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Fall 2012

Red Listed Species on a GIS Portal

By Barbara Shields, Esri Writer

The IUCN Red List of Threatened Species, published by the International Union for Conservation of Nature (IUCN), is the world standard for measuring the extinction risk of plant and animal species. The overall aim of the Red List is to convey the urgency and scale of conservation problems to the public and policy makers and to motivate the global community to work together to reduce species extinction. Its network of about 8,000 scientists from the Species Survival Commission and partner organizations, such as Conservation International, BirdLife, and NatureServe, report on the biology and conservation status of species in nearly every country.

The IUCN Red List of Threatened Species' enormous knowledge center provides researchers with a base for studying species trends and helps policy makers understand where conservation action needs to occur and be enforced. Data from the IUCN Red List and other species organizations is accessible via the IUCN Red List website (www.iucnredlist.org) and its online map explorer.

The IUCN Red List map browser is an interactive map service built on Esri's ArcGIS for Server technology. Esri is the largest producer of geographic information technologies in the world. The service allows visitors to easily explore the globe as they visualize the species' ranges and examine the abundance of scientific data available for these threatened

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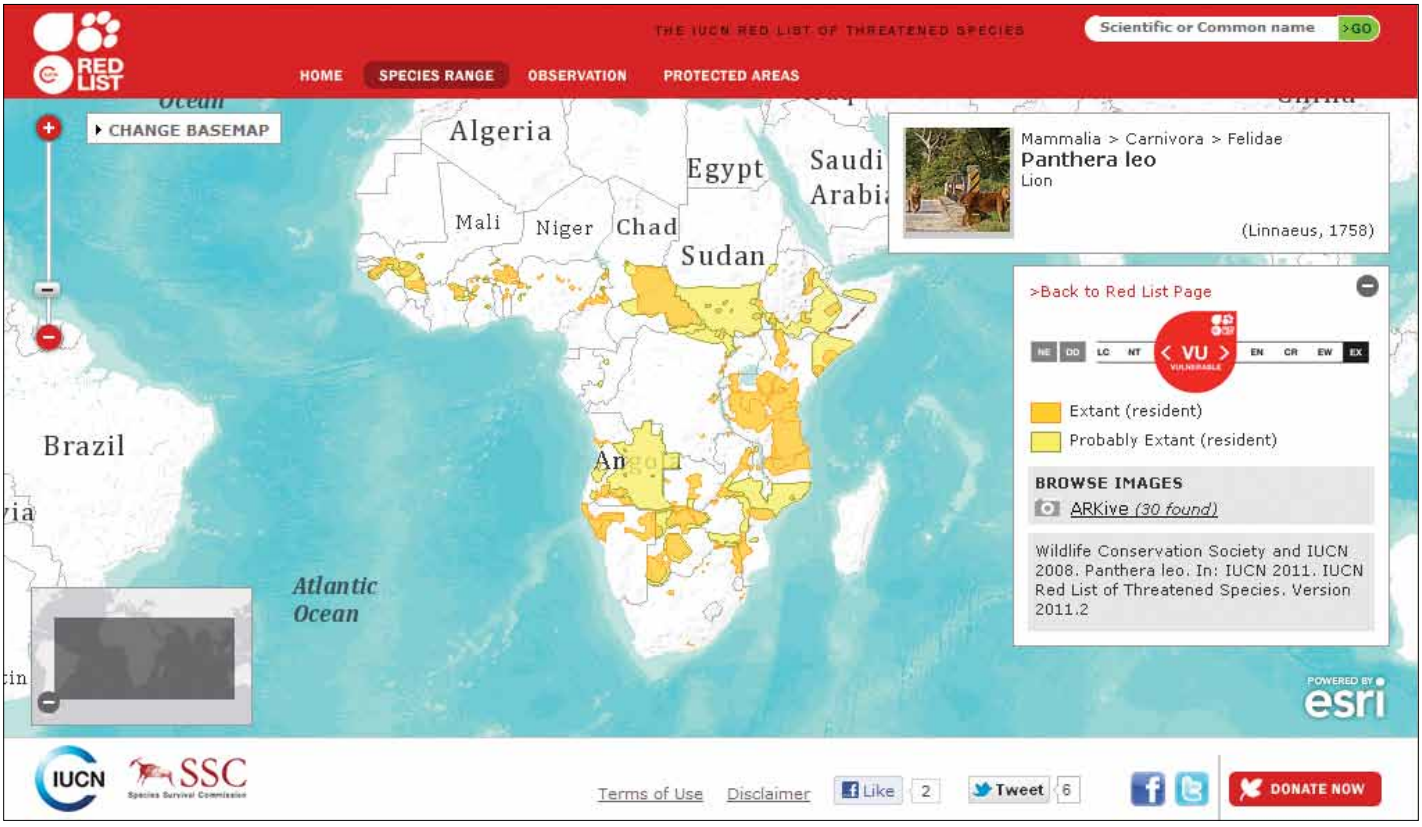

↑ The IUCN Red List of Threatened Species map shows where lions are living and are probably living.

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Geodesign for the Oceans

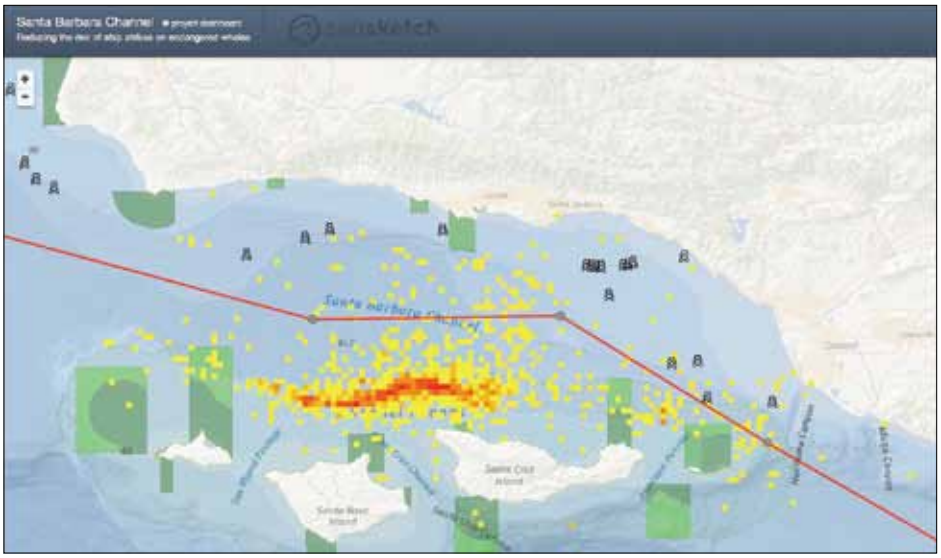
Technology allows us to see the impact an initiative could have on people and nature during the design stage; further, it plays a large role in the design process. By using geospatial tools and technologies to create geodesigned plans, policy makers, resource managers, and environmentalists can meet shared goals for synergistic coexistence with earth's environments.

Esri has launched its Oceans GIS initiative, which supports SeaSketch as an application for use in marine planning efforts around the world such as for coastal zones, sanctuaries, and fisheries. Other foci of this Esri initiative are the global oceanographic basemap, continued development of oceanographic charting capabilities, and creation of a bathymetric data management solution.

The University of California, Santa Barbara (UCSB), developed SeaSketch, a GIS platform for modeling how various what-if scenarios fulfill a design's objective. Analysts use it to model how a scenario exploiting ocean resources will affect biodiversity, the landscape, human need, and future resources. By bringing geographic technology into the design process, a resource manager can design plans that more closely follow the ocean's natural systems.

SeaSketch is a spatial decision support system built on ArcGIS, which uses cloud technology. It provides data and analytical capabilities. On the server side, it supports collaboration by providing a cloud GIS platform for content management, application development and sharing, map services, and group workspaces via ArcGIS Online. Built on Esri's ArcGIS API for JavaScript and ArcGIS for Server, SeaSketch helps GIS experts and nonexperts create plans for protecting marine life, growing fisheries, widening shipping lanes, and producing energy resources.

The GIS decision support mechanism helps governments, organizations, businesses, and conservation organizations better understand relationships, and consequences; and that is, they can see the impacts of their initiatives on the environment and communities and also see trade-offs. When geodesign goals are incorporated into the planning methodology, the project's scope is broadened to include essential considerations such as impact on key habitats, energy trade-offs, and areas of importance to fisheries. Planners can use SeaSketch to consider these concerns within constraints of regulations, boundaries, timelines, and budgets.



↑ SeaSketch is used to create a report showing the proximity of existing shipping lanes to recent whale sightings.

In 2011, the UCSB Center for Marine Assessment and Planning designed SeaSketch by borrowing some of the principles from its previous Internet mapping project, MarineMap. SeaSketch takes tools and applications to a whole new level of functionality and capacity by providing analytical feedback on plans based on best available science, supporting a platform for collaboration project design, and enabling easy use by anyone.

SeaSketch can be used by anyone with web access. The user experience is intuitive, and search tools enable easy access to various data about an area of interest. Resource managers use an administration tool to create new projects for particular planning processes. Managers can configure details such as the study area, available data layers, and feature classes that are collected from users. SeaSketch also provides an extension framework that UCSB developers can use to customize the application for particular planning tasks and incorporate specific analytical tools.

Esri's ArcGIS Online map service, which is a cloud-based, collaborative content management system for maps, applications, data, and other geospatial information, plays a major role in SeaSketch technology. It provides a platform for professional planners and stakeholders to discover and view geospatial data. A custom web framework gives users the ability to sketch potential designs onto particular geographies. The online user can display maps, share operational data layers for visualization, and post projects and analytical reports for others to use and compare with their plans. The planner can sketch a marine spatial plan that might include aquaculture sites, offshore renewable energies, and so forth. This type of collaboration supports the concept of multiple-objective planning by providing a venue for comprehensive data visualization and analysis and a forum for productive, cross-disciplinary discussion. The designs can be submitted for consideration within a decision-making process.

Will McClintock, PhD, Center for Marine Assessment and Planning, Marine Science Institute, UCSB, provided the information about SeaSketch for this article. Contact McClintock at mcclintock@msi.ucsb.edu. Contact Evan Paul at evan.paul@msi.ucsb.edu about SeaSketch applications for marine spatial planning.

Read more about geodesign at esri.com/geodesign.

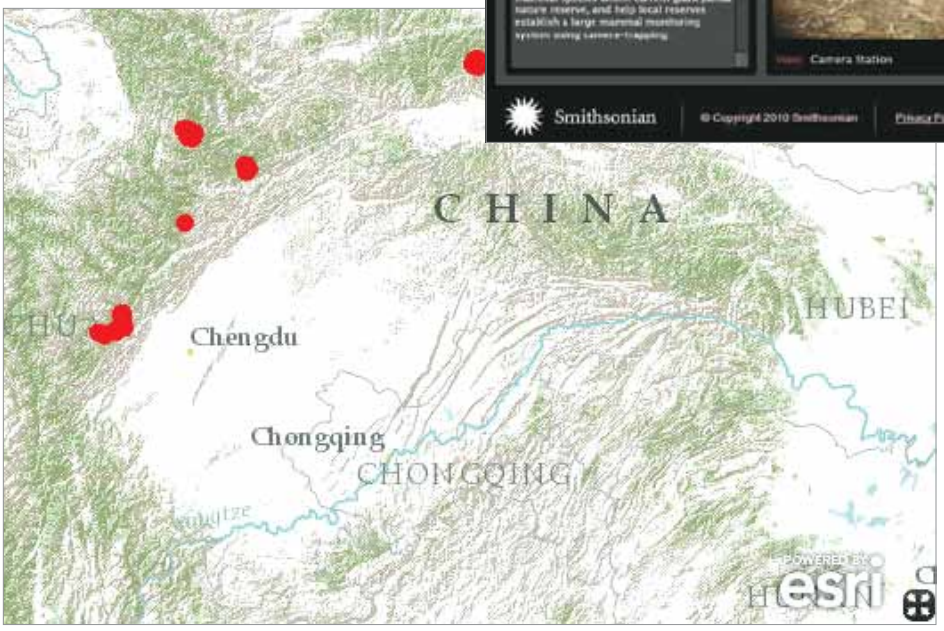
Smile, You're on Smithsonian WILD

By Barbara Shields, Esri Writer

The collared peccary of Ecuador and the black-backed jackal in Kenya act differently in the wild than in the local zoo. You can see photos of these animals in their natural habitats acting like . . . well, a collared peccary or black-backed jackal should act in the wild. Strategically placed cameras automatically capture wildlife images. More than 206,000 photos of animals taken by camera traps from all over the world are accessible from the Smithsonian WILD website.

Search on *vampire* to see a nighttime video of a vampire bat trying to latch onto a tapir's leg. The bat is so small it is nearly undetectable, but its reflective eyes give it away. On the map, zoom in to Kenya and click on a camera set up near a watering hole to see the many animals that come there such as the African buffalo, spotted hyena, and Burchell's zebra.

↑ Drill into a camera trap dot and see wildlife photos taken at that site.



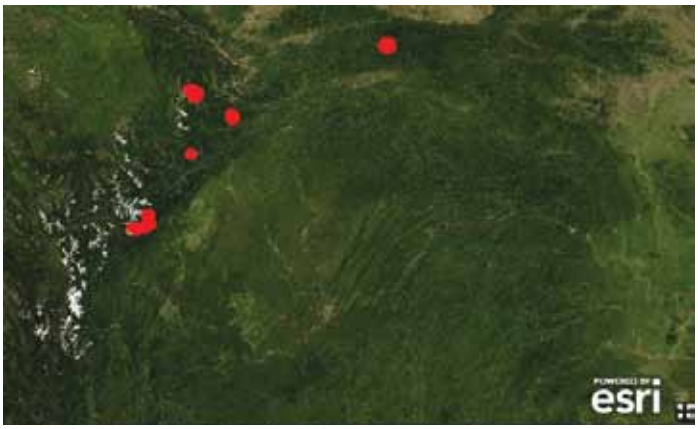
↑ Smithsonian WILD is a cloud-based website for accessing maps, source data, and photography.

Smithsonian researchers use camera traps to capture wildlife information. These small ruggedized, camouflaged cameras are waterproof, have multiple sensors, and can be locked. They are attached to trees or other natural objects. A camera's infrared recognition sensor detects animals at night and trips the camera to take rapid-fire pictures.

A longtime user of Esri technology, the Smithsonian worked with Blue Raster to build an application that accesses ArcGIS.com basemaps and images stored on Flickr that include x,y coordinates of camera locations. This makes it easy for users to search for animal photos, descriptions, and locations by entering a name, selecting an option, or clicking an area or camera site on a GIS map.

The Smithsonian WILD website (siwild.si.edu) is elegant, with a red taskbar that makes it easy for the user to select a species and learn about a project. Click the A–Z Index of Animals tab and select a category, such as bears. Click a species by name; both its common name, such as giant panda, and its scientific name (*Ailuropoda melanoleuca*) are shown. The giant panda web page has links to species source data from the *Encyclopedia of Life* and the International Union for Conservation of Nature Red List databases. The web application also has thumbnails of panda photos taken by camera traps. Click a photo, and it links to a page that has project information and an Esri-powered map. Click the map and zoom to panda habitats in Sichuan, China, where the camera traps are located. These camera points link to an album of all species photographed by that camera. The user learns about the giant panda; its behavior; and other creatures that share its habitat, such as the Chinese serow.

"GIS takes the viewer from a bird's-eye view of the region and drills down to the camera location on the ground where these animals are recorded in space and time," said Robert Costello, national outreach program manager for the Smithsonian. "Each image is like a museum



↑ Imagery map shows terrain and habitat of the area where pandas live.

specimen in a sense. The photo is a voucher for the existence of that species at that place and time. It is a record with the potential of becoming more important over decades."

When the site launched in 2011, popular media sources such as *Wired* magazine, Gizmodo, Engadget, and NBC Nightly News quickly picked up the story. Smithsonian WILD has had as many as 57,000 visits in a single day. It is a cloud-based website with tools that access Esri's basemaps from ArcGIS.com. The project's images are managed on Flickr. After paying nominal fees for a Flickr Pro account and use of the Amazon cloud, Blue Raster quickly moved the Smithsonian's 206,000 images to the Flickr platform.

Will such a species information service replace the trusty field guide? Possibly. The common field guide is comparatively inaccurate because it shows gross estimates of potential boundaries for species. Smithsonian WILD shows the location of an actual occurrence. A field guide provides one map for one species at a time, but Smithsonian WILD shows a community of species that are active at a geographic location. A field guide is easily stuffed into a rucksack. Smithsonian WILD can also be stuffed into a rucksack.

In 2012, Blue Raster built a mobile application that works on iOS (iPhone and iPad) and Android (phones and tablets) and accesses Smithsonian WILD maps via ArcGIS.com. One might expect that two development teams would be needed to build the smartphone application—one familiar with Objective-C for iOS and the other with the Android languages. However, Blue Raster wrote the application once, by using ArcGIS API for Flex to create the application and Adobe FlashBuilder to compile it into formats that run on Apple iOS and Android devices.

Users can analyze animal activity and behaviors in ways that were never before possible. The images received from the field give scientists a view of the action in almost real time. The next phase is to make it possible for the public to share this real-time experience. The Smithsonian and Blue Raster are developing an application that automatically pushes the field images to the data repository and then publishes them on Smithsonian WILD.

Esri on the Road

IUCN World Conservation Congress
September 6–15, 2012
Jeju, Korea
iucnworldconservationcongress.org

Wildlife Society Conference
October 13–17, 2012
Portland, Oregon, USA
wildlifesociety.org

Association of State Drinking Water Administrators (ASDWA) Conference
October 14–18, 2012
Little Rock, Arkansas, USA
asdwa.org

Clean Gulf
November 13–15, 2012
New Orleans, Louisiana, USA
cleangulf.org

GeoDesign Summit
January 24–25, 2013
Redlands, California, USA
geodesignsummit.com

Federal GIS Conference
February 25–27, 2013
Washington, DC, USA
esri.com/fedcon

Red Listed Species on a GIS Portal

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and endangered species. For example, if a person is interested in the conservation status of *Panthera leo* (lion), the IUCN Red List map provides information about the lion's status. The tool shows protected habitat areas, noted species observation locations, and major threats, such as habitat loss caused by human encroachment or indiscriminate trophy hunting by poachers.

The link to the species' observation page shows the visitor the locations where *Panthera leos* have been most recently reported and photos of the lion have been taken. A tool quickly identifies the limits of the lion's distribution range. Analysis can be performed by overlaying the provided basemap of a species range with protected range data layers.

In 2011, the Red List of Threatened Species contained assessments for almost 65,000 species, of which about 30,000 included spatial information. Although the IUCN Red List database is quite large and complex, the online mapping portal displays results and maps quickly and with noticeably high performance.

The portal also draws source data from iNaturalist, *Encyclopedia of Life*, Global Biodiversity Information Facility, ARKive, and World Database on Protected Areas from the United Nations Environment Programme (UNEP) World Conservation Monitoring Centre. IUCN's map portal brings together these six different databases effortlessly and seamlessly in a JavaScript-based application designed by Esri partner Blue Raster. It runs on the Esri ArcGIS for Server platform. In addition, the map portal links to thousands of geotagged wildlife images.

Challenges of Growth

Before 2006, IUCN had been relying on its partners Conservation International and NatureServe to provide GIS services. But IUCN scientists had many projects that required different types of analysis, so they wanted to directly interact with GIS to set up their projects. Administrators decided to deploy GIS. They hired GIS manager Vineet Katariya to build GIS capacity within the organization.

The GIS project began with a grant from the Society for Conservation GIS for ArcGIS software. New Esri products and licenses were added every year as the IUCN capacity grew. GIS was quite popular, and more people wanted to use the tool. Administrators decided to put GIS online so that many people could access it. The first attempt was an automated map application in Visual Basic for Applications (VBA) that served static map JPEG files. Unfortunately, the system had trouble managing IUCN's large database. Generating and managing maps was extremely difficult, and it soon became obvious that this was not a sustainable solution.

Katariya explored options for creating dynamic online environments. At an Esri conference, she learned about the capabilities of ArcGIS 10 for Server and some interesting mapping applications. "I was impressed by its web filter and search capabilities," said Katariya. "I had already seen some projects built by organizations using ArcGIS for Server that performed great. We just

↑ The IUCN Red List map service is a portal that draws source data from scientific and conservation organizations. It is built on ArcGIS for Server. Users search by name to see maps, add layers, browse images, and get species and habitat information.

couldn't keep publishing static maps. I decided to go with Esri technology rather than other options because it had the functionality we wanted out of the box."

Challenges Met

Working with a developer, Katariya set up a simple high-performance map application. "This was a big change from our static maps, and people loved it," she said. "They were able to explore our data, overlay data layers with other data, and analyze species and protected areas."

Building on this success, IUCN wanted to scale up, be even more efficient, and have higher performance so users would not need to wait for their information. In 2011, IUCN asked Blue Raster to design a solution that could handle the organization's large, complex datasets and meet its performance requirements, as well as design additional applications.

"Blue Raster built an application on ArcGIS for Server that works really well for us," Katariya noted. "Our viewers are thrilled."

Blue Raster worked with IUCN to enhance the data storage and indexing of the complex species range and observation data. In early 2012, IUCN soft launched its GIS portal, IUCN Red List map, and since then, the site has been getting about 2,000 to 3,000 hits every day. The official launch will be at the IUCN World Conservation Congress 2012 in Jeju, Korea. The application was deployed with the latest JavaScript API version, which allowed for the best user experience and performance for a global audience. The complex species range data was optimized for a web delivery that provides access to the entire catalog of species ranges without sacrificing data display quality. The IUCN service also leverages web services in open standards from several sources to provide seamless web maps with species observations (photos), range data, and protected areas intersections.

The entire system is hosted with Amazon Web Services using ArcGIS for Server on Amazon Elastic Compute Cloud (EC2). This hosting option enables IUCN to rapidly get its applications online. IUCN will soon upgrade to Esri's next version, ArcGIS 10.1. IUCN is excited about the new features in the version, especially the faster map rendering engines and dynamic map, which will be used in future versions of the IUCN map portal as the tools are expanded. With a global audience relying more on the IUCN Red List of Threatened Species for this critical data, the mapping tool is proving to be a very powerful device for conservation.

Five GIS Trends for 2012

By Michael Lippmann, Executive Director, Blue Raster, LLC

1. Growing appetite for local data

In an age when web map users can zoom in and see their cars in the driveway, technology expectations are changing rapidly and driving a new demand for data at the hyperlocal level. Large global aid organizations that once were content to map and analyze data at the national (or subnational) level now seek to geolocate their work at the village level, ensuring that investments are directed to locations that will realize the greatest benefit. Although local data often does not exist, the demand for analysis at the most granular level continues to grow and drive demand for greater access to information. This presents a great opportunity as well as a significant challenge.

2. Upsurge in geocoded social media

To satisfy the need for local data, organizations are increasingly turning to crowdsourcing via social media. Facebook, Twitter, and other social media outlets produce a tremendous volume of data with the potential to be geocoded and integrated with mapping applications. Today, organizations use social media to generate a constant feed of geolocated information about current conditions related to humanitarian crises, conservation projects, and other initiatives. Although only a small percentage of Tweets currently include geolocation, the potential to collect and distribute data through social media and short message services (SMS) will increase as the use of GPS-enabled smartphones expands. The next pattern will be expanded semantic analysis of the sentiments in data so that users understand the story as it unfolds.

3. A mobile first approach

Smartphones and tablets now enable us to collect, share, and analyze geospatial data in ways that were not possible only a few years ago. Unfortunately, many project managers still are not initially envisioning a mobile application. Last year some project managers asked our designers at Blue Raster to add a mobile component to the project in the days just before launch, which we did. Ideally, using a "mobile first" approach to planning opens the pathway for future alternative offerings for tablets and phones. Migrating to mobile is a process that requires thinking from a different angle and delivering features and functions that make sense on a small screen in the field instead of the traditional desktop/laptop browser applications. Consider mobile GIS use cases as a first step in any project, and use that knowledge throughout the entire process of designing interactive mapping applications.

4. Greater demand for online capabilities

As technology creates new opportunities for local engagement with GIS data, the demand for online editing capabilities will continue to grow. In the past, clients were happy simply to view their data online; now they want to generate, edit, and analyze data online, regardless of time or place. In addition, clients who work in remote locations may want to interact with data offline until connectivity is available.

5. Mass migration to the cloud

As the availability of more localized data and sophisticated web GIS rises, the pace of migration to cloud-based GIS services accelerates. The idea of purchasing a physical server for hosting a web mapping application is fading. The future of web mapping is the ability to deploy Amazon/Azure preinstalled ArcGIS for Server machines in minutes along with the new ArcGIS Online features with hosted map services, tile caches, and web editing. These abilities will drive innovation. By migrating GIS services to the cloud, organizations can deliver more powerful applications faster, upgrade easily, and scale up or down as needed.

Michael Lippmann is the executive director of Blue Raster, a company that specializes in developing dynamic web and mapping solutions. Among its environment clientele are Smithsonian National Museum of Natural History, World Resources Institute, International Union for Conservation of Nature, and World Wildlife Fund. Blue Raster won the 2012 Esri Partner Conference Award for best public web application design. Learn more about Blue Raster at blueraster.com, or e-mail Michael Lippmann (mlippmann@blueraster.com).

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