November 2012

The New Geographers

Stories of Real People using GIS to Make a Difference

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Introduction

> *"So many of the world's current issues—at a global scale and locally—boil down to geography, and need the geographers of the future to help us understand them."*
>
> —*Michael Palin*

"What is the capital of Madagascar?"

That's what most people think of when they hear the term *geography*.

"It's boring," they say. "It's the study of useless information. It has no practical relevance to my life."

In fact, nothing could be further from the truth. Geography is one of the most interesting, vibrant, and dynamic fields of study today. It's also one of the most vital.

We think fondly of the great explorers who led challenging expeditions to the farthest reaches of the globe—to new continents, the poles, the tops of mountains, and the bottoms of the oceans. Through their explorations, they developed a new understanding of the world, and they came back to share that understanding with us. Be they traders, hunters, adventurers, or scientists, all these explorers had one thing in common: they were geographers who learned about unknown places, people, and things and brought back information to share with the rest of the world.

About 50 years ago, a new kind of geography was born, and it has opened up our world to advanced forms of exploration—not just treks to remote jungles or uncharted oceans but also research and analysis of the relationships, patterns, and processes of geography. Today, the new geographers use a combination of computers, satellites, and science to produce a much deeper understanding of how our world works.

The primary tool of the geographer is a map. What exactly is a map? A map is an answer to a question.

There are three basic kinds of maps that answer fundamental questions:

- Location maps answer the question *Where am I?*
- Navigation maps answer the question *How do I get there?*
- Spatial relationship maps answer the question *How are these things related?*

The third type of map, which helps us understand spatial patterns and relationships, is the primary tool of the new geographers.

While we know much more about the world today than ever before, parts of our world remain unexplored, and there are many important geographic problems left to solve: population growth, environmental degradation, loss of biodiversity, climate change, globalization, lack of sustainability, urbanization, health care access, poverty, hunger, and more. Although we have made tremendous progress in the last century, we still have a long way to go to develop a comprehensive understanding of our world. To solve these important geographic problems, we need the participation of everyone—not just administrators, scientists, and politicians. *Everyone* deserves a voice in these important issues.

Today, thanks to tools such as geographic information system (GIS) technology, virtually everyone can be a geographer. The tools to explore and examine geography in different ways are widely available, and anyone who uses them has the potential to discoveries and easily share them with the rest of the world. This democratization of geography is leading to a better and more complete and more equitable understanding of our world, and it's creating additional dimensions in our relationships with each other and our planet. We are *all* new geographers.

With this e-book, we invite you to read about how some of the new geographers are making a difference by applying GIS technology to the needs within their communities and throughout the world. These are people like you and me who are using new technology to make a difference and create a better world.

Their stories are inspiring. Yours could be, as well. We hope their stories will inspire you to join the ranks of the new geographers in making a difference in the world.

It all starts with a question—and the answer is a map.

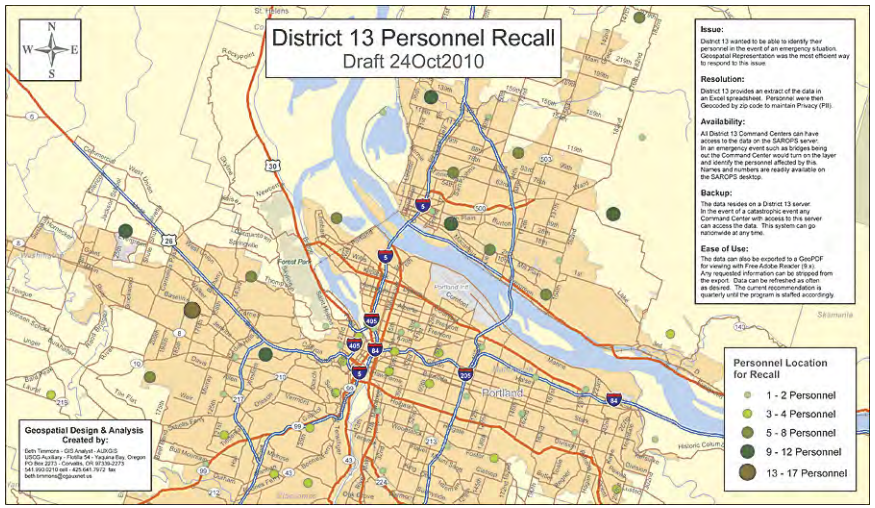
A GIS Volunteer for the US Coast Guard

Beth Timmons

GIS professionals understand workflows, development, and technology. They are proficient problem solvers who understand how to analyze and approach a project, plan it, complete it, and educate others. Many of these on-the-job skills can be applied to helping a local organization or community better address its concerns and meet its goals. GIS volunteers apply their talents in ways that make huge differences. Esri acknowledges the work of many volunteers by highlighting one of them, Beth Timmons, as a GIS Hero.

Timmons is a full-time GIS professional employed by GeoLogics as a contractor for Natural Resource GIS in Corvallis, Oregon. She also serves in the volunteer branch of the US Coast Guard, where she donates her GIS expertise an average of 50 hours per month. Along with having expertise in soil and GIS, which is highly valued by GeoLogics, Timmons has experience and is very interested in using GIS for emergency response. She looked for opportunities with the Coast Guard to see if it needed her GIS skills. The answer was a resounding "Yes!"

District 13 of the Coast Guard includes Idaho, Montana, Oregon, and Washington. The Coast Guard has an enterprise license agreement with Esri for ArcGIS but doesn't have the trained staff it needs to take full advantage of it. Rolling up her sleeves, Timmons began by leveraging the existing datasets to create geospatial products that staff could use on their desktops. For example, she worked with the Citizens Action Network, a group of local volunteers who have a view of waterways and can confirm problems that have been called in to the Coast Guard. She digitized information from the pages of the Command Center's three-ring binder and turned these into a geospatial layer for map display. If the Coast Guard receives a distress call, the user sees the location on a map along with contact information about the nearest volunteer to call and get visual verification.



Beth Timmons is a GIS volunteer for the US Coast Guard. District 13 needed to identify its personnel in the event of an emergency, so Timmons digitized information from the Command Center's three-ring binders.

Other key projects Timmons has created are a geoenabled PDF of tribal fishing zones and a Coast Guard Auxiliary personnel locator; the latter is used should members be in a disaster area and need assistance. She also mapped accidents and fatalities in inland lakes and waterways to show Coast Guard personnel the most dangerous locations. Her crab trap project convinced people not to lower traps into the shipping lane. Traps get caught in propellers and rudders and jam steering mechanisms. Overlaying a nautical chart with Oregon Department of Fish and Wildlife data, she created a map that shows that the best crabbing spots are actually outside the channel.

The benefits to the Coast Guard staff extend far beyond the maps Timmons has produced. She has saved it money by explaining how to use its existing system to solve a problem rather than buy new technology. One of her roles has been to train staff members to use ArcGIS on their desktops. Her teaching process is first to create a geoenabled PDF so that staff can get accustomed to a GIS map using familiar Adobe Reader skills. Once they are comfortable, she moves them to ArcGIS Explorer or ArcReader. The next step is working with them to use GIS. Coast Guard personnel move every few years. Timmons not only trains new people who rotate into a position; she also provides stability to the organization. Moreover, the people she has trained take these skills to their next assignment. They may even become GIS evangelists at their next assignment, saying something like, "In District 13 we could just turn on this layer and do such and such."

GeoLogics, where Timmons works, also benefits from her volunteerism. "On my volunteer projects, I get to do GIS the way I want to do GIS," says Timmons. "Working on these projects has increased my GIS skills because I have had the freedom to explore other options and come up with a better way of doing something. I have learned what works and what doesn't. This makes me a better employee. I can say, 'I can do that because I have already done it for a volunteer project.' The proof of concept has already been completed."

A self-proclaimed volunteer freak, Timmons contributes to the Oregon Framework Implementation Team for Emergency Preparedness, the Region 10 Regional Response Team for Oil Spill Response, and the West Coast Regional Ocean and Coastal Data Framework for Ocean and Coastal Health. She also started a local GIS user group. A few years ago, she got together with some other GIS users at the local pizza restaurant to talk about GIS. This GIS social continues to be a regular event that gives local users an opportunity to learn from their peers, share tips and tricks, and get advice.

Timmons enjoys her natural resource GIS day job but says that it is hard to ask a job to be 100 percent fulfilling. She finds her volunteer work to be highly gratifying and encourages other professionals to get involved locally.

Timmons offered suggestions for getting started as a GIS volunteer in a local community:

- Join the US Coast Guard Auxiliary and become part of its GIS team.
- Attend a city council meeting and listen for opportunities to use GIS skills.
- Reach out to small cities that don't have a GIS and offer assistance.
- Do a simple project, such as mapping culvert locations using existing data. Create the PDF and send it to the department's manager.
- Talk with the fire department. Perhaps you can help improve its response system.
- Check in with city or county park departments. Put a department's data layers over a basemap from ArcGIS Online and give park staff a planning map to post on a wall.

"I believe everyone should volunteer at some level," Timmons says. "We can use our GIS skills to do even a tiny project, such as overlaying flood zone data on the town's topography and creating a PDF. It could make a big difference."

(This article originally appeared as "Beth Timmons: Volunteering Is Heroic" in the Summer 2012 issue of *ArcNews*.)

Protecting Millions from Floods

As Applications Section administrator for the Information Technology Bureau of the South Florida Water Management District, James Cameron works to provide flood protection for millions of area residents. His efforts help monitor water quality, treat storm water, and restore the Everglades. For Cameron, a native Floridian, his career is a way to express his deep love for the state and a strong appreciation for the environment.

Cameron grew up in south Florida. He fished Biscayne Bay with his family and camped with his Boy Scout troop at Virginia Key, Mineral Springs, and Fortymile Bend in the Everglades. He later graduated from the University of Florida with a bachelor's degree in geography and a certificate in Florida studies.

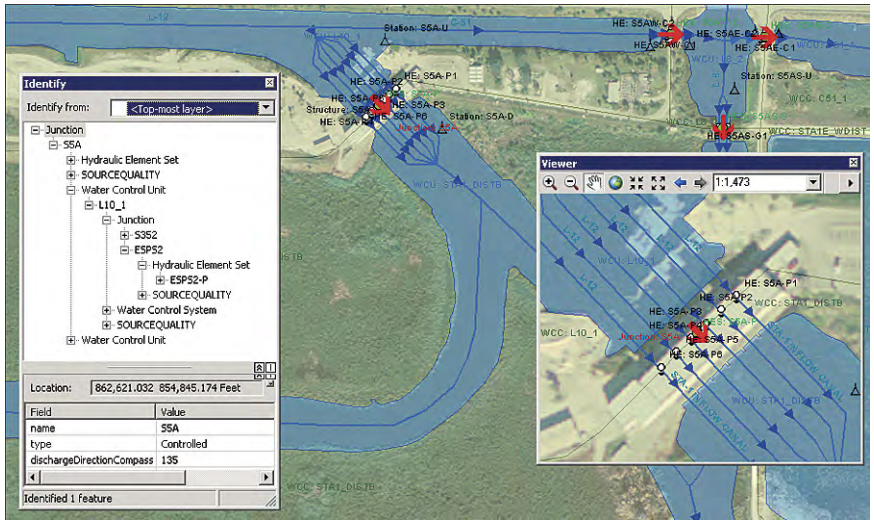
"After college, I was acutely aware of how important water is in shaping the development of Florida," Cameron says. "I felt I could contribute in a capacity of public service in protecting Florida's precious environment."

Cameron was hired as a water resource planner, and later appointed GIS manager, at the Suwannee River Water Management District (WMD). He began to see the potential for GIS to bring clarity to complex water management issues, a way to transform large volumes of hard-to-interpret information into data and maps that could be easily understood by those responsible for making water management policy decisions.

"Once I realized my work could provide management with the ability to make better-informed decisions, I was hooked; GIS was my career," Cameron says. "What I love about GIS is that we can put maps in front of decision makers, show them where the issues are so they can understand complicated data and environmental issues, and see relationships between various factors."

One of the major accomplishments during Cameron's six years at the Suwannee River WMD was the initial implementation of GIS. Data had to be put into the system, which, in most cases during the early 1980s, meant using a digitizing table to capture information from paper maps. The team constructed basemaps by digitizing hydrography, roads, the Public Land Survey System,

jurisdictional boundaries, and hypsography. Along with the basemaps, team members also digitized data layers, such as surface water drainage basins, soil surveys, and locations of groundwater monitoring wells. With the foundation of GIS complete, the Suwannee River WMD was ready to apply GIS in support of its projects and programs.



For the past 12 years, Cameron has worked with the South Florida Water Management District directing GIS development. The focus of this GIS has been the integration of both data and applications, including the development of a common hydrographic data model.

GIS played an important role in the implementation of the Suwannee River Basin Floodplain Development Ordinance that keeps people from building houses below the 100-year flood elevation in floodplain areas. Another accomplishment was the use of GIS to derive storm water retention and detention standards from delineated watersheds to support the Surface Water Management Program.

Steve Dicks studied with Cameron at the University of Florida, and the two worked together through college as roadies for rock 'n' roll shows. Dicks, who is now the information resources director at Southwest Florida Water Management District, recalls the important, early contributions Cameron made to statewide mapping.

"Jim has been a leader in feeding the statewide database with soil surveys for modeling and surface water permitting, statewide aerial photography, and digitized USGS maps," Dicks notes. "He is a big thinker. The role he played in coordinating that—he was able to get five government agencies moving in the same direction."

Building a GIS Career

Over the years, Cameron has had many job titles in several organizations, from GIS manager and director of GIS applications to chief GIS officer and GIS Division director. However, his role has always been to guide and direct the implementation of GIS to support the mission of the organization.

In the 1990s, Cameron worked as the GIS manager at the St. Johns River Water Management District, where he contributed

to the development of the US Geological Survey (USGS) topographic quad updates, digital line graphs, digital raster graphics, orthophotos, and National Aerial Photography Program. One of the most significant accomplishments, according to Cameron, was the creation of a detailed land-cover/land-use dataset needed for a variety of applications, including wetland change-over-time analysis and estimates of non-point source pollution loading to surface water bodies.

In 1997, Cameron was appointed by Florida governor Lawton Chiles as the water management district member of the Florida Geographic Information Board. That same year, he and his team were able to assist fire crews with detailed maps, saving homes and property. The following year, working with a contractor, Cameron and his team developed and implemented a methodology to produce gauge-adjusted Doppler rainfall estimates. A modification of this methodology is currently being used by water management districts throughout Florida.

David Maidment, director at the University of Texas Center for Research in Water Resources, recalls seeing Cameron's work many years ago at the Esri International User Conference. "The map of groundwater recharge constructed for the St. Johns River Water Management District remains still a great example of the use of core GIS functions to support geospatial analysis of water resources."

More recently, Maidment says he has admired Cameron's work as a leading advocate of the use of GIS for water resources at the South Florida Water Management District. Instead of having a set of unconnected streamlines, drainage areas, water control structures, and water measurement points, Cameron's efforts have made all the information geographically consistent such that the drainage area outlets fall right on the water control structures and the corresponding streamlines, and all are connected with relationships.

"It was like seeing a fuzzy image suddenly come into a precise focus," Maidment says. "Jim is a great GIS leader with a lifetime of contributions to the field of applying GIS in water resources in Florida."

Leadership on Many Levels

For the past 12 years, Cameron has worked with the South Florida Water Management District and continued the role of directing GIS development. Here, Cameron says, the focus of GIS has been toward integration of both data and applications, including the development of a common hydrographic data model.

Now, one unified database houses hydrography; drainage basins; hydrologic monitoring sites; and hydrologic elements, such as pumps, culverts, and weirs. The unified database provides the ability to define relationships among the hydrographic elements that can then be used for hydrologic modeling. This common hydrographic data model is being incorporated as a foundation

component along with the district's SCADA system and a business rules management system to create an operations decision support system that will provide a key resource to water managers. This means the data and GIS tools will support the district's work to provide flood protection for millions of residents of South Florida.

"I have been blessed to lead a team of dedicated GIS professionals who have implemented a GIS that is used by the entire agency," Cameron observes. "As the district staff learn and use existing applications, they begin to understand the power of GIS and how GIS can be applied to meet other business objectives."

Tim Minter, a GIS enterprise architect with the South Florida Water Management District, remarks on not only Cameron's skills in the application of GIS but also his effective management style.

"Jim has a consistently keen eye for spotting significant opportunities to advance the application of geographic information science and technology in water resource management communities," Minter says. "He delivers meaningful and successful GIS services because he builds and supports strong teams by supporting team members' professional interests and growth, highlighting individual and team achievements, and caring about his staff on a personal level."

(This article originally appeared as "James Cameron: A Unifier Many Times Over" in the Spring 2012 issue of *ArcNews*.)

A Tireless Advocate for Wilderness

Janice Thomson

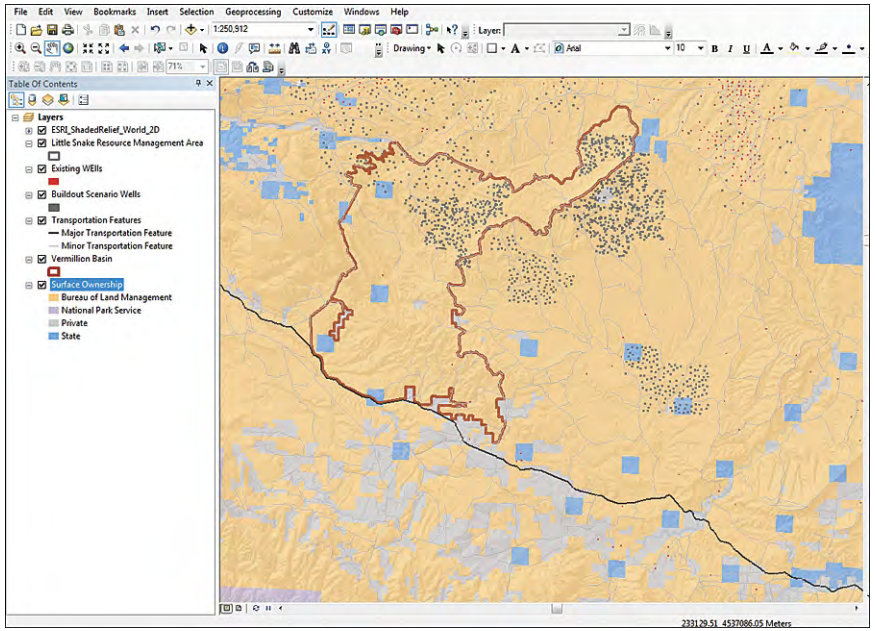
An avid hiker who adores the mountains of the Northwest, Janice Thomson was drawn to The Wilderness Society out of a desire to defend the wildlands she loves. In her current position as the society's director for the Center for Landscape Analysis, Thomson integrates a wide variety of data items into spatial analyses and tenable maps. These maps are then used to promote the goals and values of The Wilderness Society to agencies working directly with the land. As a lifelong wilderness advocate, Thomson has put her passion to work protecting America's public lands.

Cofounded in 1935 by renowned wildlife ecologist Aldo Leopold and several other prominent conservationists of the time, The Wilderness Society has a mission to "protect wilderness and inspire Americans to care for our wild places." The Wilderness Society works to protect the United States' 635 million acres of national public lands. Among other conservation actions, the organization has led the effort to permanently protect as designated wilderness nearly 110 million acres in 44 states to date. Thomson's ability to infuse these efforts with geospatial intelligence makes her integral to achieving these objectives.

Thomson received her master's and PhD degrees in geology from Dartmouth College. After graduating, she went to work for Lockheed Engineering and Sciences, mapping land cover in the Chesapeake Bay Watershed. After a year and a half with Lockheed, Thomson started her journey with The Wilderness Society in 1992.

Much of Thomson's work centers on habitat degradation sometimes associated with the extraction of fossil fuels, especially oil and gas. By applying spatial analysis to the relationship between oil and gas infrastructure and various natural resources, Thomson is able to create maps that are, in turn, used to craft development recommendations. These recommendations, made through the Bureau of Land Management (BLM), promote optimized solutions that integrate oil and gas industry development plans with strategies for protecting the land's ecological and wilderness values.

"We provide the best science possible and advocate strongly for lands that should be protected from development, and we provide recommendations for how other lands can be developed in ways that minimize ecological impacts," says Thomson.



Build-out scenarios, like this one of the Vermillion Basin, illustrate development plans and help predict habitat impacts.

The vast interdisciplinary cooperation required for development in the oil and gas industry makes the merging of information into a viable recommendation no small feat. Couple a complex industry with conservation goals and the delicate interdependence of wild ecosystems, and the task of providing sound counsel to all the stakeholders becomes even more daunting. This is where Thomson comes in. She takes natural resource datasets and industry development plans that are impracticable alone and combines them to create functional maps that expand organizational awareness. This increased understanding is crucial to facilitating sustainable development in the oil and gas industry.

"The Wilderness Society is an organization that integrates science, policy, and advocacy," says Thomson. "Our integrated approach allows us to bring unique GIS analyses to the table to answer questions that maybe other government agencies or entities aren't asking. We're then able to share that information with all the players involved in a given project—people like county commissioners, conservation partners, and oil and gas professionals."

The staggering diversity of wildlife poses a critical challenge for future development. "The effect of habitat fragmentation varies tremendously by species; that's why this work is all done on a species-by-species basis," says Thomson. "We use studies completed by field biologists who have measured the responses of different wildlife species in proximity to oil and gas development, and fortunately, some of these biologists are publishing information about spatial metrics that we can measure using GIS."

By integrating biological literature with spatial data, Thomson was able to illustrate and compare development with mule deer migration routes in the Upper Green River valley. Her efforts resulted in accessible analytic data that demonstrated the impact of infrastructure development on mule deer. This data was put to use to create specific setup recommendations BLM could use for future development plans.

Another way that Thomson encourages environmental consideration is by creating build-out scenarios of roads and well pads and providing informed projections of the impact on local species. "We give people a qualitative picture and quantitative story," says Thomson. "These projections are really powerful to bring to the table at a meeting with county commissioners, the BLM, and any other local stakeholders. Projections allow us to illustrate what the scenario they're supporting would look like on the ground and what its likely impacts would be on the important species in the region."

The scenic Vermillion Basin (photo: Sam Cox).

The employment of a similar build-out scenario contributed to a recent win for The Wilderness Society. After years of discussion surrounding potential land management plans for the Little Snake resource area in northwest Colorado, The Wilderness Society presented a build-out scenario demonstrating how proposed oil and gas development would affect the Little Snake area. A particular area of concern was Vermillion Basin, an area of northwest Colorado with profound wilderness character and value to locals. When the final management plan came to fruition, the Vermillion Basin was granted administrative withdrawal of oil and gas development.

Thomson knows that a well-crafted map has the capacity to advocate certain development methodologies simply by being available for consideration. With this function in mind, she puts relevant maps in front of decision makers.

"Creating a map about a particular resource and getting it into the hands of stakeholders often gets the map into closed-door meetings," notes Thomson. "The map can then be a voice when someone from our staff is not able to be a voice."

Thomson works courageously to promote engagement with wildlands and understanding of the tremendous value that these lands hold. "GIS helps connect people with the land," Thomson says. "These lands provide vital services to communities, whether it's clean water and air, income from recreational visitors, cultural values, or spiritual significance. It's really exciting to represent these values on maps to allow people to share their own accounts and why they believe land needs to be protected." Her tireless work advocating for wilderness has made Janice Thomson a true GIS hero.

(This article originally appeared as "Janice Thomson: Tireless Wilderness Advocate" in the Winter 2011/2012 issue of *ArcNews*.)

A Legacy of Cooperation

Paul Tessar

Driven by a hunger for challenge and a desire to bring a fresh perspective to new organizations, Paul Tessar traveled through the heartland of the United States like the legendary Johnny Appleseed, seeding state and local agencies, not with apple trees but with the ability to harness GIS capabilities for planning and cooperation. Tessar has cultivated successful GIS programs in Arizona, Colorado, Minnesota, South Dakota, and Wisconsin, but it was the state of Illinois where it all started.

After graduating with a bachelor's degree in history from the University of Illinois at Urbana-Champaign, Tessar continued to study urban and regional planning. "I've always been fascinated with cities and the built environment," Tessar notes, professing his drive to contribute to thoughtful urban arrangements.

Enabling Foresight in Government Agencies

In 1974, with his master's degree in urban and regional planning in hand, Tessar went to work for the South Dakota State Planning Bureau.

In South Dakota, Tessar used self-developed image processing software to generate statewide map layers for use in a land resource information system. He created and proffered soil classification and elevation map layers for use in land suitability analysis by South Dakota regional planning agencies. Using this dataset in conjunction with satellite-derived land-cover layers, Tessar and his team developed a "grid GIS approach to spatially solving the Universal Soil Loss Equation [USLE]." Tessar provided the resultant data to regional and local planners, empowering them to envision intuitive and farsighted urban development.

"I use GIS to facilitate superior outcomes," Tessar says. "As powerful as it is, GIS is the means, and better decision making is the end."

Just as impressive as Tessar's proactive effort to enable well-informed decision making is the context in which he worked. Completed more than 35 years ago, his work on the USLE

predated digitizing tablets and prevalent commercial GIS use, requiring that Tessar's team members hand code soil survey information into 10-acre grid cells and shepherd governmental use of GIS. South Dakota rewarded his accomplishments by naming him State Employee of the Month.

Using GIS to Reinforce Interdisciplinary Prosperity

In the early '80s, Tessar went to work for the Arizona State Land Department (SLD), where previous attempts to build a comprehensive GIS program had fallen short of fruition. In just three years, Tessar was able to establish a thorough and effective GIS program that is still in place to this day. His efforts at the Arizona SLD were recognized with a Citation of Merit from Governor Bruce Babbitt.

In addition to outfitting the Arizona SLD with valuable GIS capabilities, Tessar analyzed developable lands and ongoing revenue generation for state trust lands. Profits garnered from the state land trust went to supporting public education in Arizona. Working in conjunction with Arizona State Land Department commissioner Robert Lane, Tessar used GIS to manage public lands for long-term sustainability while simultaneously increasing revenues.

"GIS is not just manipulating data for planning and decision making," Tessar says. "It is actually a platform for collaboration, where the cooperative efforts it facilitates are just as significant, if not more so, than the base knowledge that supports their functioning."

The next few years saw Tessar move to Minnesota for a stint with the Minnesota State Planning Agency, Land Management Information Center, and then to Wisconsin, where he worked with the State Department of Natural Resources (DNR). In a collaborative effort with DNR agency management, Tessar cultivated a statewide GIS co-op called WISCLAND, the Wisconsin Initiative for Statewide Cooperation for Landscape Analysis and Data. Along with the rest of the co-op, Tessar helped establish a natural resource information system, abounding with original statewide data. This data was put to a myriad of uses by DNR staff: Wildlife management employees modeled habitat carrying capacity and animal population to determine the appropriate number of deer licenses to grant, water resources management staff determined soil erosion hazards threatening surface water quality and ways to mitigate them, and air quality managers modeled non-point ozone sources to address air quality issues.

"Our mission was to provide GIS support to planning, management, analysis, modeling, and decision-making functions for a broad array of programs in the traditional areas of conservation agencies—parks, wildlife, fisheries, water resources, wetlands—as well as newer environmental areas, such as water quality, air quality, solid waste, and hazardous materials," Tessar says.

While working for DNR, Tessar returned to school for a second master's degree in environmental monitoring—an ecology-oriented GIS and remote-sensing program housed at the University of Wisconsin Institute for Environmental Studies.

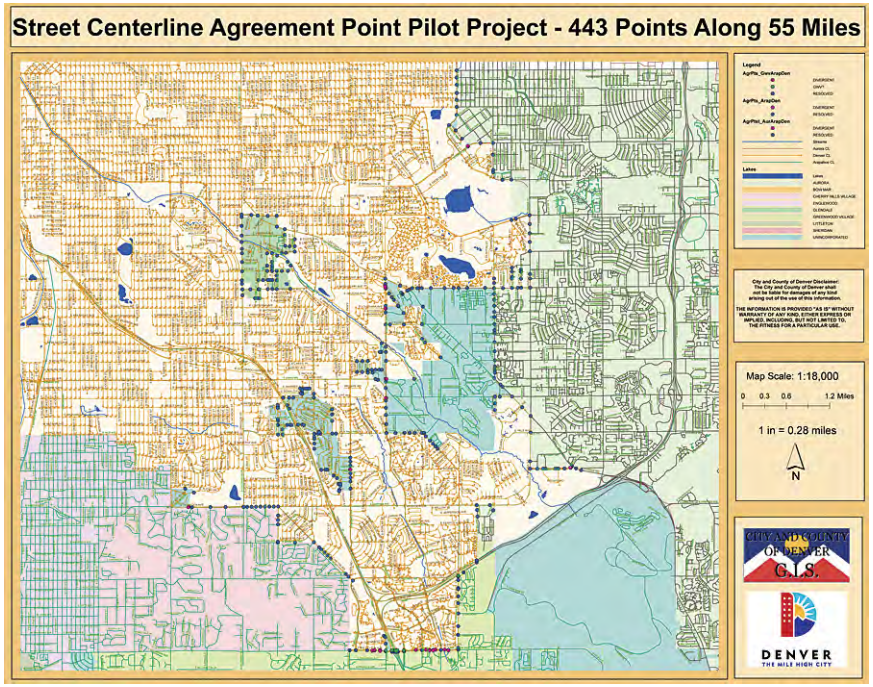
Maintaining a Thriving Civic Ecology by Encouraging Dialog

In his current position as the GIS data administrator for DenverGIS, a technology service agency of the City and County of Denver, Tessar applies his GIS savvy to maintain a vibrant urban structure.

"We use GIS as a tool to build a better model of the reality of our city," Tessar says. "GIS is about crafting a representation of our shared reality. Whether you work at the local, regional, state, national, or global scale, this is often the task that precedes planning and engineering a better future. Not only does GIS provide the tools to capture that model of reality, it provides the capabilities to manipulate it for a purpose."

In his recent efforts, Tessar has focused on enhancing regional GIS data interoperability. The Colorado Homeland Security North Central Region (NCR) has developed a regional GIS data repository for the 10-county Greater Denver metro area. The member counties provide more than 20 shared GIS layers on the NCR ArcGIS software-based site. A current endeavor coordinated by the NCR GIS steering committee, which Tessar chairs, involves the 10 NCR counties, 3 neighboring counties, and 16 cities.

This group, representing all local jurisdictions that maintain GIS centerline layers on regional county boundaries, is collaborating to establish "agreement points" along 750 miles of common borders. All the participants in this regional partnership plan to snap their centerlines to the 2,100-plus points to form a seamless regional streets layer to be hosted at the NCR repository.



DenverGIS enhances communication by integrating centerlines between jurisdictions.

Leaving a Legacy of Cooperation

Tessar's passion for using GIS to create a platform for multijurisdictional communication and collaboration is highly evident from the fruitful GIS programs he has left in his wake. "Paul's hard work has created a solid framework for future cooperation," notes Ryan Huffman of the Public Works and Development Department of Arapahoe County. Tessar credits his ability to infuse diverse agencies with GIS capabilities to his skill in perceiving receptive individuals and identifying common interests.

"GIS allows each group to express its understanding of reality, structure, process, and function in specific areas," says Tessar. "As the disciplines work together, they begin to develop more of a common world view and a better understanding of the other disciplines. All of the '-ologists,' '-ographers,' '-ticians,' and '-tists' can get together and satisfy their hunger for creating positive change. They can come to a common understanding and optimize for the best solution within the resource constraints they're working with." These are the fruits of the "orchards" Tessar has planted in the heartland.

(This article originally appeared as "Paul Tessar Is the Johnny Appleseed of GIS" in the Fall 2011 issue of *ArcNews*.)

Rethinking the Utility Industry

As director of land and field services for Houston, Texas-based CenterPoint Energy, Cindi Salas has a knack for simplifying and improving processes. She is known in the utility industry for her ability to make workflows more efficient and is adventurous in her use of technology—pushing perceived limits of integration and expansion.

Cindi Salas

Given Salas' aptitude, it makes sense that, for her, "GIS is the right fit."

In 2009 at the Esri International User Conference, Esri president Jack Dangermond presented Salas with the Enterprise Application Award, recognizing tremendous response efforts in the wake of Hurricane Ike. CenterPoint was able to restore service to 75 percent of its customers within 10 days of the storm's devastating landfall in Galveston, Texas. A key tool for CenterPoint Energy: an outage management application built on ArcGIS technology. The utility also created a multitude of GIS maps to analyze the situation before, during, and after the storm. This information was shared with customers and media, government, and support agencies.

In her current role, Salas oversees CenterPoint's enterprise GIS department, surveying and right-of-way management, underground line locating, and joint-use facilities.

With more than 5 million metered customers, CenterPoint Energy is composed of an electric transmission and distribution utility serving the Houston metropolitan area, local natural gas distribution businesses in six states, a competitive natural gas sales and service business serving customers in the eastern half of the United States, interstate pipeline operations with two natural gas pipelines in the midcontinent region, and a field services business with natural gas gathering operations also in the midcontinent region.

Twenty-seven years ago, Salas joined CenterPoint, following nearly 13 years with Allegheny Energy (now First Energy), where she worked as a technician with responsibility for budgeting and estimating all aspects of electric operation and maintenance, from distribution to power plants, as well as transmission line route certification.

When she started at CenterPoint, Salas says, GIS was protected and not well understood throughout the company. GIS was restricted to a back-room mapping operation.

"GIS was this big monster that no one could get their arms around," Salas says. "I knew what GIS was, and I wanted to have access to it. At first I was not allowed. I think I was told I would have to fund a new server, that it would be too costly, and that they just couldn't open up access." But that didn't discourage Salas.

Streetlights Create a Lightbulb Moment

About 20 years ago, while Salas was responsible for CenterPoint's streetlight design, a weighty task was set before her. She and a few additional forward-thinking individuals were asked to devise a new process to move information from the field into the company's GIS within five days of completing the work in the field. Typically, it would take months from the time of fieldwork completion to an update in the GIS. The team responded to the challenge, outlining the process changes that could be implemented to effect the dramatic transformation.

"After that, I was seen as an advocate for GIS, trying to open access to other users and leverage the system for all that it could do," Salas says.

Envisioning further opportunities to exploit GIS technology, Salas outlined a new process to manage the huge volume of

In 2002, Salas was already promoting the power of GIS in analyzing predicted storm surge relative to the utility's assets and potential areas of damage.

streetlight additions and improvements at CenterPoint. GIS was incorporated into a new workflow management system that quickly moved new street lighting requests (from homeowners associations or municipalities) through engineering, design, survey, construction, and billing. The workflow was so integrated with GIS that the city could request streetlight upgrades via an online system, the system would look for the specific lights in the GIS to determine which type of upgrade was needed, a sketch would be automatically generated for the crews to perform the work, and the corresponding updates would automatically be made in GIS.

Under this new process, CenterPoint's service area neighborhoods were brought up to a higher safety standard as the streets were upgraded with brighter lights.

"We truly embraced the tremendous potential of GIS technology, so we then started to think about using GIS to design more complex streetlight layouts," Salas says. "It was our plan to be the poster child for using GIS for design, whetting the appetites of others. It took a while, but we got there. And GIS did reach visibility elsewhere in the company as a result of these efforts—they saw GIS for what it could do."

Building the Enterprise Organization and System

Many years later, with the acquisition and merging of gas companies by and with what was previously an electric company, CenterPoint Energy was committed to developing an enterprise GIS organization and system. That decision was made in 1999, and Salas was selected to be one of the leaders in that endeavor.

"Once we decided on the common platform, we had to convert essentially 10 different systems to the latest Esri technology," Salas says. "We worked closely with our friends at Esri on developing the object-oriented data models, replacing functionality, and developing new applications that replicated what was being done with other tools."

CenterPoint completed its GIS conversion efforts under Salas' continued nurturing, and usage of the technology flourished throughout the organization.

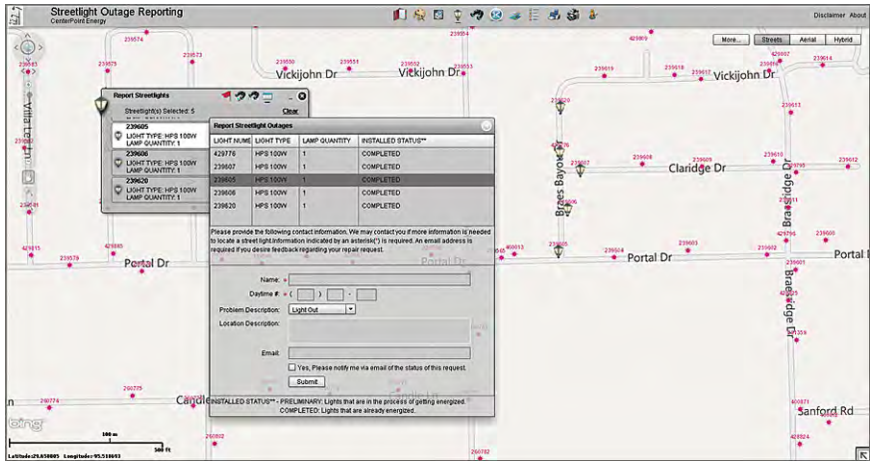
Today, CenterPoint Energy's enterprise GIS supports more than 80 applications for engineering, design, construction, maintenance, a variety of fieldwork, regulatory reporting, managing assets, and more. Eight geodatabases house information about the company's electric and gas distribution and transmission assets. This data is available throughout the company to all 8,000 employees.

From Smart Design to Smart Grid

Along with many utilities worldwide, CenterPoint is focusing on smart meter and smart grid projects. As the recipient of US Department of Energy funding, CenterPoint is committed to its deliverables, including completion of the first phase of a self-healing smart grid in 2013. The grid will use smart meters, power line sensors, remote switches, and other automated equipment to improve power reliability and restoration in the Greater Houston area.

"To that end, as we implement our advanced distribution management system [ADMS], GIS is front and center and an integral part of building the smart grid," Salas says.

Since GIS already houses the utility's critical asset and circuit information, it will feed that data to the ADMS, along with regular updates, as changes are made to the physical network.



CenterPoint's current ArcGIS API for Flex application allows customers to select and report streetlights that are out. The application is interactive and provides customers with repair status updates.

GIS assists in the design of equipment—smart meters, cell relays, take-out points, intelligent grid switching devices—as it is installed in the field. Server-based GIS applications provide a multitude of diagnostic capabilities relative to smart meter integration and equipment performance.

The Future's So Bright

"I see increased usage of GIS via web services," Salas says. "I see it becoming easier to integrate GIS with other systems because of the Software-as-a-Service environment. Where we used to hard code interfaces, we are now writing services that can be consumed and reconsumed. I see that continuing to manifest as we leverage the cloud. I see GIS evolving for use in ways that we have yet to imagine."

Currently, Salas is focusing her efforts on the nontraditional aspects of GIS knowledge and data sharing between the public and private sectors—a move she believes impacts the greater good of the community. To that end, Salas participates in various industry-related associations.

Salas says her passion for GIS was ignited 20 years ago when she could envision the possibilities of the technology. That passion hasn't waned.

"In fact, the passion is stronger," she says. "The opportunities for GIS are limitless in a world where everything is somewhere."

(This article originally appeared as "Cindi Salas' Passion for GIS Is Undeniable" in the Summer 2011 issue of *ArcNews*.)

Saving the World, One Parcel at a Time

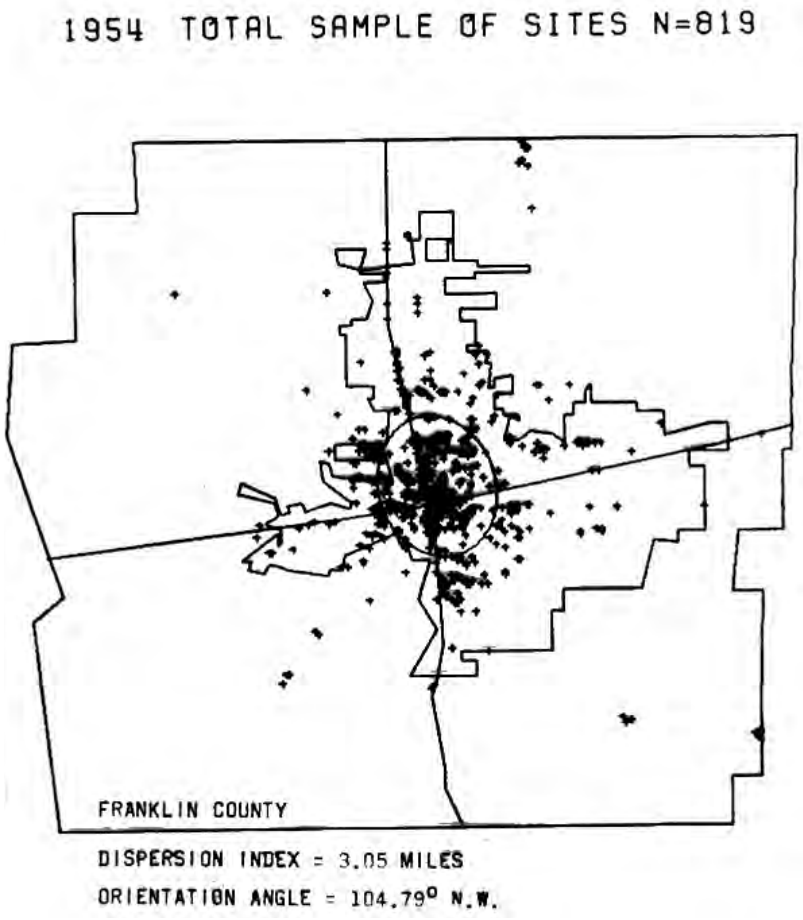
David J. Cowen

Since 1967, Dr. David J. Cowen—the current chair of the National Geospatial Advisory Committee (NGAC)—has focused his research and teaching interests on the development and implementation of GIS in a wide range of settings. A distinguished professor emeritus and former chair of the Department of Geography, University of South Carolina (USC), he established one of the first academic programs in GIS. Before chairing the Department of Geography, Cowen directed the College Computing Center and served as interim vice president for computing. The university became Esri customer number seven, one of the first to use Esri software. His management of the College of Liberal Arts computer center and teaching placed USC in a leadership position as computers and computer programming became ubiquitous in everyday business and academic life. When he was asked to be the permanent vice president for computing, his wife Sandy reminded him where his heart lies: "'You'd have to give up your GIS stuff,'" Cowen laughs as he remembers her words of advice that kept him on a path paved with accomplishments.

Throughout his career, Cowen has been involved in many projects ranging from decision support systems, economic development, and school performance to land-use changes and real estate. Even in retirement, Cowen continues in his advocacy of GIS, serving as the chair of the Department of the Interior's NGAC and as a member of the National Research Council (NRC) Board on Earth Sciences and Resources and as a national associate of the National Academy of Sciences, consulting with the US Census Bureau on its modernization program, as well as serving as an adviser to Pennsylvania State's Geospatial Revolution Project.

Seeing Areas Through the Lines

Cowen began his long and storied career receiving both bachelor and master of arts degrees in economic geography from the State University of New York at Buffalo. He went on to earn a PhD in geography from Ohio State University in 1971. His dissertation research in 1969 provided the impetus for his career in GIS. Motivated by the need for tools to map and analyze the



Motivated by the need for tools to map and analyze the movement of manufacturing firms back in the early 1970s, Cowen wrote his own FORTRAN routines to calculate measurements and generate maps on pen plotters.

movement of manufacturing firms, he wrote his own FORTRAN routines to calculate measurements and generate maps on pen plotters.

Afterward, Cowen moved to South Carolina, where he devoted time and energy to teaching students and evangelizing the use of GIS in the state. His vision helped promote the adoption of the technology throughout South Carolina. "Computer programmers would look at coastal maps and see just a bunch of boundaries," says Cowen. "I saw these not as lines but as areas that could be calculated, shaded, and analyzed." As a result, the State of South Carolina implemented one of the first Coastal Zone Management Plans with a complete inventory of existing land uses.

Cowen has influenced many people, as Tim De Troye, GISP, state GIS coordinator for South Carolina and president elect of the National States Geographic Information Council, explains: "I have known Dave Cowen for 16 years. My first exposure to him was as a master's student at USC, where I took an independent study course with him on GIS. When I decided to return to school to pursue my PhD, my one condition was to have Dave as my dissertation adviser. Our paths still cross, and I appreciate the valuable insight he provides. I'm continually amazed by the great number of people in the profession I run across who have been positively impacted either by working with him directly or by reading his work."

Doug Calvert, chairman of the South Carolina GIS Coordinating Council, agrees: "Dr. Cowen has been referred to by many as the 'father of GIS' in South Carolina. His influence will persist through the multitude of students he taught now working in GIS, as well as his tireless efforts promoting GIS solutions for state and national issues. He has been a longtime champion for GIS coordination here in South Carolina."

Land Parcels Represent the Critical Geographic Dimension

Cowen's impact and desire to apply GIS analysis earned him Esri's Lifetime Achievement Award in 2005. Afterward, Cowen devoted time chairing NRC's study *National Land Parcel Data: A Vision for the Future*. For the study, Cowen examined the status of land parcel data in the United States. He believes that land parcels represent the critical geographic dimension to analyze the use, value, and ownership of property. Cowen's interest in this subject is particularly important, as the public sector questions whether it is technically or economically feasible to integrate parcel data. Several private-sector firms, including insurance and real estate firm CoreLogic, have raced to complete just such a system. Today, businesses are finding that parcel data is critical to their business applications.

Under Cowen's direction, the committee of 12 experts from all levels of government and the private sector developed a vision and series of findings and recommendations. The committee envisioned a system employing modern, distributed database concepts and practices similar to those employed in many local governments or businesses. Conclusions from the study were that a nationally integrated land parcel database is necessary, feasible, and affordable.

Opportunities Arise out of Crisis

Since the recent mortgage crisis in the United States, the need for federally mandated parcel data was again investigated, and Cowen served on the Cadastral Subcommittee Mortgage Study Team Steering Committee. The Federal Geographic Data Committee (FGDC) Cadastral Subcommittee met with the International Association of Assessing Officers in 2009 to explore the potential uses of land parcel data for more effective management of mortgage and financial oversight programs and activities.

The recommendations from the steering committee pointed again to a national parcel database and included the need to add local parcel ID numbers to Home Mortgage Disclosure Act data that would serve as a link to a wide range of attribute information. This information could be used in a parcel early warning system, much like that used at the Centers for Disease Control and Prevention to track early warning indicators for public health. This national system would detect early indicators of a financially distressed housing and mortgage market. As a result, the Dodd-Frank Wall Street Reform and Consumer Protection Act includes

amendments to the 1975 Home Mortgage Disclosure Act. FGDC also made a national perspective on land parcels the focus of its 2009 Annual Report.

Think Globally, Act Locally

During his tenure at USC, Cowen directed 45 master's students and 11 PhD students, many of whom are now leaders in the academic and public- and private-sector GIS industry. "It is always great to have a teacher, mentor, and friend all wrapped into one person," says Anne Hale Miglarese, a principal with Booz Allen Hamilton and past chair of the National Geospatial Advisory Committee. "Through the years, Dave has always stayed on the edge of the technology, curious and energized by driving innovation. This intellectual curiosity has served us all well, and I, for one, continue to learn from him."

Even in retirement, Cowen continues to educate those around him in the capabilities of GIS. These days, he can be found at the USC Columbia campus evangelizing the use of GIS not for mapping parcels across the United States but focusing on the university itself. Through his guidance, facilities managers are looking at how GIS can create a comprehensive geospatial database that includes everything aboveground, on the ground, and underground.

"We saw the need to have emergency medical services, police, and our maintenance team know where everything is on campus, so campus safety and protection have driven our desire to map out all the utilities," says Don Gibson, assistant director of maintenance services. "We have all this talent in the university, and we have a world-class program in GIS studies. Fortunately for us, Dave Cowen is available to assist us on this project."

(This article originally appeared in the Spring 2011 issue of *ArcNews*.)

Improving Government Improves People's Lives

Using GIS to enhance the way government works is what drives the City and County of Honolulu's (Hawaii) GIS administrator Ken Schmidt. "Improving the efficiency of government operations makes people's lives better in many different ways and helps us protect the citizens in our communities," he says.

Ken Schmidt

Beyond the direct impact on the lives of Honolulu's residents, he believes GIS also plays an important role in protecting the island environment. "We're protecting what makes Hawaii unique—the aesthetics of Honolulu—by having better information to make better decisions about issues such as development patterns, water resources, or how the sewer system operates. We're using GIS to create livable and sustainable communities."

After more than 20 years in Honolulu, this GIS hero has established a strong enterprise-wide GIS program, including centralized GIS data management, GIS-based work management systems, and public-facing online maps at gis.hicentral.com.

"There's no doubt that the success of the City and County of Honolulu's GIS program is due to Ken's vision, strong leadership, and single-minded determination," says Arthur Buto, GIS coordinator for the State of Hawaii Department of Land and Natural Resources and president of the Hawaii Geographic Information Coordinating Council (HIGICC). "Through at least five mayors and acting mayors, he guided the growth of the program from its infancy to the nationally recognized program it is today. He and his team demonstrated the value of geospatial data not only to their bosses but to state leaders and to the general public with the introduction of online mapping and permitting systems, building on early successes with parcel and infrastructure data."

Charting His Course

Schmidt began his career with a company in Florida, mapping wetlands in the northern United States and Canadian provinces for the U.S. Fish and Wildlife Service in association with Ducks Unlimited. Soon, a position opened up at the Suwannee River (Florida) Water Management District for a GIS analyst. "It was the

early '80s, and I wasn't quite sure what that job was at the time," jokes Schmidt.

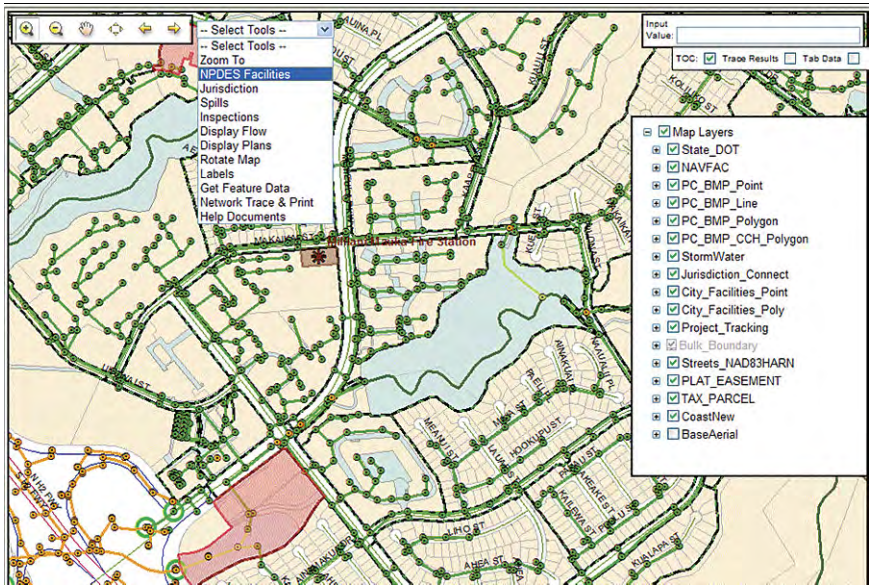
Graduating from Southwest Texas State University (now Texas State University) with a geography degree a few years earlier, Schmidt didn't know what he was going to do with his degree, but the emerging field of geographic information system technology would end up playing a key role. "GIS was becoming a profession, and I happened to get in at the right time," he says.

At the Suwannee River Water Management District, Schmidt began using ArcInfo to map drainage basins, land use, and watershed protection. "It was inspiring, but the potential of the technology we were using was still an unknown," he says. "Yet I knew GIS was going to provide a very useful tool to policy makers, especially at that point for those involved in managing the water resources in the area."

Soon, the Southwest Florida Water Management District asked him to migrate its legacy mapping operations into ArcInfo. Five years later, with that task complete, he accepted a job as the GIS coordinator for the City and County of Honolulu.

Building Community

Beyond the work that he does for Honolulu, Schmidt is dedicated to educating people about geography and GIS. In addition to the GIS Day events his department hosted for many years, which spawned GIS education programs in local schools, he has been



The recently updated Storm Water Drainage System viewer, which meets National Pollutant Discharge Elimination System permit requirements.

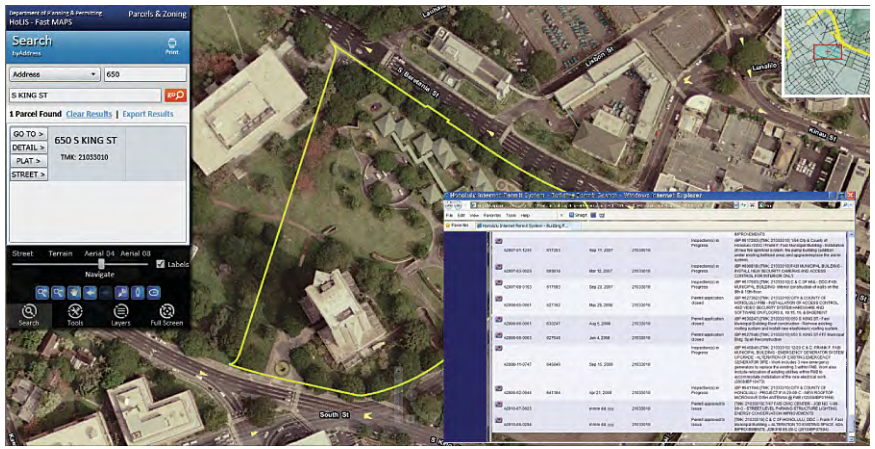
involved in the National Geographic Bee for some time. The contest tests the geographic knowledge of fourth through eighth graders. "It's been an honor to participate in that, either as a moderator or judge," he says. "It's really rewarding to see these kids learning about geography."

Schmidt also helped start a GIS user group on the island in the early 1990s. "He lives and breathes GIS," says Henry Wolter, U.S. Geological Survey geospatial liaison, Hawaii and Pacific Basin Islands. "Even during our biweekly tennis matches, he's talking

about whether the ball landed in the right polygon, or a project he's working on for the county."

The user groups he helped create have evolved into various other user groups and GIS conferences in the region. He was also a founding member of HIGICC, which promotes communication, data sharing, interagency coordination among GIS professionals, and education of the public and policy makers about the benefits of GIS. HIGICC has also assumed the primary role in hosting GIS Day on Oahu.

"During his two terms as president, Ken helped lead HIGICC through a number of trying times," says Wolter. "He was fiscally conservative, looked at our needs, and determined what would work. He always reminded us that we needed to share our data and get it out to our partners and clients in the GIS community who need it."



The online permitting system was created to modernize the permitting process.

"Hawaiian values have a very strong sense of community and its connection with the land and water that sustains them," he says. "We embraced those values in our program with the motto 'Palapala aina o ka mokupuni o Oahu,' which translates to 'describing the land of the Island of Oahu,' or simply 'mapping our island.'"

(This article originally appeared as "GIS Administrator Inspired to Make a Difference" in the Winter 2010/2011 issue of *ArcNews*.)

Helping Preserve Natural Resources

Every once in a while, you meet individuals who impress you with their ability to build a rewarding life and innovative career based on uncompromised ideals. Steve Beckwitt is one of them and is a GIS hero. His passion for conservation led him to become a pioneer in the use of GIS to assess and protect our natural resources.

He carries out his work from his home on an organic farm in the Sierra Nevada foothills, which—as you'll soon find out—is where his family's remarkable conservation story began in the 1980s. What started as a heartfelt effort initiated by his two sons to protect old-growth forests turned into a career supporting scientists, organizations, and governments around the globe in using GIS to better manage our land and water.

Building an Environmental Consciousness

Beckwitt developed an awareness of the importance of conservation at a young age. Particularly compelling was the time he spent exploring the natural environment in the Desert Hot Springs area of California with an older cousin, Dorothy Green, who went on to become a water conservation advocate and founded Heal the Bay in Santa Monica, California.

Steve Beckwitt, above center, in old Lhasa, Tibet, near the Jokhang Temple. Beckwitt was in the country to work on a GIS project to establish citizen-managed protected areas. Also pictured is a Tibetan prince from Chamdo in eastern Tibet (left) and a Tibetan Buddhist monk (right).

"We kind of coevolved a conservation ethic and understanding together just by discussing and reading about environmental issues," says Beckwitt.

Beckwitt's time as a student at the University of California, Berkeley, in the 1960s was another important catalyst in shaping his conservation career. Among other "green" endeavors, he contributed to the creation of an environmentalist take on the *Declaration of Independence* called the "Unanimous Declaration

of Interdependence," which influenced Greenpeace's famous 1976 "Declaration of Interdependence."

Just short of completing a Ph.D. in biophysics, he left Berkeley for the wilderness of the Sierra Nevada. In the 1980s, his two young sons expressed an interest in botany, inspiring the launch of a family nursery business. They propagated several hundred species of unusual and difficult-to-grow native plants, as well as over a thousand other Mediterranean plant species, which they sold to many of California's botanical gardens.

Conservation Activism: A Family Affair

In the process of gathering seeds and cuttings for their nursery, the Beckwitts noticed alterations in the landscape. At the time, significant areas of the Sierra Nevada Mountains were being clear-cut, resulting in the degradation of the ecosystem.

Beckwitt and his sons, who were teenagers at the time, founded the nonprofit Sierra Biodiversity Institute to submit scientifically based appeals to protect old-growth forests in the Sierra Nevada Mountains under the provisions of the National Environmental Policy Act (NEPA).

"We did our own fieldwork," says Beckwitt. "We evaluated the landscape and tried to discover what potential ecological impacts were not addressed in the original NEPA documents and called them out with photographs."

This work was done before the U.S. Forest Service or the Beckwitts were using GIS technology, but the appeals did include Forest Service maps overlaid with data on environmental aspects that had not yet been considered in policy making.

"My sons really were the lead," he adds. "I helped them when they needed help, but most of the work they did themselves."

They won 23 of the 24 appeals they submitted, and most of them were reviewed by the Forest Service at the national level. The Beckwitts' technical appeals, along with the work of many other concerned citizens, prompted the Forest Service to reverse forestry policy decisions and readdress environmental issues raised in the appeals.

What GIS Means for Conservation

In 1989, Beckwitt was asked to write an article on ecological restoration for the *Whole Earth Review*, an alternative culture magazine of that time. He had read about GIS technology and was interested in its potential uses in restoration planning. He researched and wrote about this emerging technology and quickly began to use GIS in his conservation work.

The Sierra Biodiversity Institute incorporated the data it gathered in the field with quad maps from the U.S. Geological Survey, which the Forest Service had just captured as cartographic feature files (CFFs). Using ARC Macro Language, the group

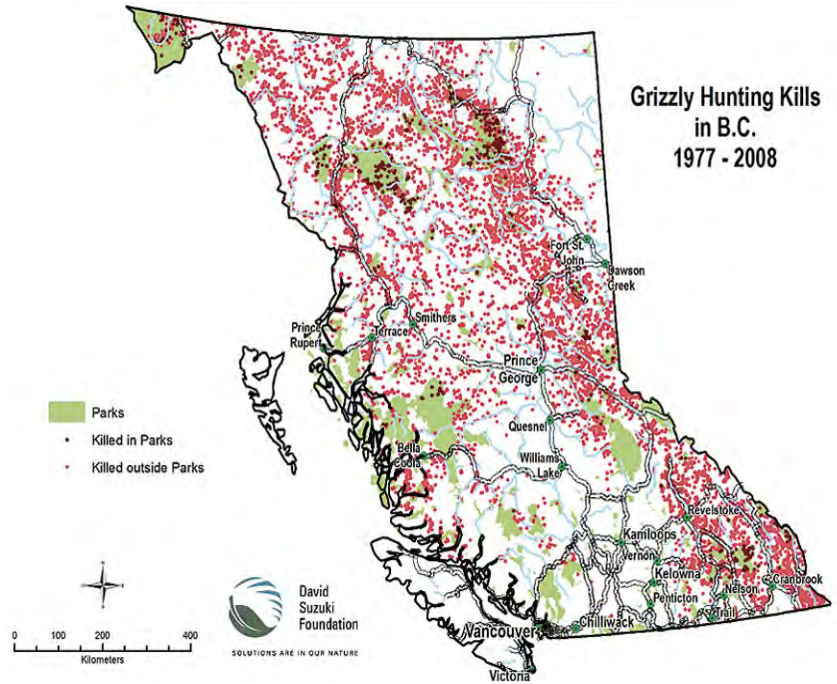
translated CFF data for the entire Sierra Nevada into ArcInfo format.

"We used GIS to prepare a full-fledged dataset for the Sierra Nevada, then captured a lot of timber cutting history and made what were among the first presentations using GIS to Senate and congressional staff," says Beckwitt. "It was all about educating the public and our legislators about the landscape impacts of the forest practices of the time."

In the 1990s, Beckwitt began focusing on professional GIS consulting work, primarily in support of academic scientific research projects. He contributed his expertise to an assessment of the Pacific Northwest's Inland Empire, published by the Wildlife Society, which eventually led to a major Forest Service study. He trained graduate students at the University of California, Davis, to use GIS for the Sierra Nevada Ecosystem Project, a regional landscape assessment requested by Congress in 1992. Later, among many other consulting projects, he provided fire impact modeling for Grand Canyon National Park's Environmental Impact Statement.

"Once GIS became available, it was impossible to do a thorough assessment without it because of the power of the tools and the ability to explore relationships between different themes," says Beckwitt. "GIS is fundamental for inventorying the various facets of our environment and for developing indicators to monitor and assess environmental change over time. It helps guide public policy—and personal policy, too."

By this point, Beckwitt was also consulting internationally. Under a U.S. Agency for International Development (USAID) grant, he and one of his sons traveled through Russia to evaluate how GIS could be applied toward conservation efforts in protected areas that were struggling after the collapse of the Soviet Union.



This image, depicting grizzly bear killings in British Columbia, was produced for the media as part of a series of GIS analyses on endangered species, which Beckwitt performed for the Suzuki Foundation of Canada.

Shortly thereafter, he met a representative from the Wildlife Institute of India who was preparing a presentation on the Narmada Dam for the World Bank. Beckwitt assisted with the GIS analysis portion of the presentation, which communicated the potential impact of the dam and had a powerful effect on policy. The Wildlife Institute of India then asked him to become a United Nations consultant. In that capacity, he trained scientists to integrate GIS into their wildlife research and helped establish a database of protected areas, including tiger and elephant habitats.

In 2006 and 2007, Beckwitt worked with a team of scientists to establish citizen-managed protected areas in the Four Great Rivers region of eastern Tibet. In 2008, Tibetan political turmoil limited access to the area and halted the project. "We'd love to go back and continue," he says.

Sharing Technology to Help Preserve Natural Resources

For the past 20 years, Beckwitt has helped others pursue their conservation efforts by advising Esri on its grants of GIS technology to deserving organizations. He helps ascertain each organization's goals, accomplishments, resilience, and technical capacity and determines which products best meet their needs. He continues to support grantees by evaluating maintenance grant requests to keep their GIS technology up-to-date. In addition, since 1996, he has consulted for the U.S. Forest Service and other government agencies on their conservation-related contracts with Esri. He also currently serves as the senior GIS consultant to the State of California's Sierra Nevada Conservancy.

Beckwitt cites several exceptional examples of large organizations leveraging GIS technology to advance conservation efforts, such as the Nature Conservancy and the Wilderness Society. Those that stand out the most to him, however, are small, grassroots organizations, such as the Pacific Biodiversity Institute, that use GIS to create maps and models to analyze vegetation and habitat suitability.

"I'm most proud of having been involved in helping thousands of organizations get GIS projects up and running and providing technical support when needed," notes Beckwitt. "If I were to look back at my life in terms of having an impact on the world, that's probably it. It was a small impact, but it was wide ranging, and I'm glad I did it."

(This article originally appeared as "Environmental Advocate Creates Path to More Informed and Effective Conservation Efforts" in the Fall 2010 issue of *ArcNews*.)

Helping Others Help Others

"The best way to find yourself is to lose yourself in the service of others."

—Ghandi

Shoreh Elhami

Some people are skillful, some people are givers, and some people are both. People who are trained GIS professionals have many opportunities to serve the earth and help its environments and its inhabitants. Shoreh Elhami has made a way for GIS professionals to offer their skills to people in need, whether it be to support humanitarian relief, enhance environmental analysis, or provide support for disaster response. Cofounder of the volunteer GIS assistance program GISCorps (www.giscorps.org), Elhami is a GIS hero who helps GIS workers become heroes too.

URISA's GISCorps coordinates the deployment of GIS voluWnteers to communities in need around the world. These volunteers provide their GIS expertise remotely or on-site and have been involved in a variety of missions. The business of GISCorps is run by a core committee of six individuals who volunteer their time in the evenings and on weekends to keep the program running.

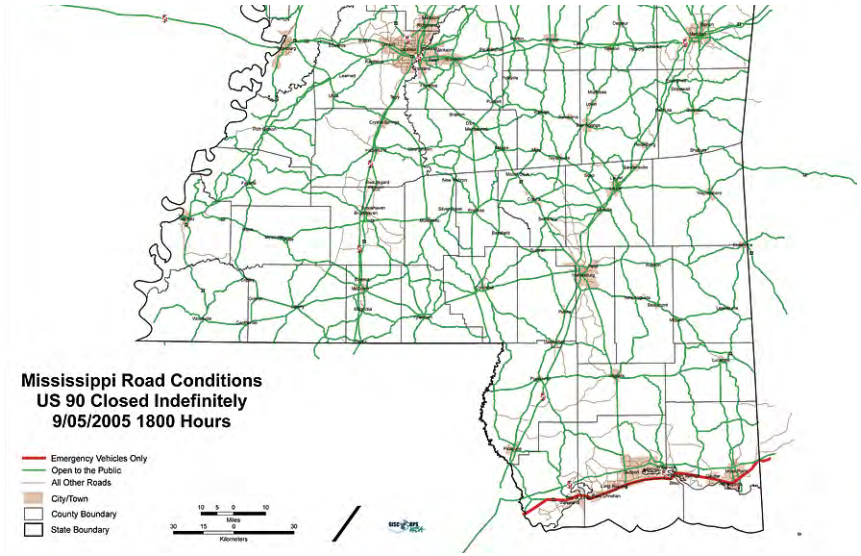
Elhami is the GIS director for Delaware County in Ohio and has been working for that county for 21 years. In her spare time, she can be found administering various aspects of GISCorps, such as finding recruits for a project in Southeast Asia. Why? "Helping others makes me happy," says Elhami. "If a person can help others, and do it in a timely manner in a way that meets other people's needs, it is the best success that can happen in a life."

In October 2001, while attending URISA's annual conference in Long Beach, California, Elhami shared an idea with several of her colleagues. The idea was born out of a simple question that she put to those colleagues: "Would GIS professionals be willing to volunteer their time and expertise—for a short time—to communities in need?" The reaction to the question was very encouraging. In October 2003, after two years of brainstorming and presenting the idea to various groups, the URISA Board of Directors adopted GISCorps as an initiative and later as a

program of URISA. As of April 2010, GISCorps has launched 60 missions in 30 countries around the world. Its volunteers have contributed more than 7,400 hours to those missions.

"GISCorps assists nonprofit organizations, which, without our help, would not be able to serve their target groups," explains Elhami. "The initial concept was to build the organizations' GIS capacity so they, in turn, could better serve their communities. We teach their people how to use the technology, and we provide support until they become self-sufficient."

For example, a 2010 project is to build digital maps for North Korea. The United Nations World Food Programme (WFP), via the



The status of Mississippi road conditions on September 5, 2005, a few days following Hurricane Katrina's landfall.

Information Management and Mining Program (iMMAP), needs maps so it can deliver services, food, and other necessities. It also needs to know the obstacles to getting to those locations. WFP sent a request to GISCorps for expert volunteers to conduct heads-up digitizing. Mapmakers, during the Union of Soviet Socialist Republics era, had created 400 hard-copy maps. Elhami and her coworkers looked at the specifications from WFP's request and estimated how many volunteers and volunteer hours would be needed to finish the project in six months. They found that it would take 20 volunteers contributing 180 hours each to complete the project. Since WFP wants to use ArcGIS for the project, volunteers are required to be adept in ArcGIS 9.3. Elhami scanned the database of volunteers and sent an announcement to people whose skill sets met the criteria of the request. Within the first hour after sending the announcement, 14 people had responded. These volunteers will never set foot in North Korea to work on this mission because everything on the project will be done remotely from the volunteers' locations, probably from home. Each volunteer just needs to donate time and expertise.

GISCorps provided response support for the 2004 tsunami that hit the coasts of the Indian Ocean; 2005's Hurricane Katrina that devastated Louisiana and Mississippi; and, most recently, the earthquake that crumbled so many Haitian cities and villages. Some GIS volunteers do work on-site. In these cases, the requesting organizations are responsible to pay the volunteers' travel and accommodation expenses. However, in a disaster

situation, volunteers may need to find a free spot for a sleeping bag in the corner of a crowded community building.

"People in the GIS community are very special," notes Elhami. "It has been an honor to be a facilitator at GISCorps that has become a conduit of help to so many. We have sent people all over the world to provide assistance that makes other people's lives better."

Raised in Tehran, Iran, Elhami and her husband became architects. They moved to the United States 25 years ago, and Elhami went to graduate school at Ohio State University. While working there as a research assistant, she discovered GIS technology. She fell in love with GIS and its concepts. She was then hired by Delaware County for her GIS expertise. She also taught GIS at the university for 10 years but finally stopped teaching because of her commitment to GISCorps.

The first on-site mission that Elhami worked on was in Kabul, Afghanistan. She wanted to learn what it was like to work at a location and know firsthand how hard it would be. The project was in partnership with the United Nations Development Programme (UNDP) and Afghanistan Information Management Services (AIMS). AIMS had set up shop in Pakistan because the Taliban forces were ruling Afghanistan. Once the Taliban forces were removed from power, AIMS relocated to Afghanistan and requested support. Specifically, AIMS wanted to grow its GIS capacity by moving from ArcView to ArcGIS. At that time, Elhami

Shoreh Elhami speaking to Afghanistan Information Management Services personnel.

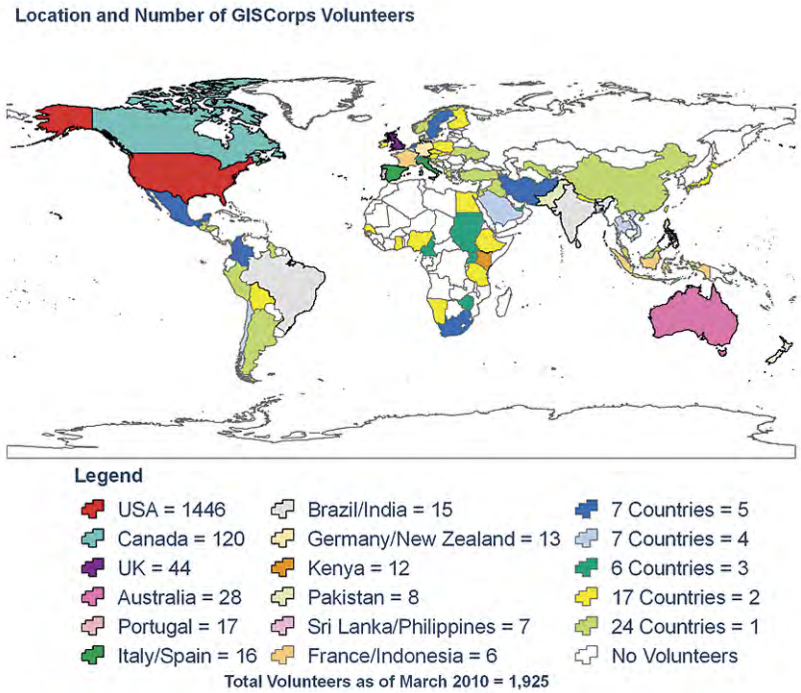
was an authorized ArcGIS instructor, so she taught Afghans how to use ArcGIS. GISCorps has since sent three more volunteers to provide advanced ArcGIS and ArcGIS Server training.

"Kabul was interesting," says Elhami. "I learned a lot. I thought that if a country as turbulent as Afghanistan can welcome a volunteer, any country can. I have since kept in touch with those people, and two of my AIMS Afghan students actually came to last year's Esri User Conference."

Of GISCorps' 60 missions, 38 have been handled remotely. When Elhami initially conceived the program, she had not imagined that people could provide support from home. The Internet technology at that time was unable to support the work that needed to be done. But now, this is possible, and, what's more, affordable. People—such as mothers with young families—who

would not have previously been able to work can now volunteer their help.

Mission assignments vary. Some may be extensive, while others can be as short as two hours. Short projects may include judging a map contest or teaching a class. Some projects are complex, requiring very specialized skills. For instance, two volunteers who are ArcGIS Server specialists are working with the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER). The goal of this UN initiative is to ensure that countries and international organizations have access to and develop the capacity to use all types of space-based information for disaster management. These GIS volunteers are doing high-level work, such as determining the GIS needs of UN-SPIDER by performing a needs assessment. They are developing a plan of action for the GIS configuration of software and hardware so that the organization will be able to react more rapidly when disasters occur.



As of March 2010, GISCorps has attracted 1,925 volunteers. These volunteers come from 76 countries around the world.

People interested in volunteering can register via the GISCorps Web site. Organizations can also use the Web site to request GISCorps' assistance. These requests are reviewed and screened by GISCorps' core committee. "We have no paperwork and no bureaucracy, and work gets done quickly," says Elhami. "E-mails fly, and we give fast answers and get quick responses. This method has proved very successful. Everybody cares, everybody knows why we are here, and we try to do our best to make things happen."

More Information

To see how you can become involved, visit the GISCorps Web site at www.giscorps.org.

(This article originally appeared as "URISA's GISCorps Is a Place for Service" in the Summer 2010 issue of *ArcNews*.)

Urban Planning in the Slums of Venezuela

The United Nations Center for Human Settlements reports that more than one billion people in the world live in slums and squatter settlements without adequate shelter and basic services. Worldwide, slums are considered to be residential areas in urban geographic areas that are inhabited by the poor. Because of these characteristics, urban planners can use GIS to manage geographic data about slum areas to show relationships, elevations, landmarks, slope, water sources, and other attributes that affect these urban populations.

Rosario C. Giusti de Pérez, architect and urban designer, exemplifies the importance of combining the human element of concern with the capabilities of technology to turn the tide of despair to one of hope and benefit for the community. Because of her many years of commitment to helping improve the quality of life in the slums (barrios) of Venezuela, Esri recognizes Rosario C. Giusti de Pérez as a GIS hero.

Rosario C. Giusti de Pérez.

Despite the fact that Venezuela is an oil rich nation, approximately 50 percent of its people live in poverty. Those in urban areas have constructed shantytowns with homes made of plywood, corrugated metal, and sheets of plastic. Giusti de Pérez does not see these neighborhoods as targets for the bulldozer but rather as communities whose residents need to be involved in planning and redevelopment.

Many cities do not consider these squatter lands as communities and consider demolition to be a solution to urban blight. But this ruthless approach of displacement creates disorder, increases crime, and adds to the misery of poverty. A slum is more than corrugated tin and plastic; it is human faces, neighborhoods of people with social structures that protect and support their communities. Giusti de Pérez has spent the last 10 years working with people and using GIS as a means to understand how urban squatter developments are organized, which in turn offers the foundation for devising improvement efforts.

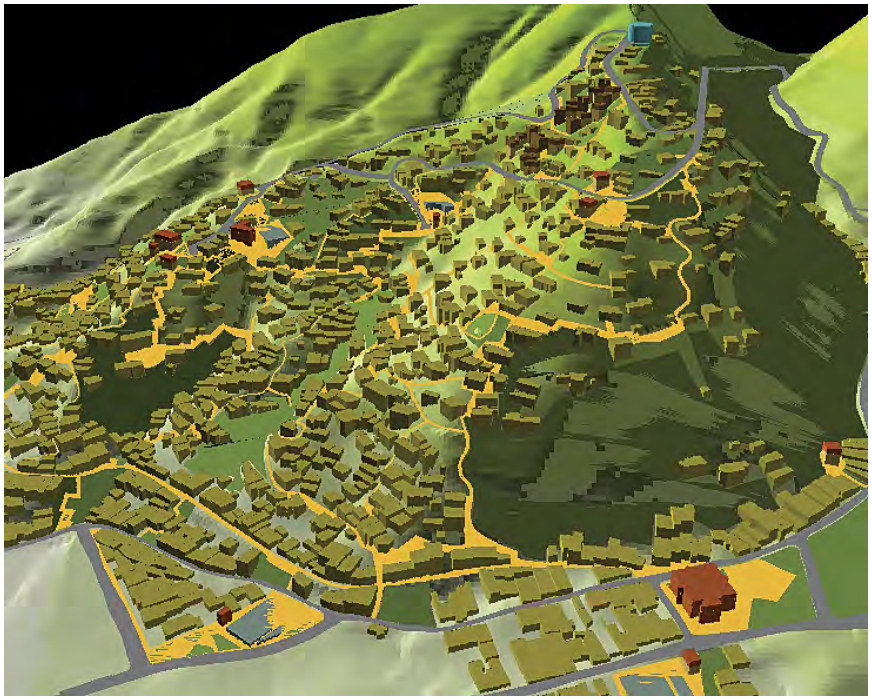
"When visualizing squatter developments as cities within cities, GIS helps us see the internal connections that constitute

the barrio's underlying order, which is fully perceived by the residents of the area," notes Giusti de Pérez. "To fully understand social networks within a community, planners need to obtain information directly from the community. Inhabitants have knowledge about who belongs to each social group and how social groups connect. This is valuable data with a geographic element."

Giusti de Pérez advocates an approach that recognizes the slum inhabitants as being deeply rooted in their communities. As people who have a sense of belonging, they are territorial and fear relocation plans. People want to remain where they have their social relations. Giusti de Pérez, who holds a master's degree in urban design, initiated an approach to developing urban planning models that includes input from residents so that squatter settlements can become an asset to the city. "We need to collect information that is significant to residents," says Giusti de Pérez.

With this thought in mind, Giusti de Pérez developed a framework for sustainable improvement planning with the ultimate goal of advancing the residents' quality of life. The objective of this planning approach is to introduce what she calls "friendly interventions" into the as-built environment. In this model, residents agree on behavioral and building rules, such as sharing waste disposal to maintain clean open space and limiting building height so as not to impede natural light. These are simple resolutions. Of course, squatter communities have much more complex issues, such as unstable slopes, inadequate utilities, and insufficient schools. GIS allows planners and residents to visualize the answers to the questions they are asking: What would happen if we put a concrete fascia on the slope? How can we run sewers into this area? Where is the best location for an elementary school?

Giusti de Pérez uses GIS to create what-if scenarios and generate maps that show what a concept would look like, whom it would



Barrio Los Claveles, Maiquetia, Venezuela, seen in ArcGIS 3D Analyst.

affect, and how it would help. These images go a long way in providing information that engenders community participation in planning.

The maps that Giusti de Pérez and Ramón A. Pérez, a GIS professional, were creating in the 1980s using Esri's ARC/INFO began to be noticed. These GIS maps were instrumental in winning several national competitions against other urban planners who used CAD. Soon, several Venezuelan government institutions recognized that GIS is a clever tool.

"Barrio analysis is very complex," explains Giusti de Pérez. "GIS can take this mess of barrio data and organize it into something that makes sense. We would select a barrio, meet with its community leader, and explain that we wanted to help. The community leader would then invite other people from the community to a meeting, sometimes at a school or sometimes just on a slab made of some odd building materials. Together, we would identify what they needed and prioritize their concerns."

GIS was key to a three-year project in the barrio of Petare in Caracas to visualize and assess the area's urban built conditions and social networks. It proved essential to creating a sustainable planning strategy and for designing a development that fit both building and social needs within the conditions dictated by the geography of the site. With an ultimate goal of improving the quality of life, the urban planners worked with residents and identified 93 sectors within 82 hectares. Data included vehicular and pedestrian pathways, sector boundaries, social spaces, and built places. The group determined areas that were at risk for landslides and focused on building control policies for these areas.

Community concerns varied. In the Petare barrio, the community's main concern was accessibility to urban facilities and infrastructure. Residents wanted better drainage and solid-waste disposal. Priorities that were included on another barrio community's list were drainage, open space for children, and lighting. Each project was unique.

Proposed infrastructure systems for barrio Petare.

"Sometimes we can do a little and sometimes more," explains Giusti de Pérez. "We make our presentations using GIS, and people are glad to see what their community looks like. We use the ArcGIS 3D Analyst extension to create visualizations that show residents what their community could look like if they implemented changes. Based on community input and planners' assessments, we created site analyses that helped communities successfully request government program funding."

In 2008, Giusti de Pérez coauthored the book *Analyzing Urban Poverty: GIS for the Developing World*, published by Esri Press. In it, she and Ramón A. Pérez offer a step-by-step approach to working with squatter communities and improving their neighborhoods. The authors provide several rules for using GIS to support sustainable communities. One rule is to create procedures for involving communities in collecting the information required for identifying their problems and opportunities. This will help planners with the problem of lack of data. Another rule is to identify the social relations and interactions of the populations with the open spaces in the community. This is more important than merely describing land use. Finally, the authors advise using ArcGIS Spatial Analyst ModelBuilder in hilly squatter developments to understand the rules of urban and social functioning and identify steep slopes, drainage patterns, and accessibility from the neighborhood to the city.

Giusti de Pérez is hoping to expand the use of GIS models for urban redevelopment and promoting its capabilities to identify real, sustainable solutions for improving the quality of life for millions. She is truly a GIS hero.

(This article originally appeared as "Rosario C. Giusti de Pérez Brings Urban Planning to the Slums of Venezuela" in the Spring 2010 issue of *ArcNews*.)

Building a Foundation for Understanding

A geologist by education, Dr. Mukund Rao understands how studying the earth can uncover solutions to problems that affect people all over the world. His passion for understanding the earth and its activities led Rao to a rich career furthering earth observation, GIS, and spatial data infrastructure (SDI) applications at both the national and international levels.

Mukund Rao is a GIS Hero.

To honor this exemplary work record for the past three decades, Rao has been bestowed two honors, the 2008 National Geospatial Award for Excellence from the Indian Society of Remote Sensing and the Exemplary Service Medal from the Global Spatial Data Infrastructure (GSDI) Association. The Indian Society of Remote Sensing recognized Rao's outstanding contributions in promoting geospatial science and technology and applications in India through longtime association and involvement in GIS technology, including his current position as president and chief operating officer of NIIT GIS Limited (Esri India). The GSDI Association recognized Rao for his role in building and developing GSDI in its formative years and steering its activities as its first president from 2004 to 2006. Rao served as president at the GSDI-7/8 conferences in Bangalore, India/Cairo, Egypt, and has been involved in directing and furthering the technology and application of SDI throughout the world.

"To me, these awards are a humble reminder of the opportunity I've had to work with GIS right from the beginning," says Rao. He was introduced to GIS in 1984 while working at the Indian Space Research Organization (ISRO) to create the first prototype of the Natural Resources Information System (NRIS), a solution for handling images, making thematic maps, and supporting decision making in natural resources management. Rao conceptualized and performed an initial study for the Mineral Exploration Information System (MEIS), which was an integration of images with geophysical and geochemical data that allowed analysts to find mineral indicators. Rao discovered GIS through a course introducing the fundamental concepts of GIS in Mumbai, India, led by one of the early originators of GIS, Dr. Duane Marble, professor emeritus of geography at the Ohio State University.

Later, in 1987, Rao was exposed to an excellent training suite in GIS at the Asian Institute of Technology (AIT).

In 1985, Rao was involved in the process of selecting the best-suited GIS package for the support of India's remote-sensing applications and the NRIS program (finally, ISRO selected PC ARC/INFO, then the later versions of ArcInfo). "The innovative methods of handling maps, building spatial models, and creating different spatial perspectives captivated me right away—I could easily perceive their importance and relevance due to my background in geology, where maps and visualization are the key," adds Rao. He went on to apply GIS to urban and regional planning and wasteland management in many cities in India. Ultimately, he became the lead in the NRIS program of ISRO and was instrumental in developing the comprehensive NRIS Standards for GIS in India and, more recently, the National Natural Resources Management System (NNRMS) Standards, the national standards for EO and GIS.

During the late 1990s, Rao realized that SDI was the path for both the NRIS and ISRO imaging programs, conceptualizing India's NSDI program and transforming it into an intergovernmental mechanism. Rao was the key person in authoring the *NSDI Strategy and Action Plan* and prepared the NSDI Metadata Standards. To demonstrate the first GIS portal for NNRMS, Rao developed a prototype that was officially launched and hosted on ISRO's Web site in early 2000. Soon after, he steered the concept of agency SDI portals through the National Urban Information, NNRMS, and a number of state-level portals of SDI, bringing about an integrated system for India's NSDI. This system is now becoming the foundation of NSDI in India. He is currently working on concepts for SDI Applications Portal services and enabling a cross-linking network of application visualization for SDI.

This activity launched Rao into the GSDI movement, and he was elected as the first president of the GSDI Association. During this time, GSDI was incorporated and its activities defined, including a coordinated approach furthering SDI throughout the world through cookbooks, Esri grant projects, conferences, and committee activities.

In 2005, Rao took over as CEO of Navayuga Spatial Technologies, an Indian startup company located in Bangalore, and headed up many successful projects, including the establishment of an ArcGIS software-based enterprise solution for the Ras-Al Khaimah emirate in the United Arab Emirates (UAE) and the largest enterprise solution project in India, the creation of an SDI in Delhi.

Since joining Esri India in 2008, Rao has been involved in furthering GIS throughout India by promoting efficient and successful business models. With a deep understanding of earth observation and GIS, Esri India now operates and helps many successful GIS projects in India and other parts of the world, focusing on urban, power, utilities, disaster, and imagery sectors.

Rao is quick to point out that his associations with other leaders in the field have helped him achieve his successes in spearheading the movement of GIS and remote sensing to assist in solving the challenges faced in the world. Jack Dangermond, president of Esri, and Dr. Krishnaswamy Kasturirangan, the former chairman of ISRO and chairman of the Planning Commission of India, are two such leaders. Rao also credits a large number of professionals that he has worked with in India and abroad for his GIS accomplishments, learning from their capabilities and expertise in undertaking GIS activities in a better and meaningful way.

Rao is a strong believer that GIS representation will be a key factor in most human activities and a benefit to society and humanity, providing the key technology necessary for information processing and visualization. "While, on one hand," says Rao, "GIS will become easier and simpler to use—thus making it usable by the common man—it will also become integrative and overarching to bring together various technologies of surveying, imaging, and mapping for GIS content; databases and warehousing for GIS storage; and seamless data fusion and merging for GIS applications. Finally, it will provide a tremendous way of visualizing information in a spatial domain. No longer are maps the only output from a GIS."

(This article originally appeared as "Mukund Rao Steers Data and GIS for Global Spatial Data Infrastructure" in the Winter 2009/2010 issue of *ArcNews*.)

People and Nature Working Together

An advocate of using technology to integrate human and natural systems, Gary Moll has been a force in bringing the value of urban ecology to the attention of federal and local leaders and uses GIS to apply solid scientific and engineering data to decision making.

Gary Moll

Along his life path as a conservationist, Moll has successfully worked with the Congress of the United States to increase funding for urban forestry and with the U.S. Forest Service (USFS) to expand urban forestry programs to 50 states. His work on the development of the GIS software program CITYgreen helps local governments measure urban forests and harness their benefits.

"The human network needs to be built with the natural system in mind," says Moll. "Urban forests and green infrastructure are part of the city ecosystem. GIS shows the relationships between social systems and ecosystems and offers a means for us to weave the city structure into the natural system." Moll is the senior vice president of the Urban Ecosystem Center at American Forests and is one of the nation's foremost authorities on urban forestry and urban ecosystems.

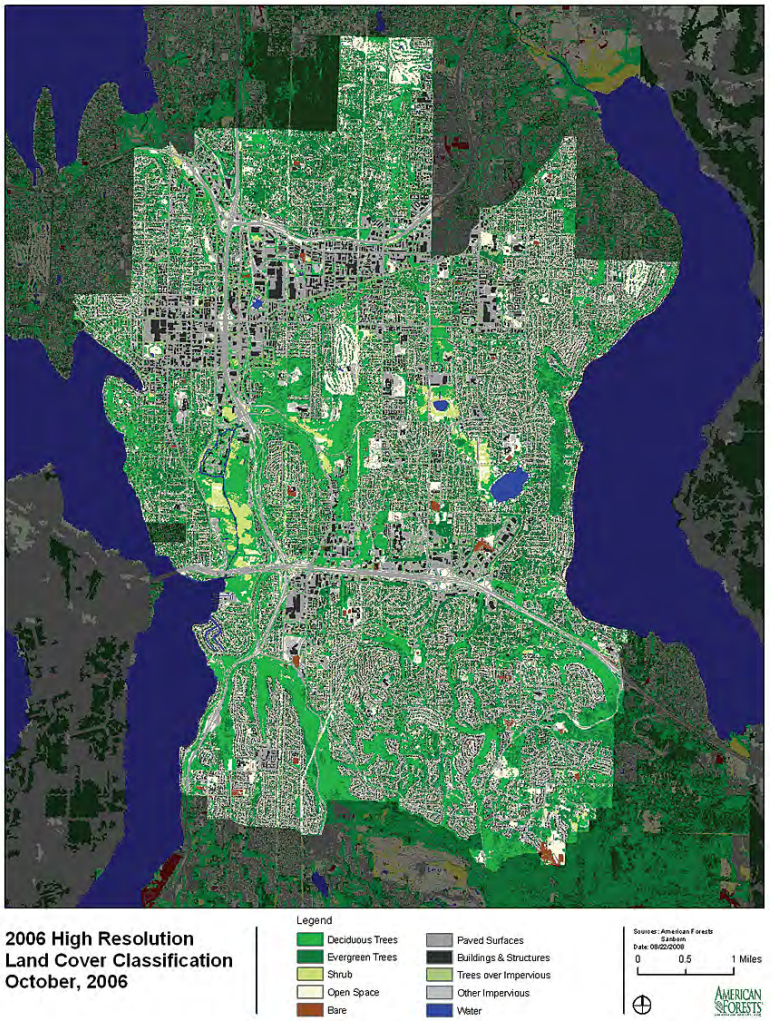
Community leaders traditionally make their decisions about community structures based on dollar values. Sadly, they almost always overlook the value of the natural system upon which these community structures are built. People need to be made aware that if the natural system remains intact, it can do much of the work a structure does. Moll and his team use GIS to show that the original natural system provides similar ecosystem services to those offered by expensive structures. This has huge financial value. For example, using Landsat imagery and GIS technology, Moll was able to show that the 10 counties of the Atlanta, Georgia, metro area lost $2 billion worth of storm water runoff benefits. The analysis measured the tree loss in the region between the years 1972 and 1986. The team then ran the CITYgreen analysis on both scenarios. The good news was that the area still had about $1 billion of that natural storm water benefit left. When community leaders become aware of these

dollar amounts, "environmentalists" suddenly are invited to join the urban development discussion.

In the early 1990s, Moll was introduced to GIS technology while working with USFS on an urban forest research project. The agency was planning to issue two urban forest research proposals, one for tree inventory and one for cost-benefit calculations. Moll suggested these two projects should be one and successfully convinced the agency leaders to combine them before issuing the final proposal. The project introduced urban forestry specialists to GIS and proposed a new way to look at urban forests, not as street trees, but as comprehensive urban forest ecosystems.

The proposal recognizes that urban forests are a mix of street trees, yard trees, park trees, and all the other land cover that makes up a community. The national hydrologist, Don Woodward, who worked for the Natural Resources Conservation Service (NRCS) (formerly known as the Soil Conservation Service), showed Moll's team how to calculate the movement of storm water based on land cover. NRCS developed a runoff "curve number" system after monitoring streamflow for 50 years. This became the basis for the most widely used storm water planning model in the country.

Woodward helped Moll's team add the impact trees had on that curve number. As a result, for the first time, people could calculate the ecosystem services provided by tree cover.



This high-resolution leaf-on image of Bellevue, Washington, WWprovides city officials with a detailed analysis of their green infrastructure. Trees (vegetation) and soils provide the basic foundation for the movement of air and water through this landscape.

The engineering formulas provided by Woodward produced accurate volume measurements for storm water, Moll's team determined dollar values by obtaining the cost of building storm water retention structures from engineering firms, and the Environmental Protection Agency costs were calculated using cubic foot storage metrics.

Ultimately, however, USFS did not adopt the methods developed by Moll's team as a national standard. Then in 1995, Moll and his team developed an ArcView extension using this technique and, in 1996, released the desktop software CITYgreen. This program makes it possible for local communities to calculate the functions of their natural system, attach dollar values to storm water and air quality, and use this information to make better decisions about managing their communities. Along with the advances in ArcGIS software, the CITYgreen extension has since undergone six iterations.

Moll played a central role in the growth and development of the urban forestry movement and was chairman of the National Urban Forest Conference from 1984 until 2001. But his view of urban forests, not as street trees but as an ecological system, led him to organize the first National Urban Ecosystem Conference in 2003 and drop the National Urban Forest Conference altogether. Taking the broader ecological view of the places where people live has led Moll to work with nontraditional partners and rethink traditional approaches.

Along with Michael Gallis, a renowned expert in large-scale metropolitan regional development strategies, Moll and his nontraditional partners proposed the concept of coevolution, which proposes the management of the human network and the natural system in concert and in parallel. This requires a new framework for efficiently guiding economic growth and rebuilding ecosystems. (See Moll's, Gallis', and Heather Millar's series of three People–Nature articles in *ArcNews*—Winter 2006/2007, Summer 2007, and Fall 2007.)

Moll says, "An aphorism of coevolution is that the global network is the most useful framework for understanding the pressures on ecosystems and human systems around the country and around the world. Simply put, global networks are patterns of trade, transportation, and information that people use to meet their needs, such as roads, shipping routes, and economic regions."

This network forms a pattern of centers and corridors that reaches around the world like a web. Looking at the world this way makes it possible to break down problems and begin to identify goals and strategies. The idea is to start at the global scale, then come down to areas on a regional scale, putting together the natural and human networks.

Recently, Moll and his team, along with Gallis and his associates, and Dr. Michael Flaxman of the Massachusetts Institute of Technology, applied the method to the Piedmont Crescent that lies between Birmingham, Alabama, and southern Virginia,

including North Carolina, South Carolina, the Appalachian Mountains, and parts of Tennessee and Kentucky. The task to collect the data and maps about the many different systems was quite involved. Using GIS to analyze data from the Army Corps of Engineers, the Census Bureau, the National Oceanic and Atmospheric Administration, USFS, and USGS, the team found the area to be much different than expected. The southern forest of the Piedmont area is 99 percent gone; the forest of the Great Smoky Mountains is 93 percent gone. The system is in total disarray. These findings have been published in a map book called *Piedmont Crescent*. One of the biggest surprises was that all the thousands of rivers in this Piedmont Crescent area had been altered—every single one. In reality, the area is not a natural system but actually an unnatural one.

The sobering question asks, if expansion of the human network is inevitable, how do we manage its impact? It would help if everyone stopped to take some time to determine ways the human network can move through these places without destroying them. Questions need to be asked: What economic and social patterns are driving the development of a region? Where are the transportation corridors? Where are the economic corridors? What metro areas are nearby? How are they linked? How is expansion and change happening? How do air and water move through these ecosystems?

"The solution to building better communities in the future lies in learning how to integrate the natural system with the human network," advises Moll. "The first step is to understand how the natural system functions, and the second is to understand the human network. This must be done at various scales. Once that is done, GIS technology can help people understand how the two will interact so we can develop human networks that are low impact and highly efficient."

More Information

Read more about American Forests at www.americanforests.org. Download a free PDF version of the booklet *Co-Evolution* at www.kckay.com/pdfs/coevolution_brochure_final.pdf.

(This article originally appeared as "Gary Moll Wants People and Nature to Work Together" in the Fall 2009 issue of *ArcNews*.)

Governor of Maryland Leads with GIS

Governor Martin O'Malley of Maryland believes that geography matters to the people he serves. For him, it is critical to the relationships that sustain us and vital to making government work for the people.

"When you show people how you are using GIS, they inevitably ask this question, 'Can you show me my house?'" says O'Malley. "People want to know that they matter to their government and that their government is relevant to them. They want to understand the forces at work around them."

Maryland Governor Martin O'Malley.

He continues, "This question speaks to the innate human need to understand the relationship of oneself to others and to the world we live in. With GIS, we develop a deeper understanding of our actions across time and space. With that knowledge, we can progress in a way that strengthens our relationships with one another and with the earth."

Service Oriented

O'Malley's career has always been focused on service. After graduating from the University of Maryland School of Law in 1988, he began his career as an assistant state attorney for the City of Baltimore. Three years later, he was elected to serve on the Baltimore City Council. And then he was elected to govern the city from 1999 to 2007.

During his first of two terms as mayor, O'Malley learned of COMSTAT, the successful GIS-based program the New York City Police Department (NYPD) was using to revolutionize crime fighting. He began to consider applying the same method of performance accountability to improve life in Baltimore.

"The NYPD was using GIS to map crimes, deploy more cops to those areas, and maintain close follow-up on hot spots to

drive crime down," explains O'Malley. "We began to realize that if [the NYPD] could use mapping technology to improve law enforcement, it could also be used to improve other government activities, everything from removing dead trees to repairing traffic lights and collecting garbage."

At the time, the City of Baltimore was facing high rates of violent crime, absenteeism and overtime, slow response time to citizen complaints, and illegal dumping, to name just a few of the problems. Seeking change, in 2001 the governor implemented CitiStat, a performance-based management process that holds government agencies accountable. GIS is at its heart.

Each week, O'Malley and top cabinet members would meet with representatives from a city agency to analyze data, field research, and resident feedback. The GIS-based analysis provided a framework for discussion and a way to see patterns, problems, and ways forward.

"We started using GIS to map every conceivable service, problem, and opportunity so we could measure outcomes and performance every day," says O'Malley. "Then we were able to adeptly deploy resources and make real progress."

The results of the CitiStat program are remarkable. During O'Malley's tenure, for example, violent crime dropped 40 percent, the number of children with lead poisoning fell 65 percent, and the cleaning and boarding of vacant houses moved from response times of 319 days for cleaning and 152 days for boarding to 5 days for each.

"Governor O'Malley pushes GIS initiatives forward because they give him the information he and his staff need to quickly and comprehensively understand issues and examine program effectiveness," says Kenny Miller, Maryland's geographic information officer. "By displaying program information on a map, a clear picture emerges showing the best ways to target resources, track performance, and reach out to the public."

Though O'Malley has moved on to govern the state, CitiStat remains a vital program in the mayor's office, and the same model is now used in cities across the United States, such as Springfield, Massachusetts, and Buffalo, New York.

Broadening Vision

When O'Malley became governor of Maryland in 2007, he brought the CitiStat ideals with him and developed StateStat, which expands the CitiStat model to a state scale and even includes stimulus spending statistics. Currently, the following agencies participate in the process: the Maryland State Police and the Departments of Agriculture; Business and Economic Development; Environment; General Services; Health and Mental Hygiene; Housing and Community Development; Human Resources; Juvenile Services; Labor, Licensing, and Regulation; Natural Resources; Planning; Public Safety and Correctional Services; and Transportation.

"There is great power in merging mapping, human effort, and imaginative public policy," states O'Malley. "Government has traditionally been very good at measuring input, and not as good at measuring output. This is where GIS comes in to propel progress. Just as it is impossible to steer a ship without a compass or controls, it is impossible to drive government forward without measuring outputs and outcomes. It is only with that information that we know where challenges and opportunities lie. With GIS, we can all see exactly where and how progress is being made or where it is stalling."

With BayStat and GreenPrint, which measure Chesapeake Bay restoration projects and land conservation, respectively, the governor has expanded his performance measurement programs in Maryland. They measure the health of the environment in Maryland, help the government make decisions about the best ways to implement effective conservation strategies and preserve green spaces for future generations, and provide effective communication with stakeholders and the public.

"Sustainability is a defining issue of our times," O'Malley notes. "In Maryland, we must focus on improving the condition of the Chesapeake Bay, which has been polluted for generations. We are tackling this issue with the same approach we took with CitiStat and StateStat—using geography and performance measurement to improve the bay's health each year."

GreenPrint supports BayStat efforts, and the GIS-based GreenPrint Web mapping application serves as the framework for discussion in the combined BayStat/GreenPrint meetings. GreenPrint data is also accessible via MD iMap, Maryland's launched portal into the state's enterprise GIS.

MD iMap (www.imap.maryland.gov), which includes seamless, geocoded centerlines and six-inch imagery for the entire state, provides an overarching look into Maryland state government performance. It gives citizens, government staff, and other stakeholders access to a variety of information, such as designated open spaces, protected targeted ecological areas, and the progress of highway beautification projects.

"Governor O'Malley's administration has made what was once impossible become reality in Maryland—bringing together state and local government to form a uniform GIS foundation across the entire state of Maryland," says Marshall L. Stevenson III, enterprise GIS and public safety manager, Frederick County, Maryland. "This was first seen with the statewide road centerline and geocoding service project and is now moving forward with the soon-to-be-created statewide vector cadastral layer, with data provided by local jurisdictions."

(This article originally appeared as "Governor Martin O'Malley Leads with GIS" in the Summer 2009 issue of *ArcNews*.)

Understanding our world.

Esri inspires and enables people to positively impact their future through a deeper, geographic understanding of the changing world around them.

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