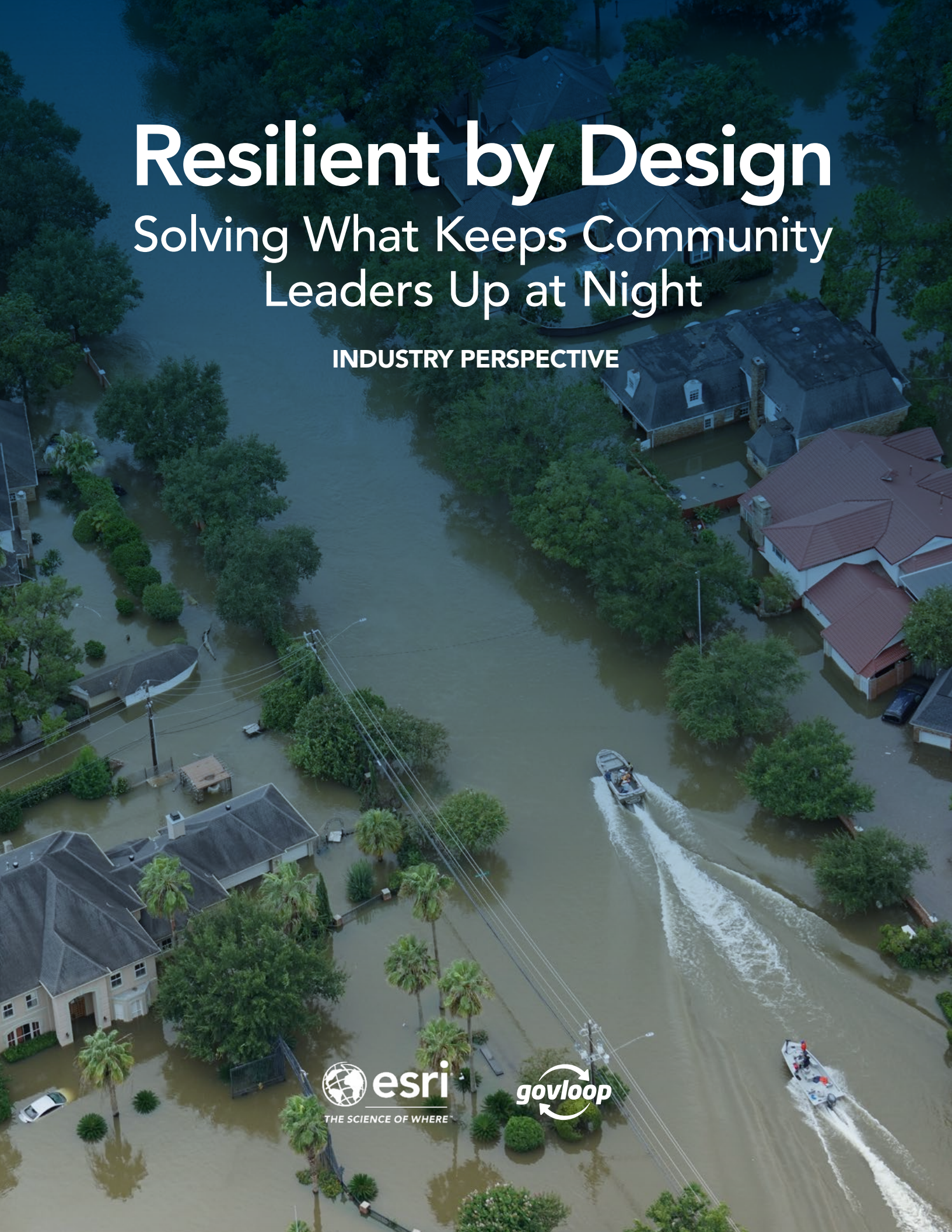
Resilient by Design

Solving What Keeps Community Leaders Up at Night

INDUSTRY PERSPECTIVE



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Modern Challenges for Today's Communities

Our communities are constantly changing. The pace of change is accelerating exponentially. This is creating many challenges, such as overpopulation, climate change, drought, social conflict and urbanization. These stresses correspond with impacts on infrastructure, environment, economic capacity and more. And as always, the expectations and demands of citizens and how their government can best serve them are evolving and increasing.

Other challenges exist as well. People across the nation are feeling the impacts of climate change and more severe natural disasters, such as wildfires and hurricanes. Additionally, more common problems such as traffic congestion, insufficient public transit options, blighted areas with lack of economic opportunity and neighborhoods without affordable housing for local workers are all issues that many communities face.

The confluence of all of these stressors can affect the very potential of a community to thrive, grow and create a safe and healthy place for its citizens to succeed.

So what is a community to do?

Building resiliency is one answer. Resilience is the actions that state and local governments can take now to minimize the inevitable impact of shocks and stresses for the community, and accelerate the response for when those stresses occur. A geographic information system (GIS) is a critical part of building resilience.

To better understand how GIS can help communities increase their resilience, GovLoop partnered with Esri, a leader in GIS and location intelligence, for this industry report. In the following pages we'll further explore the importance of resiliency, discuss how GIS empowers resilient design and gain insights from Esri experts. We'll also highlight specific resiliency success stories from across the country.

Understanding the Importance of Resiliency

Resiliency is the capacity of a city, county or community to survive, adapt and overcome chronic stresses and acute shocks, according to the Rockefeller Foundation.

Modern challenges that governments face today are evidence that it can be more difficult than ever to become truly resilient.

But ignoring resiliency efforts can put governments and their communities at risk of succumbing to chronic stresses or acute shocks, which are ongoing events that weaken the fabric of a community on a day-to-day or cyclical basis and sudden, sharp, often unexpected events that disrupt and threaten a community, respectively.

Chronic stresses that affect a community can be anything from social inequity or inefficient transportation to a lack of affordable housing. Acute shocks – the most difficult situations for which to prepare – can include natural disasters, terrorist attacks, disease outbreaks and others.

A community that prioritizes resiliency knows that it's not a matter of if but when that chronic stressor or acute shock will occur. Efforts are then placed on advanced preparation and ways to quickly rebound. And many communities are practicing resiliency already.

Because so many resiliency issues deal with location-based data, GIS is an essential tool for communities to use to understand and articulate where these challenges are, where they're likely to be in coming years, as well as how and where these unforeseen issues can be either mitigated or rectified.

How GIS Empowers and Validates Resilient Design

Bringing about understanding can help government leaders develop responsible, sustainable plans for making their communities resilient to both acute shocks and chronic stresses. Understanding precedes action. And GIS accelerates understanding. For example, GIS can help us understand the number of residences and businesses in areas that experience 50-, 100- and 500-year floods, or the storm surge of a hurricane. GIS can also help quantify the economic and social impacts to a neighborhood if a business expands or relocates. It can help us design and analyze developments and understand their economic, social and environmental impact on a community. GIS can help us see where social services would have the greatest impact.

And perhaps most importantly, GIS allows for the ability to run prediction models that reveal patterns that help develop long-range plans to mitigate threats, such as floods, poor infrastructure and the lack of economic opportunity.

When a community thinks about resiliency, the focus needs to be on planning, preparedness and mitigation. GIS can help identify areas that are at risk, such as flood plains or low-lying property vulnerable to storm surge. A community could use GIS to quantify the cost of relocating residences or businesses, or more likely, implement building codes that can mitigate some of the damage from these events.

To be resilient, communities must use GIS to:

Serve as a System of Record for Analyzing Historic Patterns

The locations of some shocks aren't always as finitely predictable, such as earthquakes, wildfires or tornados. However there are ways that GIS can still be used to plan for these events, such as plan fire lines or controlled burns. Using historic storm tracks and demographic information, GIS can also be used to identify where community storm shelters would be most useful.

Establish Broad Availability of GIS

When it comes to response and recovery, accessibility of GIS is critical to the planning process. Simple web apps that display damage assessment, search and rescue, and emergency facility monitoring, can be put right in the hands of experts in the field. That way, information can be immediately transmitted back to an emergency operations center, where incident command can stay informed and make quick, data-driven decisions.

Empower Community Leaders to Make More Data-Driven Decisions

Using GIS to inform and empower community leaders across fields is a critical aspect of resiliency planning. These leaders decide where and how to prioritize resilience efforts. So providing them with the web maps and apps that outline vulnerable areas, provide analysis or visualize design alternatives is critical to these conversations – and that's what GIS delivers every day.

Create Genuine Citizen Engagement

Government leaders don't work in a vacuum. GIS can help create genuine citizen engagement. As technology has changed, so have the expectations of the public. They expect to be able to communicate with others, including their government, on their own terms and timeline. Simply relying on traditional public notification is insufficient in today's modern world. GIS can provide apps that allow the public to be informed about resiliency efforts, provide feedback through comments and even maps that go back to leadership to help the latter understand their concerns and priorities.

Carry Out Scenario Planning and Analysis

Finally, GIS can help us locate challenges and problems such as traffic congestion or blighted neighborhoods, as well as aid a community to play out different development and design scenarios to correct these issues. The fact is that stressors on a community are often tied together – few are independent of other forces. Fortunately, GIS can help understand how rectifying one stress can also alleviate other stresses. For example, many communities are seeing rapid growth in their downtown areas as younger citizens move in. A community could use GIS to visualize new affordable housing downtown, measure the number of new residences and employees for area businesses, predict the revenue impact for the neighborhood and analyze the impact this has in reducing traffic congestion.

Case Study #1

Leon County, FL: Bringing Together Coordinated Emergency Responses in the Face of Powerful Hurricanes

Challenge: The spike in powerful hurricanes over the past several years has pushed emergency personnel to implement new ways of dealing with storm fallout. One issue that's often difficult to deal with in the face of a natural disaster like a hurricane is coordination between emergency response and other departments. In Leon County, Florida, the GIS team in particular struggled with multiple asks coming from different groups needing mapping and analysis help.

Solution: GIS has helped the area prepare and respond in a highly effective manner after two powerful hurricanes in the last two years. In particular, Leon County stood up a powerful incident management system centered around GIS and location intelligence that anybody could access so they could analyze their own issues.

The GIS application has two dozen layers of information that anybody can use without having to make the ask specifically of the GIS department. It shows everything from flood hazard nuisance areas, to critical facilities, to damage assessment trackers, road closures, to priority road clearing routes and more.

The GIS team at Tallahassee-Leon County also embeds in the Leon County's Emergency Management Operations Center prior, during, and after a major event. Hurricanes Hermine and Irma tested the GIS department's capacity to prepare and deal with the many aspects after the storm passed. GIS solutions helped the departments stand up applications quickly in order to visualize the damage, activities and response.

"GIS gives us the ability to visualize the many events associated with hurricanes and natural disasters," said Scott Weisman, GIS Program Coordinator, Tallahassee-Leon County GIS. "The initial damage assessment tools also allowed us to tally the damage and quickly convey it to the state of Florida and FEMA representatives."

> "Our strategy is to empower agencies to maintain and use their own data with the right GIS training."

Scott Weisman, GIS Program Coordinator, Tallahassee-Leon County GIS, FL

Case Study #2

Auburn, AL: Creating a Green Infrastructure Master Plan With GIS

Challenge: More and more communities across the country are looking to green infrastructure best management practices (BMPs) for protecting streams, rivers and other habitats within watersheds around the nation. The city of Auburn, Alabama wanted to use green infrastructure to align the city's stormwater management program with the goals, objectives, and vision established in the City's comprehensive planning documents; improve the quality of life of their citizens, and address existing water quality impairments and help prevent future impairments.

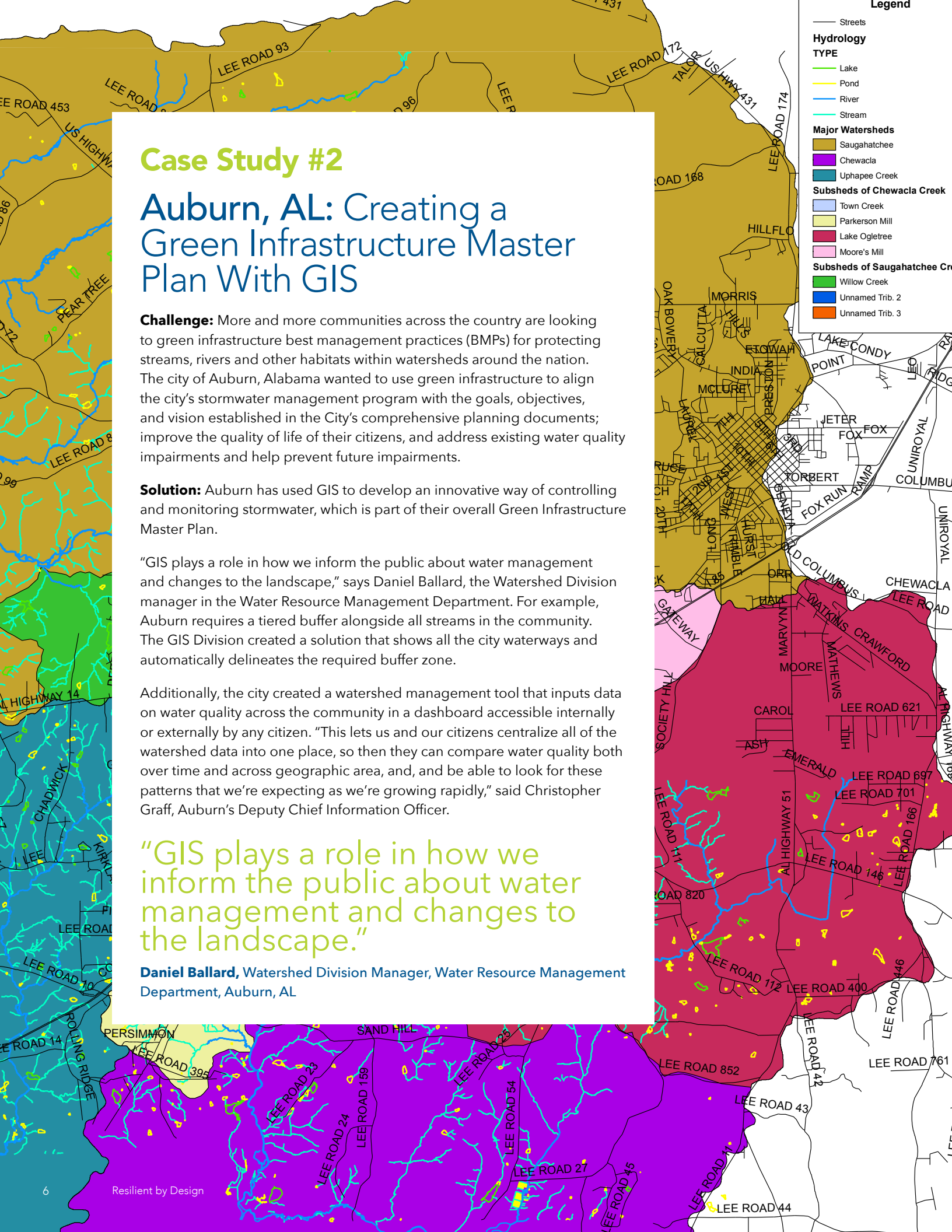
Solution: Auburn has used GIS to develop an innovative way of controlling and monitoring stormwater, which is part of their overall Green Infrastructure Master Plan.

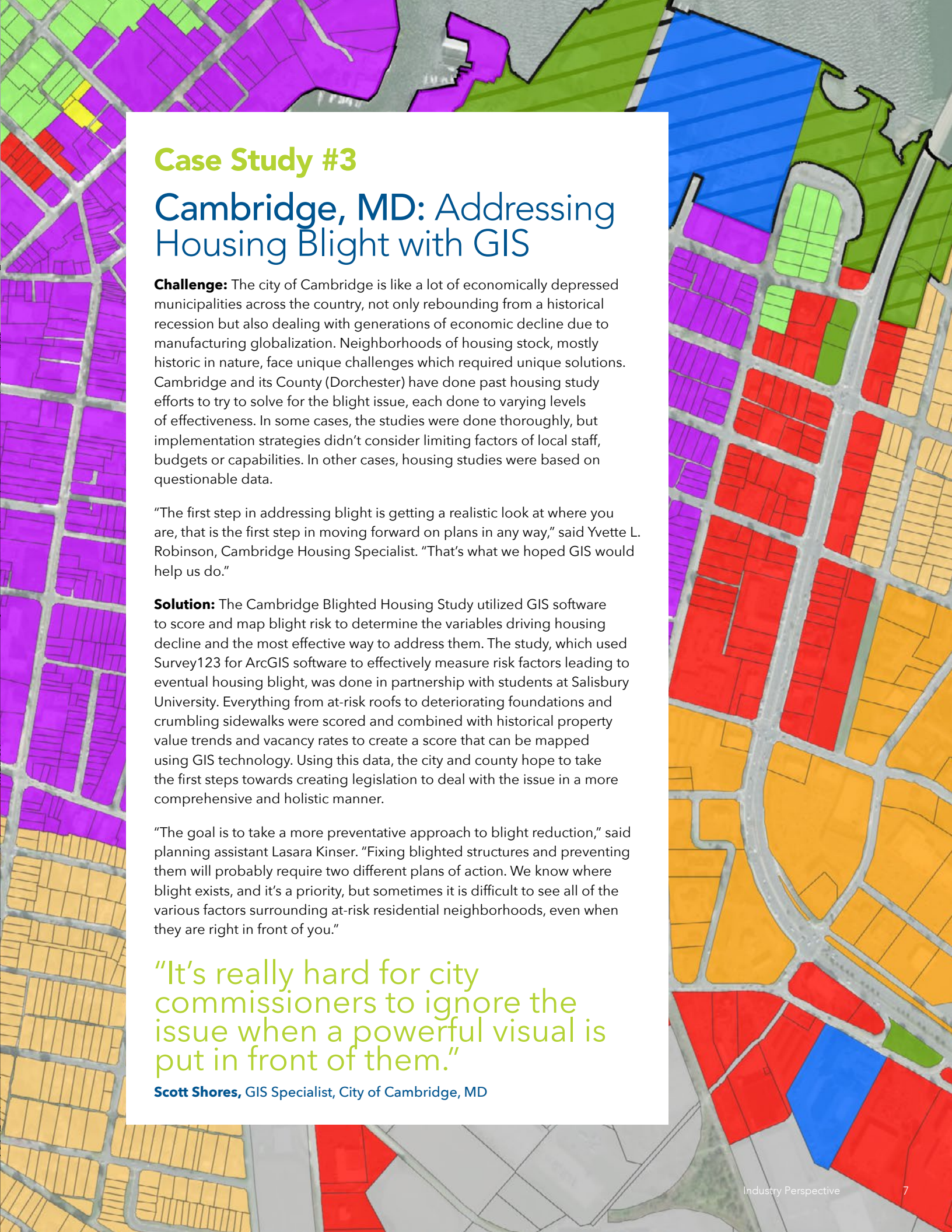
"GIS plays a role in how we inform the public about water management and changes to the landscape," says Daniel Ballard, the Watershed Division manager in the Water Resource Management Department. For example, Auburn requires a tiered buffer alongside all streams in the community. The GIS Division created a solution that shows all the city waterways and automatically delineates the required buffer zone.

Additionally, the city created a watershed management tool that inputs data on water quality across the community in a dashboard accessible internally or externally by any citizen. "This lets us and our citizens centralize all of the watershed data into one place, so then they can compare water quality both over time and across geographic area, and, and be able to look for these patterns that we're expecting as we're growing rapidly," said Christopher Graff, Auburn's Deputy Chief Information Officer.

> "GIS plays a role in how we inform the public about water management and changes to the landscape."

Daniel Ballard, Watershed Division Manager, Water Resource Management Department, Auburn, AL





Case Study #3

Cambridge, MD: Addressing Housing Blight with GIS

Challenge: The city of Cambridge is like a lot of economically depressed municipalities across the country, not only rebounding from a historical recession but also dealing with generations of economic decline due to manufacturing globalization. Neighborhoods of housing stock, mostly historic in nature, face unique challenges which required unique solutions. Cambridge and its County (Dorchester) have done past housing study efforts to try to solve for the blight issue, each done to varying levels of effectiveness. In some cases, the studies were done thoroughly, but implementation strategies didn't consider limiting factors of local staff, budgets or capabilities. In other cases, housing studies were based on questionable data.

"The first step in addressing blight is getting a realistic look at where you are, that is the first step in moving forward on plans in any way," said Yvette L. Robinson, Cambridge Housing Specialist. "That's what we hoped GIS would help us do."

Solution: The Cambridge Blighted Housing Study utilized GIS software to score and map blight risk to determine the variables driving housing decline and the most effective way to address them. The study, which used Survey123 for ArcGIS software to effectively measure risk factors leading to eventual housing blight, was done in partnership with students at Salisbury University. Everything from at-risk roofs to deteriorating foundations and crumbling sidewalks were scored and combined with historical property value trends and vacancy rates to create a score that can be mapped using GIS technology. Using this data, the city and county hope to take the first steps towards creating legislation to deal with the issue in a more comprehensive and holistic manner.

"The goal is to take a more preventative approach to blight reduction," said planning assistant Lasara Kinser. "Fixing blighted structures and preventing them will probably require two different plans of action. We know where blight exists, and it's a priority, but sometimes it is difficult to see all of the various factors surrounding at-risk residential neighborhoods, even when they are right in front of you."

> "It's really hard for city commissioners to ignore the issue when a powerful visual is put in front of them."
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> **Scott Shores,** GIS Specialist, City of Cambridge, MD

Where to Start With Esri and Resiliency Through GIS

Esri helps communities assess and analyze risk, evaluate potential impacts, plan resilience activities and view status of resilience efforts. In particular, these products are critical to any community's resiliency efforts:

ArcGIS Hub provides a two-way engagement platform to connect government and citizens. It provides the mechanism for a genuine citizen partnership by providing purposeful, initiative-driven open data that enables citizens to subscribe to resilience initiatives they're interested in and want to follow. It notifies them of upcoming events, educates them about planned strategies and lets them have a voice in how the plan will look or how it will be carried out. In short, it meets the public's modern expectations about how they communicate with one another, and with their government.

ArcGIS Urban is a new way of collaborating across departments and agencies to make the right decisions for the community. This web-based application allows planners, property developers, city leaders and the public to work together to create and measure multiple development scenarios for a property, a block or an entire community. It gives them the tools to visualize these developments before the first site plan is even drawn up, but it also provides a critical data-driven approach. ArcGIS Urban is going to change the way planning departments work in allowing them to be more efficient and proactive in the design of their city, and by extension, in establishing resiliency initiatives.

ArcGIS Pro is the latest advanced desktop tool that allows users to get started solving problems by visualizing, querying, creating, editing, analyzing and presenting geospatial data in both 2D and 3D environments. It also allows users to create and manage data, solve spatial problems and extend the reach of GIS by sharing maps and apps with the entire organization.

ArcGIS for State and Local Government:

- Community Resilience App can be used by preparedness personnel to aggregate asset information, create asset resilience scores and assess a community's resiliency.
- Resilience Dashboard can be used by preparedness personnel to monitor asset resilience and measure progress toward resiliency objectives.
- Community Impact Reporter can be used by the general public to report the short- and long-term impacts of a natural disaster.
- Community Impact Dashboard can be used by emergency management personnel to monitor impact reports and understand how community resiliency can be improved.
- Community Resilience Surveys can be used by preparedness personnel to capture asset, vulnerability and resilience information used in a resiliency assessment.
- Resilience Outreach App can be used by preparedness personnel to share resilience initiatives to reduce the impact of acute shocks and chronic stresses on the community.

Operations Dashboard for ArcGIS is a configurable web app that provides location-aware data visualization and analytics for a real-time operational view of people, services, assets and events. From a dynamic dashboard, view the activities and key performance indicators most vital to meeting your organization's objectives.

Conclusion

State and local governments are struggling with a similar problem: limited resources are complicated by a demand for improved delivery of government services. At the same time, conditions have become more challenging: the lack of diversity in economic opportunities; extreme weather events brought on by climate change; and the need to make communities safer, healthier, places to live.

Governments are turning to GIS technology to create usable information from the data they collect, then analyze that information to understand and develop better strategies to solve problems and subsequently become more resilient. With Esri's GIS technology, governments at all levels can discover that the power of location and spatial thinking can be applied to nearly every area to realize higher levels of service, promote transparency and to create a truly healthy, resilient community that can withstand any challenge it faces.

When Esri was founded in 1969, we realized even then that geographic information system (GIS) technology could make a difference in society. Working with others who shared this passion, we were encouraged by the vast possibilities of GIS.

Today our confidence in GIS is built on the belief that geography matters - it connects our many cultures and societies and influences our way of life. GIS leverage geographic insight to ensure better communication and collaboration.

Explore our website to discover how our customers have obtained the geographic advantage by using Esri software to address social, economic, business, and environmental concerns at local, regional, national, and global scales. We hope you will be inspired to join the Esri community in using GIS to create a better world

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