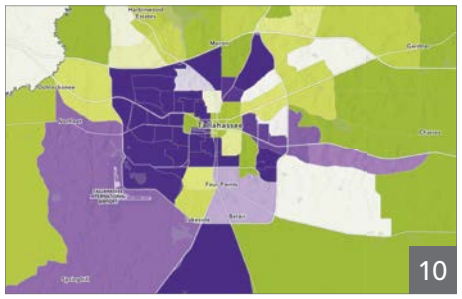
Some claim that Easter Island suffered from ecological and societal collapse. Using drone and satellite imagery along with GIS, archaeologists have developed a digital twin that disproves this theory and uncovers new evidence about the island's legendary statues.



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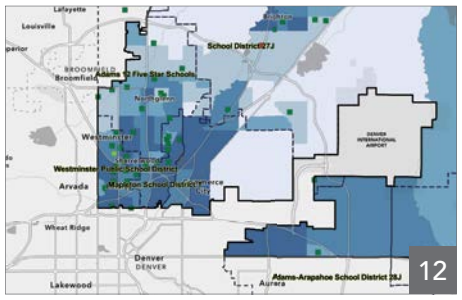

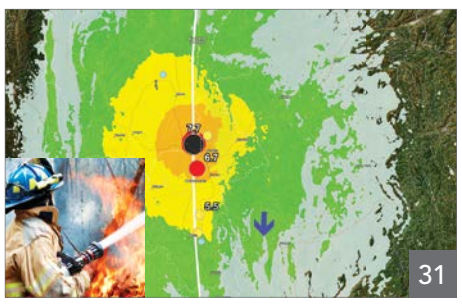

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AI Assistants in ArcGIS Provide Practical Help and Give Useful Results

To help users boost productivity, streamline workflows, and access information faster, Esri has expanded and enhanced AI-powered assistants across ArcGIS—and they are all steeped in the trusted security Esri is known for.

These assistants—available in beta or preview—now support natural language input, transforming how users interact with ArcGIS. From data collection, cartographic labeling, and translation to app creation, coding, and storytelling, AI assistants make many GIS tasks more intuitive and efficient.

Here's a roundup of the AI assistants that are available now.

Quickly Improve Metadata for Items in ArcGIS

Use the Item Details assistant (beta) to get suggestions on titles, summaries, descriptions, tags, and field properties when filling out item details. Integrated directly into the item page, this assistant enhances searchability by both people and AI. Available in ArcGIS Online in private beta and ArcGIS Enterprise 12.0 in beta, this assistant supports the creation of meaningful, complete, and discoverable metadata, whether users are creating content from scratch or refining it.

A Helper for ArcGIS Arcade Expressions

The Arcade assistant (beta) helps users write Arcade expressions more efficiently. It supports a variety of tasks, including doing field calculations; making pop-ups; writing attribute and element expressions; creating labels; generating renderers for smart mapping; and aggregating field expressions, such as clustering or binning. The assistant uses a consistent language and toolset across experiences and is currently available in Map Viewer, ArcGIS Web Editor, and Scene Viewer. Support for the assistant will also be added in other areas where authoring Arcade expressions is possible.

Work Faster in ArcGIS Business Analyst

The Business Analyst assistant (preview) employs natural language prompts to help users complete common tasks more quickly, such as generating reports, building color-coded maps, and comparing sites. This in-app tool makes mapping and analysis more accessible to users with varying levels of experience. By simplifying workflows in ArcGIS Business Analyst, the assistant helps users focus on garnering insight rather than managing the interface.

Easily Find Maps, Layers, and Data in Microsoft Teams

Accelerate productivity with the ArcGIS for Teams assistant (beta). Using natural language prompts or search queries, users get step-by-step guidance; relevant search results; and recommendations for ArcGIS maps, layers, datasets, and more. The assistant makes it easier to find ArcGIS items without leaving Microsoft Teams.

Equip Communities to Use ArcGIS Hub

The ArcGIS Hub assistant (beta) is designed to help users interact with open data more intuitively. Embedded within an organization's Hub site, it interprets natural language questions and produces answers using the public datasets shared on that site. Available with an ArcGIS Hub Premium license, the assistant finds relevant content and, if applicable, returns answers along with a map displaying related spatial data. This makes complex data easier to understand and empowers users to make informed decisions.

The Robust Capabilities of ArcGIS Pro Get Democratized

The ArcGIS Pro assistant (beta) enhances the ArcGIS Pro experience by enabling users of varying abilities to take advantage of the software's robust capabilities. With the assistant, users can explore documentation, generate ArcPy code and SQL and openCypher queries, and trigger common actions using natural language. Available now in private beta through the Early Adopter Community, this assistant is accessible by invitation only. To request to be added to the Early Adopter Community for the ArcGIS Pro assistant, go to links.esri.com/pro-assistant.

Multiple AI Tools in ArcGIS StoryMaps

Four tools in the ArcGIS StoryMaps assistant (beta) help creators craft more engaging, accessible, and visually consistent stories through intelligent, context-aware support. The Writing assistant refines tone and structure to make text more polished and audience appropriate. The Insights assistant provides metrics related to readability, tone, and estimated reading time to help authors fine-tune their stories. The Accessibility assistant suggests descriptive alternative text for images to ensure inclusivity and compliance with accessibility best practices. Finally, the Theme assistant generates cohesive color and font combinations based on written prompts, helping users design compelling stories.

Help for Building Surveys in ArcGIS Survey123

The Survey123 assistant (preview) lets users quickly transform their ideas into structured questions and draft surveys in ArcGIS Survey123. Using natural language prompts in a conversational interface, users generate surveys and refine them in the web designer. The assistant's translation capability makes it easier to localize surveys by converting questions into multiple languages in both Survey123 Connect and the web designer. Additionally, users can implement machine learning models in the Survey123 field app to analyze image responses and automatically classify conditions, detect objects, or redact sensitive information from photos.

Get Fast Answers from Esri Documentation

The documentation assistant (beta) provides a seamless, natural-language interface for interacting with Esri documentation. Users can ask direct questions and receive clear, concise answers without having to manually browse through pages. The assistant helps locate specific details, understand configuration steps, and discover best practices—making it easier to find the right information faster.

Create Multilingual Experiences in ArcGIS Instant Apps

Simplify the translation process for ArcGIS Instant Apps by using the translation assistant (preview). This powerful tool, accessed through the language switcher feature, helps quickly convert app content into multiple languages, reducing manual effort. Whether preparing apps for global audiences or complying with specific requirements, the assistant makes it easier to deliver inclusive experiences. Keep in mind, it's always good practice to review translations for accuracy.

Why You Can Trust AI in ArcGIS

As AI assistants get integrated across ArcGIS, security teams at various organizations are asking important questions about the safety of AI. To build confidence in Esri's commitment to security and data protection, Esri has clearly outlined its principles when it comes to developing with AI and is offering practical resources to users.

A new Trusted AI tab can be found on Esri's ArcGIS Trust Center website (trust.arcgis.com). There, users can explore Esri's guiding principles for AI, which revolve around security, privacy, transparency, fairness, reliability, and accountability.

Additional resources within the Trust AI tab include:

- AI transparency cards: These are standardized summary cards that answer common questions about an AI feature, such as what it does, how it works, what data it uses, and what safeguards are in place. Esri is rolling this out progressively, as transparency cards are finalized for each AI assistant.
- Implementation best practices: This guidance helps organizations prepare to implement Esri's AI assistants to significantly improve decision-making and operational efficiency.

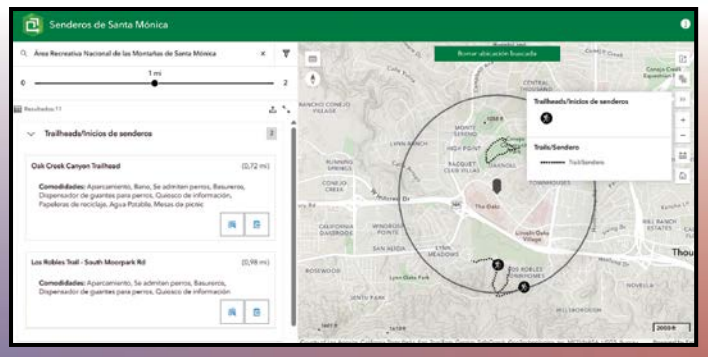
While AI assistants are powerful tools, Esri encourages users to validate the results before making decisions based on them.

How to Access the AI Assistants

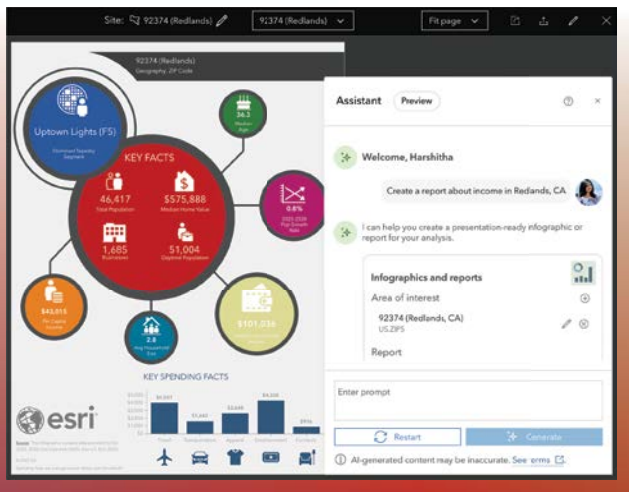
Currently, Esri's AI assistants are available, either in beta or preview, in ArcGIS Online. (The Item Details assistant is the only assistant in ArcGIS Enterprise 12.0 and ArcGIS Online.) Preview allows users to use AI assistant features in their ArcGIS environment for a limited time and provide feedback before general release. Beta is an earlier release stage.

To enable the assistants, go to the **Settings** tab on the ArcGIS Online organization page. In the AI assistants section, toggle **Allow use of AI assistants by members of your organization**. Note for beta access: Users need to disable the **Block Esri apps and capabilities while they are in beta** setting. This can be done in the Security section under Apps.

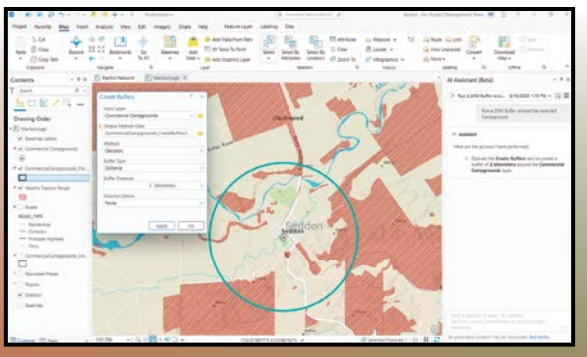
To learn more and explore setup guidance and best practices, visit the AI Configuration site at link.esri.com/configure-ai.



↑ The translation assistant helps convert app content into multiple languages.



→ With the Business Analyst assistant, users can complete common tasks—such as generating reports or comparing sites—more quickly.



↑ The ArcGIS Pro assistant triggers common actions, such as creating buffers.

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Iraq Counts Its People

at Esri. "By providing comprehensive data on current conditions—including population distribution, living arrangements, and family composition—a census facilitates the fair allocation of resources to effectively serve Iraqi society."

The census form was long and detailed. Workers often made two or three visits to each household. They asked extensive questions about people's dwellings—the condition of buildings, the number of rooms, the types of utilities and appliances—as well as household composition and economic circumstances. They also documented building damage to understand where rebuilding still needed to happen. The message before, during, and after the census centered on development—capturing data to meet people's needs.

This operation would have been impossible just years earlier when the Islamic State, or ISIS, controlled large portions of the country. Sectarian violence made coordinated national efforts unthinkable. But Iraq had achieved enough stability to complete an ambitious census that would reveal not just how many people had survived decades of conflict but also where they lived, what they needed, and how the government could finally plan for their future.

The final count reached 46.1 million people—an increase of 14.5 million since the last unofficial estimate in 2009. The data showed what statisticians call an expansive pyramid: a large young population at the base with more than half born after 2003, supporting smaller numbers of middle-aged and elderly residents. It's the structure of a nation rebuilding and looking forward, with the comprehensive data foundation needed to make informed decisions about where to build new schools, hospitals, and roads—and where to deliver services—for the first time in decades.

Technology Enables the Count

Planners at the country's Commission of Statistics and GIS (CSGIS) agency used satellite imagery and ArcGIS Pro to divide Iraq into enumeration areas—geographic zones sized so each census worker could survey roughly 50 households within the two-day window. Each of the 125,000 mobile workers received a tablet preloaded with satellite imagery showing their assigned area and the households they would survey.

The tablets ran a mobile data collection app developed by RealSoft, an Esri partner from Jordan, that integrated the incoming data into ArcGIS. The census itself demonstrated Iraq's improving connectivity infrastructure. Workers relied on mobile networks to transmit data in real time across most of the country. The results validated this progress: Roughly 80 percent of Iraqis now have internet access. While gaps remain—particularly in desert regions and remote villages—this expanding digital infrastructure both enabled the census and revealed where investments in connectivity could serve citizens and unlock economic opportunities and government services.

Atlas GIS, Esri's distributor in the region, played a crucial role in building this technical capacity. Staff hosted services and training workshops that enabled the CSGIS team to migrate from ArcMap to ArcGIS Pro. They also provided ongoing technical support throughout the census operation.

Officials monitored progress from a command center where dashboards built with ArcGIS Dashboards tracked completion rates and flagged areas needing support. The geospatial planning involved designing reports that could quickly tabulate the data to provide insights about the questions the census was designed to answer, guiding data-driven decision-making.

The geospatial framework proved essential for managing an operation across a country still rebuilding from conflict. Iraq's infrastructure remains uneven—some neighborhoods have reliable electricity and internet, while others lack basic services. The census planners used GIS to map these disparities, ensuring that enumeration areas accounted for factors like road conditions, security considerations,

→ The agency used ArcGIS Pro and high-resolution satellite imagery to divide the country into precise enumeration areas.

← The prime minister's visit to CSGIS took place at the start of the census.

and communication infrastructure. This same geographic intelligence that enabled the census will now guide reconstruction priorities, showing exactly where new schools, hospitals, water systems, and power grids are most needed.

What the Census Left Out

Census planners made a strategic decision: no questions about ethnicity or religion. Ignoring all political pressure, the questionnaire focused solely on Iraqis' practical needs, such as housing, education, employment, and infrastructure.

Iraq's population includes Arabs, Kurds, Turkmen, Assyrians, and other groups, along with multiple religious communities. The country's post-2003 political system operates on a delicate sectarian power-sharing arrangement. This makes demographic data potentially volatile. Questions about ethnicity derailed previous census attempts. This time, officials avoided those questions entirely.

An extensive media campaign promoted the effort under the slogan "Census for Development." Prime minister Mohammed Shia al-Sudani reinforced this message in an official address, stating that "the census is not merely an accumulation of numbers but the dividing line between estimation and facts—a decisive tool for making effective and vital decisions." The messaging emphasized that accurate data would drive the fair distribution of resources and guide infrastructure investments. It succeeded: People cooperated with census workers.

Security forces provided crucial support, particularly in neighborhoods where workers might face resistance. Some residents, especially those receiving social security benefits, worried that disclosing details about their households might threaten their assistance. In these areas—often poorer neighborhoods with lower education levels—police protection helped ensure workers could complete their jobs safely.

From Census Data to National Planning

The results of the census carry substantial implications for Iraq's political and administrative planning. The census took place November 20–21, 2024, with preliminary results announced November 25. The final, more detailed results were released a year later, in November 2025.

Iraq holds elections every four years for both national and regional governments. Parliamentary representation is tied to population, with 100,000 people corresponding to one parliamentary seat. Since the census results came in after the 2025 election, it will be another four years before any shifts in population affect parliamentary outcomes.

The federal budget will now be distributed according to actual population figures rather than estimates. This addresses a long-standing source of friction between provinces and establishes a data-driven basis for resource allocation.

The census documented not just where people live but also the quality of their housing, their access to basic services, and their economic activities. This detailed information enables targeted investments in areas that have lagged behind.

One of the most concrete development priorities involves education. The government has announced plans to build thousands of new schools based on census findings. The geospatial framework lets planners identify optimal locations by analyzing population density, age distribution, existing school locations, and transportation networks. This geographic approach promises to place schools where they're most needed rather than where political considerations might otherwise dictate. Similar logic applies to roads, water systems, electricity grids, and health-care facilities.

The census establishes a baseline for measuring progress. Iraq's tradition has been to conduct a census every decade, though conflict prevented that for nearly four decades. If the country maintains this schedule, the next count will show whether living conditions improved, displacement reversed, and opportunities expanded.

A Generation Born After War

More than half of Iraq's population was born after 2003. For this generation, the conflicts that dominated their parents' lives—the Iran-Iraq War, the Gulf Wars, the sectarian violence, the ISIS occupation—have abated. The demographic data confirms what's visible on Iraqi streets: a vibrant young population that expects connectivity, education, and opportunity.

The census provides the foundation to meet those expectations. Population clusters reveal where development has concentrated and where infrastructure gaps remain. The geographic data identifies neighborhoods with overcrowded schools, areas where water and electricity access lags, and regions where economic activity could expand with targeted support.

Recent years have shown what stability enables. Baghdad has seen new towers rise, infrastructure restored, and schools and hospitals reopened. The census documents this progress while identifying where similar investments will have the greatest impact. Those who grew up during decades of instability often speak of wanting different futures for their children—futures the census data can now help plan systematically.

International opportunities followed the completed population census. Iraq's statistical delegation visited Armenia with support from the United Nations Population Fund to share their methodology and experience. Iraq presented its census workflow improvements and the digital transformation of civil registration and vital statistics.

For a country that spent nearly 40 years disrupted by conflict, the census represents a shift toward evidence-based governance. The foundation exists to plan systematically for a population that, for the first time in generations, has reason to expect stability rather than crisis.

Drone Imagery and GIS Help Recast the Story of Easter Island

When Dutch explorers arrived on Easter Island more than 300 years ago, the legendary giant statues known as *moai* filled them with wonder. Looking around, they saw no trees, no signs of cordage, and a relatively small population. They couldn't explain how the people of this remote Polynesian island, more than 2,000 miles from Chile, erected hundreds of these figures that stood three stories high along the coastline.

The narrative they constructed about Easter Island—known as Rapa Nui to locals—was one of ecological and societal collapse that would endure for generations. The explorers assumed the locals had cut down all the trees as part of the process for moving the statues. They also believed there must have been more people to move the monuments, but that a serious population decline had occurred. They speculated that overpopulation and depletion of resources led to war and cannibalism, culminating in a devastated island.

This cautionary tale of Rapa Nui is now being challenged by archaeologists Dr. Carl Lipo, professor at Binghamton University, and Dr. Terry Hunt, professor at the University of Arizona. They're using remote sensing techniques and GIS to uncover new evidence about the island's history.

"As an island without trees," Lipo said, "it's pretty well suited for remote sensing." When he and Hunt began their research in 2001, they had expected to add evidence to the collapse theory. But they found no signs of warfare—no weapons, fortifications, or traumatized skeletons.

To learn what really happened there, they began studying the island's historical settlements, available resources, and agricultural practices.

Evolving Data Collection, from Kites to Drones to Advanced GIS

The initial remote sensing methods Lipo and Hunt employed were born from masterful creativity. In 2001, satellite imagery didn't deliver the level of detail available today, and drones weren't yet widely accessible.

"We started flying kites with digital cameras that had mechanical shutters, using little triggers to press the buttons with radio controls," Lipo said. "We'd take photos of wherever the wind would take the kites, and then we'd stitch the photos together as best we could." It took months to document a site, and more time to process the imagery.

Advancements in remote sensing and GIS technologies, along with the democratization of drones, have created new opportunities for the researchers. They can now fly drones over Rapa Nui and capture high-resolution images of the entire island in just a few days. Using ArcGIS Reality for ArcGIS Pro, they can process the drone footage within hours and quickly layer on satellite images that provide robust detail, useful for quantifying change even at the ground level.

GIS mapping and analytics software has also been crucial for turning the research into something shareable.

"We took 20,000 photos and were like, 'Now what?'" Lipo said. "It was a challenge not only to figure out how we'd process the data, but how we could turn it into a product and share it in a way that was meaningful."

There are many ways archaeologists can generate data, but it often ends up in a hard disk or in a file format that few people can use. GIS is helping turn the Rapa Nui data into a visual story anyone can understand.

Using Scene Viewer in ArcGIS Online, the researchers created a digital twin, or 3D replica, of the island (available at arcg.is/qu59O1). This means they can study Rapa Nui digitally, without damaging sites through excavations. They can also use it to share their data and models with locals, collaborate with other experts, and monitor changes to the landscape over time. The digital twin is proving to be an essential tool in efforts to engage the Rapa Nui community and uncover the truth about their past.

Imagery Reveals a History of Ingenuity

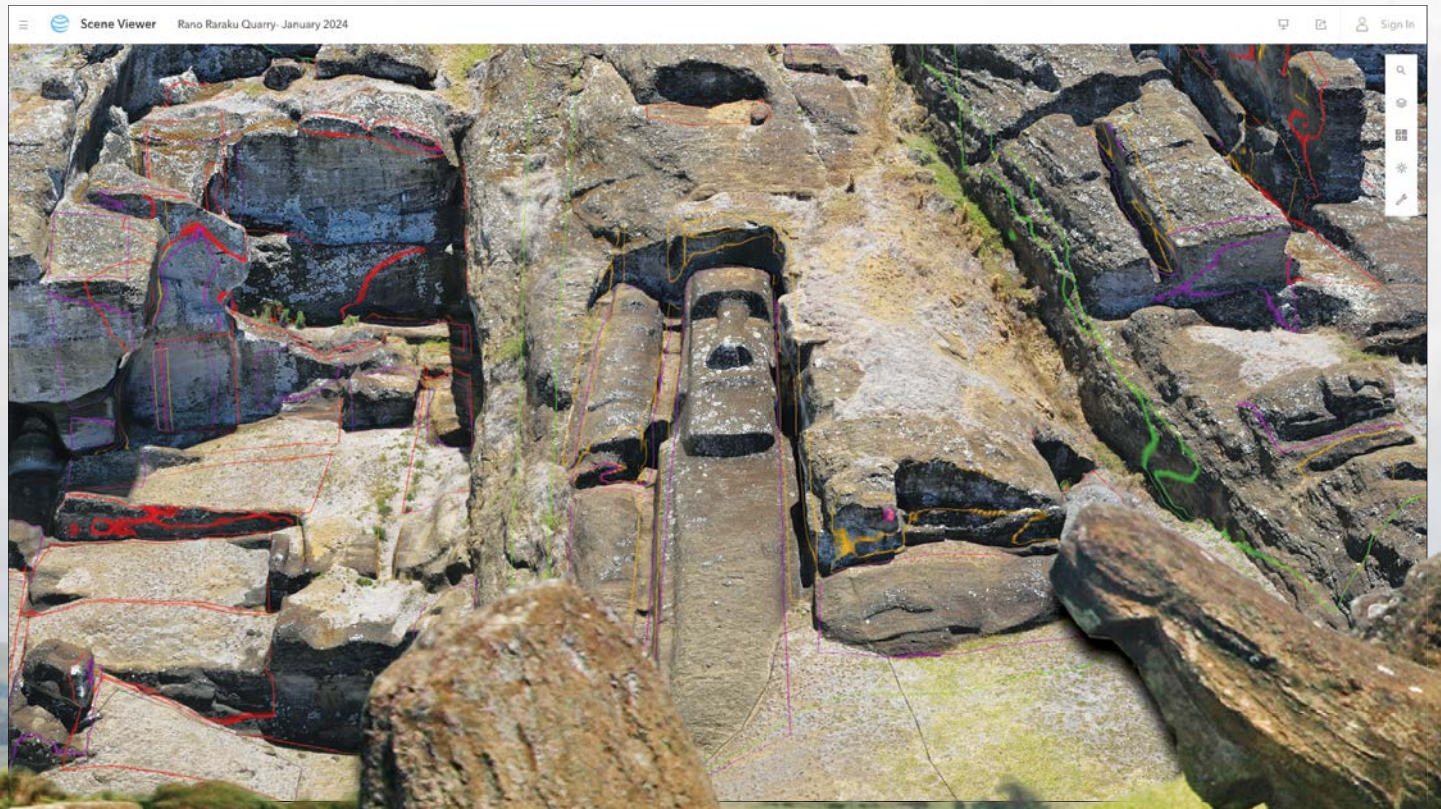
Studying images of Rapa Nui, Lipo and Hunt found that early inhabitants—in stark contrast to common theories—were living well within the means of their limited resources. In fact, they established sophisticated agricultural practices in a place that was not ideal for growing crops. The island's soil was weathered and depleted of nutrients needed for plant growth. Yet they were able to increase plant productivity by covering the soil with pulverized rock. This custom, known as rock mulch gardening, helped produce nearly half the food they ate, which included sweet potatoes, taro, yams, and bananas.

Further analyzing the island's rock mulch gardens, the researchers calculated that previous claims regarding the amount of food they produced were overestimated. This finding has helped verify that Rapa Nui's population was never more than a few thousand people at any given time.

Equally sophisticated among early Rapa Nui people were their water management practices. Lipo and Hunt use thermal imaging drones to study water features around the island. There are no permanent surface freshwater sources, leaving many scholars to believe forest loss was to blame for the population decline. However, imagery analysis with GIS has helped reveal other water sources that sustained the islanders. Along the coastline are locations where groundwater emerges at the tide line, known as submarine groundwater discharge. These springs would have been resilient to droughts. And though the seawater in these locations is brackish, the people of Rapa Nui built well-like traps to capture groundwater before it mixed with salt water.

While there is no question the island experienced deforestation, the research Lipo and Hunt have collected demonstrates that trees were not critical to the community's survival. Furthermore, the trees weren't used to move the famous moai. "Palm wood isn't very strong," Lipo said, "so the trees could not have supported the weight of the statues."

Locals have long claimed the moai "walked out" into the landscape. In a 2012 *National Geographic* feature (links.esri.com/NatGeoHuntLipo), Lipo and Hunt suggested a new theory that, in a way, speaks to this account. They proposed that the Rapa Nui people engineered the statues to move in a rocking motion, and that it only took a little physical effort and some rope to transport them



← High-resolution drone imagery captures *moai* in various completion stages—some barely roughed out, others nearly finished. This level of detail helps archaeologists understand carving techniques without disturbing the fragile archaeological site.

→ Completed moai stand along the quarry slopes—evidence of the sophisticated engineering that moved these multiton figures. Locals long claimed the statues "walked" into place, and research suggests they were rocked into place with rope.

into place. A video to support this theory—links.esri.com/StatueWalk—shows a team organized by the researchers demonstrating how it could have worked.

What We Can Learn from the Rapa Nui People

Lipo and Hunt have surfaced a story of ingenuity, countering those of catastrophe. Based on imagery analysis and archaeological data, it's evident that the islanders found inventive ways to live sustainably—and did so until contact with Europeans in 1722.

Outsiders brought disease, violence, and slave raids. But up until that point, the evidence shows impressive adaptability. It shows that this was a collaborative community. It shows that rather than being responsible for their own downfall, the people made the most of what was available to them. "They had no choice but to figure it out," Lipo said.

In this way, Rapa Nui research offers modern-day societies hope for how we can adapt to overcome our own challenges. And the digital twin of the island connects the local community to prove their history is one to be proud of.

The latest Rapa Nui research from Lipo and Hunt is available on *PLOS One* at links.esri.com/LipoHuntResearch.

↓ Archaeologists created a digital twin of Easter Island using drone imagery processed in GIS. Pink and purple highlights mark hundreds of moai at Rano Raraku volcano's quarry, the birthplace of the legendary statues.

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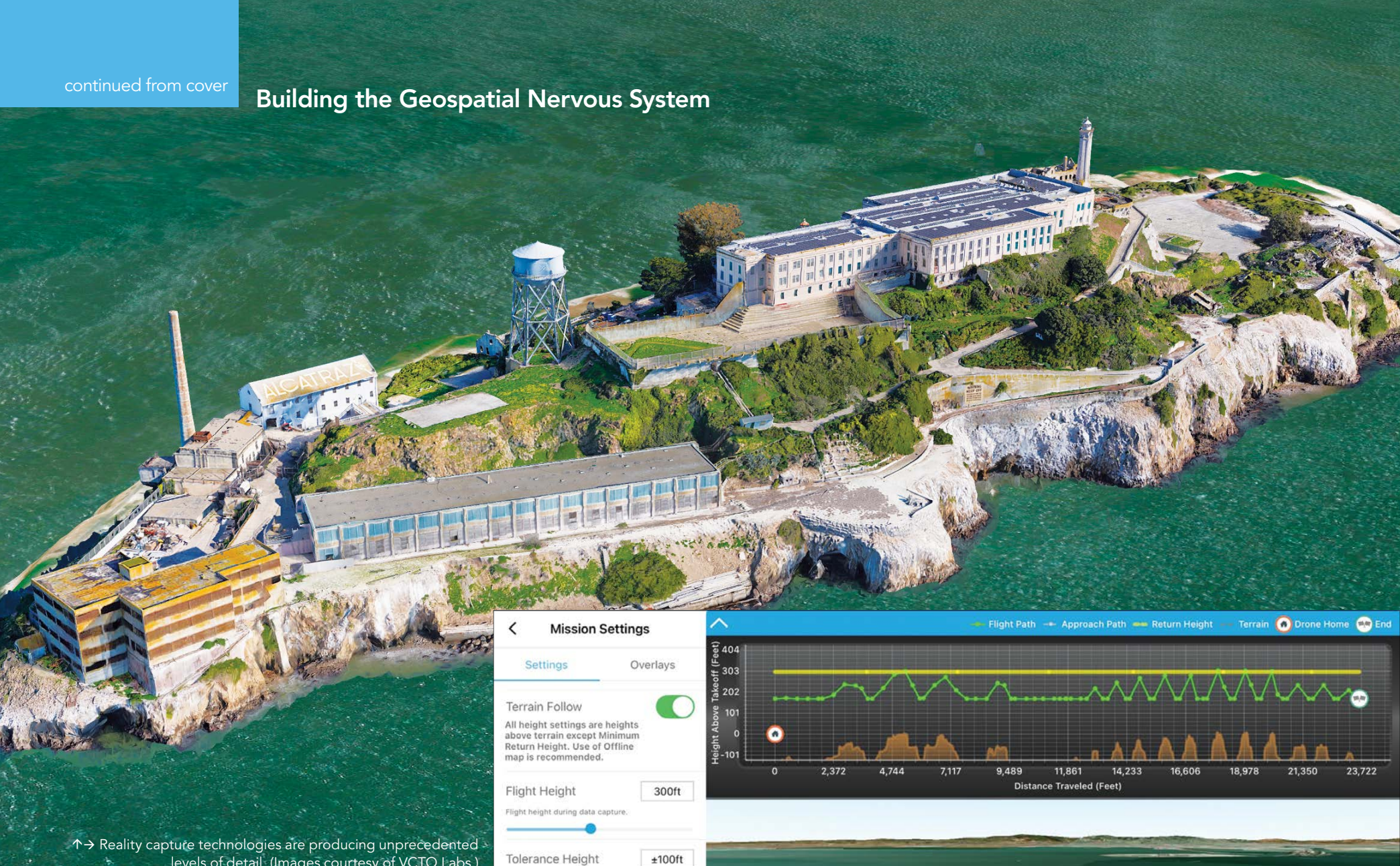
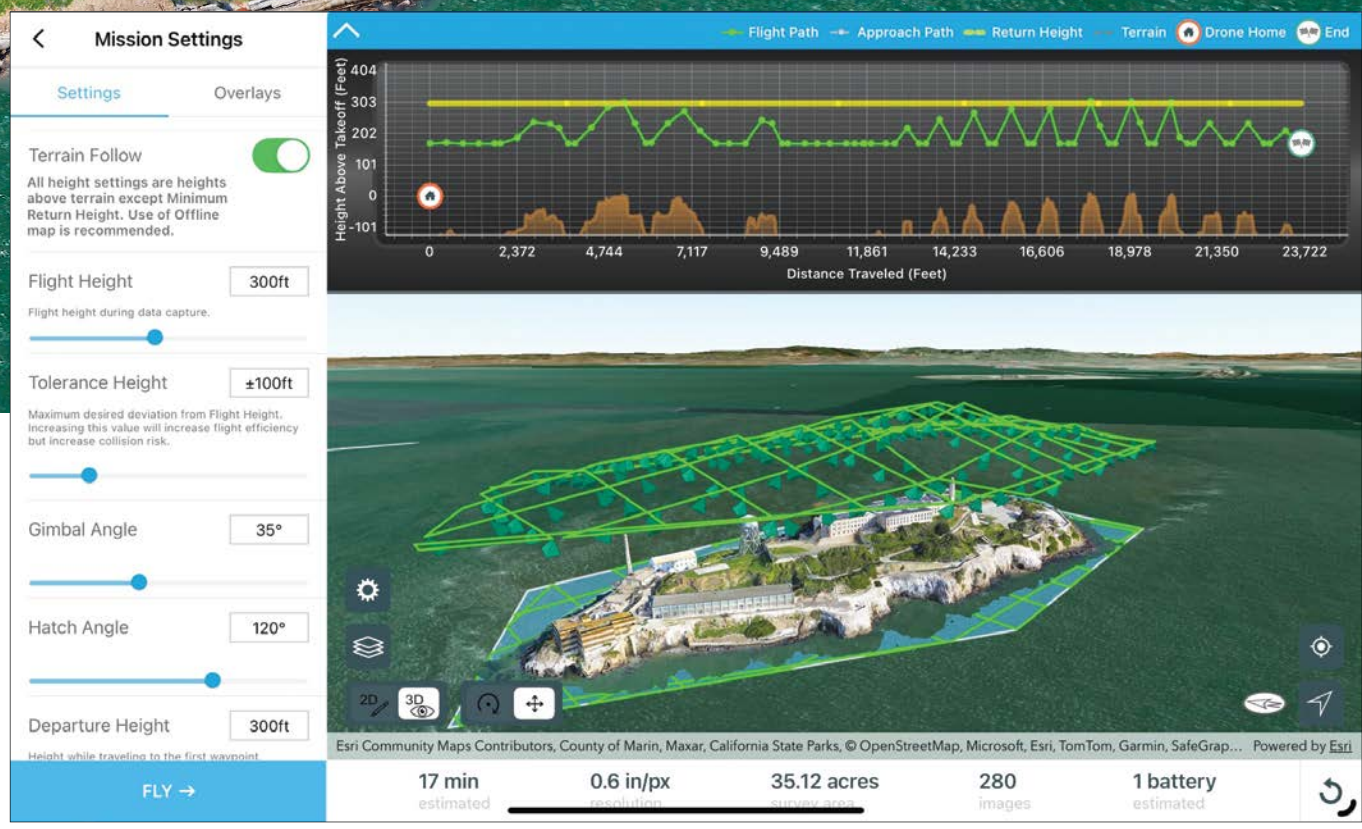
Building the Geospatial Nervous System





↑→ Reality capture technologies are producing unprecedented levels of detail. (Images courtesy of VCTO Labs.)

the cultural work needed to bring it all together. The picture he painted is not simply about software—it is about reshaping how society organizes knowledge and acts upon it.

Geography as the Science of Integration

Dangermond returned again and again to geography itself, which he describes as the science of integration. Geography, in his words, "is everything." It weaves together geology, sociology, climatology, hydrology, and countless other disciplines into a coherent framework for understanding the world.

GIS, he explained, is the tool that abstracts those disciplines into usable form. By organizing observations and measurements into layers—cadastral boundaries, soil maps, land use classifications, transportation networks, imagery—GIS makes geography computable. The common denominator is location, which he called "the integrator." Location allows data from disparate sources to be aligned, compared, and analyzed.

This integrative function is more than an academic exercise. It allows planners, scientists, and policymakers to see patterns that would otherwise remain invisible. When zoning maps are overlaid with floodplain data, risks emerge. When vegetation indexes are combined with soil and climate models, agricultural opportunities become clearer. Geography, mediated by GIS, becomes actionable knowledge.

Digital Twins as Living Systems

From this foundation, Dangermond turned to digital twins, one of the most rapidly advancing applications of GIS today. Reality capture technologies—lidar, photogrammetry, unpiloted aerial vehicle (UAV) point clouds—are producing unprecedented levels of detail. Building information models and meshes add another layer of fidelity. But for Dangermond, the real challenge is not capture but integration.

Digital twins, he argued, should not be treated as static deliverables. Too often they are created for a project, handed over, and left to gather digital dust. In his view, that misses the point. "Digital twins are the living synthesis of GIS layers," he explained. They should be maintained and continuously updated, ingesting sensor data and adapting as reality changes.

The implications are significant. A city that integrates building information modeling (BIM), traffic flows, environmental monitoring, and social data into a GIS-based digital twin can do more than document its infrastructure. It can simulate future conditions, model the impact of policies, and guide decisions with an unprecedented level of precision. A river basin twin that incorporates hydrology, land use, weather forecasts, and soil data becomes a dynamic tool for predicting floods and managing resources. The key is continuity—a twin that evolves as the world does.

A Global Geospatial Infrastructure

Perhaps the most ambitious element of Dangermond's vision is what he describes as a global geospatial infrastructure—a distributed system he likens to the internet. Just as the internet began as isolated networks before coalescing into a connected framework that underpins modern life, geospatial is moving in the same direction.

The outlines are already visible. National efforts like the US National Spatial Data Infrastructure and Europe's INSPIRE program laid early foundations. Statewide platforms in Alaska and national portals in Australia demonstrate the model at different scales. ArcGIS Online alone now connects millions of maps and datasets.

Yet Dangermond sees this as only the beginning. He imagines a leap from today's 4 or 5 billion maps to 50 billion, all interconnected, interoperable, and searchable. In this vision, a planetary nervous system emerges—not replacing local datasets but connecting them, allowing distributed content to be discovered and integrated. APIs, metadata standards, and governance frameworks form the scaffolding, but the real power lies in the ability to align data globally.

The urgency is clear. Climate adaptation, urban growth, supply chain resilience—all depend on cross-border, cross-domain geospatial intelligence. No single agency or nation can achieve this alone. Only a connected infrastructure can deliver the insights needed at the scale of today's challenges.

The Challenge of Sharing

For all the promise, Dangermond was candid about the obstacles. The greatest barrier is not technology but culture. "The

← Digital twins are one of the most rapidly advancing applications of GIS today. (Image courtesy of GeoFly GmbH.)

↓ Digital twins should be maintained and updated as reality changes.

willingness to share is the key component," he said. Agencies and organizations withhold data for reasons ranging from national security to privacy concerns to institutional inertia. Without trust and openness, the nervous system cannot function.

Esri has sought to make sharing easier through platforms like ArcGIS Online and ArcGIS Enterprise, which provide metadata management, controlled access, and selective sharing. But Dangermond stressed that tools alone are insufficient. What matters most is building trust and shifting organizational culture. Sharing is not about giving up control; it is about enabling collaboration. Unless that shift happens, the broader vision will remain out of reach.

Artificial Intelligence and Intelligent Agents

Artificial intelligence is another force reshaping geospatial, and Dangermond offered a nuanced view. Esri has already deployed neural networks for feature extraction, teaching machines to recognize roads, buildings, and vegetation in imagery. That work, though valuable, is just the beginning.

The next stage, he explained, involves intelligent agents embedded in GIS. These agents could guide professionals through workflows, assist with documentation, or suggest new datasets to consider. They would augment, not replace, human expertise. By mining geographic data for patterns across time and space, agents could surface insights that even experienced analysts might overlook.

The distinction matters. In a field where professionals may fear being displaced by automation, Dangermond emphasized that AI is best understood as a companion—a way to make human work more effective and insightful.

Esri and the Ecosystem

Although Esri plays a central role in this vision, Dangermond positioned the company as a facilitator rather than a monopolist. Esri's philosophy, he said, is to build generic software guided by customer feedback, while leaving room for partners to specialize and extend. The result is an ecosystem that includes global giants like Microsoft and Amazon as well as countless smaller firms innovating in their own niches.

The nervous system, in his view, can only succeed if it is open. Proprietary lock-in would undermine the very goal of interoperability. For Esri, the path forward lies in partnership and collaboration rather than control.

The Historical Arc

Throughout the conversation, Dangermond placed today's developments in a longer historical arc. Geography and mapping, he reminded us, have always been central to civilization, from the cadastral surveys of ancient empires to the charts of explorers. GIS, in his view, is simply the continuation of that legacy—a way to see, understand, and act at scales unimagined in previous centuries.

What distinguishes this era is the possibility of creating a common language for decision-making. By integrating layers of data into shared systems, GIS provides the framework for governments, companies, and communities to act with greater intelligence. In the nervous system Dangermond envisions, society itself becomes more resilient, capable of responding to crises and planning for the future with clarity.

Systematic, Long-Term Work

Despite his optimism, Dangermond warned against the allure of quick fixes. Building the geospatial nervous system will not be achieved overnight. It requires consistent, systematic work: policies, standards, governance, and investment sustained over decades.

The temptation to chase hype must be resisted. The progress that matters will come from steady, collaborative effort. For Dangermond, this patience is not a call for delay but a recognition that lasting infrastructure is built layer by layer, through persistent commitment.

A Shared Responsibility

What made this conversation distinctive was not only the scope of Dangermond's vision but also his acknowledgment that Esri cannot achieve it alone. At several moments, he paused and noted that help is needed—help from the community, from organizations, from thought leaders and practitioners alike.

That acknowledgment reframes the conversation. The geospatial nervous system is not an Esri project; it is a collective endeavor. The living digital twins he describes will only function if organizations commit to maintaining them. The AI agents he anticipates will only be useful if professionals adopt and adapt them responsibly. The global infrastructure he imagines will only take shape if agencies and institutions are willing to share.

Jack Dangermond has been many things: entrepreneur, innovator, thought leader. But in this conversation, he emerged most clearly as a guide. His vision is both inspiring and demanding. It calls not only for technological progress but for cultural change, patient investment, and a willingness to see beyond organizational boundaries. The nervous system he describes is ambitious, but it is also essential. It is up to the geospatial community to bring it to life.

Tell Your Community's Story with Esri Maps for Public Policy

By Jim Herries, Esri

The right map presented at the right time helps advance conversations about the issues communities face. For GIS analysts and managers, the challenge is not simply creating a map—it's crafting a map that shows where there's an opportunity to intervene.

If you're a GIS analyst for a city grappling with housing affordability, you could easily create a dozen maps showing median income, rent prices, and housing density. But what if you could create a map that shows which neighborhoods have the highest number of residents spending more than 30 percent of their income on housing? What if you could further break that down by renters and owners? That's the power of a policy map. It doesn't just present data—it tells a story and points to solutions.

Esri Maps for Public Policy—or Policy Maps for short—is a collection of thousands of high-quality maps and layers in ArcGIS Living Atlas of the World that provides a powerful starting point for developing policies that can change communities. These ready-to-use maps and resources, which can be integrated with other relevant data, help GIS practitioners dig deeper into key geographic information and show leaders and the public the best ways to move forward.

From Data to Wisdom

Many GIS professionals are familiar with the DIKW—data, information, knowledge, and wisdom—pyramid, a concept that illustrates the progression from raw data to actionable wisdom. A policy map is a great example of this progression. It transforms raw data into information—which, when analyzed and understood, becomes knowledge.

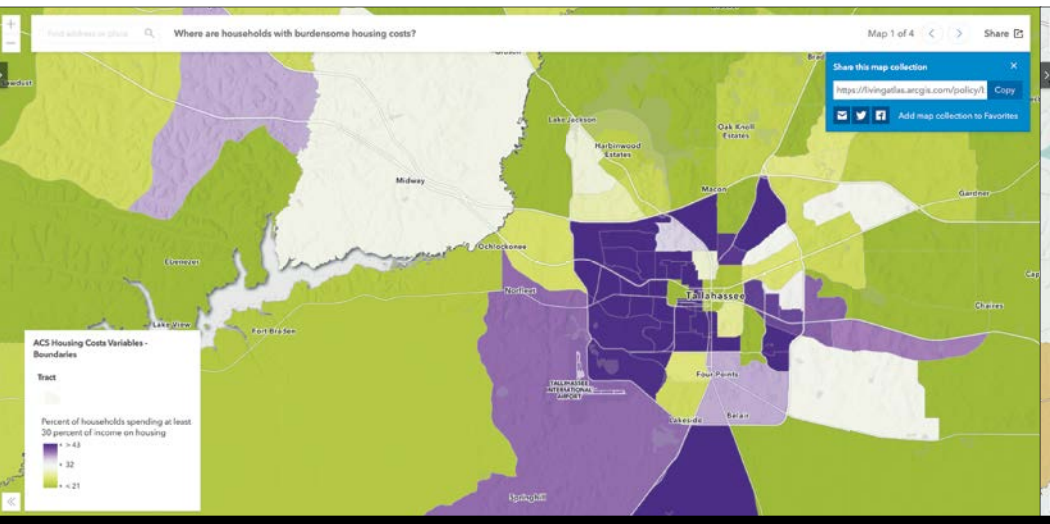
This knowledge informs the wisdom of sound policy decisions. Any policy that is intended to address real issues must be informed by good data and valid reasoning. At the same time, many issues that are addressed by policy have a spatial component. Sound policy decision-makers consider the spatial component when evaluating problems, reviewing alternatives, implementing new plans, and communicating results.

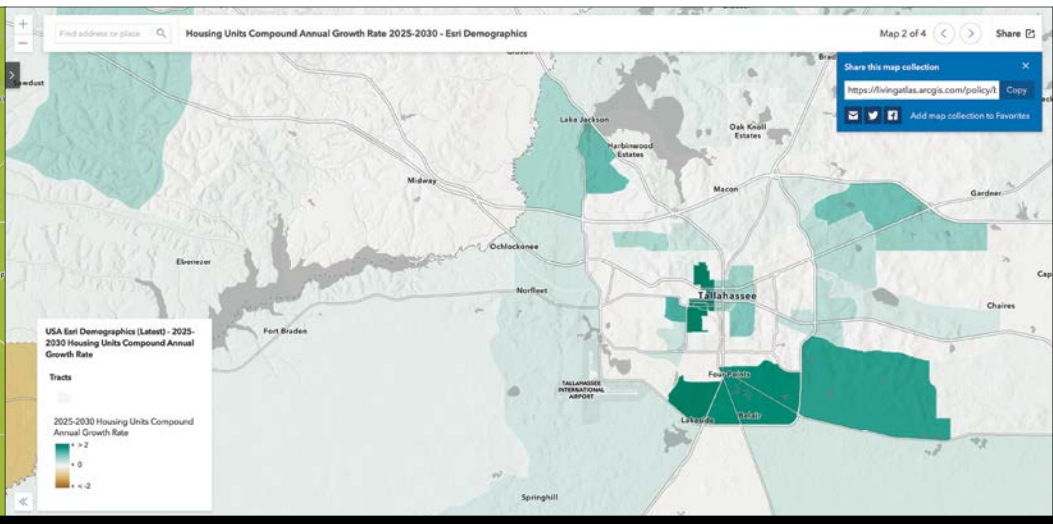
As an example, a standard GIS map might show all the snowplow routes in a city. This is an infrastructure map, useful for operational purposes. A policy map, on the other hand, might focus on the efficiency or frequency of service, showing areas of success alongside areas needing improvement. It answers a specific question, such as, "Are all neighborhoods receiving equitable snowplow service within 24 hours of a major snowfall?"

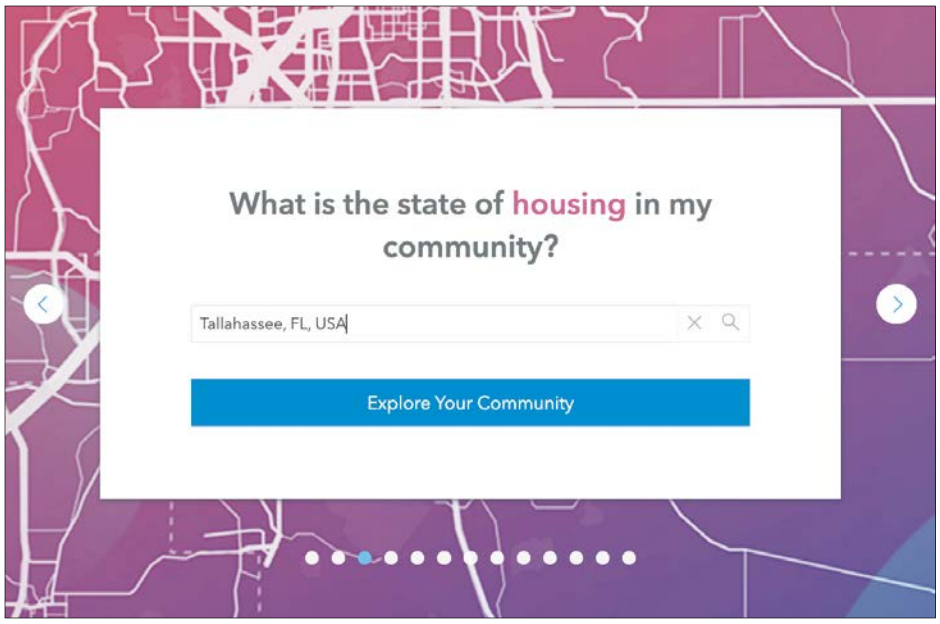
This distinction is important: A GIS map can have many layers to answer many questions; a policy map presents data in a way that highlights opportunities for action.

↑ Esri Maps for Public Policy in ArcGIS Living Atlas of the World help point people toward solutions.

Browse the Policy Maps gallery, take a tutorial, and contribute your own maps at **esri.com/policymaps**.







↑ Policy Maps can answer specific questions.

Insights from Hurricanes to Housing

The use of geographic data to inform public policy has a long and storied history. In 1961, the TIROS III satellite detected a weather disturbance that would become Hurricane Esther. This was the first time a hurricane had been discovered by satellite imagery, and the warnings that followed were a direct result of this new geographic perspective.

This also marked a turning point in using geographic data to protect lives and property. Before this, forecasters relied on ship reports and reconnaissance aircraft, which left vast parts of the ocean unmonitored. The satellite image provided the first piece of evidence—the data part of the DIKW pyramid—that a storm was forming. This data was then transformed into information as meteorologists tracked the storm's path and intensity. This information became knowledge as they applied their understanding of atmospheric science to predict the storm's future movements and layered that information on maps to show where people, housing, and businesses were at risk of inundation and damage—leading to public warnings that saved countless lives. Finally, this knowledge became wisdom when those and other related maps were used to illustrate where cities could develop policies to improve infrastructure, strengthen insurance coverage, enhance evacuation routes, and more.

Today, we have access to an unprecedented amount of geographic data, and the applications for policy mapping are virtually limitless. From tracking the spread of diseases to identifying areas in need of affordable housing, policy maps are an essential tool for understanding and addressing the complex challenges facing our communities. For example, a map showing the percentage of income people spend on rent can quickly identify neighborhoods where housing costs are burdensome, allowing policymakers to target assistance programs more effectively. Another map might show the average educational attainment of adults in different census tracts, informing decisions about where to put new job training centers or establish adult education programs.

Your ArcGIS Online Advantage with Policy Maps

Esri Maps for Public Policy is a curated collection of maps and layers that are freely available to all ArcGIS users. This library of content is designed to help users create compelling policy maps quickly and easily. The maps are fueled by living data from sources such as the US Census Bureau's American Community Survey and cover timely issues, so they are constantly evolving and being updated.

Because these maps are part of ArcGIS Online, users can easily integrate them with their own GIS data. This allows you to create custom maps that are tailored to the specific needs of your community. You could take a map of an area's housing cost burden and overlay it with your city's zoning data to see if there is a correlation between zoning regulations and housing affordability. You can also customize the symbology and pop-up explanations of the data to suit your needs.

Building Your Community's Map Portfolio

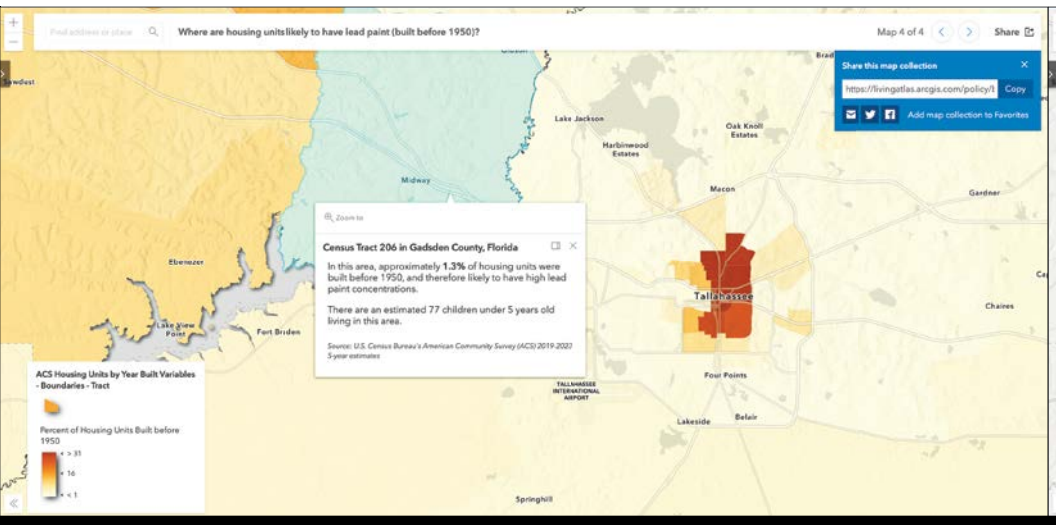
As a GIS professional, you are in a unique position to deliver high-quality maps and geospatial information products that support policy initiatives. The Policy Maps website provides a wealth of resources to help you get started. You can browse maps by topic, explore curated content, and access training resources and best practices. An ideal map portfolio for your area would orient people to the basic facts, teach them that things vary by geography, and inform them how policies are helping or not helping a given issue.

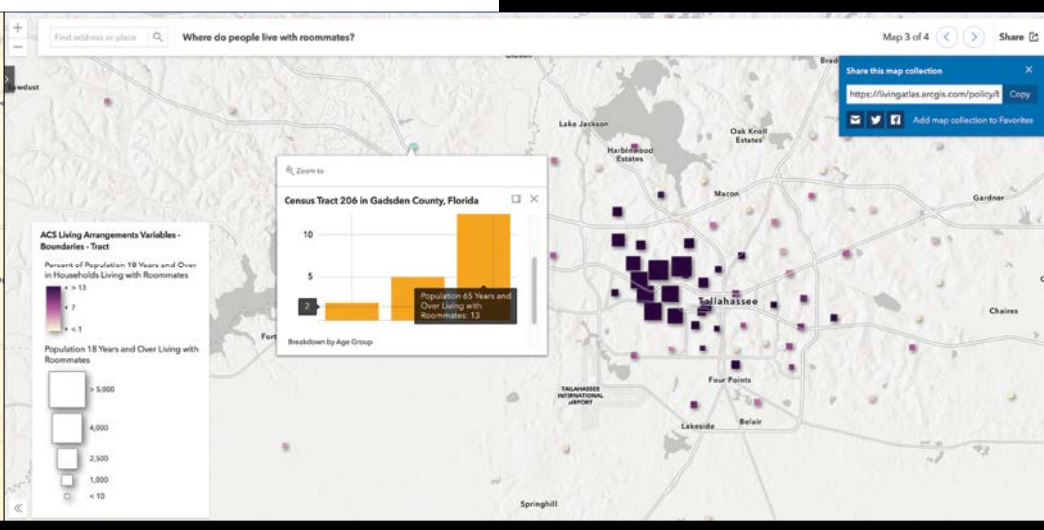
We encourage you to build a collection of maps on topics that are important to your community and share them with your leadership. You can even contribute your own policy maps to the site so that others can benefit from your efforts. By working together, we can create a rich and diverse collection of policy maps that will help us all make better-informed decisions and build stronger, more resilient communities.

Esri distributors around the world are developing policy maps related to issues in their regions. Mapas en Acción (links.esri.com/spain-pm), from Esri Spain, contains maps made using public data that show Spain's hydrography, solar infrastructure, contaminated waterways, and more. Esri France provides a similar collection (links.esri.com/france-pm). Esri Mexico is creating policy maps (links.esri.com/mexico-pm) as well.

About the Author

Jim Herries, a geographer at Esri, makes maps every day. He works with customers and Esri software developers to identify pain points in the mapmaking process and eliminate them. He listens for map ideas when he talks to people about their data, the problems they are trying to solve, and the analysis they believe will help them solve it.



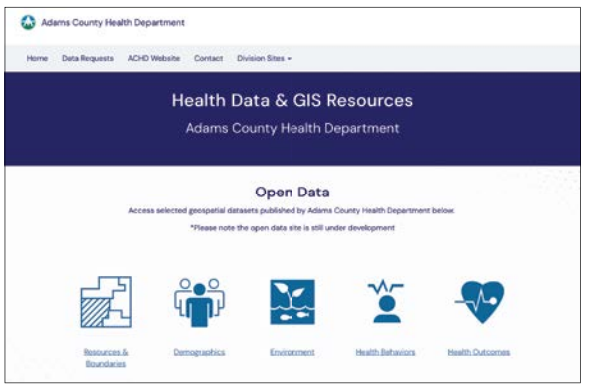


↓ Policy Maps can present various datasets on housing, such as how much people pay for it, what kinds of units are being built, families' living arrangements, and the likely composition of building materials based on when units were built.

Rebuilding a Public Health Data System on a Spatial Foundation

When the newly formed Adams County Health Department (ACHD) in Colorado set out to modernize its operations in 2023, it sought to create a unified, data-informed foundation for public health. Emerging from the dissolution of the Tri-County Health Department, ACHD began with a rare opportunity: to design its systems from the ground up.

ACHD prioritized GIS technology and made it the backbone of its operations. The department built the Integrated Data System (IDS) that now connects every division, dataset, and workflow. The enterprise-wide platform enables Adams County to manage data, streamline public health processes, and respond rapidly to community-specific needs—all through the power of location intelligence.



↑ ArcGIS Hub sites provide the public with data, maps, and resources.

From Fragmented Data to Integrated Systems

Before the IDS, Adams County staff relied on spreadsheets, manual data entry, and isolated databases. Data for programs such as communicable disease investigations and tracking, environmental inspections, and client referrals lived in different systems. This made it difficult to understand cross-program trends or identify at-risk populations in real time.

ACHD leadership recognized that traditional data systems would not meet modern expectations for transparency, interoperability, or spatial context. The department needed a comprehensive, well-governed, and secure approach that would unite health, environmental, and community data in one enterprise framework. Not only would this connect datasets, but it would also improve cross-program communication by enabling staff from different divisions to work from a unified view of public health information.

Now, the IDS is the foundation for ACHD's internal data. It links datasets, workflows, and documentation across all divisions through a centrally governed geospatial framework. Built on ArcGIS Enterprise, SQL Server, and FME from Esri partner Safe Software, the IDS standardizes data collection and enables continual data exchange. Additionally, ACHD uses ArcGIS Knowledge for data cataloging, which ensures that staff can access current, authoritative information across programs.

"The IDS ties together every dataset, workflow, and program," said Adam Anderson, director of epidemiology and data science at ACHD. "GIS is the thread that turns data into insight across the entire department."

The Building Blocks of Modernization

From the outset, ACHD established a robust data governance framework—an essential aspect of long-term system sustainability and trust. Staff use ArcGIS Knowledge to catalog every dataset with its ownership, user access, update cycles, and defined connections to apps and projects. This ensures transparency and security, reduces duplication, and allows leadership to see how data is used across programs. It also ensures that as system access expands across diverse programs and roles, the data remains consistent, secure, and appropriately managed. Governance documentation—including data dictionaries and workflows—formalizes each project's life cycle, creating a repeatable model for future systems.

To replace fragmented manual workflows, ACHD adopted ArcGIS Survey123 to standardize data collection across the department. Survey data automatically feeds into SQL databases and ArcGIS through FME-based automation pipelines, enabling near real-time updates. This unified approach simplifies how programs collect, share, and visualize data and supports initiatives ranging from food inspection and lead exposure monitoring to client referral tracking.

The IDS is also linked to multiple data systems, including HealthSpace, the state's system for public health permitting and inspections; the Colorado Department of Public Health and Environment; demographic data; and county parcel data. This means that the ACHD created a single ecosystem for public health. Staff can now analyze the complex relationships between factors such as pollution exposure, housing density, and health outcomes, providing insight that was previously difficult to garner.

Everything on the Same Spatial Foundation

Adams County faces major environmental challenges from the impacts of air pollution, Superfund sites, Resource Conservation and Recovery Act (RCRA) sites, and ongoing oil and gas operations. GIS tools help identify, monitor, and communicate information about these risks.

The Parcel-Based Search Tool allows staff to search for environmental records—such as on-site wastewater treatment system (OWTS) permits, RCRA sites, landfills, and spills—by parcel, integrating county, state, and federal datasets. The OWTS Search Tool, which pulls data from HealthSpace and links it to parcel boundaries, enables the public to find septic permit records. The Boil Water Advisory Response Tool uses GIS to identify every facility within a water district during advisories, improving communication and response times. And the Environmental Health Call Log tracks community complaints spatially for trend monitoring and program accountability.

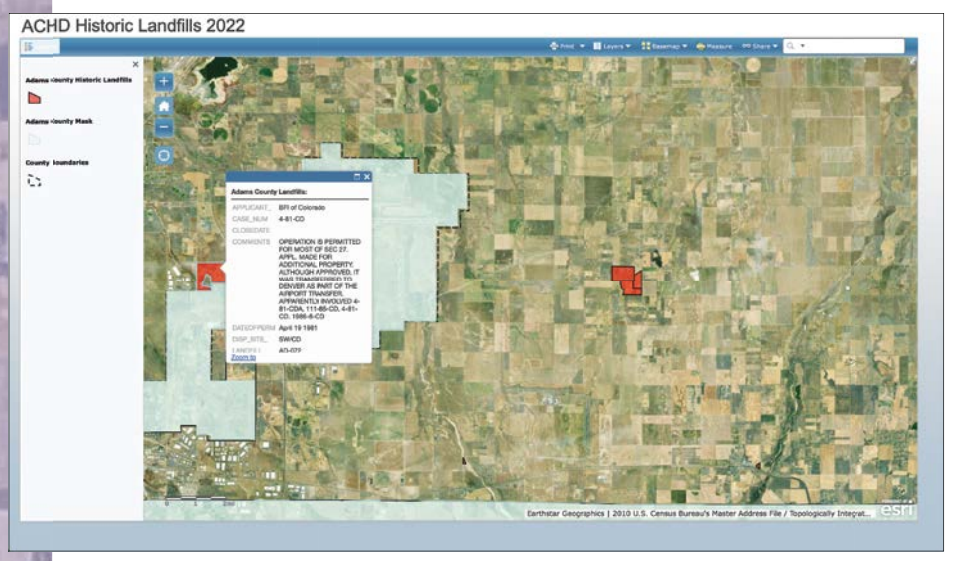
To provide better surveillance of communicable diseases, ACHD replaced spreadsheet-based tracking with its automated Communicable Disease Surveillance program, which integrates with the state's reporting system, EpiTrax. Case data now flows automatically into dashboards, built with ArcGIS Dashboards, for visualization and analysis, allowing real-time monitoring of outbreaks.

GIS-based outbreak mapping also improves internal coordination among teams. For example, environmental health and communicable disease staff can view and act on the same exposure data simultaneously, enhancing situational awareness and collaborative response. A measles outbreak simulation demonstrated how automated dataflows help staff immediately map exposure sites and engage in rapid containment.

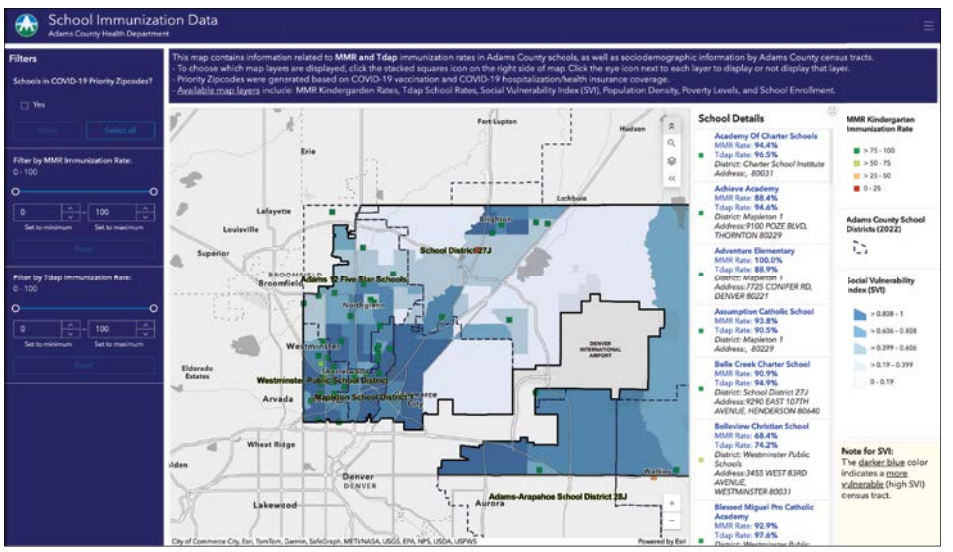
Other core systems built on the IDS include:

- The Central Referral System, which digitizes client intake forms and referral tracking to help with follow-ups.
- The Sexual Health and Harm Reduction application, which integrates with state systems to manage testing, outreach, and resource distribution.
- ArcGIS Hub sites that provide the public with data, maps, and resources via dedicated portals for substance abuse, mental health, and healthy aging.

"Every public health program in Adams County runs on the same spatial foundation," said Anderson. "GIS connects our daily work, from inspections to surveillance to community outreach."



↑ Staff at the Adams County Health Department (ACHD) can use the new system to search for environmental records, such as landfills and solid waste facilities.



↑ The public can easily see immunization rates for Adams County schools.

Better Opportunities for Good Health

As ACHD aimed to break down its data silos, unify workflow systems, manage data, and provide user access to that data, the team realized significant benefits that extend far beyond the staff's own efficiency and effectiveness. Residents of Adams County are now served with better options and opportunities for good health.

Integrating data eliminated redundant spreadsheets and manual data entry across divisions. Automated data collection and near real-time reporting has improved operational efficiency. Staff can now track how data is being used across projects and programs, increasing transparency and accountability. And GIS dashboards now allow internal teams to work from a shared spatial understanding of public health issues while improving external communication—supporting faster, more aligned interventions.

All this helps ACHD respond more quickly to public health events and keep community members in the know. The public-facing hubs, in particular, make complex data accessible to ACHD's partners and residents, enhancing equity and engagement and boosting people's trust in the public health system.

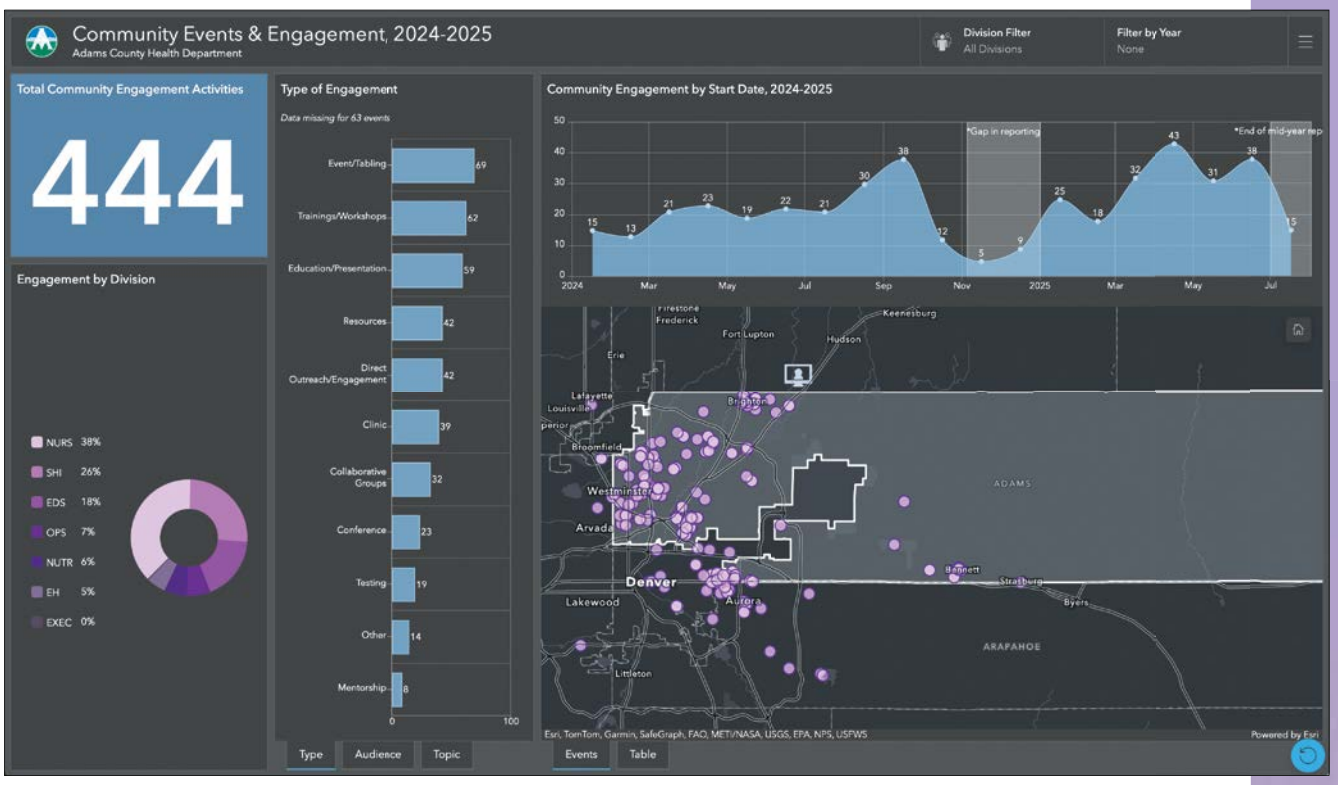
A Blueprint for Modern Public Health

By centering GIS in its data modernization strategy, ACHD built more than an information system—it built a living, spatially intelligent infrastructure. The IDS connects people, data, and programs, supporting every public health function from disease surveillance to environmental response.

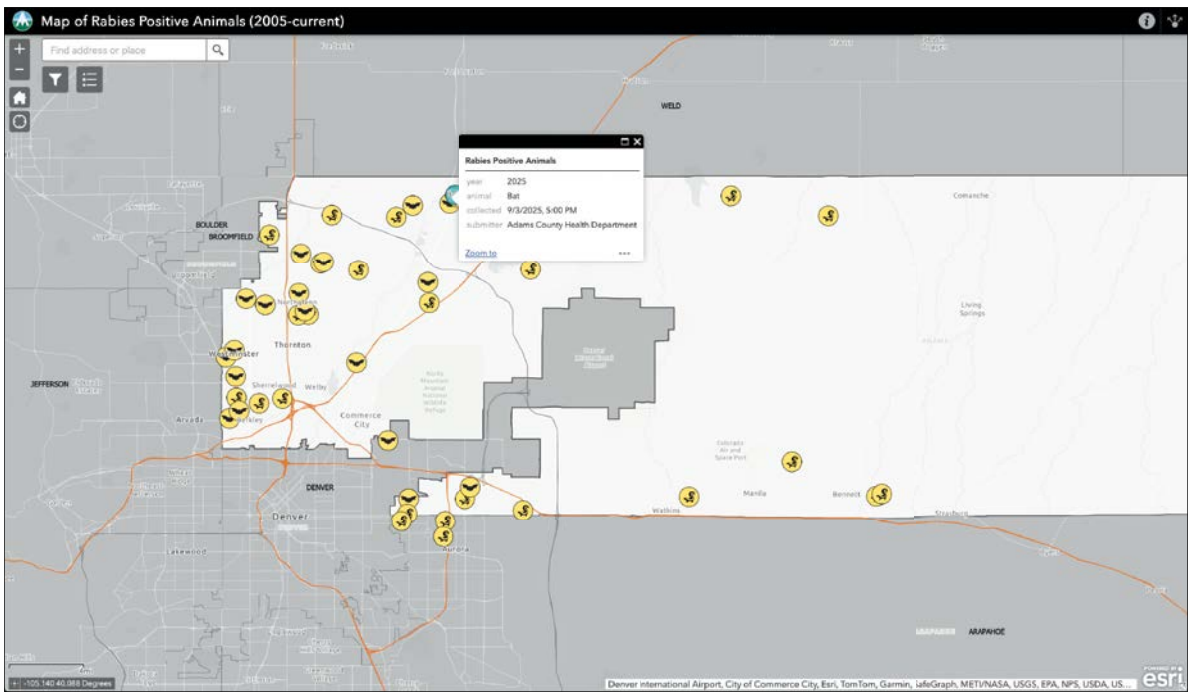
"GIS is the connective tissue of our health department—it links programs, reveals context, and drives smarter action for our community," said Anderson.

Adams County's experience demonstrates that GIS is not simply a mapping tool but a core component of modern public health operations. It allows departments to integrate disparate data, visualize community needs, and act decisively.

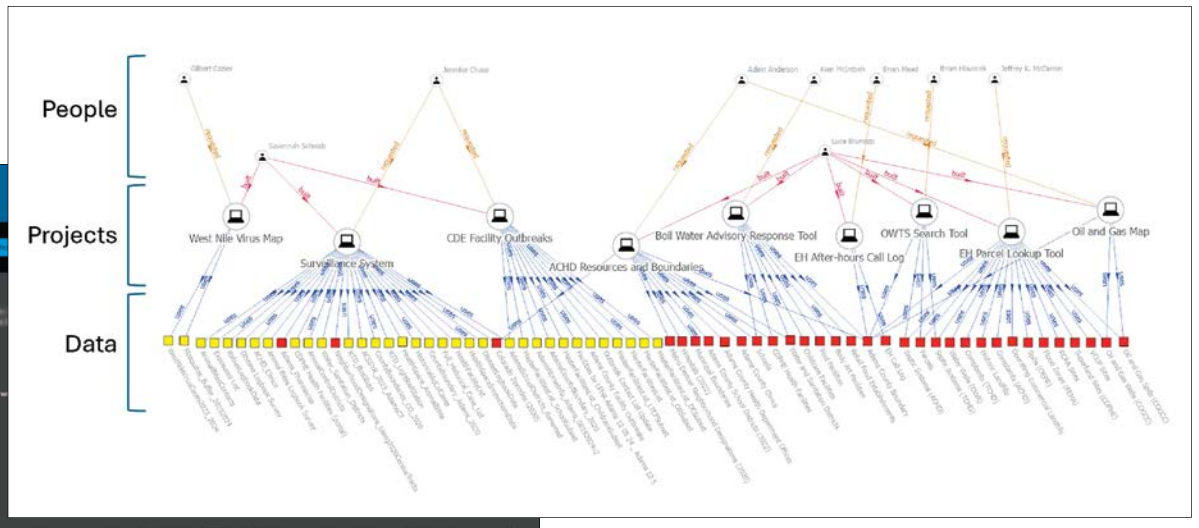
This data modernization strategy is repeatable by any health department looking to centralize its data resources and make them accessible to all relevant stakeholders. To learn more about how you can adopt this pattern for your organization, get in touch with Esri's Health and Human Services team at healthinfo@esri.com.



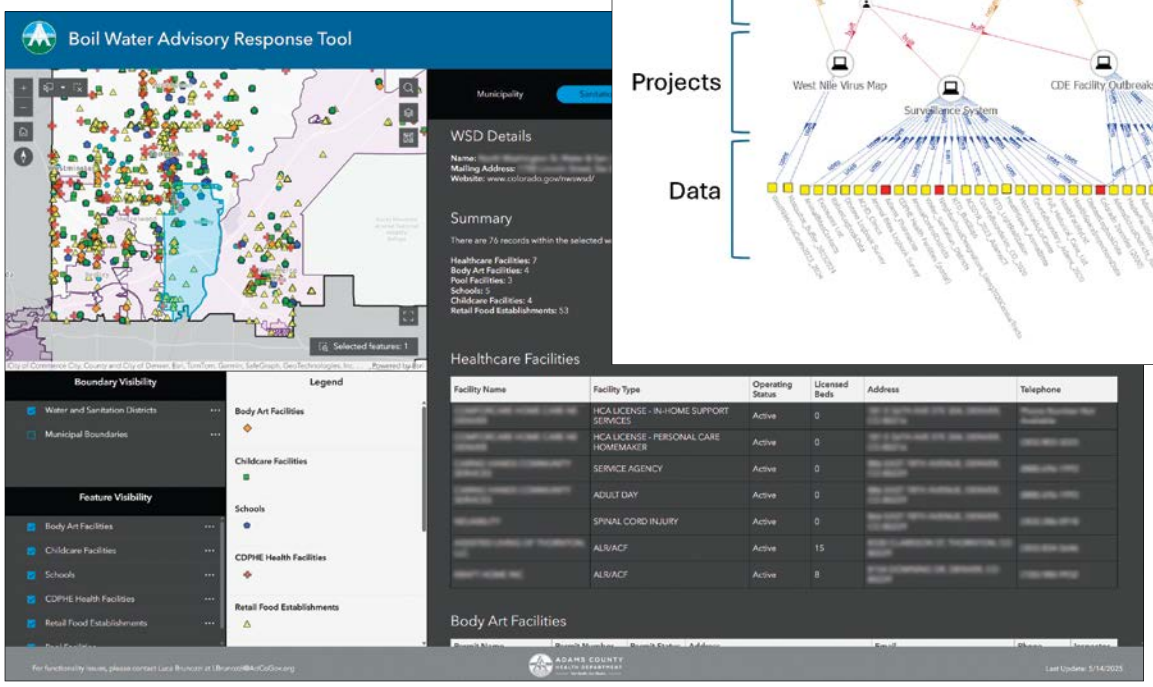
↑ Dashboards help ACHD communicate information both internally and externally.



↑ Public-facing hubs communicate important information to the community, including all reports of rabies-positive animals in the county from 2005 to now..

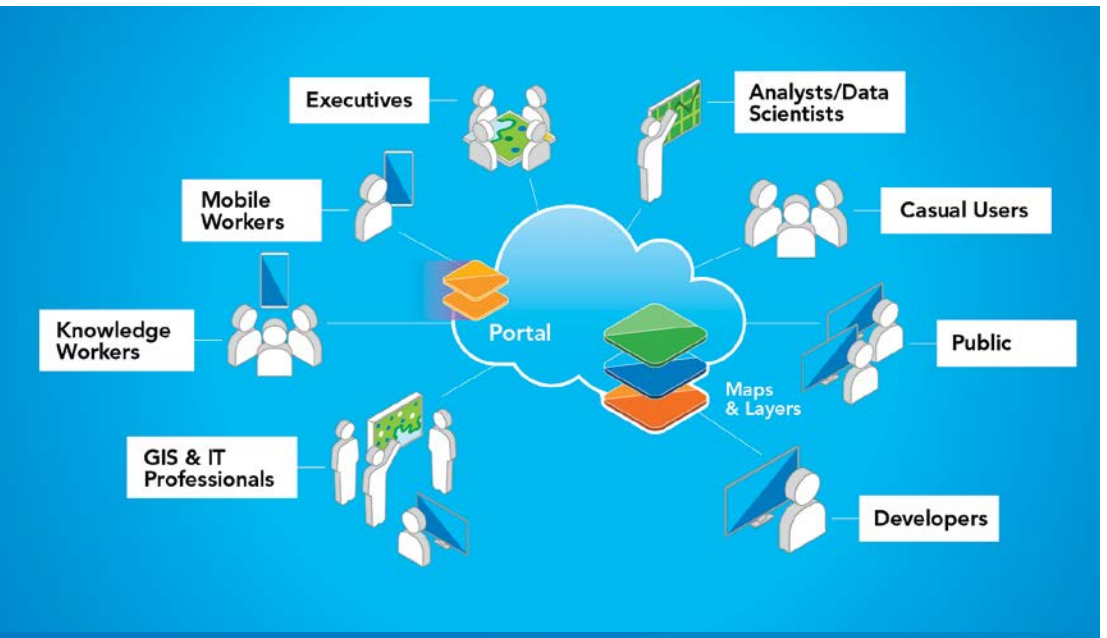


↑ With ArcGIS Knowledge, staff catalog every dataset's connections to apps, projects, and people.

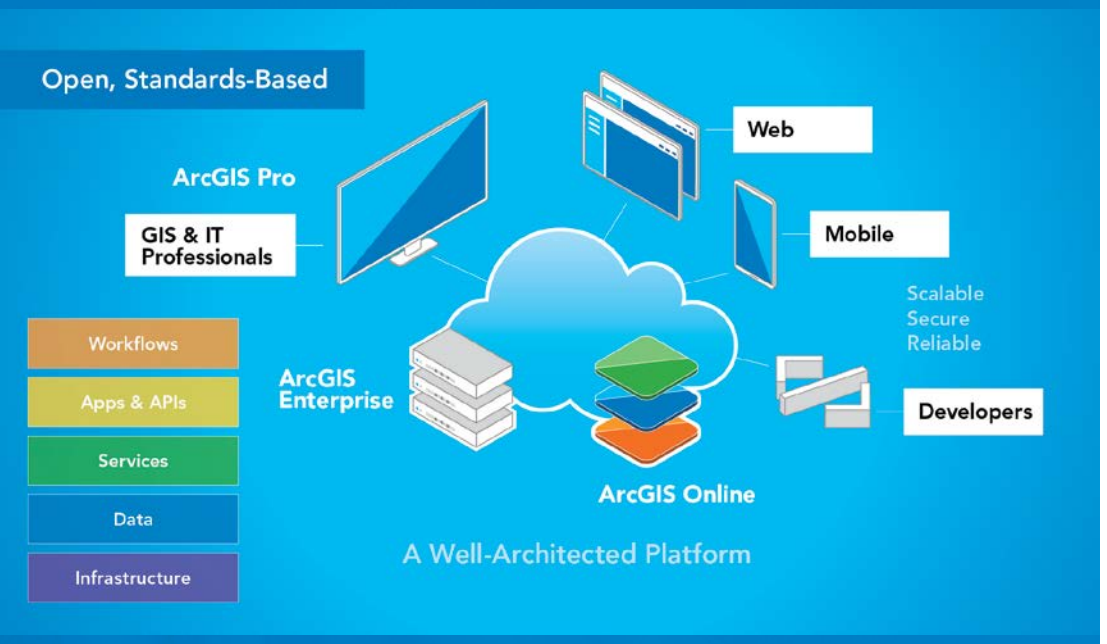


← The Boil Water Advisory Response Tool identifies every facility within a water district affected by an advisory.

ArcGIS Online and ArcGIS Enterprise Provide the Backbone of Geospatial Infrastructure



↑ ArcGIS Online and ArcGIS Enterprise are designed for everyone. They bring together people, organizations, and entire communities.



↑ ArcGIS is an enterprise IT platform that's open, interoperable, and secure.

↑ ArcGIS supports multiple implementation patterns.

Technology has advanced significantly since the first release of ArcMap over 25 years ago. Whereas GIS professionals used to work only on desktop computers, now many types of users employ geospatial capabilities across desktop, web, and mobile environments.

For more than a decade, ArcGIS has been a comprehensive sharing and collaboration platform that forms the IT backbone of both large and small systems. ArcGIS users routinely build and define these foundational systems to meet their organizations' needs.

The geospatial infrastructure powered by ArcGIS Online and ArcGIS Enterprise is open, interoperable, and secure. Just like any other enterprise IT platform, it also has observability tools built in so administrators can monitor system performance, usage, and health. All this ensures that teams can access the content and tools they need, when they need them most.

ArcGIS as Geospatial Infrastructure

ArcGIS is an enterprise-ready technology platform that thousands of organizations globally use to design, build, and sustain the geospatial systems they need to fulfill their missions. This means that implementation options for ArcGIS must be flexible—and they are.

ArcGIS can be deployed as an Esri-hosted software as a service in the form of ArcGIS Online, or it can be deployed as self-hosted software in the form of ArcGIS Enterprise. Both deployment options come with advanced capabilities in mapping, visualization, data management, spatial analysis, app development, data sharing, collaboration, and engagement. These capabilities empower small teams, multinational organizations, and everyone in between, in both the private and public sectors, to infuse their work with the geospatial approach.

For organizations setting up a new system, ArcGIS Online is often a great entry point. As organizational needs increase, teams can take advantage of premium options available in both ArcGIS Online and ArcGIS Enterprise.

ArcGIS Enterprise provides flexibility in terms of form, functionality, and location. It comes in a fully cloud-native form—ArcGIS Enterprise on Kubernetes—that organizations with fewer requirements can configure simply or organizations with more demands can configure intricately. As self-hosted software, ArcGIS Enterprise lets organizations choose where to host servers to satisfy their unique data sovereignty and security conditions.

Beyond the foundations of ArcGIS Online and ArcGIS Enterprise, organizations can add advanced extensions to build systems that can tackle virtually any geospatial challenge—whether it involves real-time data feeds, large-volume image processing, orchestrating work orders across large groups of people, or map production.

When to Collaborate and When to Scale

Many organizations choose to build business systems that use ArcGIS Online and ArcGIS Enterprise together to serve different purposes while maintaining one system of record. This distributed collaboration enables users to share layers, maps, and other data from one system to the other.

For many customers, this makes data more accessible across the organization. It also allows for interoperable workflows, such as managing data in ArcGIS Enterprise and sharing it with partner organizations or the public via ArcGIS Online.

When organizations scale and integrate their geospatial infrastructure—connecting more people, processes, and data—a system of systems emerges that enables users to work across borders, jurisdictions, and sectors. This implementation pattern melds spatial data, geospatial technologies, and supporting systems and processes to enable informed decision-making across industries and various levels of government.

Multiorganizational communities of practice that share geospatial infrastructure can cooperatively manage geospatial data and create online destinations, such as ArcGIS Hub sites and open data portals, to share data and map products either openly or securely. Partners and other organizations can participate and benefit from shared knowledge and authoritative information, turning insight into measurable impact.

Shape the Future

To continue making IT departments and GIS professionals successful in managing their organizations' geospatial infrastructure, Esri will persist in advancing ArcGIS technology, training, and resources for its community of users.

Ensuring that organizations have robust and secure ArcGIS deployments is a team effort. As your teams continue to innovate with ArcGIS, take advantage of the many world-class training courses Esri Academy has to offer, and explore reference resources such as the ArcGIS Architecture Center at architecture.arcgis.com. You can also share your ideas with Esri product teams at ArcGIS Ideas on Esri Community at ideas.arcgis.com.

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Jesse Hamlin's path to becoming a renowned GIS professional with the HALO Trust, a humanitarian organization dedicated to clearing landmines and other explosives, was fueled by a passion, a purpose, and commitment to meaningful work.

Hamlin '14 chose to study at what he said is the "best GIS school in the world," — University of Redlands. He was drawn by U of R's prestigious program and its close relationship with Esri®, the global leader in GIS technology. While earning his MSGIS degree, Hamlin said he enjoyed the unique access to Esri's resources and staff which gave him an invaluable mix of theoretical and hands-on learning, preparing him for the challenges of his future career.

" I don't want to be one of these people that realizes late in life, when it's too late, that I failed to make a positive difference...I can confidently look back and say when I retire that I helped some of the most vulnerable and forgotten people in the world get back on their feet, minimized my environmental impact, and was a true humanitarian."

— Jesse Hamlin '14 MSGIS

Enterprise GIS Unifies Workflows for UN's Humanitarian Aid Coordinators

In humanitarian crises, having access to timely and accurate geospatial data is crucial for delivering aid to those who need it most. To achieve this, coordination and unity among response teams are essential.

This is why the United Nations (UN) Office for the Coordination of Humanitarian Affairs (OCHA)—guided by a geospatial data strategy drafted in 2022—secured an enterprise agreement with Esri in 2023. The partnership enables all OCHA staff, both at UN headquarters and in the field, to access the same ArcGIS technology and online resources. This creates a unified and efficient geospatial environment that enhances decision-making and response efforts.

Now, OCHA's humanitarian workers can use the same authoritative data—coming from the same geodatabase and held to the same metadata standards—to collaborate during critical, fast-moving events. And that can make all the difference.

A Geospatial Strategy

OCHA's enterprise transformation began when its field information services (FIS) team drafted a geospatial data strategy in 2022. The strategy summarized the need for consistent tools, centralized data, and shared services across OCHA. It highlighted how efforts were frequently duplicated and costs rose when individual offices managed their own licenses, data storage, and mapping standards.

The strategy helped senior management recognize both the operational value and cost savings of a consolidated approach. The next year, OCHA signed an enterprise agreement with Esri, turning this strategy into action.

OCHA staff worked closely with Esri engineers to design the enterprise infrastructure and refine the approach, ensuring that its system could support staff at headquarters and those in field offices. In addition to being a sound financial decision for OCHA, the enterprise agreement reflected leadership's commitment to building predictable, reliable geospatial capacity across the organization.

Centralized Data and Sound Metadata

At the heart of OCHA's mandate is maintaining Common Operational Datasets for Administrative Boundaries (COD-AB). Historically, these datasets were scattered across different country offices and managed in various formats. Through the enterprise rollout, OCHA consolidated COD-AB into a centralized SQL geodatabase connected to ArcGIS Enterprise. This provides a single authoritative source for administrative boundaries that underpins all field mapping activities and ensures consistency across humanitarian relief operations.

Equally important is an emphasis on metadata governance. Each COD-AB record is tagged with standard metadata fields, including review dates, validity periods, and lineage information. Taking a systematic approach to metadata ensures transparency and trust in the boundaries, which humanitarian relief providers use to develop population statistics, create needs assessments, and coordinate efforts.

OCHA also automated COD-AB data sharing with the Humanitarian Data Exchange (HDX), a website managed by OCHA that makes it easy for humanitarian workers around the world to find and use relevant data. OCHA's FIS team worked with the HDX team to integrate the site with ArcGIS Enterprise. Whereas field offices used to send their COD-AB data (which typically wasn't standardized) to HDX, now a Python coding pipeline automatically checks for new data and updates the HDX website when needed. The old manual and time-consuming process is streamlined, with boundary updates flowing seamlessly to the wider humanitarian community, keeping partners aligned during rapidly evolving crises.

Streamlined License Management

In addition to improving workflows and data sharing, OCHA centralized license management under the enterprise agreement. Now, all staff members have access to the level of software and user types they need, rather than having individual field offices and sections negotiate separately with Esri. This unified approach reduces administrative overhead and guarantees that technical capacity matches operational needs across the organization.

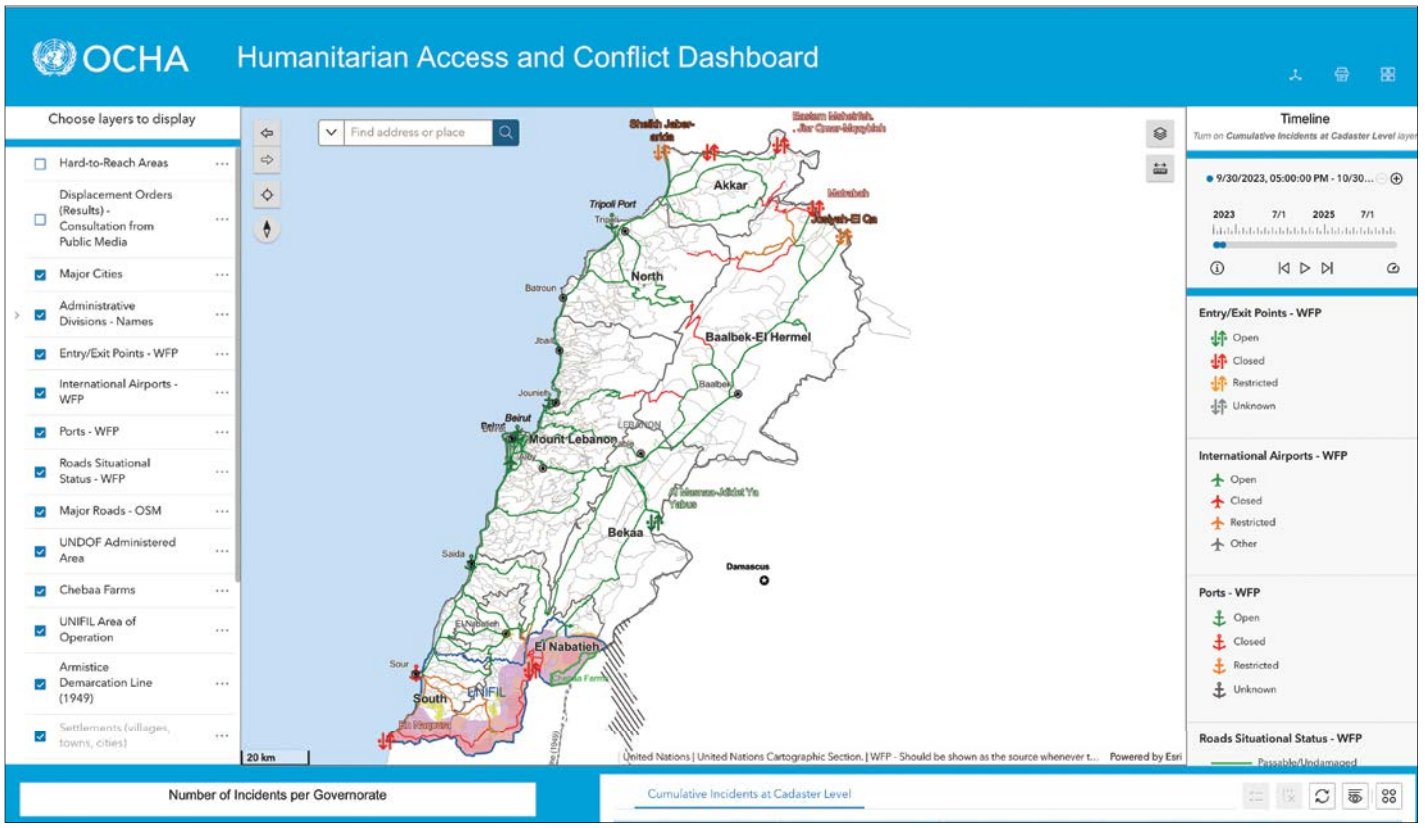
With consistent access to ArcGIS Pro and ArcGIS Enterprise, OCHA staff have standardized online mapping templates for situation

↑ Leaders at the United Nations (UN) Office for the Coordination of Humanitarian Affairs (OCHA) are committed to enhancing geospatial capacity across the organization.

← OCHA's enterprise agreement with Esri ensures that all employees—both in the office and in the field—have access to the same data and tools.

Metadata Matters

- COD-AB datasets now carry standard fields such as review dates, validity periods, and lineage.
- Automated connections between ArcGIS Enterprise and HDX keep updates flowing to the wider humanitarian community.
- This approach improves transparency, consistency, and reliability and can serve as a model for other shared datasets.



↑ The Humanitarian Access and Conflict Dashboard for Lebanon was built with ArcGIS Experience Builder.

and reference maps, as well as interactive dashboards. These templates allow field offices to build products that are visually coherent, technically robust, and easy to update. The result is faster turnaround times and greater comparability across crises.

Collaboration Gets Transformed

Enterprise technology, shared structures, and elevated trust have transformed collaboration during humanitarian responses.

Instead of exchanging shapefiles or PDFs via email, OCHA staff, clusters (groups of humanitarian responders organized by sector), and UN agencies coauthor web maps, apps, and analyses in real time. Permissions are managed through enterprise groups to protect sensitive data while enabling authorized partners to contribute directly. This approach saves time, reduces duplication, and ensures that all actors are working from the same authoritative information.

To extend participation beyond OCHA, the organization has established distributed collaboration with several trusted partners, including the Logistics Cluster, which coordinates and provides shared logistics services to keep humanitarian aid moving efficiently during emergencies. Datasets and apps flow seamlessly between systems, giving logisticians and coordinators access to the same operational picture.

One public-facing example of this coordination is the Humanitarian Access and Conflict Dashboard for Lebanon, available at links.esri.com/ocha-lebanon. The app, built with ArcGIS Experience Builder, shows—in a single GIS-based interface—up-to-date data on resources and infrastructure in Lebanon. These include entry and exit points, airports, and ports; where damage has been reported; population movements; and critical facilities. The maps, charts, satellite imagery, and time slider support coordination and decision-making in this sensitive and fast-changing context.

Building for the Future

OCHA spent more than two years testing and piloting everything from data standardization, schemas, and metadata to web map styles, templates, and apps. In 2026, the organization plans to roll out operational web maps like the Lebanon example across all its country and regional offices. These apps will give field teams a consistent way to track essential issues and needs in areas where humanitarian crises are bubbling up and in full force.

In parallel, OCHA is expanding automation and analytics using ArcGIS API for Python to support content-audit dashboards and strengthen metadata governance. Vector tile basemaps, versioned COD-AB workflows, and offline-ready mobile solutions are also in development to ensure that OCHA's geospatial backbone remains predictable and reliable even in the most demanding field environments.

Acknowledgements

People and teams across OCHA contributed to its enterprise transformation. The FIS team—including Tarek Elgebely, Metehan Ergen, Filiz Yildirim, Julia Chatellier, Tom Westby Haythornthwaite, and Janet O'Callaghan—set the vision, negotiated the enterprise agreement, developed the strategy, trained people, and rolled out licensing changes. The Information Services Section did system design and procurement, making the enterprise environment technically sound and sustainable. OCHA's field information management officers continue to apply, test, and refine the system in diverse and demanding humanitarian contexts, ensuring that it delivers what's needed, where it is needed most. Experts from other UN agencies were instrumental from the outset, sharing advice during strategy development and working with OCHA through early implementation. The Centre for Humanitarian Data, including Maxym Malynowsky, further strengthened the effort by automating COD-AB sharing with HDX.

Systemwide Approaches Work

By centralizing data, standardizing workflows, and consolidating licensing, OCHA has turned a fragmented system into an organization-wide geospatial service. The enterprise agreement with Esri has improved internal efficiency while strengthening OCHA's ability to deliver timely, trusted geospatial information to the humanitarian community.

In just two years, OCHA moved from developing a strategy to implementing systemwide approaches. Although there is much more work to do, the foundation has been laid with clear guidance, a focus on metadata, standardized templates, and training—ensuring sustainable growth.

ArcGIS Pro Transforms Flood Management in Texas

In 1929 and 1935, two catastrophic storms submerged downtown Houston and damaged infrastructure throughout surrounding Harris County, Texas. Shortly thereafter, in 1937, the special-purpose Harris County Flood Control District was established to help reduce flood risks for more than 2.7 million residents across 1,777 square miles, including Houston. The region's flat terrain and clay soils, coupled with increasing rainfall rates, make it especially vulnerable to flooding.

With a mission rooted in keeping people safe and infrastructure strong, the Flood Control District maintains and implements flood damage reduction projects on more than 2,500 miles of channels. That's nearly the distance from Los Angeles to New York. As Matthew Barr, the GIS section manager at the Flood Control District, said, "Every second counts in our world." Which means having the most powerful tools before, during, and after flooding is integral to the safety of the community.

Managing Flood Risk at Scale

The Flood Control District has long been a GIS-forward organization, with over two decades of experience using ArcGIS technology. However, as the county's population and infrastructure demands grew, so did the complexity of the data and visualizations needed for managing current and future floods. Barr and his team historically leveraged ArcMap for their mapping work—but the need for an even more powerful mapping and analysis tool became increasingly apparent.

In the past, GIS work at the Flood Control District was decentralized, with each technician creating maps independently, often using different styles and standards. This was sufficient when most work was internal, but as the organization's operations became more public-facing, consistency and speed became critical.

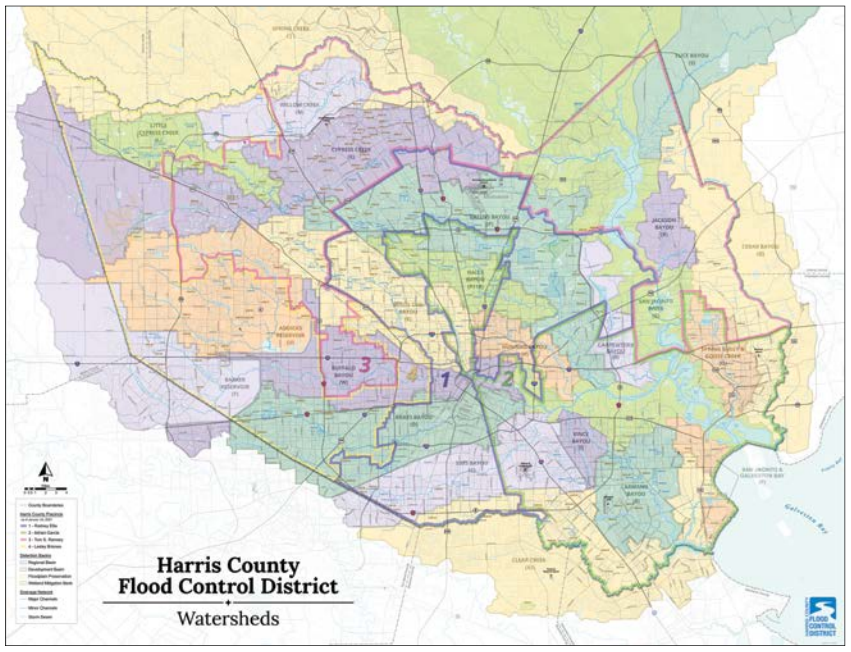
"We're not just making maps for an engineer anymore," said Barr.

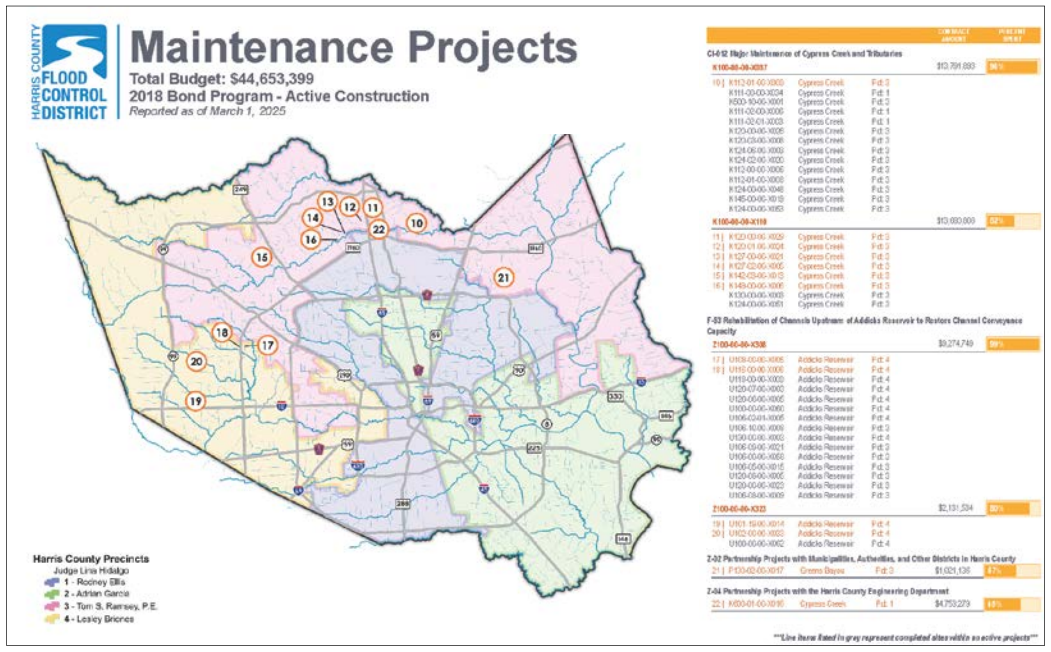
Map requests were increasing in volume and complexity, and the team needed to deliver polished, consistent products, often within hours.

"It's very common to get a call saying, 'We need a map in two hours for a meeting with an elected official,'" Barr explained. "We couldn't keep up with that pace using ArcMap."

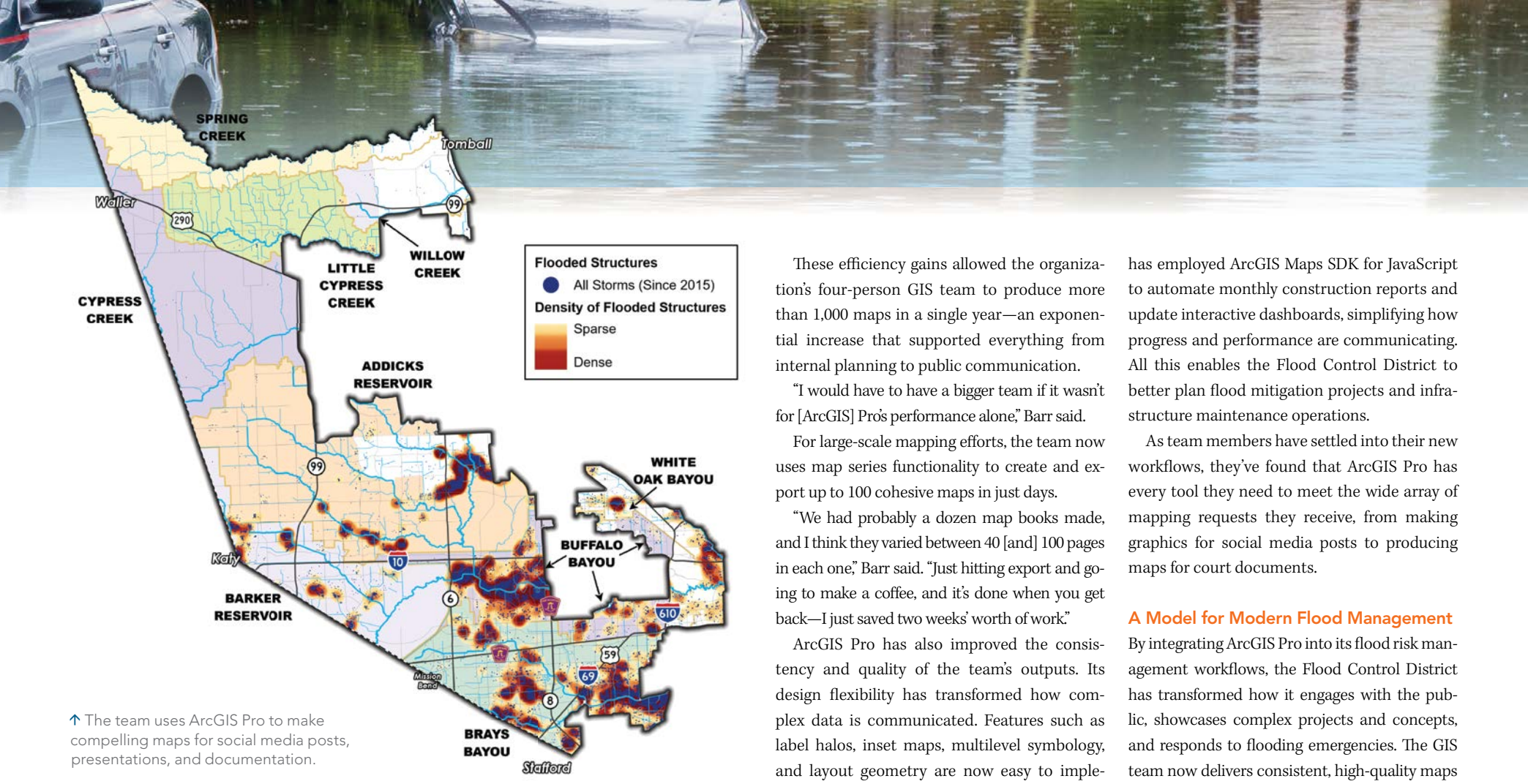
The inability to automate workflows and the manual effort needed to create each map were preventing the team from keeping up with demands. During an emergency event, the geoprocessing tools in ArcMap often required more processing

↓ The Harris County Flood Control District serves more than 2.7 million residents across 1,777 square miles.





↓ Using ArcGIS Maps SDK for JavaScript, the team has automated the creation of monthly construction reports.



↑ The team uses ArcGIS Pro to make compelling maps for social media posts, presentations, and documentation.

time than the team could spare. The design capabilities of ArcMap also made it difficult for the team to produce clear, polished visuals under tight deadlines and for public-facing materials. Staff often relied on external tools such as Adobe Illustrator or Adobe Photoshop to achieve the level of clarity and visual consistency they wanted, adding hours of extra work and complexity.

These constraints slowed down production and made it harder to communicate critical information during emergencies.

More Powerful Software

To meet growing demands, the Flood Control District migrated from ArcMap to ArcGIS Pro. The modern desktop software seamlessly integrated with the organization's existing ArcGIS implementations and offered a powerful, unified platform where the team could create high-quality maps and processes that would boost collaboration.

"We used to pass around [.mxd files] on the network. Now we share layout files and templates in [ArcGIS] Pro," said Barr. "It's a game changer."

The ability to create and share standardized layout templates helped the Flood Control District establish a unified visual language. Now, staff use consistent fonts, colors, and other design elements across all communications. The templates helped the team overcome the inconsistencies of its old, decentralized workflow.

And the transition was smooth—thanks in part to strong organizational support for GIS and a team culture that embraces innovation. Team members appreciate the intuitive and extensive design, customization, and automation options in ArcGIS Pro, as well as its direct integration with well-known scripting languages. While the ribbon interface took a few days to adjust to, the benefits of using ArcGIS Pro quickly became clear as staff adapted to it and the quality and quantity of their outputs rapidly improved.

"It was just really easy for us to make the change," said Barr.

As a result, ArcGIS Pro swiftly became central to the inner workings of the Flood Control District.

Smarter, Faster Maps Delivered Across Operations

The migration to ArcGIS Pro delivered immediate and transformative results, starting with a dramatic increase in speed and performance. ArcGIS Pro enabled the Flood Control District to respond more effectively during flooding emergencies. Tasks that previously took 30 minutes to complete were reduced to just three minutes. Full map production cycles dropped from two days to as little as two hours.

These efficiency gains allowed the organization's four-person GIS team to produce more than 1,000 maps in a single year—an exponential increase that supported everything from internal planning to public communication.

"I would have to have a bigger team if it wasn't for [ArcGIS] Pro's performance alone," Barr said.

For large-scale mapping efforts, the team now uses map series functionality to create and export up to 100 cohesive maps in just days.

"We had probably a dozen map books made, and I think they varied between 40 [and] 100 pages in each one," Barr said. "Just hitting export and going to make a coffee, and it's done when you get back—I just saved two weeks' worth of work."

ArcGIS Pro has also improved the consistency and quality of the team's outputs. Its design flexibility has transformed how complex data is communicated. Features such as label halos, inset maps, multilevel symbology, and layout geometry are now easy to implement. Even small touches—like switching from square to circular inset maps—enhance a map's readability and professionalism. What's more, the wide range of cartographic tools available in ArcGIS Pro empowers the team to create maps that are not only technically accurate but also visually compelling.

"You do this, and it's like, wow, everyone thinks you're a magician," said Barr. "It's just there in [ArcGIS] Pro!"

The Flood Control District's new combination of speed and quality has elevated the team's impact across the organization. For example, using the Python integration to implement custom scripts, the team built a web app that allows users to generate maps and reports nearly on demand during critical moments. The team has employed ArcGIS Maps SDK for JavaScript to automate monthly construction reports and update interactive dashboards, simplifying how progress and performance are communicating. All this enables the Flood Control District to better plan flood mitigation projects and infrastructure maintenance operations.

As team members have settled into their new workflows, they've found that ArcGIS Pro has every tool they need to meet the wide array of mapping requests they receive, from making graphics for social media posts to producing maps for court documents.

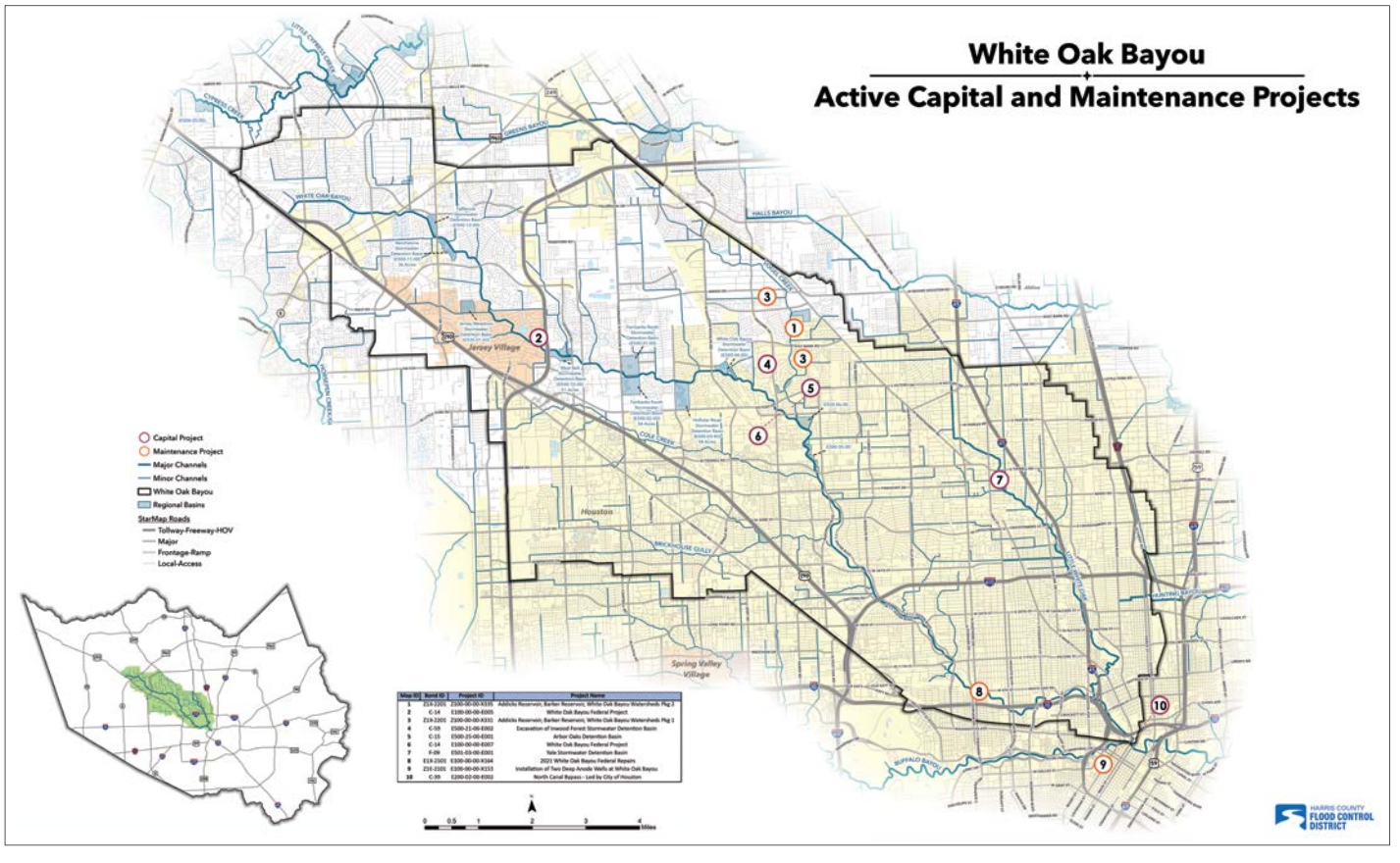
A Model for Modern Flood Management

By integrating ArcGIS Pro into its flood risk management workflows, the Flood Control District has transformed how it engages with the public, showcases complex projects and concepts, and responds to flooding emergencies. The GIS team now delivers consistent, high-quality maps at scale, enabling faster decision-making and clearer public communication. With standardized templates, advanced spatial analysis, and automation capabilities, the district has built a resilient system that supports both daily operations and critical response efforts.

As the team prepares to train others in how to use ArcGIS Pro, its story is a powerful example of how GIS can help communities stay safe and informed in the face of growing challenges.

"Everything starts in [ArcGIS] Pro—whether it's a static map, a web app, or a field data collection project," said Barr. "It's the foundation of everything we do."

↓ With ArcGIS Pro, the team can export high-quality maps in various formats for large printed wall maps or general-use PDFs.



Cross-Border Collaboration Aims to Heal the Tijuana River

The Tijuana River travels for more than 120 miles through Mexico before crossing into the United States at the Tijuana River Estuary and flowing into the Pacific Ocean.

Toxic waste and raw sewage have polluted the estuary and adjacent beaches for decades. This is the result of failing treatment systems and poor sewage and industrial waste disposal in Tijuana. The American Rivers foundation estimates that the quantity of discharged effluent is 35–50 million gallons per day. It lists the Tijuana River as one of the most endangered rivers in the United States.

The population of Tijuana is about 2.3 million, while north of the border lies San Diego, California, with nearly 1.4 million residents. The health and quality of life for these 3.7 million people are directly impacted by this ongoing toxic discharge.

That's why several organizations have come together and employed advanced GIS to identify key issues along the river and prioritize sustainable interventions that have a good chance of being funded. They've also created a GIS-powered app to evaluate the effectiveness of these interventions and share information with stakeholders and the public.

Altogether, it's a novel way to approach environmental risks that span international borders.

Organizations with Similar Goals Come Together

In 2024, the San Diego/Tijuana region was the first-ever cross-border area to be designated the World Design Capital (WDC) by the World Design Organization, an international nongovernmental organization that promotes using industrial design to support a sustainable environment and an engaged society. This region's appointment as WDC 2024 sparked dialogue and surfaced shared priorities for addressing the Tijuana River's environmental and economic challenges.

Arup, a global multidisciplinary consulting firm with deep expertise in digital and geospatial analysis, was invited to participate in the WDC 2024 Climate and Sustainability design-to-action network, where staff helped vet and support various projects tied to the yearlong designation. It was through this opportunity that they were connected to two regional organizations—Iniciativa Río Tijuana Asociación Civil (A.C.) and 4 Walls International—both with similar goals.

Tijuana-based Iniciativa Río Tijuana A.C. promoted the concept of the Tijuana River Index (TRI), an interactive platform to analyze the various issues facing the Tijuana River and identify potential areas for sustainable interventions. Similarly, San Diego-based nonprofit 4 Walls International was looking for a way to better understand project opportunities that could be prioritized for funding.

To facilitate the development of the TRI, Arup, 4 Walls International, World Design Capital, and Iniciativa Río Tijuana A.C. formed an alliance to leverage their collective expertise and address the persistent environmental and public health issues resulting from pollution in the river.

"Each organization in the alliance plays a unique and vital role in developing the TRI," said Waylon Matson, cofounder of 4 Walls International. "Arup contributed engineering and technical expertise, 4 Walls International brought community-based design experience. World Design Capital supported the initiative through marketing and events. And Iniciativa Río Tijuana A.C. provided perspectives from those directly impacted by watershed conditions."

Developing and Evaluating Priority Interventions

The team conducted a workshop with community members and nonprofit leaders from both sides of the United States-Mexico border and identified five priority interventions: waste cleanup, erosion reduction, revegetation and reforestation, access to green space, and decentralized wastewater treatment.

From there, the team used the Generate Tessellations tool in ArcGIS Pro to develop a hexagon grid that gives stakeholders a uniform way to examine the entire watershed and pinpoint where to implement these potential interventions. Hexagons were assigned an index score from zero to one for each of the five priority interventions, resulting in a total possible score of five for each hexagon. The higher the score, the higher the need for intervention in that area.

These scores were calculated using datasets processed with FME from Esri partner Safe Software in ArcGIS. The team used ArcGIS Pro to examine the data outputs and stage it before publishing it to ArcGIS Online. Then, they used ArcGIS Experience Builder to create the TRI app.

The app, available at links.esri.com/TRI, provides users with a seamless interface to view the TRI hexagon scores and their associated priority interventions for different areas of the watershed.

"Several supplementary datasets and a methodology page were included to provide clarity on how the index and scores were calculated," said Gabriella Marquez, geospatial analyst at Arup and the TRI geospatial lead. "A data sources page was included to point the user towards more information on the underlying datasets, and all the data shown in the tool is also available to download."

The team obtained authoritative datasets through Mexico's National Institute of Statistics and Geography and the country's National Water Commission. The San Diego Association of Governments and the California Open Data Portal also provided data for the project.

How Success Is Measured

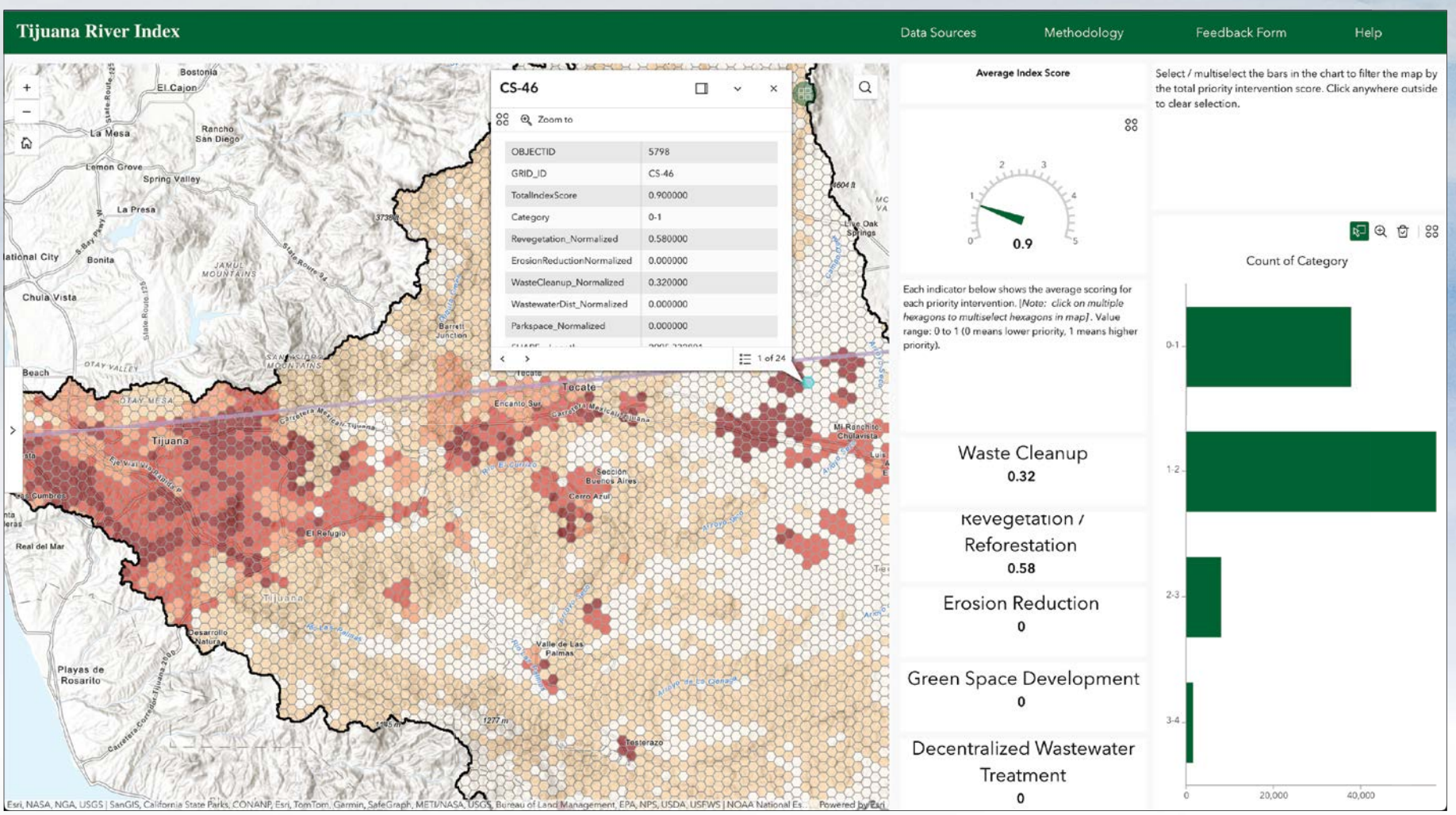
The TRI hexagon scores help prioritize interventions in the five selected areas that critically impact water quality. The highest scores identify the highest-priority areas within the watershed where projects could be carried out. The designated interventions are currently in various stages of implementation.

This helps the team apply a stochastic, or randomly determined, hydro-financial modeling framework to the systems that are most critical to transboundary pollution.

"The framework combines environmental modeling with financial forecasting," said Matson. "By modeling intervention outcomes and associated climatic uncertainties—such as wet years, dry years, and periods of economic uncertainty—the model helps predict potential outcomes under various conditions. This promotes more informed decision-making and allows stakeholders to quantify potential cost savings and performance outcomes."

The model prioritizes upstream and downstream intervention strategies that are high impact and likely to succeed, aligning investor returns with environmental outcomes. This is an approach to conservation financing in

↓ The main channel of the Tijuana River runs along the United States-Mexico border between San Ysidro and Tijuana. (Image courtesy of the Surfrider Foundation and Veriditas Rising Aerial Photography.)



↑ The team used ArcGIS Experience Builder to create the Tijuana River Index (TRI) app. (Image courtesy of Arup.)

which success is measured based on the outcomes of the interventions.

"Let's say you plant vegetation on hillsides or reinforce a river channel upstream, which are both designated interventions. The model tells you how likely it is that those actions will reduce pollution downstream," Matson explained.

That prediction is used to develop an Environmental Impact Bond (EIB) structure, where investors get a bonus if the project performs well based on monitoring data. If the project doesn't meet its goals, investors may get less money back.

"The EIB provides a measurable return on investment," said Matson. "This makes investors more comfortable taking part in environmental projects and helps communities invest in solutions that are more likely to succeed."

Expanding Collaboration to Reveal New Opportunities

The team plans to further develop the capabilities of the TRI by including additional data collected by universities, nonprofit organizations, and others. This will depict a more accurate picture of the river's evolving condition and uncover more opportunities for remediation.

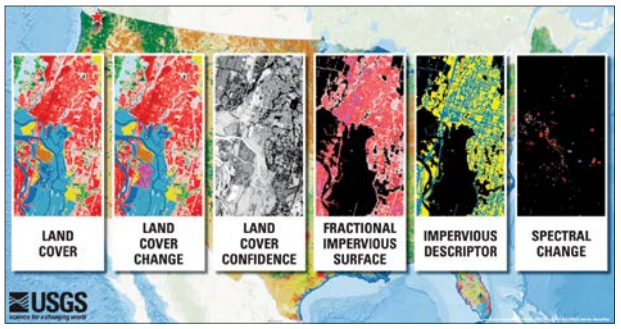
The TRI also provides a location to host data that has historically been siloed—in some cases, on two sides of an international border. This will facilitate additional interventions and project development from organizations working the length of the river.

To learn more about or support the TRI, email Marquez at Gabriella.Marquez@arup.com or Matson at waylonmatson@4wallsintl.org.

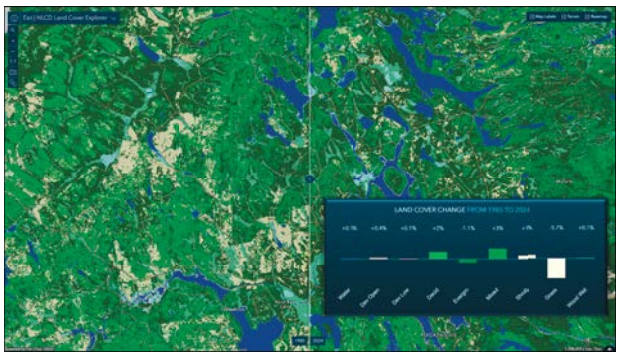
↑ Stakeholders explain how they can use the TRI app. (Image courtesy of Arup.)

40 Years of USGS Land-Cover Data in ArcGIS Living Atlas

Land-use land-cover maps are an increasingly important source of information for decision-makers across many industries and land management practices. Agriculture, forestry, insurance, urban planning, environmental conservation, and real estate are among the sectors that benefit most from using these kinds of maps. The insight derived from the maps helps assess risk and inform policy and management decisions by fostering better understanding—and quantifying the potential impacts—of Earth's natural processes and human activity.



↑ The United States Geological Survey (USGS) offers six different Annual National Land Cover Database (NLCD) science products. (Image courtesy of USGS.)



↑ The NLCD Land Cover Explorer shows land-cover changes in northwestern Maine between 1985 and 2024.

↑ ArcGIS Living Atlas of the World includes a growing list of imagery layers that are optimized for scaled and multisource analysis.

The National Land Cover Database (NLCD) has long been the standard for land-cover mapping in the United States. In 2025, the United States Geological Survey (USGS) announced a major advancement in land-cover mapping when it said it would release the Annual NLCD Collection, a product suite that leverages older methodologies together with modern innovations in geospatial deep learning.

This represents a new era of land-cover mapping for the United States—and the collection is available in ArcGIS Living Atlas of the World.

A Brief History of NLCD

In the late 1980s, the USGS Earth Resources Observation and Science Center began producing greenness maps showing the health and vigor of vegetation. Creating these maps from one-kilometer satellite imagery provided a cost-effective and efficient way to monitor vegetation conditions—and it inspired a new generation of mapping projects.

In the 1990s, USGS partnered with other government agencies to form the Multi-Resolution Land Characteristics consortium. This consortium set out to leverage 30-meter resolution Landsat satellite imagery as the basis for a variety of mapping projects, including NLCD.

In 2000, USGS released NLCD 92, the first comprehensive, national, digital land-cover map. This served as the foundation for subsequent NLCD versions and land-cover change products. Subsequent versions included nine epochs spanning two- to three-year intervals, from 2001 to 2021.

The new Annual NLCD Collection harnesses the full Landsat data record, providing a scientific product suite of land-cover data from 1985 to the present. There are six Annual NLCD science products:

- **Land Cover**, which shows the physical materials on the Earth's surface, such as forests, water, and bare soil
- **Land Cover Change**, which reveals how these physical materials have changed from one year to the next
- **Land Cover Confidence**, a measure of confidence that the land-cover label matches the training data
- **Fractional Impervious Surface**, the percentage of surface area in a 30-meter map pixel that is covered with impervious materials, such as buildings or concrete
- **Impervious Descriptor**, which distinguishes roads from other built surfaces
- **Spectral Change Day of Year**, which shows the day of the year when a significant change in surface reflectance was detected on a map product

These comprehensive data products are the result of bringing together legacy classification and change algorithms with the latest advancements in AI and machine learning. They run in high-performance computing and cloud-based processing environments.

NLCD Land Cover as a Single, Ready-to-Use Layer

ArcGIS Living Atlas has provided access to NLCD for seven years. Since June 2025, users have had access to all 40 years of the Annual NLCD Collection, from 1985 to 2024, as a single, ready-to-use imagery layer. It is also available in a web mapping app: the NLCD Land Cover Explorer.

Built on ArcGIS Maps SDK for JavaScript, the NLCD Land Cover Explorer further democratizes the data and introduces the Annual NLCD Collection to people who may be less familiar with it. For users of all levels, the app highlights some of the collection's unique capabilities, including:

- Performing visual change analysis via Animate Mode or Swipe Mode.
- Conducting dynamic statistical change analysis by year, map extent, and land-cover class.
- Filtering map content by selected land-cover class.
- Investigating and validating land cover in Landsat Imagery Mode.

Analyzing change over time is a fundamental way to derive insight from the Annual NLCD data. Leveraging Swipe Mode within the NLCD Land Cover Explorer, for example, makes it easy to see how land has changed over time. As users adjust the geographic and temporal extents of the map, the app dynamically calculates and quantifies the amount of change that has happened.

For users looking to do additional analysis beyond what is available in the NLCD Land Cover Explorer app, the Annual NLCD imagery layer can be used directly in ArcGIS Online. Most imagery layers in ArcGIS Living Atlas are enabled for varying levels of analysis. In fact, NLCD is included in a group of imagery layers that have been optimized for advanced workflows, enabling users to combine them with other data sources and scale up their analysis.

> To explore the Annual NLCD Collection, go to the NLCD Land Cover Explorer app at links.esri.com/LCExplorer, and access the USA Annual NLCD Land Cover imagery layer in ArcGIS Online at links.esri.com/LCLayer.

Open Geospatial Consortium (OGC) Recognizes Esri's Keith Ryden with Award

Keith Ryden

Esri's Keith Ryden, director of software development for operations and standards, was recognized by the Open Geospatial Consortium (OGC) with the prestigious Kenneth D. Gardels Award. Each year, the award is presented to an individual who has made exemplary contributions to the consortium's consensus standards process.

Ryden is a longtime member of OGC and has actively contributed to the creation and adoption of several OGC standards over the past 30 years. He was part of the team in 1997 that created the Simple Feature Specification, which standardized how spatial data should be stored in a relational database management system. He has cochaired efforts to advance and standardize coordinate reference systems to provide locational and temporal frameworks that allow geometric features to be properly positioned in space and time. Ryden is a current member of—and has served multiple terms on—the OGC Architecture Board, which reviews proposed standards and technologies and provides guidance for them as they move through the OGC process.

"I am proud that Keith Ryden is being recognized with this distinguished honor," said Esri president Jack Dangermond. "I've worked with Keith for 40 years, and he's not only a great engineer—he's an example for all of us in terms of his integrity and his willingness to collaborate, and the impact of his work will be felt for a long time."

The Gardels Award memorializes the spirit of Kenneth Gardels, a founding member and director of the OGC, who passed away in 1999. Gardels was renowned for his dedication to making the world a better place through open communication and the use of information technology to improve the quality of human life. The OGC has honored a member of the consortium with the Gardels Award every year since 1999. Ryden is the second Esri employee to receive the award, following David Danko's recognition in 2009.

Across Africa, Excitement Grows Over Applied Earth Observation Science

Scientific Currents

By Dr. Dawn Wright
Esri

Since the founding of the Group on Earth Observations (GEO) 20 years ago, Esri has been a proud collaborator, most recently as an associate member. GEO is a mini-United Nations of more than 100 governments and organizations working together to use Earth observation technology to tackle climate-related challenges and disasters while enhancing sustainable environmental management and public health.

Indeed, as we cope with the present and future dangers of increasing temperatures, rising sea levels, and more frequent and intense natural hazards, it is more critical than ever to have continuous, near real-time mapping and monitoring of the entire surface of the Earth. Esri sees GEO as one of the most thorough collaboratives doing just that—and at a time when such multilateral approaches seem to be waning or under attack.

For years, GEO has also had regional initiatives, including AmeriGEO in the Americas, EuroGEO in Europe, AOGEO in Asia-Oceana, and AfriGEO in Africa. Through these initiatives, there has been a significant rise in organizations harnessing Earth imagery and geospatial technologies to engage in sustainable development—particularly by several African countries. Recent collaborations among these nations is boosting data sharing and fostering better research and understanding. The tools they're using provide crucial data for monitoring environmental changes and are playing a vital role in agricultural science, disaster management, and urban planning. They are shaping the continent's future.

AfriGEO currently consists of 32 GEO member states, with a few more countries seeking to officially join. In addition, there are 15 participating regional institutions contributing to AfriGEO's mission, including the African Center of Meteorological Applications for Development, the Intergovernmental Authority on Development's Climate Prediction and Applications Centre, the African Regional Institute for Geospatial Information Science and Technology, and the Regional Centre for Mapping of Resources for Development. There are 14 nonaffiliated organizations—such as South Africa's Department of Science, Technology and Innovation and the Council for Scientific and Industrial Research—that are not officially part of AfriGEO's core structure but that still share data; collaborate on events such as symposia and workshops; and implement projects that have to do with agriculture, water management, and disaster risk reduction. Esri is one of six donor organizations that sponsor activities and contribute data, tools, and web portal infrastructure.

AfriGEO seeks to accomplish many things, and Esri supports its key objectives in four main ways:

- Providing a platform for countries to participate in GEO, especially by helping member states and other associated organizations in Africa set up websites to contribute and disseminate geospatial data
- Identifying challenges, gaps, and opportunities for African organizations to contribute to GEO, especially via technical enablement or capacity building
- Supporting knowledge sharing and global collaboration by, for example, hosting mapping challenges for geospatial communities in AfriGEO member states
- Bringing together relevant stakeholders, institutions, and agencies across Africa that are involved in GEO and other Earth observation activities

Each year, AfriGEO hosts the AfriGEO Symposium, a major event attended by hundreds of delegates from across the continent. The 2025 event focused on key topics such as advancing Africa's geospatial ecosystem by improving data collection, accessibility, and sharing; integrating geospatial data into decision-making; strengthening geospatial infrastructure, policies, and capacity; how to embrace AI, big data analytics, and cloud computing; and investing in education and training, especially for youth and across genders. The thematic areas the event covered included agriculture, food security, and soil moisture; biodiversity, land degradation, and sustainable forest management; the blue economy and water resource management; and innovation, data, and infrastructure.

For the AfriGEO Symposium, Esri provided hands-on ArcGIS training to attendees. The sessions included an overview of the Africa GeoPortal (africageoportal.com); how to explore African reservoirs using ArcGIS Living Atlas of the World; how to conduct watershed planning in ArcGIS Online; and how to prepare for floods using the ArcGIS Instant Apps Streamflow Viewer template, according to the principles of GEO's Global Water Sustainability initiative. Streamflow Viewer—which serves a range of users, from small landowners to businesses and governments of many sizes—is a regional-to-global streamflow service wrapped in an open-access web map featuring updated hydrologic modeling and cartography. Esri staff also presented in and moderated key sessions, including ones on marine and coastal management, compliance with the European Union's Regulation on Deforestation-free Products, the Data Infrastructure Community of Practice, and the African Caucus meeting on GEO's strategic plans.

Another exciting collaboration is Esri's work with Geoscience Australia and others to integrate imagery from Digital Earth Africa (digitalearthafrica.org) into the Africa GeoPortal and to develop tailored apps and training materials specific to Africa. The Africa GeoPortal—a sister platform to Digital Earth Africa that's built with ArcGIS Hub—is an open mapping community for data sharing, capacity building, and cooperation across Africa. It enables countries to work together on applied science projects, investment opportunities, and challenges. In the spirit of technical sustainability, Esri is committed to keeping the Africa GeoPortal running as long as needed, including as a portal of portals that references and hosts geospatial data, regardless of its source.

To that end, it is wonderful to see some AfriGEO member countries developing their own national GeoPortals under the umbrella of the Africa GeoPortal, integrating their own customized web mapping apps, imagery, and ArcGIS tutorials. In addition, participating regional institutions, such as the International Water Management Institute and the Consultative Group on International Agricultural Research (better known as CGIAR, the world's largest global agricultural innovation network), are also moving forward with their own specialized open data portals—all of which are included on a growing list of GeoPortals under the Community tab of the Africa GeoPortal website. Participating regional institutions will also nominate some of their own authoritative datasets to be included in ArcGIS Living Atlas.

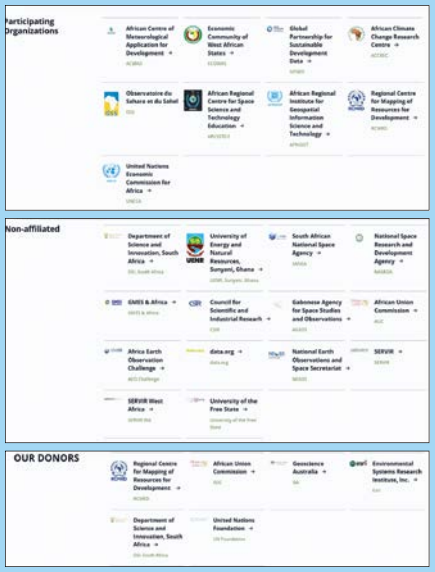
There are many other activities taking place in the applied Earth observations realm in Africa, though there is not enough space in this column to list them. That speaks to the excitement and momentum growing across the African continent over Earth observation science—including using web services and apps to transform raw data into actionable insights that drive policy, economic growth, disaster resilience, and sustainable development.

Esri is proud to assist AfriGEO in fulfilling its credo to provide regional, coordinated, comprehensive, and sustained Earth observation for better and faster decision-making that stimulates innovation and growth while tearing down digital divides.

Kudos to the following Esri staff members who are deeply involved in boosting applied Earth observation technology use across Africa:

- Senior solution engineer Pauline Okeyo, elected cochair of the AfriGEO Data Infrastructure Community of Practice and a member of the Digital Earth Africa Technical Advisory Committee and the Africa GeoPortal Regional Content & Technical Committee
- Senior business and sustainable development manager Lorien Innes, internal lead for AfriGEO and Digital Earth Africa and manager of the Africa GeoPortal
- Director for global community engagement Matthew Pennells, member of the Digital Earth Africa board
- Director of emerging markets and Africa GeoPortal strategy Sohail Elabd

32 AfriGEO Members +



→ AfriGEO consists of 32 GEO member states (shown here in blue), plus many nonaffiliated organizations and donors.

About the Author

As chief scientist of Esri, Dr. Dawn Wright aids in strengthening the scientific foundation for Esri software and services while also representing Esri to the scientific community. A specialist in marine geology, she is an elected member of both the National Academy of Sciences and the National Academy of Engineering, having authored and contributed to some of the most definitive literature on marine GIS.

Designing Smarter from the Start with Live GIS Data

For decades, the worlds of GIS and computer-aided design (CAD) operated separately, with little to no direct connection. GIS professionals analyzed spatial relationships, while civil designers used CAD to craft engineering plans.

That divide is closing at HDR, a global professional services firm and Esri partner. By leveraging a strategic partnership with parcel data provider ReportAll, as well as the integration capabilities of ArcGIS for AutoCAD, HDR's design teams can now access live, authoritative GIS data within their native Autodesk Civil 3D environment, streamlining how civil designers plan and execute their projects.

Building on Better Data

With more than 14,000 employees in over 200 locations around the world, HDR tackles large-scale architecture, engineering, environmental, and construction design projects. Many of these projects span multiple municipal and county jurisdictions, which adds complexity.

For these undertakings, having a clear picture of existing conditions—including accurate parcel data such as property tax boundaries, ownership, and land-use constraints—is the foundation of a successful project.

"Accurate parcel data allows our teams to immediately understand landownership, identify regulatory or physical constraints, and spot opportunities for development, conservation, or community engagement," said Bridget Brown, vice president and director of geospatial services at HDR. "The sooner we can get that data into the hands of our project teams, the better. It accelerates decision-making when we have trusted datasets from the start."

Overcoming the Data Disconnect

The first challenge was accessing this crucial data efficiently. The conventional workflow—where a civil designer requests parcel information from a GIS analyst, who then packages and delivers static files—is slow and inefficient. This approach sets off a cycle of requests and manual data handoffs, extending project timelines and isolating civil designers from the dynamic data they need to make informed decisions.

To break this cycle, HDR teamed up with Esri partner ReportAll, a data vendor that provides a comprehensive, nationwide parcel data solution. ReportAll specializes in aggregating and standardizing parcel information from thousands of counties across the United States, providing a single source of truth.

HDR and ReportAll built their partnership on the concept of authoritative data, according to Scott Nelson, ReportAll sales director.

"We're refreshing our data here every single day," he said. "And for most parcels across the US, we will provide a link to the county GIS page so that a team at HDR can identify a parcel that's of particular interest. They can just click on that link to go directly to that county page to do more research and to verify that none of the data has changed."

A Direct Line from GIS to Design

The next challenge was getting the data to civil designers without disrupting their established workflows in Autodesk Civil 3D.

The key to bridging this gap has been ArcGIS for AutoCAD—a no-cost plug-in app from Esri that integrates ArcGIS directly into the AutoCAD and Civil 3D environments. Once installed, the app appears as a ribbon in the design software, providing on-demand access to GIS maps, features, and imagery.

This integration allows HDR's civil designers to stream ReportAll's data directly into their projects. Rather than working with static files, they connect to a live feature service—a web service that provides access to geographic data, allowing users to view, query, and sometimes edit information via the web. This ensures that civil designers are working with the most current information available.

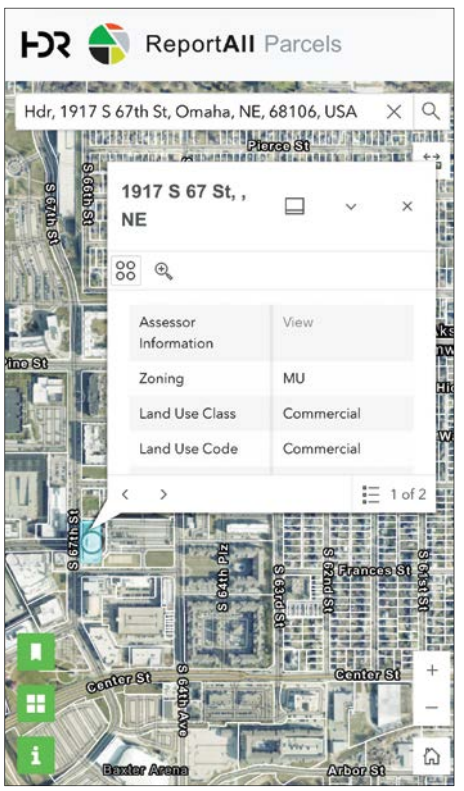
"ReportAll makes our parcel data available to clients in different formats and delivery methods according to their needs," said Dave Fuhry, ReportAll co-owner and chief technical officer. "In this case, HDR is utilizing ReportAll's feature service, which enables on-demand streaming of the freshest data we have, through ArcGIS for AutoCAD, to HDR."

This connection eliminates the need for manual data requests and file conversions, enabling a seamless flow of information from the GIS database to the CAD drawing.

Getting Data to Civil Designers

HDR adopted this new workflow while following a simple but powerful principle: adapting it to existing workflows, according to Brown.

For nontechnical users and project managers, the HDR team built a simple web viewer that combines premium parcel data with other publicly available information from ArcGIS Living Atlas of the World. For GIS professionals and civil designers, HDR provided direct access to the feature service, allowing designers to pull the data into their own custom web maps or into Civil 3D via the ArcGIS for AutoCAD app.



→ ReportAll provides HDR with a nationwide dataset of standardized parcel information from thousands of counties across the United States. (Image courtesy of HDR.)

"It's super helpful to have parcel-level [information] right inside the design tools we're already using," said Brown. "There's no more jumping between platforms or emailing files back and forth. The data just flows in, making everything faster and easier."

HDR's civil designers quickly adopted the technology, said Chris Abbott, senior GIS analyst at HDR.

"ArcGIS for AutoCAD isn't just a cool tool," Abbott said. "It's making collaboration between GIS and design teams smoother than ever."

The app allows HDR teams to import key GIS layers such as parcel boundaries, zoning, land use, and environmental constraints from concept-phase web maps into CAD templates. CAD designers can query rich attribute tables within the design environment, revealing relationships between features that might otherwise go unnoticed.

ArcGIS for AutoCAD also supports automated label generation using ReportAll content and customizable LISP files. This enables tailored symbology and shared editing of design files—all within the CAD platform.

"It's great because our CAD folks don't have to learn a whole new software suite," Abbott said. "They get the data they need, in the format they're used to, and it just works."

This direct access has not only streamlined existing tasks but also sparked new ideas.

"Once our designers see what's possible with parcel data, they immediately ask, 'Can we get [another dataset] here too?'" Brown explained. "They're realizing they can access all kinds of data right in their own design tools."

A Culture of Collaboration

This project is part of a broader shift at HDR, embodied by an internal initiative called "CAD and GIS Are Friends." The goal is to connect the two disciplines, share best practices, and improve project delivery via better collaboration.

Quick buy-in from local HDR offices was a testament to the immediate value civil designers recognized.

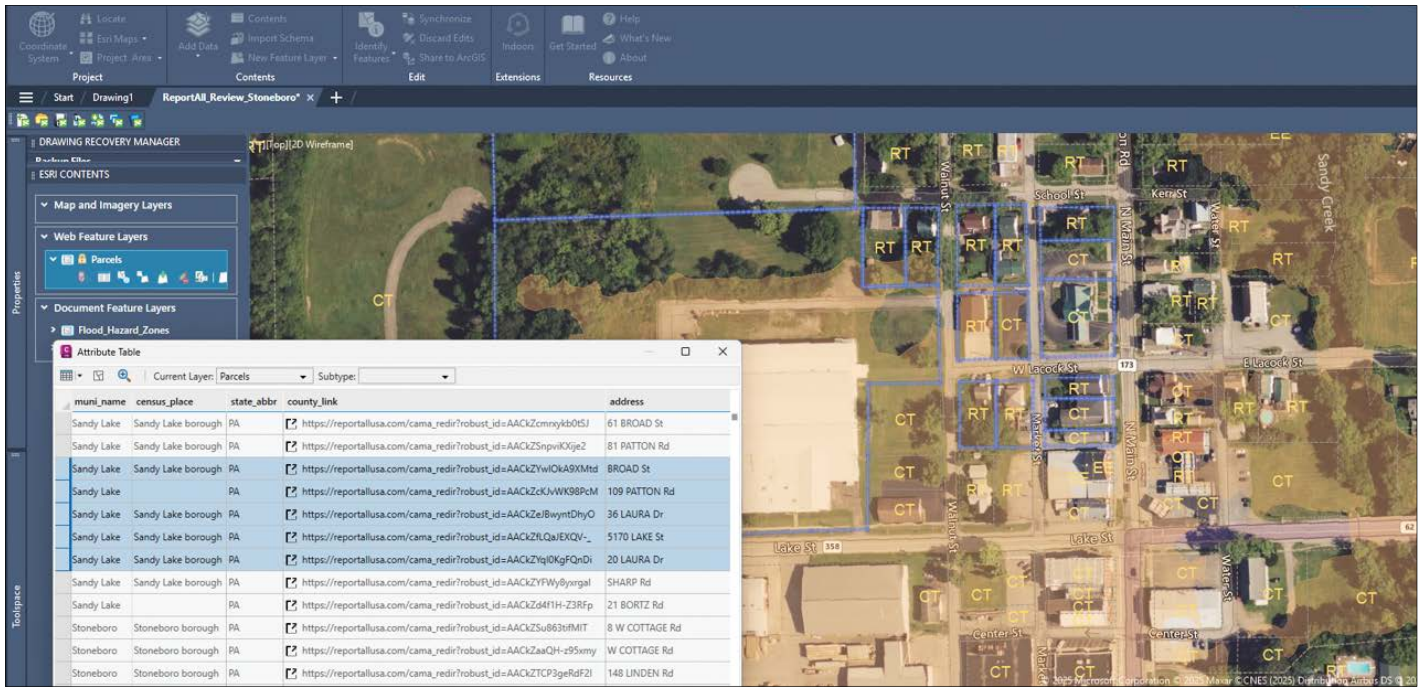
"We made their workflows more efficient by empowering them to have access to the data right away," Brown said.

She added that, when real estate professionals have a web map where they can simply click on a parcel to get assessor information, it saves time and eliminates ambiguity about which properties to research.

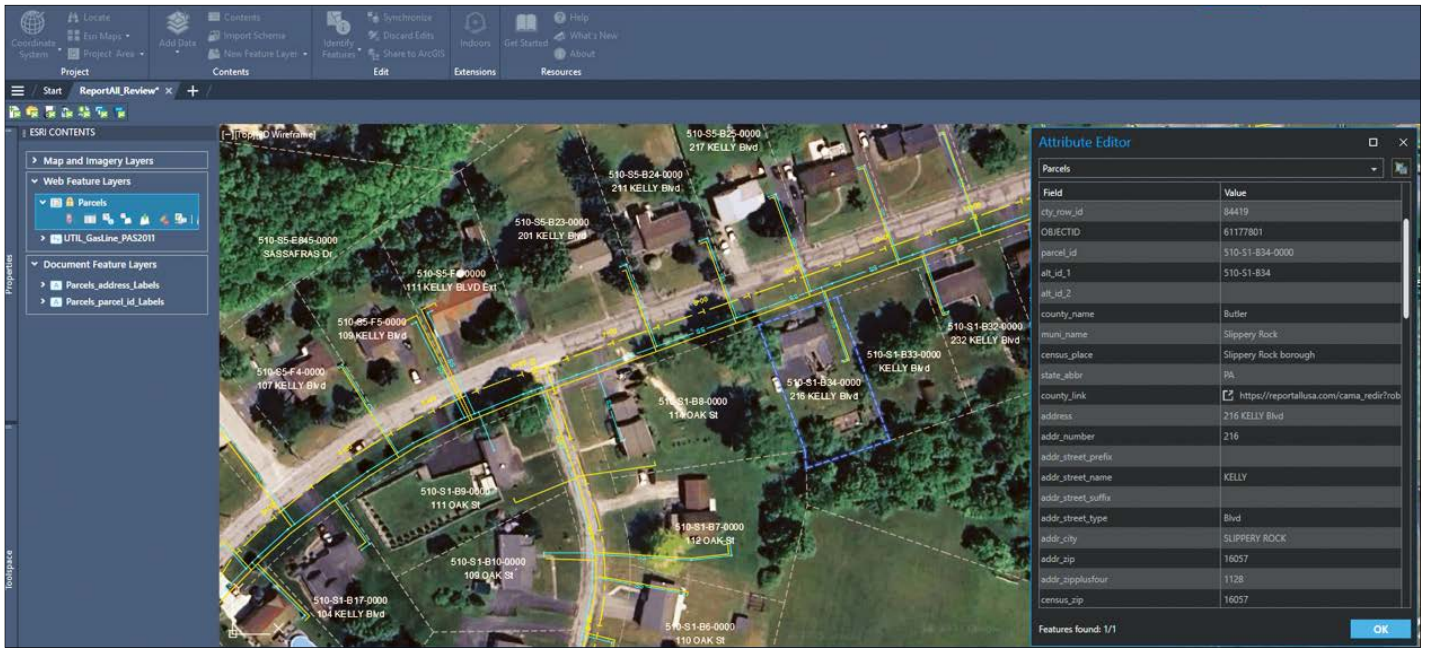
A Return on Data Investment

While the initiative is still relatively new, the benefits are already clear. According to an initial business case developed at HDR, the time spent researching parcel data using the old workflow typically ranged from one to four hours per parcel, whereas having instant access to a nationwide dataset has reduced this by at least half, according to Brown. This allows teams to focus on other tasks.

The original business case for ReportAll came from HDR's right-of-way teams, which wanted a faster way to research tax parcels.



↑ Civil designers and engineers now have access to data tables with links to county assessment offices. (Image courtesy of HDR.)



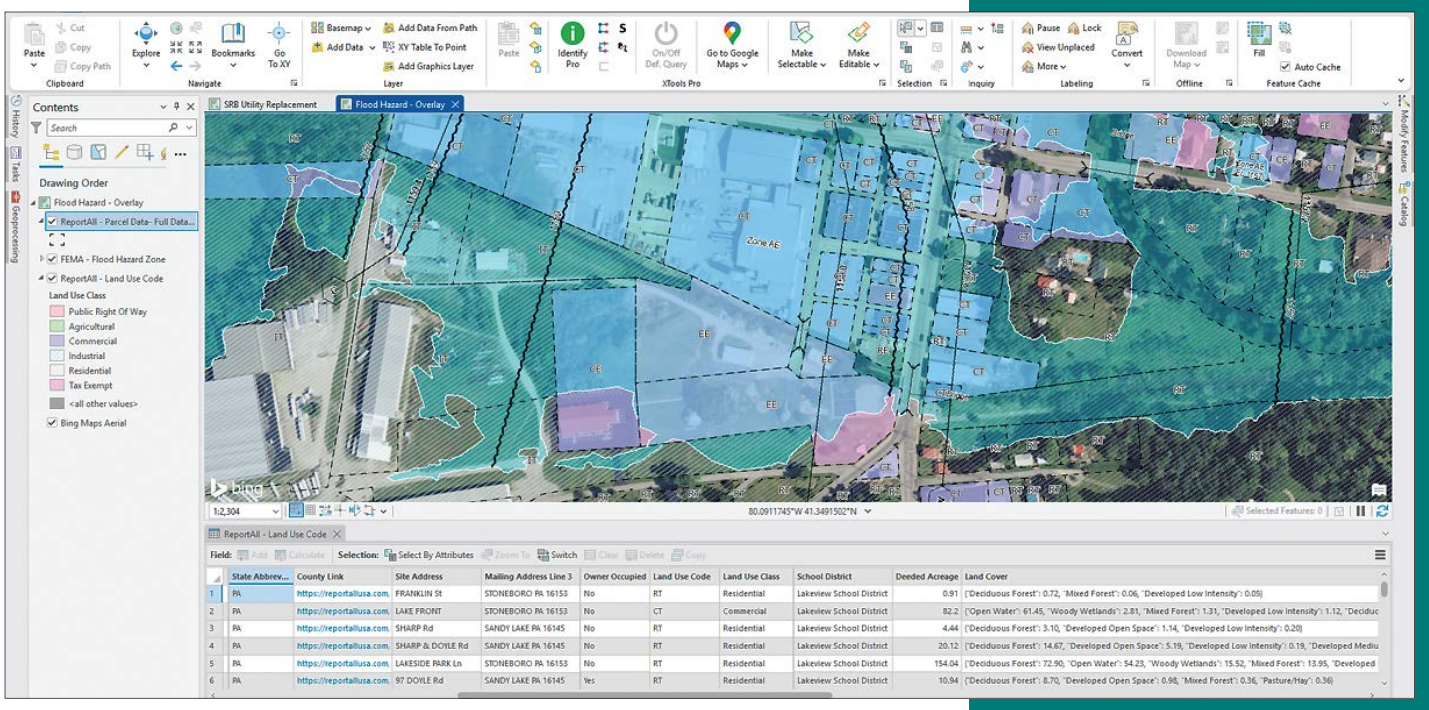
↑ ArcGIS for AutoCAD lets users generate labels for ReportAll's feature service fields. (Image courtesy of HDR.)

"We knew that with direct links to assessor data, we'd save a ton of clicks and manual effort," Brown said. "And we really liked the idea of having a standardized data schema to reduce time spent normalizing data across regions."

The real surprise was the secondhand value of simply making this data available to all teams, she added. Once designers and analysts realized they could access consistent parcel data directly in their workflows, it opened the door to broader adoption and even more time saved.

The "CAD and GIS Are Friends" initiative is rooted in four strategic principles that guide HDR's approach to data, Brown said. The first two are empowering teams with the best information and using the idea of premium data as a strategic investment.

"The third thing is, we are meeting teams where they are, in the platforms they already use—no extra logins, no switching systems. That makes adoption faster and change management a whole lot easier," Brown said. "Finally, there's broad cross-disciplinary value when we expose these premium datasets to our project teams."



↑ Overlaying current parcel ownership data with flood zone information from the Federal Emergency Management Agency (FEMA) aids emergency planning. (Image courtesy of HDR.)

Enhanced Design, Collaboration, and Customization in ArcGIS for AutoCAD

The November 2025 release of ArcGIS for AutoCAD provides powerful new capabilities to enhance civil design decisions and improve collaboration between offices and field teams. ArcGIS for AutoCAD supports both services-based and file-based workflows, allowing users of Autodesk AutoCAD and Autodesk Civil 3D to work with GIS content from either ArcGIS Online or ArcGIS Enterprise.

This release enhances support for a variety of services, including map image, dynamic imagery, and feature services (points, lines, and polygons). A key update for feature layers is support for related records, which allows users to instantly view and edit related GIS data, such as asset conditions from field inspections, directly within their designs. This helps civil engineers make more informed decisions using the most up-to-date information. The new capability complements existing workflows that use branch versioning—an ArcGIS capability that allows users to simultaneously collaborate on the same data, enabling teams to incorporate design recommendations without overwriting project data.

The release also adds support for m-enabled polylines, which preserves linear alignment information from a GIS. This is critical for civil-to-field workflows involving infrastructure such as roads, rails, and pipelines. With this feature, civil designers can use asset centerline data from ArcGIS to better inform their plans, while also sharing stationed centerlines with field crews to help them get accurately situated on-site.

ArcGIS for AutoCAD also supports coded domain values, sublayers, and attachments to features and is compatible with ArcGIS Field Maps, parcel fabric in ArcGIS Pro, and more. A new Microsoft .NET SDK gives developers expanded options to customize, automate, and extend ArcGIS for AutoCAD to create experiences tailored to an organization's specific needs.

Unite Data and Collaborators with Help from Esri Partners

When organizations need to bring together stakeholders and data, ensuring that everyone working on a project has a unified view of the issues and potential solutions, Esri partners can help. Their expertise in applying the geographic approach and implementing ArcGIS technology to achieve digital transformation is unmatched.

See how four Esri partners spanning the hemispheres helped their clients develop GIS solutions that galvanize data-driven decision-making in fields ranging from bird conservation to broadband expansion.

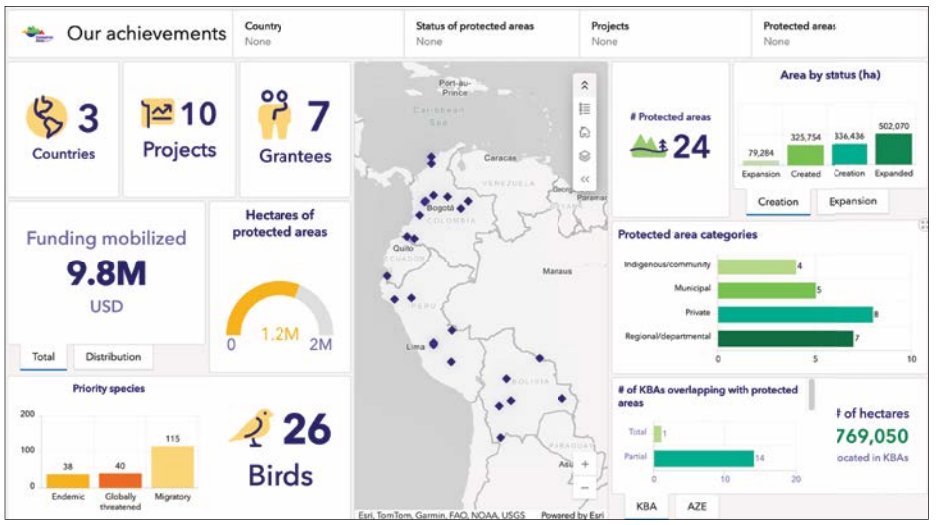
Dashboards for Diverse Stakeholders

Conserva Aves is a hemispheric initiative that advances bird and biodiversity conservation across Latin America and the Caribbean. Led by the National Audubon Society, BirdLife International, the American Bird Conservancy, and the Latin American and Caribbean Network of Environmental Funds, the program supports the creation and effective management of protected areas while empowering local and Indigenous communities to be active partners in conservation. The initiative's long-term vision aligns with globally adopted goals to protect 30 percent of critical ecosystems by 2030 and promote sustainable livelihoods.

With activities spanning multiple countries and organizations, Conserva Aves needed a unified and transparent system to consolidate data, monitor biodiversity indicators, and clearly communicate results to funders, partners, and communities. So the National Audubon Society partnered with **DreamGIS** (dreamgis.com) to design and implement a series of interactive dashboards that allow near real-time visualization and management of all Conserva Aves indicators. The company, based in Colombia, specializes in satellite data integration and geospatial analytics.

The team from DreamGIS custom built each data relationship, function, and analytical process using ArcGIS Online and ArcGIS Notebooks to mirror the planning and decision-making workflows of the program's multiple stakeholders. This tailored design ensures that the dashboards go beyond visual display and represent the initiative's operational and strategic dynamics. The system supports on-the-fly data updates, advanced querying, and the integration of field information from local organizations—guaranteeing that conservation actions and outcomes across participating regions are fully traceable.

The dashboards have transformed how the consortium monitors and communicates impact. Project managers can now visualize key indicators across more than 7,000 square miles of biodiversity hot spots, link ecological results with social benefits, and generate reports instantly. This digital transformation enhances transparency, accountability, and data-driven decision-making, paving the way for Conserva Aves to expand into new regions throughout Latin America.



↑ Dashboards display progress on projects, funding, protected areas, and priority bird species across Latin America.

From Data Silos to Digital Twins

After three water agencies in Southern California's Santa Clarita Valley merged to form Santa Clarita Valley Water, the new unified agency needed to consolidate and digitally transform asset management across its 195-square-mile service area. Initially, distribution networks and facilities were managed separately through disconnected databases and legacy applications. This limited visibility, slowed maintenance, and prevented employees from having a real-time, systemwide view of infrastructure.

To overcome these challenges, Santa Clarita Valley Water partnered with **DCSE, Inc.** (dcse.com) to build a GIS-centric asset management framework powered by ArcGIS Utility Network. The goal was to create a single, authoritative GIS asset registry that connected office and mobile staff through a unified spatial view of all network and facility assets.

While having one asset registry provided clear operational advantages, leadership at Santa Clarita Valley Water recognized that facility managers and operators need different things compared to GIS professionals. To bridge this gap, DCSE introduced the award-winning GIS-Enabled Asset Registry (GEAR), an intuitive digital twin that's compatible with ArcGIS Utility Network and gives non-GIS staff direct, browser-based access to asset data.

GEAR helps employees manage treatment plants, pump stations, tanks, and wells using immersive 2D and 3D visualizations. Within GEAR, asset managers can move seamlessly from viewing assets in the digital twin to creating and tracking work orders, which are automatically routed to Trimble Unity Maintain and reflected across ArcGIS Utility Network via the single asset registry.

This feature service-based architecture eliminates data silos, fixes issues with synchronization, speeds up field response, and supports coming to sound resolutions quickly. Today, Santa Clarita Valley Water operates within one unified geospatial environment where 3D visualization, web access, and digital twin technology have streamlined workflows, improved data accuracy, and laid the foundation for doing predictive maintenance. Santa Clarita Valley Water is a connected utility today that's preparing for tomorrow.

↑ This 3D view of a well in Scene Viewer is based on ArcGIS Utility Network data.

Esri partners represent the rich ecosystem of organizations around the world that work together to extend the ArcGIS system and implement it in distinct ways to solve specific challenges. Find partners that meet your needs at **esri.com/partners**.

Expanding Broadband Collaboratively

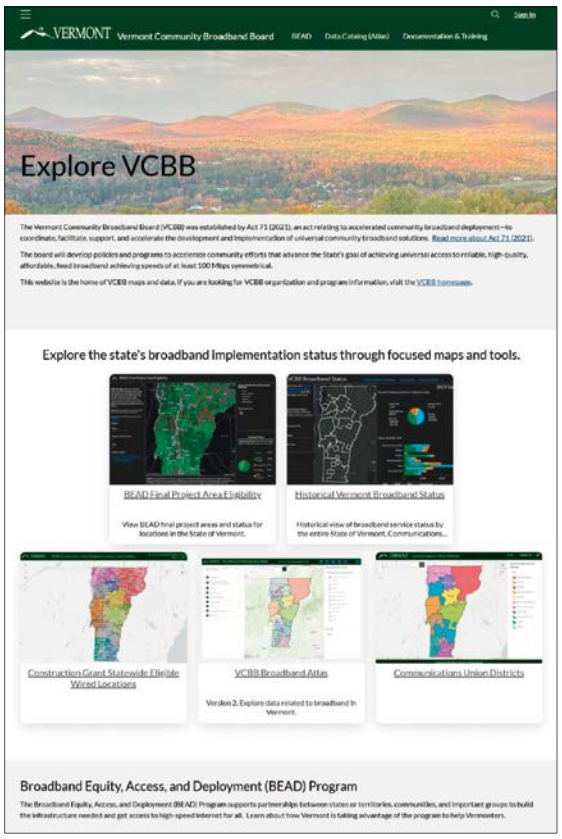
In rural, mountainous Vermont, many residents still lack affordable and reliable high-speed internet. This absence has caused economic, public health, and educational challenges for the state and stifled connections between people and their communities.

Since 2021, the Vermont Community Broadband Board (VCBB) has supported and overseen the significant expansion of broadband internet access across the state. Knowing that GIS is key to understanding spatial distribution and identifying infrastructure gaps, the VCBB enlisted **Stone Environmental** (stone-env.com)—an employee-owned science and engineering firm located in Montpelier, Vermont—to deploy ArcGIS Online and create a wide range of data, maps, and apps.

The VCBB allocates funding to Communications Union Districts around the state that manage broadband infrastructure deployment regionally. To help districts report their progress to the VCBB, Stone's geospatial and data solutions team established workflows in ArcGIS Online to efficiently aggregate data from the districts and other sources in standardized, statewide datasets. The team also developed dashboards using ArcGIS Dashboards and web-based apps using ArcGIS Experience Builder. Additionally, the VCBB maintains transparency by sharing content via a public-facing ArcGIS Hub site built by Stone.

Stone's geospatial and data solutions team also conducts data analysis for the VCBB to support federal, state, and legislative reporting and performance monitoring. Recently, Stone helped with Vermont's Broadband Equity, Access, and Deployment program, which enabled the state to secure an additional $228.9 million in federal funding for broadband expansion and $5.3 million to improve accessibility and technology education.

Over the past five years—with help from the geographic approach and GIS technology—high-speed internet access has expanded to 97 percent of serviceable addresses in Vermont, connecting neighbors and communities with each other and the world.



→ The Explore VCBB ArcGIS Hub site contains apps, dashboards, data, documentation, and training content for public access.

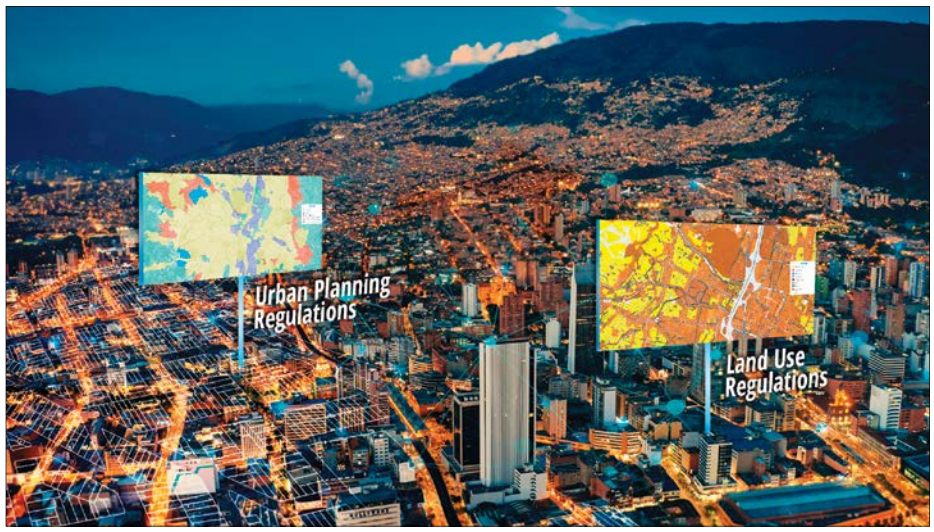
Data-Driven Land-Use Planning

To comply with national regulations and address issues including urban expansion, mobility, and pressure on rural areas, the city of Medellín, Colombia, is updating its zoning and land-use plans—called Planes de Ordenamiento Territorial, or POT. The update incorporates a national standard—the LADM_COL-POT Extended Model—that facilitates the unified and effective management of spatial and regulatory data within the area and promotes institutional interoperability.

Through its Department of Planning, the District of Medellín hired technical teams and **H&G Consultores S.A.S.** (hyg.com.co) to provide methodological and technological support throughout the project. Together, the teams harmonized the spatial layers of Medellín's zoning and land-use plans and updated nearly 78 percent of the city's regulatory framework, covering essential areas such as public infrastructure, housing, land use, project financing, resident participation, and climate adaptation.

H&G Consultores developed a technological solution called MapGIS-POT, which integrates with ArcGIS Enterprise, ArcGIS Pro, ArcGIS Online, and ArcGIS Dashboards. The platform allows users to manage multiple versions of the POT, streamline data editing and review, assign roles, and validate both topological and logical data. Additionally, it ensures compliance with the LADM_COL-POT standard.

The integration of MapGIS-POT with Esri technology has enabled the City of Medellín to unify the regulatory and technical management of the POT within a robust and collaborative geospatial environment. As a result, Medellín has established itself as a national leader in modernizing territorial planning. The platform strengthens traceability, interoperability, and efficiency and represents a critical step forward in Medellín becoming a digital-first, collaborative, and data-driven city.



↑ A robust GIS implementation is helping the City of Medellín, Colombia, connect its zoning and land-use plans with other spatial and regulatory data.

AI and ArcGIS Help Automate Design for Large-Scale Developments

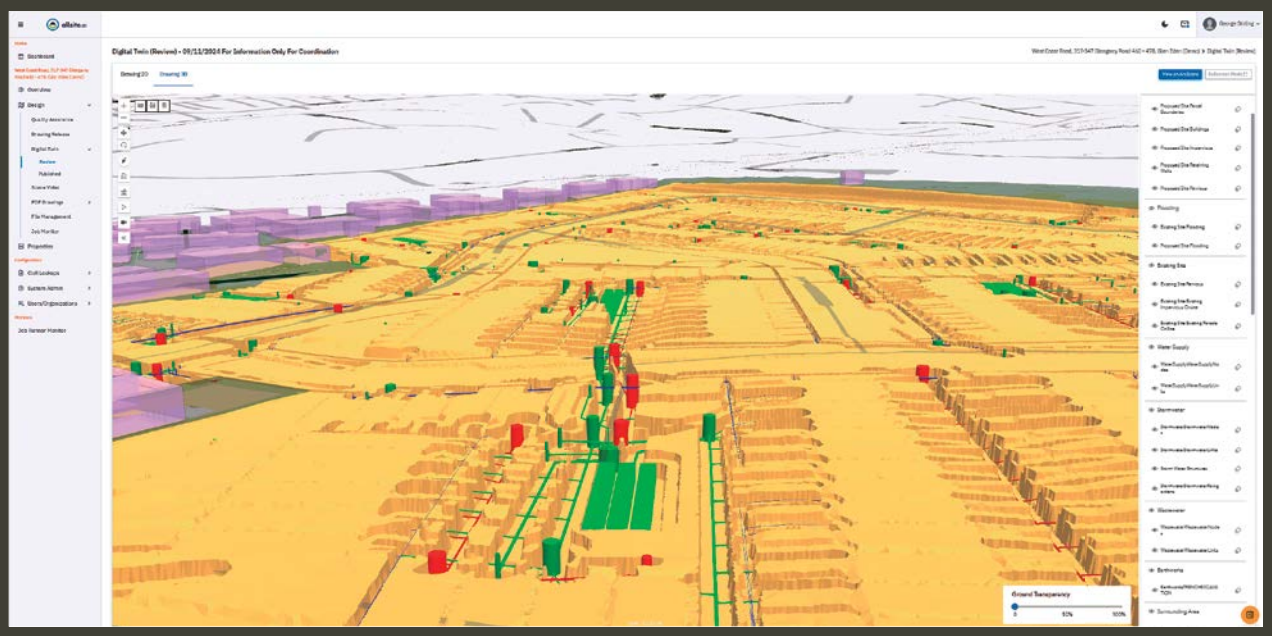
Thanks to AI, new approaches to civil engineering design are emerging—particularly for large-scale land development. Allsite.ai (allsite.ai), a recent graduate of the Esri Startup program, has built a design platform that incorporates AI with ArcGIS technology to automate parts of the design process and develop digital twins.

"Esri's technology provides us with the means to work with data at a massive scale, which is critical for us because the projects running on our programs can be the size of a city," said Sam Blackbourn, cofounder and CEO of Allsite.ai, which has used Esri technology since its founding in 2021. "Our software uses the ArcGIS 3D Analyst extension to prepare spatial data for Allsite.ai's proprietary AI models and algorithms that rely on huge graphics processing unit (GPU) clusters for processing."

The resultant platform allows civil engineers to generate cut-and-fill plans to create level construction sites, build road profiles (perpendicular views of roads that show the ups and downs of their surfaces), and produce long sections that display a project's elevation profile. ArcGIS Pro SDK for .NET and ArcPy are used as well to extract and process data.

Initially, the Allsite.ai team used ArcGIS to develop automations, such as generating scheme plans—detailed drawings that illustrate the design, layout, and other aspects of a property development project—and doing quality assurance verifications on engineering designs to ensure they meet local engineering requirements.

"More recently, we have used ArcGIS to prepare data for AI model runs and visualizing our design outputs for the development of digital twins," said George Stirling, cofounder and CTO of Allsite.ai.



↑ Service AI was used to model trenches for a project in New Zealand.

↑ Level AI allows engineers to generate cut-and-fill plans with raster overlays, like at this site in New Zealand.

The company has built two AI-powered design agents: one, called Level AI, for surface designs, and another, called Service AI, for underground infrastructure. The agents work with ArcGIS Pro and Autodesk's Civil 3D software, leveraging their interoperability and the robust collaboration between Esri and Autodesk. All assets are hosted in ArcGIS Online, and ArcGIS Maps SDK for JavaScript provides additional information in the digital twin models.

"Our optimization engine was a significant challenge to develop—but an essential part of our work," said Blackbourn. "The scale of the parameters required for our projects is huge, which prompted the development of a distributed architecture. This required us to utilize advances in cloud GPU computing to rapidly produce optimal designs that would be difficult to achieve without AI."

The Level AI design agent provides compliant surface and roading designs from a 2D layout. It is an advanced grading optimizer that considers many factors—including flood risks, roadways, and the ability to service the site—in its analysis and recommendations. The Service AI design agent automatically designs storm sewer and storm drain pipe sizes and invert levels to create optimal pipe networks that stand up to local engineering requirements. Additionally, Service AI combines generative AI and algorithms to forecast operating and capital expenditures.

"Our customers are primarily civil engineering land development consultancies that can utilize the technology to rapidly progress civil engineering land development projects," said Blackbourn. "The end user deriving the greatest benefit is the land developer . . . because our design platform provides faster and more comprehensive development insights, which improves decision-making and saves money."

Allsite.ai is working with some large homebuilders in the United States on development projects in California, Arizona, and Texas. One project is a 2,000-house subdivision near Sacramento. The site has a large number of detention ponds to hold stormwater runoff during flooding events, as well as a tunnel under a parkway—and these were all automatically designed using Level AI. For a 38-acre project in San Francisco, roadway surfaces were automatically generated by AI rather than manually designed, leading to more than $1 million in savings for earthwork grading.

"By using Allsite.ai, our customers get rapid design iterations in days, not weeks," said Stirling. "This allows engineering consultancies to spend more time ensuring that their clients have greater options and are better served. Our design platform allows the time-consuming aspects of large land development projects, like grading, to be handled by the computer, whilst the more challenging engineering problems can be tackled by the engineer."

For more information on the Esri Startup program, go to links.esri.com/startup.

Driven by Passion and Purpose

→ In using AI to analyze years of aerial footage, geographer Gabriel Ortiz and his team found that forest cover in Cantabria has increased since the 1950s.

Gabriel Ortiz has devoted his life to geography, and he's always been fascinated by technology.

"I'll never forget the day I touched a computer for the first time," he said, reminiscing about being a student at the University of Cantabria in Spain. "It really changed my life."

Drawn to that fascinating point that many in the GIS world know so well—where art and science meet in cartography—he studied geography. He was enthralled when, as a student in the mid-1990s, he combined 3D models and imaging to build an animated digital terrain for the first time. He dove headfirst into learning ARC/INFO, never shying away from trying the latest technology and always keeping an eye on what was coming next.

From then on, Ortiz has been driven by a deep-seated passion for his profession, which he finds fun and challenging, and for public service.

"I'm attracted to solving problems and thinking about creative ideas that I can try," he said. "I find energy to do all of this because I am serving a bigger purpose, which is creating a better society."

Innovating at New Scales

As the head of cartography and GIS services for the government of Cantabria—a 2,100-square-mile swath of mountains and beaches in northern Spain—Ortiz and his team of five have spearheaded ways of using GIS with AI and 3D modeling at scale. They're employing computer vision trained on decades of aerial photos to see what others can't: which beaches will overflow on summer weekends, or where forestland has doubled over the last 60 years.

The team is also building a digital twin of the whole region, which Ortiz believes will help project Cantabria's rich archival data into the future, giving three-dimensional insight into planning future transportation systems, how first responders approach emergency situations, and more.

"We are constantly using AI to make society aware of the problems and why those problems happen," Ortiz said. "And I am totally invested in the idea of bringing live data to the digital twin—starting the journey to the next evolution of cartography and GIS."

Gabriel Ortiz

Too Many Beachgoers, Too Little Beach

Following the COVID-19 pandemic, when people became more conscientious about space constraints, the government of Cantabria wanted to investigate overcrowding on beaches. Ortiz's bosses asked him to make some maps. He counted people instead.

Training AI to detect beachgoers in aerial photos was difficult. People appear as faint shadows, barely distinguishable from towels and umbrellas. His team labeled images and taught the model to recognize patterns across five aerial surveys from 2002 to 2017.

The results changed beach management in Cantabria. On sunny summer holidays, about 76,000 people visit the area's 104 beaches, but the distribution is uneven. Eastern beaches attract the heaviest crowds, while western beaches offer similar beauty with far fewer people.

Pressure maps encourage visitors to make smarter choices. Small popular beaches face the greatest stress: A tiny beach packed with people suffers more damage per square meter than a large beach with double the crowds.

The model assigns weights to usable beach area: Dry sand counts fully, wet sand counts at 50 percent, dune systems count at 10 percent, and rocky areas count at 5 percent. This reveals environmental pressure per square meter, based on each beach's composition.

Beyond counting beachgoers, the team also analyzes where vehicles cluster—often in sensitive coastal areas—to identify where better public transit could reduce damage. Ortiz's vehicle detection models reveal clear patterns: hundreds of cars parked in grasslands, and campers in areas never meant for them.

The maps suggest solutions. By pinpointing popular spots and transport bottlenecks, officials can plan new bus routes and better manage parking areas to serve visitors while protecting the landscape.

Imagery Shows an Anomaly: Forest Growth

The team's most surprising discovery so far in using AI to analyze years of aerial footage is a welcome treat: Forest cover in Cantabria more than doubled between 1957 and 2020. Unlike global stories of deforestation, this region's forests are recovering.

"This is not an opinion. This is what is really happening," Ortiz said while highlighting yellow areas on maps that show vegetation gains far exceeding losses in red.

The change reflects social and economic shifts. As people abandoned farming and moved to cities, marginal agricultural lands reverted to forest. Industrial eucalyptus plantations expanded, but native species also thrived. The landscape is dramatically more forested than it was in the 1950s.

National officials confirmed that the findings match broader trends. The analysis shows that forests can recover when human pressure shifts—and underscores the urgency for managing that growth.

To that end, Ortiz has developed an innovative, AI-based system to automatically detect and monitor forest areas that are being logged. Moving from data to action, he expects that this will open up new possibilities for overseeing official permits.

Doing More with Less—for the People

Ortiz calls computer vision "a force multiplier" that lets his six-person team accomplish what would traditionally require dozens of specialists and millions of dollars.

"We will see smaller and smaller teams creating the most important value," he predicted. "This is going to be the new normal."

His team's efficiency comes from choosing the right problems to solve with automation.

"Many people try to do crazy things with AI," Ortiz said. "This technology is excellent, but it's not suitable for all problems. Choosing the right one and choosing the right strategy is very important."

Rather than automating everything, Ortiz's team uses computer vision for tasks that would be impossible or infeasible for human observers to do. And above all, they are motivated by an ethos of public service, which shapes how they view data sharing. Unlike organizations that guard datasets, Cantabria makes everything open.

"This data belongs to the taxpayer. It's not our information," Ortiz said.

The team's mobile mapping apps put decades of territorial analysis into residents' hands. Since 2016, the apps have allowed residents to access datasets anywhere in the region. The team's ArcGIS StoryMaps stories combine analysis with informative explanations.

"One image has much more power than a thousand words," Ortiz said. "When you publish something meaningful in a story map, people can interact with all the data. You can really tell stories and connect with people through them."

A New Way to Experience Cartography

The next project for Ortiz and his team is building digital twins that capture lifelike 3D replicas of the region.

"Digital twins are the next evolution in cartography," Ortiz said. "For centuries, we have been using projections to simplify reality to a flat canvas, to a paper map. But as digital technology evolves, the world doesn't need to be projected anymore. We are going to be able to reflect reality with less demanding abstractions. We will be able to create lifelike replicas of our world."

Traditional maps require specialized knowledge to interpret. Digital twins let people explore their landscape naturally.

"When you see something in 3D, it's easier to understand than seeing a technical map full of colors and symbologies," Ortiz said.

This accessibility could transform how people participate in land use planning. As digital twins evolve, these tools could guide residents and visitors in real time—helping them find uncrowded coves and forest trails while protecting fragile places. Everyone could see Cantabria through the eyes of those who know it best, experiencing the landscape with less pressure and more wonder.

Geographers Aren't Going Anywhere: How AI Is Supercharging Geography

Spatial Foundations

By Dr. Trisalyn Nelson
University of California, Santa Barbara

This article was originally published in the Santa Barbara Independent. *It has been lightly edited for style and clarity.*

There is a lot of talk about how AI will impact various careers and the workforce. Recently a list of 40 jobs that AI will make obsolete went viral on social media. Geographer was on the list.

As a professional geographer, I think breakthroughs in AI are making a meaningful career in geography more exciting, essential, and impactful than ever before.

The study on AI and careers evaluated tasks that were effectively performed or supported by Microsoft Copilot. Using data stratified by career, researchers scored how well the AI completed or assisted tasks and labeled careers with a high degree of successful task completion as likely to suffer job loss. We don't know for certain, but it's likely the AI assistant succeeded at tasks like name identification and navigation. Without putting too fine a point on it, there's a lot more that goes into being a geographer than memorizing country names and capitals.

Let's talk about what a geographer does in 2025. When I attend parties, people are always surprised that I direct a geographic research center because their assumption is that all the lakes are already named. What could we possibly be researching?

Being a geographer isn't about knowing the names of capitals. It involves thinking about our planet holistically. It entails leveraging cutting-edge technology to connect the where and the why, not sifting through dusty atlases in the back of a library.

Simply put, in 2025, being a geographer is about using the lens of place and a systems approach to people and the planet to solve some of our most pressing challenges. From affordable housing and sustainable businesses to food security and physical security, geographers are actively working across organizations and agencies to map a better future.

Geographers have historically been hard to spot, which means they're not top of mind. After all, nobody hangs a shingle that says, "geographer for hire." But geographers work in many fields and across all levels of agencies. Geographers help solve health epidemics, triage resources during disasters, manage water availability, track supply chains, and find optimal locations for everything from conservation areas to the best place to open a new coffee shop. Geography touches every industry you can imagine, and the approaches to solving location problems are just as diverse.

AI is not taking over for geographers. It's actually empowering them with new tools and capabilities that operationalize and make sense of the massive amounts of geographic data that already exist and the petabytes of new data created every day.

There is more geographic data available today than ever before. Thanks to the proliferation of GPS-enabled devices, drones, and satellites, there's been an explosion of data about the built and natural worlds. Today's geographers routinely leverage data from cell phones, weather stations, vehicle navigation, and satellites that measure everything from the atmosphere to geology. AI makes the process of sifting through that data and transforming it into actionable insights easier and faster.

For geographers, AI is a heaven-sent tool that enables us to have more impact—and fun. Geographers are systems thinkers that use the lens of location to tackle issues relating to people and place. Speeding up data crunching means that geographers can spend more time on higher-order tasks.

For example, my graduate research on forest change required me to start by mapping trees from a satellite image. I spent 80 percent of my two-year degree writing code to map trees, leaving little time for addressing substantive questions that can inform decisions and improve forest management. Today, AI could map those trees in seconds. Which means today's geographers have more time to do the creative and impactful work that addresses meaningful challenges. AI can count cars in an image, interpolate missing data, and even translate images into text descriptions. But it takes a human to analyze and combine traffic counts, dwell patterns, utility networks, and local regulations to realize that the corner of Main and Second is the best place to build a new electric vehicle (EV) charging station.

AI is not replacing the geographer; it is supercharging the geographer. Geographers are poised to have the biggest impact on communities, businesses, and the planet in decades.

Of course, not all geographers are AI wonks. It's a diverse field. But for anyone considering careers with potential for employment and impact, the intersection of AI and massive amounts of novel spatial data make the skills and perspectives of geographers more powerful and essential. AI makes geography more relevant than ever in the modern world.

If you're looking for a meaningful career that will be energized, rather than threatened, by developments in AI, consider geography.

About the Author

Dr. Trisalyn Nelson is a professor and holder of the Jack and Laura Dangermond Endowed Chair of Geography at the University of California, Santa Barbara. She is also a Public Voices fellow of the OpEd Project, which seeks to elevate underrepresented expert voices.

Leading Through Time and Technology

Lessons Learned from 20 Years of GIS Management in Emergency Response

By Janine Latham, ROK Technologies

I was a 27-year-old GIS analyst in Philadelphia, Pennsylvania, when I volunteered to support my company's response to Hurricane Katrina. The hurricane devastated communities and showed a nation that while we can't control nature, we can control how we respond to it. I didn't know it then, but those first two weeks would set the trajectory for the next 20 years of my career.

What was supposed to be a short deployment to Baton Rouge, Louisiana, quickly turned into nine months on-site, where I stayed to manage and lead the GIS unit—a 24-hour mapping shop with analysts working around the clock to supply responders with operational and situational data.

It was there that I learned my first true management lesson: Success isn't about how much data gets processed; it's about how well others see what GIS can do. Managing people through possibility rather than pressure became the foundation for how I lead teams.

One of my first nights in Baton Rouge, I went back to the command post at 2:00 a.m. The head database administrator (DBA) looked up and asked, "What are you here for?"

"GIS," I said.

He laughed. "GIS is easy," he responded.

Instead of throwing my laptop bag at him, I made it my mission to show him how GIS, databases, and systems all had to work together for us to succeed. GIS is a team sport and a critical component of emergency operations.

That same DBA is now one of my favorite collaborators and friends. Together, we've helped move the perception from "GIS is easy" to "GIS is essential." His technical expertise and willingness to evolve have pushed our team's use of GIS forward. I am forever grateful to him and every teammate who's helped shape what GIS in emergency response has become: a trusted partner in saving lives and restoring communities.

Improvising Under Pressure: 2005–2010

Those early years were raw, exhausting, and transformative. I was still learning what it meant to manage people, technology, and expectations in a nonstop operational environment. GIS lived in the world of ArcGIS Desktop, on-premises servers, emailed shapefiles, and binders full of printed map books. Hundreds of e-size (huge) maps and stapled data tables filled command posts, and 24-hour turnarounds were considered successes.

But in that chaos came some clarity: Managing isn't about control, it's about building teams and trust among them. That means listening to analysts who see better ways to automate a task, encouraging DBAs to spatially enable data, and recognizing how exhausted a GIS analyst can get pumping out operational maps.

These experiences taught me that managing through possibility means taking frustrations and turning them into better ways to use technology. Our goal wasn't to make prettier maps; it was to move operations forward faster and with more accuracy. That mindset built trust and earned GIS a seat at the table.

The Shift to Digital Collaboration: 2010–2015

Everything with GIS began to change with the explosion of the Deepwater Horizon oil rig in the Gulf of Mexico in 2010, which caused the largest marine oil spill in US history; the 2011 tornado in Joplin, Missouri, that damaged nearly 8,000 buildings and killed more than 150 people; and Hurricane Sandy, which ravaged areas from the Caribbean to eastern Canada in October 2012 and caused $65 billion (about $85 billion today) in damages in the United States. Esri ushered in ArcGIS Server to replace ArcIMS and launched ArcGIS Online. The enterprise GIS mindset began to emerge.

Managing GIS in this era required translating between the old and the new. This meant helping field staff, analysts, and IT teams see that cloud-based systems weren't a burden and weren't replacing them, but empowering them.

During this time, an IT architect on my team asked to use an $8-per-month cloud coupon to stand up an early web-based GIS for operations. That small experiment became a model for our company's enterprise response systems. There, I learned that managing is about creating space for curiosity and calculated risk within the emerging technology landscape. When people feel trusted to try new ideas, innovation follows.

From Static Maps to Dynamic Data: 2015–2020

Technology leaped forward again. ArcGIS Collector, ArcGIS Survey123, ArcGIS Dashboards, and ArcGIS StoryMaps transformed how data was collected and shared—not just within operational teams but also with the public. During Hurricanes Harvey and Irma, as well as wildfires in California, the turnaround for situational data dropped from days to minutes.

Managing teams through this era meant balancing opportunity with overload, asking lots of questions, and not being afraid to try something new. A common question I asked was, "What did we learn during the last disaster response, and how can we do better next time?"

Listening to what works and what doesn't helps teams design better workflows after every response.

The Rise of Intelligent Response: 2020–the Present

When COVID-19 hit, GIS moved from the command post to the world stage. GIS-based dashboards became public lifelines, informing millions in real time how and where the disease was spreading. Every data point carried weight, and with that visibility came pressure for teams to be accurate and responsive.

Managing through this period required more than keeping systems running; it entailed keeping people motivated and connected. Cloud-based platforms and systems pushed technology forward, but teamwork and trust enabled successful implementations.

This experience reshaped how I manage today. The technological environment integrates AI-driven analytics, automation, drones, and real-time mapping, but the core principle remains the same: Technology only works when people collaborate and listen to each other.

GIS in disaster response is no longer reactive; it's proactive, predictive, and purpose-driven. Managing through possibility now means empowering others to question assumptions, innovate responsibly, and build teams that carry the mission forward.

Developing Leaders

Over time, I learned that my job wasn't to have every answer; it was to create the conditions for others to find them. Managing today means giving people space to innovate, permission to take risks, and the confidence to challenge "the way it's always been done."

People thrive when they feel heard and trusted. Listening is what transforms management into mentorship. It shows respect for the expertise and lived experiences of those closest to the data, systems, and disaster sites.

The teams I helped guide now understand their mission deeply: to serve responders and communities by giving them reliable, real-time information. Their hearts are in the world, their tools are modern, and their management style is rooted in trust, empathy, and continuous listening.

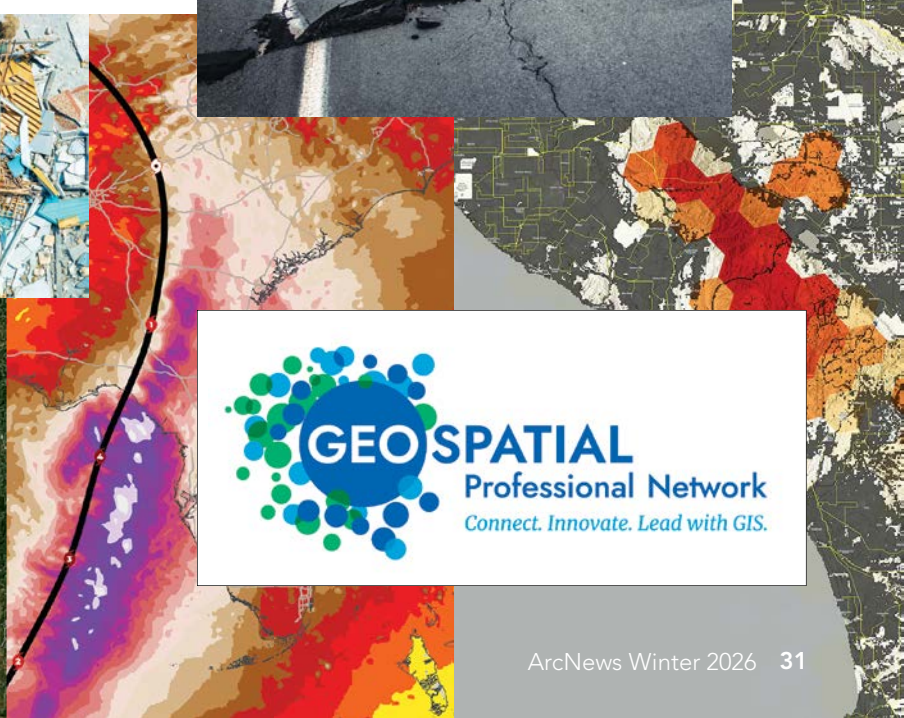
Full Circle

That night in Baton Rouge responding to Hurricane Katrina was the start of a journey I never could have imagined. The colleague who once said "GIS is easy" is now someone I can't imagine working without. Our friendship is built on listening and the belief that technology and data serve communities for good.

Together, he and I have created more than dynamic systems and dashboards. We've built a culture of trust and possibility. From producing static maps to designing intelligent, connected platforms, our work has evolved from "easy" to essential, just as our teams have.

About the Author

Janine Latham, GISP, is a client success manager at Esri partner ROK Technologies. She has more than 20 years of experience in bridging technology and business using geospatial systems to improve decision-making, streamline operations, and uncover opportunities for dißgital innovation.



For Hurricane Helene, Implementing ArcGIS Quickly Changed Response Efforts

When Hurricane Helene struck the southeastern United States in late September 2024, it carried devastation well inland from coastal areas, challenging response efforts across several states. In South Carolina, the storm struck in areas less accustomed to dealing with severe hurricane impacts. Enormous piles of vegetative debris, extensive road closures, and widespread power and communications outages compounded the difficulty of establishing a clear common operating picture among responding agencies.

Counties in the western part of the state were initially overwhelmed when trying to support their residents. This, in turn, hindered situational awareness and made it difficult for agencies at the local, state, and federal levels to grasp the scope of the disaster and decipher how to rapidly prioritize resources.

After struggling to gain a solid understanding of the situation, the South Carolina National Guard (SCNG) worked with selected units from its 117th Engineer Brigade (known as the Pioneer Brigade) to deploy ArcGIS technology—ArcGIS Online, ArcGIS Pro, and several apps—significantly changing the response.

Combining and Crowdsourcing GIS Data

After Hurricane Helene passed, the immediate challenge was to remove trees and other debris from critical roads so emergency responders could move around and assess the damage to infrastructure and utilities. The SCNG GIS office partnered with the Pioneer Brigade to bring in satellite imagery and drone data. The two groups also set up National Guard soldiers, first responders, and residents across the state with ArcGIS Survey123 and ArcGIS QuickCapture so they could file damage reports.

The teams overlaid this crowdsourced information onto county- and state-provided road closure data to build custom damage assessment maps that helped visualize the storm's impact. Planners from the Pioneer Brigade then used the maps to prioritize operations and delegate resources to clear vegetative debris from roads that connected affected areas to assistance.

As the focus shifted from immediate response to recovery, SCNG continued to use ArcGIS Online to track the restoration of crucial infrastructure, including roads, bridges, power lines, and water systems. To reduce redundancies and maximize limited resources, the Pioneer Brigade used ArcGIS Online as a foundational tool when partnering with local officials to map damage and prioritize repairs. The team also built interactive dashboards with ArcGIS Dashboards to help local and county emergency managers monitor vegetative debris removal in real time. This enabled them to forecast resource requirements and available capacity in a swiftly changing environment.

"By using GIS, the scope of the problem was clarified within 48 hours, and a clear picture of Helene's impact began to take shape," said Christy Jacobs, the state GIS coordinator for the South Carolina Revenue and Fiscal Affairs Office. "We were able to combine geospatial data from all levels of government to develop an effective response plan."

Collaborating with Emergency Operations Centers

In Upstate South Carolina, GIS allowed seamless data sharing between SCNG and county emergency operations centers (EOCs).

For the county governments that activated EOCs, their GIS staff members were able to leverage a cross-section of datasets to elevate situational awareness. The partnering county agencies used SCNG-built dashboards and apps (created using ArcGIS Instant Apps), along with the data gathered using QuickCapture, to get the real-time status of road closures and vegetative debris management efforts. Having this information allowed county leadership to not only assess current needs but also plan longer-term recovery efforts.

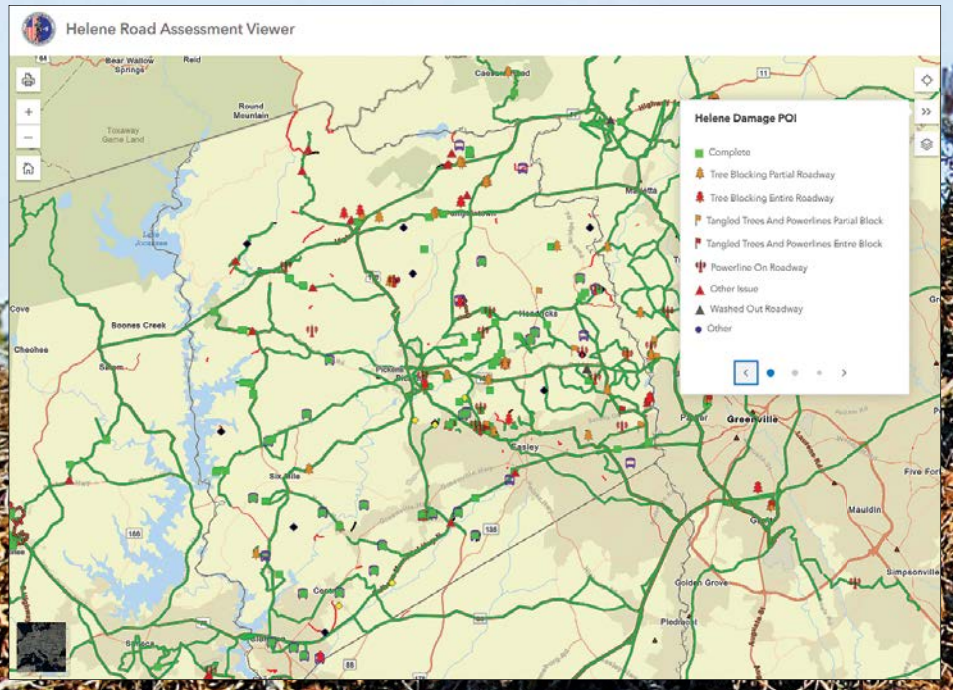
"In the chaos of post-storm recovery, information is submitted in many forms—spreadsheets, handwritten notes, phone calls, and verbal reports," said Jacobs. "Using common geospatial data allows efficiency in overall mission planning."

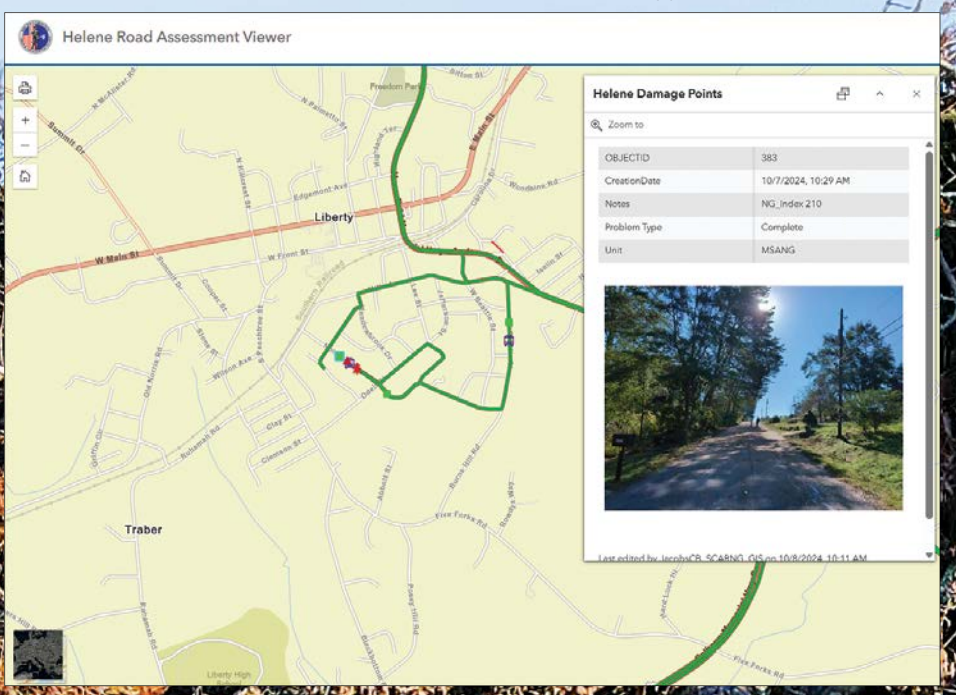
Additionally, because county-level EOC staff integrated multiple sources of real-time data, they were able to use ArcGIS Pro to make rapid updates to public-facing map services. This ensured that all responding agencies could continue working together, using ArcGIS technology and up-to-date data, as the event evolved.

Working from a Common Operating Picture

Centering the geographic approach in South Carolina's Hurricane Helene response and recovery operations had an array of positive effects. When every hour that passed mattered,

↓ The South Carolina National Guard (SCNG) recorded downed trees blocking roads, trees tangled with power lines, washed out roadways, and more.





↓ National Guard soldiers, first responders, and residents sent in damage reports using GIS-based field apps.




↑ SCNG and local authorities worked to clear vegetative debris from roads.

GIS reduced the amount of time analysts spent transcribing information from first responders and SCNG units. As response shifted to recovery, it allowed leaders to conduct meaningful analyses to determine where resources were needed most—both in the moment and days or weeks in the future. And when many residents were stuck in place or didn't know how to get to their loved ones, dashboards and web apps provided them with faster updates than they could have gotten otherwise.

Ultimately, implementing the geographic approach fostered a common operating picture that was vital in determining priorities across multiple programs.

"Thanks to SCNG's—and Christy's—efforts, we were able to integrate real-time field intelligence and share that information on-screen to support decision-making inside the county's EOC," said Michael Herzberger, deputy director of the South Carolina Office of Regulatory Staff's Broadband Office. "Collectively, the team was able to communicate spatially, which was vital in determining priorities across multiple programs supporting field efforts throughout the jurisdiction."

Building Trust with Other Agencies

Hurricane Helene reinforced the importance of having stakeholders work together to understand available tools and resources during emergency operations. Interagency collaboration—enhanced by the use of ArcGIS technology—streamlined decision-making when it mattered most. For local and county emergency managers, having the ability to access and use geospatial data ensured that hurricane recovery efforts were well informed and effectively executed.

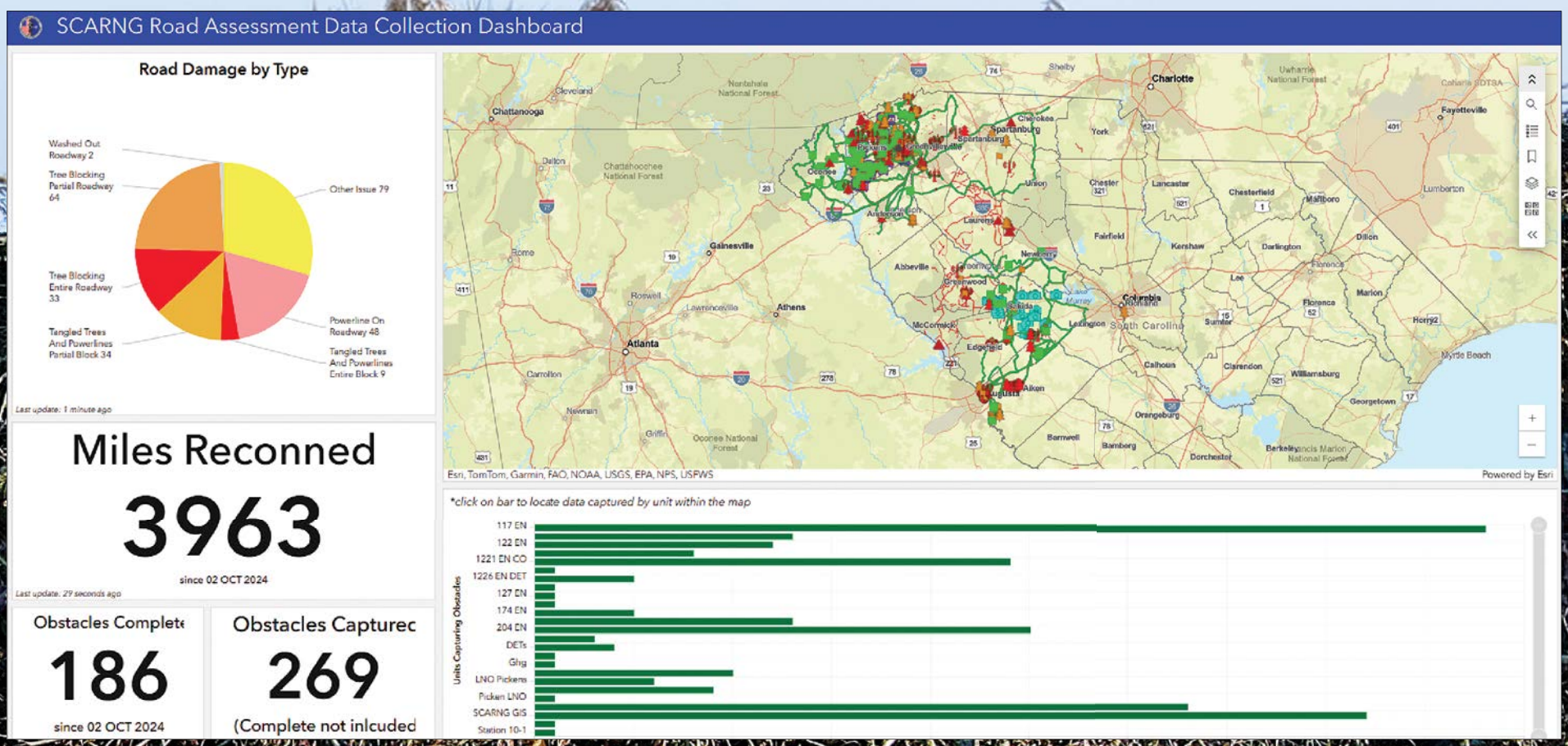
While SCNG leadership has employed GIS for years in response and recovery planning, the real breakthrough during Hurricane Helene came from having people in multiple agencies use the technology in real time to engage with one another and develop a comprehensive understanding of the situation. Responding agencies from various levels of government were able to collaborate effectively—establishing open communication, promoting effective data sharing, and building trust. Teams innovated in ways that were both timely and highly relevant to the immediate needs of counties across the state.

Hurricane Helene, of course, affected more than South Carolina. Residents of North Carolina, Georgia, and Tennessee all experienced devastating impacts from the storm. Agencies across geographies, serving various populations, are always looking for ways to improve disaster response and recovery. Putting GIS at the center of these efforts can benefit disaster recovery in every state.

SCNG will continue to use ArcGIS technology to plan and coordinate storm preparation and recovery operations.

"As hurricanes continue to threaten South Carolina, innovating ways to leverage technology will remain a critical component of disaster response and resilience planning," said Col. William Matheny, commander of the Pioneer Brigade. "The SCNG is always ready and will continue to seek out ways to collaborate in support of the residents of the Palmetto State."

The views expressed in this article are those of the authors and do not reflect the official policy or position of the US Department of War; the National Guard Bureau; the South Carolina National Guard; or the South Carolina Office of Regulatory Staff, Broadband Office.



↓ Interactive dashboards, like this one from the end of the response event, helped emergency managers monitor vegetative debris removal in real time.

With GIS Technology, Drone Industry Alights in Reality

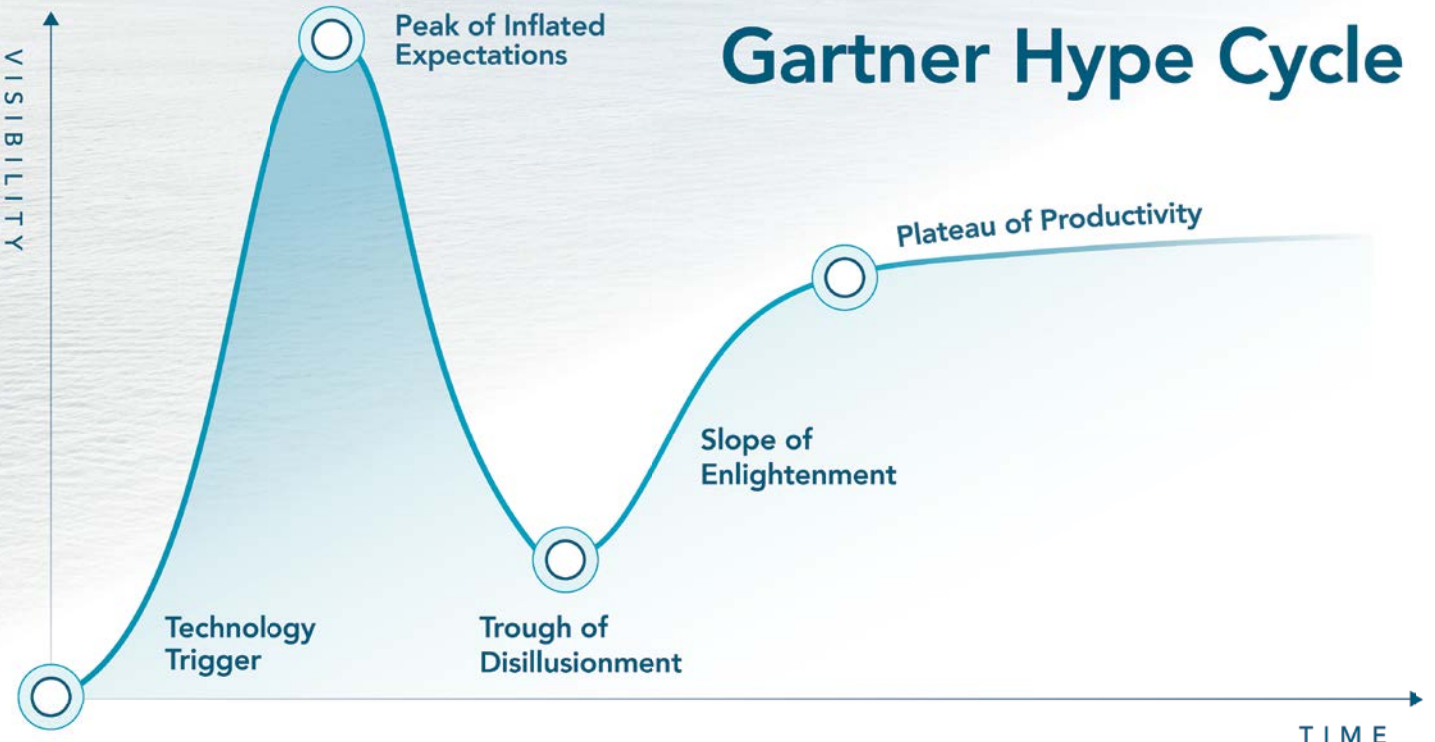
By Jeremiah Johnson, Esri

For most of my career, I've worked with small uncrewed aircraft systems, or drones—from the days when people built them at home to now, as they become a viable commercial enterprise. I remember when excitement about drones was real, and I took pictures with them for novelty's sake. Fast-forward to today: I don't think I've used a drone to take a photo for something other than mapping or inspection purposes for several years.

The drone industry journey has been a roller-coaster of hype—a cycle of excitement and disillusionment for many people in the GIS world and beyond. We've been through highs and lows. Now, we stand at a crucial point, looking at where the drone industry currently is and where it is likely to go in the next few years. From my vantage point, where it's headed is closely related to mapping and GIS technology.

Understanding the Hype Cycle

To interpret the drone industry's trajectory, it helps to look at the Gartner Hype Cycle. Created by a Gartner analyst, the Gartner Hype Cycle illustrates the typical life cycle of emerging technologies. It maps a technology's visibility over time, starting with a "Technology Trigger."



↑ The Gartner Hype Cycle, developed by an analyst at Gartner, encapsulates trends in the drone industry over the past 15 years.

For drones, this trigger was the commercialization of small, lightweight, and inexpensive components—such as inertial measurement units, compasses, and GPS units—that were initially created for the smartphone and video game industries.

For those of us who work with drones, this innovation sparked our imaginations and led the industry to a "Peak of Inflated Expectations." About 10 years ago, there were many ambitious venture capital funding rounds. It was an exciting time. Promotional videos featured monkeys flying drones. One venture-funded company even started its own venture capital fund with its borrowed dollars. The hype was palpable, culminating in the first successful delivery via drone in the United States in 2015, when a drone carried medical supplies from an airport to a health clinic in rural Virginia.

But what goes up must come down. Neither the hardware nor the regulatory environment could keep pace with the hype, leading to the "Trough of Disillusionment." The reality of technology limitations set in. Government restrictions, especially in the United States and Europe, hampered real-world implementation. There were headlines about the fall of the drone industry. One company shut down in 2018 after burning through more than $100 million. Much-anticipated drone-based package delivery programs are still largely proofs of concept.

Now, however, I believe we're climbing out of that trough and ascending the "Slope of Enlightenment." This is where companies find patterns of use that are practical, productive, and profitable. It's a phase marked by growing confidence in the technology. It's no longer a science experiment; for organizations to adopt it, the technology needs to foster high levels of productivity and be better than what came before. As more organizations see success, they pave the way for others to follow, and it becomes easier to progress.

Enlightenment in Action

One example of this advancement is an ambitious undertaking by project development and construction firm Skanska Norge AS. The company is working to connect five Norwegian islands to the mainland via a 22-mile stretch of roadways, bridges, and subsea tunnels. Naturally, conducting site visits and monitoring construction progress presented a massive logistical challenge—but drones have helped make it feasible.

For this project, a Skanska Norge drone team is using the ArcGIS Flight planning app to automate data collection with a Phantom 4 RTK drone. The collected imagery is then uploaded to the cloud and processed in Site Scan for ArcGIS. This allows the team to create highly accurate 2D orthomosaics, digital elevation models, 3D point clouds, and 3D meshes. On-site project engineers overlay computer-aided design (CAD) files on drone data to compare as-built versus as-designed conditions in near real time. Cloud-based integrations between ArcGIS and Autodesk technology allow the team to see construction data in concert with their GIS data, including terrain and environmental information. Employees across the company have access to the cloud-based data, and island residents and other stakeholders can see the project's status.

Another example comes from environmental engineering consulting firm Dudek, which employs drones and ArcGIS technology to streamline land surveying operations. Staff used ArcGIS Flight for flight planning and data collection, along with Site Scan to process and analyze the data. With this integration, Dudek's clients were able to see dynamic visualizations of project data, including topographic information and easements, in near real time. By adopting this technology, Dudek saved more than $80,000 in one year and improved its workflow efficiency.

A third example stems from project management firm OCMI, which used Site Scan to track the movement of construction materials and provide progress reports while building San Diego, California's new Snapdragon Stadium—home to two professional soccer teams and San Diego State University's football team. OCMI used drones to capture imagery of concrete being moved from an old stadium to be reused in the new stadium and then processed the imagery using Site Scan. This enabled OCMI to provide stakeholders with up-to-date images, 2D orthomosaics, and 3D mesh models while helping the company quantify material stockpiles and validate contractor data. This improved project management and led to significant cost savings.

These companies' successes demonstrate how organizations that lean into innovation can standardize the use of drones and prove their value. It is evidence that the wild ride the drone industry has been on so far is stabilizing—that it's moving past the research and development phase and arriving at established standard practices.

The Future Is Boring, and Probably Profitable

What's next for the drone industry? Likely, drones will become boring. The final stage of the hype curve is the "Plateau of Productivity." This is where a technology becomes so ingrained in workflows that it's no longer considered innovative. Think about how automatic sprinklers and robot vacuums work. They feel pretty normal, don't they? That's where drones are headed.

The last piece of the puzzle—for most countries with drone regulations, at least—will be getting drones to fly autonomously, without a drone pilot at the controls. In many countries, this is possible to do now with a waiver, and more widespread regulatory approvals are in the works. When these issues are addressed and drones are automated, reliable, and trustworthy, organizations will be able to use them regularly to increase productivity, develop a larger user base, generate higher profits, and stimulate technological advances.

About the Author

Jeremiah Johnson is a lead solutions engineer at Esri, specializing in drones and drone workflows. He has worked with small drones for most of his career, doing everything from surveying and mapping to building drone hardware and guiding the development of drone software.

The Art of Persuasion in Cartography: Why Design Makes Maps Powerful

The Relevance of Cartography

A Cartographer's Perspective

By Dr. Georg Gartner
International Cartographic Association

Maps speak—not with words, but with form, color, and proportion. A well-designed map does more than locate; it persuades, explains, and reveals.

A map's visual rhetoric guides the eye toward meaning, much like a poem leads the reader through rhythm and line, or an actor bends silence into emotion. To design a powerful map is not merely to depict geography—it is to craft an argument about the world.

In the professional realm of cartography, urban planning, data visualization, and geospatial analysis, design is often treated as an afterthought—something to clean up the output after the real analytical work is done. Yet design is analysis, performed through composition rather than computation. The decisions a mapmaker makes about color gradients, typographic hierarchy, symbol density, and projection are not decorative, they are interpretive. They determine what the viewer understands, remembers, and feels.

The Map as a Poem

If we compare a map to a poem, design becomes its meter and metaphor. Both the poet and the cartographer face a paradox: how to compress infinite complexity into a finite frame. The poet must choose each word carefully, leaving space for suggestion. The cartographer must choose each visual element deliberately, balancing inclusion with omission. The strength of both forms lies in what they leave unsaid.

A poem's power often emerges from its structure—the line breaks, rhythm, and white space. Similarly, the rhythm of a map lies in its composition—the flow between dense and open areas and the pacing of visual attention. A cluttered map, like a poem with no punctuation, confuses. A sparse map, like a haiku, invites reflection.

Consider a topographic map of a mountain range. The delicate contour lines are visual enjambments, linking one elevation to the next in a steady visual rhythm. The reader ascends through the landscape much as a reader of verse climbs through metaphor and cadence.

Maps and poems also share the capacity for emotional resonance. A poem can make us feel the loneliness of a winter night; a map can make us feel the immensity of an ocean. The design choices—color palette, texture, and typeface—serve as tone and diction. A map drawn in deep indigo and ochre whispers differently than one in sharp reds and metallic blues.

The Map as Art

The boundary between cartography and art has always been porous. Renaissance maps adorned with cherubs and sea monsters were paintings as much as they were navigational tools. Contemporary artists—from Piet Mondrian to Anselm Kiefer—have used maps as metaphors for exploration, memory, and power. What unites those artists is an understanding that maps are aesthetic objects that frame perception.

Good map design borrows from the painter's toolkit: composition, contrast, balance, and light. The painter studies how color harmonies evoke emotion; the cartographer studies how hues convey data. A heat map of population density, for instance, draws on the same psychological principles of color that painters use to evoke tension or calm. A gradient from pale yellow to crimson doesn't merely show numbers—it dramatizes them.

Design also defines focus. In art, the viewer's eye is guided toward a focal point. In cartography, visual hierarchy directs attention to what matters most—an outbreak cluster or a navigational route. The designer decides which story the map will tell, just as a painter decides which form will dominate the canvas. Every layer, symbol, and label participates in this choreography of attention.

The greatest maps, like great works of art, achieve clarity through restraint. They know when to stop. This requires aesthetic judgment—balancing legibility with elegance and precision with persuasion. Good design disciplines emotion without erasing it.

The Map as Performance

A map, like a play, unfolds in time. The audience—the map reader—moves through it, scene by scene. A dynamic web map that lets users zoom and filter is a performance. Even static maps perform: They anticipate the reader's gaze and choreograph it across the page.

Think of an actor interpreting a script. The words are fixed, but their meaning depends on gesture, tone, and pacing. Similarly, the data behind a map is fixed—the coordinates, the statistics, and the shapefiles—but its meaning depends on how the designer performs it visually. The same dataset can look urgent or tranquil, optimistic or tragic, depending on the staging. A pandemic map shaded in reds provokes anxiety, whereas the same map shaded in muted blues encourages contemplation.

In this sense, cartographic design is a rhetorical act, a performance aimed at persuasion. The designer must ask, "What am I trying to make the viewer think or feel?" Is the map a call to action, a neutral report, or a lament? Even neutrality is a performance choice: It conveys authority and distance just as a monotone delivery might in theater.

The Rhetoric of Design

Rhetoric, the ancient art of persuasion, offers a useful lens for understanding map design. Aristotle identified three appeals: ethos (credibility), logos (logic), and pathos (emotion). A powerful map integrates all three.

- **Ethos:** A map's authority is derived from its precision and consistency. Clean typography, coherent color logic, and accurate spatial relationships establish trust. Without design discipline, even accurate data looks dubious.
- **Logos:** The logical structure of a map—its legend, scale, and layers—provides the reasoning. How clearly does the design communicate patterns, relationships, and causes? A well-designed map allows the viewer to infer meaning intuitively.
- **Pathos:** Emotional engagement transforms comprehension into conviction. Through color temperature, texture, or contrast, design can evoke empathy, urgency, or wonder. Pathos does not undermine accuracy—it animates it.

Rhetorical design acknowledges that maps, like speeches, are not neutral—they argue a point. A choropleth showing income inequality, for example, may use stark contrasts to dramatize disparity. That contrast is a rhetorical device akin to alliteration in speech or crescendo in a play. The cartographer, like the orator, must wield it responsibly.

The Ethics of Beauty

Powerful maps persuade because they are beautiful, and that beauty carries ethical weight. A beautiful map can expose injustice or disguise it, clarify reality or obscure it. When beauty serves truth, it deepens understanding. When it serves manipulation, it deceives. The ethical cartographer recognizes design's double-edged power.

In professional practice, this means being transparent about sources, scales, and simplifications. It also means designing with empathy for the map's subjects. Communities aren't data points, and landscapes aren't voids. To map is to represent others—sometimes without their consent. The design should reflect that responsibility, balancing clarity with sensitivity.

Beauty, in this context, is not decoration; it is care—the care taken to represent information accurately and evocatively. The best maps, like the best poems and performances, achieve a kind of moral elegance: They make complexity legible without arrogance and evoke emotions without coercion.

Designing to Think

Design in cartography is not about making maps look better; it's about making them think better. Design is the bridge between data and meaning, measurement and imagination. It shapes how knowledge enters the mind and moves the heart.

A powerful map, like a powerful poem, doesn't simply inform—it transforms. It changes how we see space and, therefore, how we inhabit it. The next time you design a map, think of yourself as the poet and the performer, the artist and the rhetorician. Your tools are grids and gradients rather than syllables or gestures—but your purpose is the same: to move the human mind toward insight.

For in the end, every map is an act of storytelling. And every great story—in words or in lines—is made not by the information it contains but by the design that gives it life.

About the Author

Dr. Georg Gartner is a full professor of cartography at Vienna University of Technology in Austria. He is currently serving his second term as president of the International Cartographic Association.

Building Community in Geography, Specialty by Specialty

From the Meridian

By Eddie McInerney
American Association of Geographers

Geography touches every facet of the world we live in. This can be a blessing and a curse. Although it allows geographers to diversify their research to suit a variety of interests, geography's breadth can make it hard to "find your people."

The American Association of Geographers' solution to this dilemma is its many practice groups, known as Specialty Groups. As a professional association representing the wide range of practitioners, educators, and students in geography, the American Association of Geographers (AAG) seeks to sustain and serve its members in a way that helps them maintain the different facets of their professional identities while also reflecting the geography discipline as a whole.

This tension isn't new. In October 1976, during a relatively innocuous internal governance audit, the AAG Council established the Long-Range Planning Committee. The group was tasked with assessing AAG's organizational priorities, including member services, governance, and finances.

One of the committee's major concerns was membership fragmentation, which persisted through the middle of the 20th century. The committee came up with a solution to attract members while recognizing their need for specialty peer groups—and this is where the Specialty Groups come in.

Creating Connections in a Broad Discipline

In the 50 years since that internal audit, the number of AAG Specialty Groups has ballooned to more than 70, including many related to GIS, cartography, and remote sensing. The AAG Community program serves these groups, as well as nine regional divisions in North America. It also provides information and connection to the chairs of countless geography departments and programs. In addition, AAG has eight Affinity Groups for members in different career stages—including undergraduates and graduate students—and who have particular interests, such as mental health in the academy and caregiving.

While the Specialty Groups are affiliated with AAG, they are also largely self-governed. Each group can set its own policies (while following AAG's Code of Conduct), raise funds, issue calls for papers, plan sessions for AAG's annual meeting, give grants to scholars, and recognize excellence via awards. AAG members have attested that they've made lifelong friends and formed strong networks through the Specialty Groups.

But the central question lingers: How can AAG ensure that its members feel valued for their contributions to the broader discipline, as well as within their more focused communities?

Strengthening Collaboration

The AAG Community team recently introduced new approaches to support Specialty Group leadership. These include creating management systems for the work the groups' volunteer chairs do and helping communicate member services, opportunities, and group business such as elections. The team also helps Specialty Group leaders develop opportunities for their groups to meet and connect across their interests, since the cross-pollination of ideas is so important to geography practice.

For example, the GIS, spatial analysis, and remote sensing groups each have more than 300 members who often cross-collaborate. AAG's online knowledge platforms are teeming with opportunities that members share within and across the Specialty Groups, including faculty openings, calls for papers, talks, and networking events. Additionally, the broader AAG membership gets a peek into Specialty Group activities at AAG's annual meeting, where the Specialty Groups sponsor sessions, networking events, and social hours.

It is not uncommon for an AAG member to belong to half a dozen or more Specialty Groups. Membership in these groups is either free or very affordable (think $5–$10 per year), added to a base AAG membership. The AAG Specialty Groups are often the top reason people remain members of AAG for years and even decades—because they value the collegiality and information they get from these groups throughout the year.

Whether you're a student just discovering GIS and geography, a researcher pushing the boundaries of current practice, or a practitioner applying spatial thinking in new contexts, there's an AAG Specialty Group for you. Explore them all at aag.org/groups.

In Geography, the Big Picture Is a Mosaic

In a world of increased specialization, it's a privilege to work in a field as broad as geography. Within that extent, of course, there are dozens of specialties and subspecialties. As with many matters of geography, it's all about scale: Sometimes a big-picture view is needed, and other times it's better to have the granular details. In keeping with the interdisciplinary nature of the field, AAG is looking to meet both needs simultaneously.

Working together, let's ensure that geography remains a vibrant, inclusive, and multifaceted field—one that thrives by finding common ground and shared perspectives via its diversity.

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

About the Author

Eddie McInerney is the community impact coordinator at AAG. He has been on AAG's staff since January 2022 and has experience supporting the organization's policy and engagement initiatives.

↓ Geographers at all stages of their careers, from all around the world, come together at the American Association of Geographers (AAG) Annual Meeting. (Photo courtesy of Becky Pendergast, AAG.)

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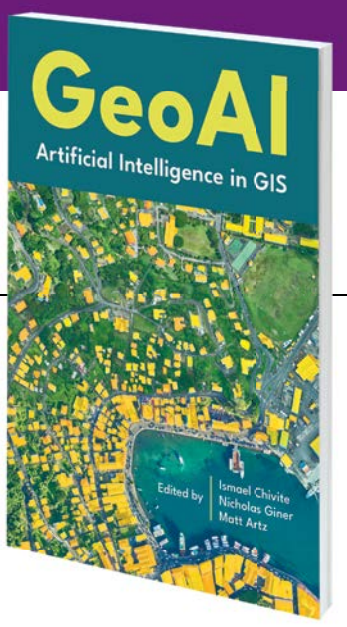
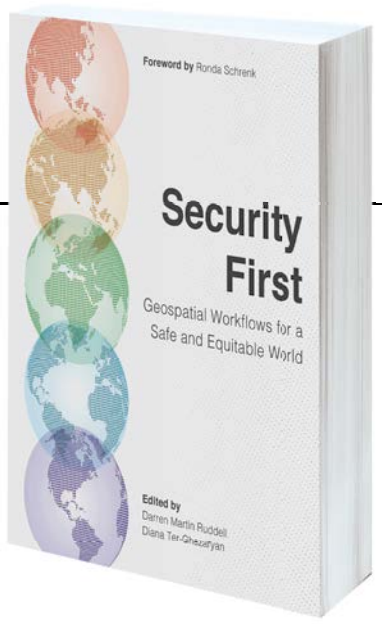


GeoAI: Artificial Intelligence in GIS

By Ismael Chivite, Dr. Nicholas Giner, and Matt Artz

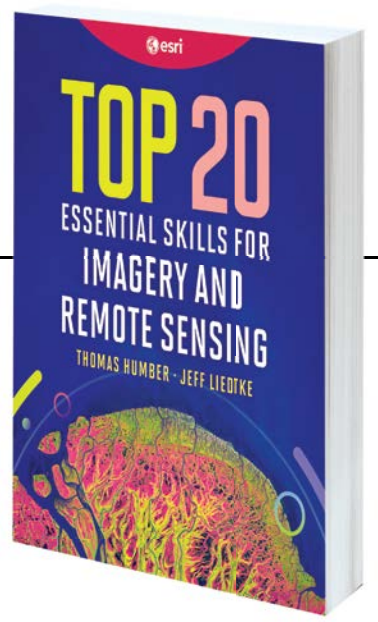
The emergence of AI-enhanced GIS has unveiled new opportunities to democratize the technology and automate complex spatial analyses, helping both new and experienced users—from city planners and policymakers to business professionals and research groups—make better decisions faster. *GeoAI: Artificial Intelligence in GIS* is a collection of real-world stories about how public, private, and nongovernmental organizations successfully use geospatial AI to manage processes, workflows, policies, and communication. The book also includes a technology showcase that provides ideas, strategies, tools, and actions to get readers to jump-start their own use of GeoAI. September 2025, 124 pp. Ebook ISBN: 9781589488458 and paperback ISBN: 9781589488441.



Security First: Geospatial Workflows for a Safe and Equitable World

By Dr. Darren Martin Ruddell and Dr. Diana Ter-Ghazaryan

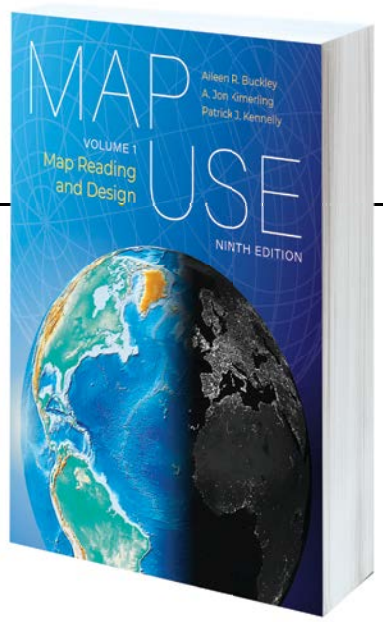
To resolve the complex challenges humanity faces today, learning GIS has never been more critical for visualizing and interpreting data. *Security First: Geospatial Workflows for a Safe and Equitable World* guides readers through targeted exercises and examples to show how GIS can be used in the fields of human security and global intelligence. Each chapter outlines learning objectives, technical requirements, and prerequisite knowledge and includes a geospatial workflow, an analysis, and additional resources. All detailed exercises use ArcGIS software and downloadable data, helping readers establish and reinforce their technical skills. After each exercise, readers interpret their results and write an intelligence brief, fostering critical thinking about how to incorporate GIS into analytical work. October 2025, 428 pp. Ebook ISBN: 9781589487840 and paperback ISBN: 9781589487857.



Top 20 Essential Skills for Imagery and Remote Sensing

By Thomas Humber and Jeff Liedtke

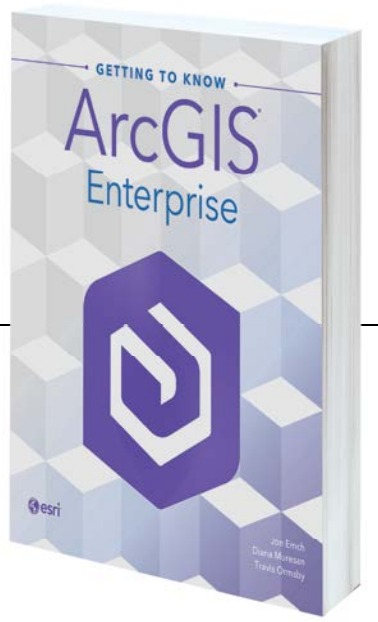
Top 20 Essential Skills for Imagery and Remote Sensing guides readers step by step through the key techniques needed to visualize, process, analyze, and manage imagery and raster products. The book contains concise chapters—each of which takes about 45 minutes to complete—with easy-to-follow tutorials and practical examples. This is an approachable resource for users of all skill levels, from GIS professionals who want to deepen their understanding of imagery to students who are eager to learn about remote sensing. March 2026, 330 pp. Ebook ISBN: 9781589488229, paperback ISBN: 9781589488212, and hardcover ISBN: 9781589488731.



Map Use: Map Reading and Design, Volume 1, Ninth Edition

By Dr. Aileen R. Buckley, Dr. A. Jon Kimerling, and Dr. Patrick J. Kennelly

Maps are sophisticated conceptual creations. They convey as much about how people think and communicate as they do about the mapped environment. *Map Use: Map Reading and Design*, Volume 1, ninth edition, is a comprehensive primer on how to read and understand maps, design and make maps, and recognize the limitations and inaccuracies of maps. Combining authoritative text with hundreds of stunning visuals, the book describes foundational cartographic concepts in the context of the industry's latest innovations. Changes for the ninth edition include reindexing; revised datums, maps, and images; an updated map projection guide; a new state plane coordinate system; and updated text to reflect new concepts, practices, and technology. An online glossary is also available. March 2026, 334 pp. Ebook ISBN: 9781589487765, paperback ISBN: 9781589487758, and hardcover ISBN: 9781589488816.



Getting to Know ArcGIS Enterprise

By Jon Emch, Diana Muresan, and Travis Ormsby

In today's increasingly demanding and rapidly changing business environment, understanding how to work with ArcGIS Enterprise is key to increasing collaboration and being resilient. *Getting to Know ArcGIS Enterprise*—the first book from Esri Press focused on ArcGIS Enterprise—covers the essential skills of planning, deploying, administering, using, and maintaining this foundational software system so users can securely organize and share their work on any device, anywhere, at any time. The book addresses the most common and vital workflows that ArcGIS Enterprise administrators need to comprehend and put into practice. November 2025, 298 pp. Ebook ISBN: 9781589487918, paperback ISBN: 9781589487932, and hardcover ISBN: 9781589488557.

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Training

Maximize Productivity, Efficiency, and Insight Using GIS

As the new year begins, many organizations resolve to expand their GIS capabilities to optimize operations and transform data into information that supports holistic decision-making. Instructor-led training is a reliable method of developing workforce skills and maximizing the impact of technology.

The following two new courses are available to help GIS users confidently apply ArcGIS best practices, work more efficiently, and unlock valuable information:

- **Get Started with CAD Data in ArcGIS:** This course is for GIS professionals, computer-aided design (CAD) technicians, and anyone who needs an introduction to CAD-GIS workflows in ArcGIS Pro. Attendees gain practical skills and knowledge about integrating 2D and 3D CAD data with GIS data, visualizing CAD data on maps, editing GIS data based on current CAD drawings, and more. Explore course details at links.esri.com/cad-course.
- **Streamline GIS Content Management with ArcGIS API for Python:** GIS professionals, administrators, and developers who want to automate time-consuming workflows should attend this one-day class. Participants get introduced to ArcGIS API for Python and learn to script common tasks for managing resources in their ArcGIS Online organizations. Course concepts also apply to ArcGIS Enterprise. Explore class dates at links.esri.com/manage-content.

Simplify Workforce Development

The Esri Training Pass is a flexible solution to boost workforce capabilities while minimizing administrative overhead. With a single purchase, organizations can procure training days and redeem them as needed throughout the year to ensure that their teams are consistently equipped for success. Get started at links.esri.com/trpass2026.

The Easy Way to Keep Up with Ever-Changing Technology

To help members of the GIS community keep pace with technology advancements, Esri hosts frequent, no-cost live training seminars. In one hour, experts share insights on trending topics while demonstrating the latest ArcGIS capabilities. Attendees can ask questions and join their GIS peers in the lively chat.

Upcoming topics include the role of metadata in furthering AI initiatives, CAD and building information modeling (BIM) workflows in ArcGIS, and ArcGIS Notebooks. Explore the seminar schedule and sign up at esri.com/lts.

A Flexible—and Fun—Way to Stay Up to Date

No-cost massive open online courses (MOOCs) are a popular option for people to grow their GIS knowledge while developing in-demand ArcGIS skills. Open to lifelong learners worldwide, Esri courses include access to ArcGIS software, expert videos, guided exercises, and a certificate of completion. Head to links.esri.com/moocs-2026 to browse the MOOC schedule or enroll in one of the following upcoming MOOCs:

- **Going Places with Spatial Analysis—**Opening January 21, this MOOC is a popular way for students and new GIS users to learn the basics of spatial data and analysis techniques, as well as for experienced professionals to try out the latest ArcGIS Online tools. Register for the course at links.esri.com/gpsa-mooc-2026.
- **GIS for Climate Action—**This six-week course hosted by Esri chief scientist Dr. Dawn Wright opens February 18. Participants analyze climate-related indicators, risks, and impacts using ArcGIS Pro, ArcGIS Online, and ArcGIS apps. Discover the key role that GIS plays in building more resilient communities and infrastructure. Register through March 4 at links.esri.com/climate-mooc-2026.

Certification

New Year, New Exams

To support the advancement of ArcGIS users and GIS professionals everywhere, Esri's technical certification team is updating six exams this year. Blueprint survey participation is vital to ensure the GIS community has a voice in the skills and knowledge that each exam measures. Blueprint surveys for the following new exams will open in February and March—and you are kindly invited to contribute. Each survey takes approximately 20 minutes to complete.

Visit the following Esri Community pages for survey dates:

- ArcGIS Developer Foundation 2026: links.esri.com/eadf-2026
- ArcGIS Online Administration Associate 2026: links.esri.com/eaoa-2026
- ArcGIS API for Python Associate 2026: links.esri.com/epya-2026

Go to **esri.com/training** for more information. Find courses at **esri.com/coursecatalog**. Keep up with *Esri Training News* by subscribing to the newsletter (**links.esri.com/training-news**), reading the *Esri Training Blog* (**links.esri.com/trainingblog**), connecting with the Esri Training community on Esri Community (**links.esri.com/training-community**), and following **@EsriTraining** on X.

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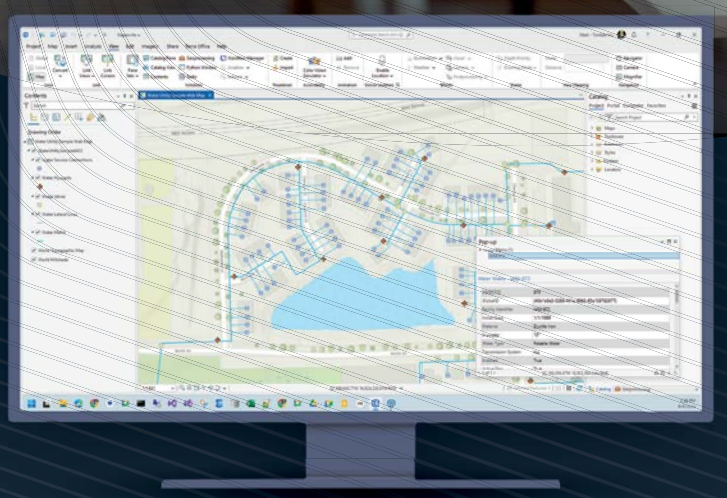

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