



Geography Matters™

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Geography Matters

An ESRI White Paper

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Geography Matters

Why Geography Matters

A transformation is taking place. Businesses and government, schools and hospitals, nonprofit organizations, and others are taking advantage of it. All around the world, people are working more efficiently because of it. Information that was limited to spreadsheets and databases is being unleashed in a new, exciting way—all using geography.

This isn't your elementary school's geography. This is using geography, or location of information, to gain new insights and make better, more informed decisions. Consider an example. In Texas, a department store analyzing credit card receipts by ZIP Code finds that a large number of its customers drive along a particular section of the freeway to reach a mall. The store could then make smart choices about where to place its billboard ads.

Linking location to information is a process that applies to many aspects of decision making in business and the community. Choosing a site, targeting a market segment, planning a distribution network, zoning a neighborhood, allocating resources, and responding to emergencies—all these problems involve questions of geography. Where are my customers and potential customers? In which neighborhoods or ZIP Code areas do consumers with particular profiles live? Which areas of a city are most vulnerable to seasonal flooding or other natural disasters? Where are power poles located, and when did they last receive maintenance?

How do organizations unlock geography from the data they use every day to make decisions? For anyone trying to evaluate information, the best way to view it is on a map. Not just any map—intelligent digital maps made possible by geographic information system (GIS) technology. Everyone, including people who have never used maps to analyze data, is finding that maps make processing information much easier and more effective.

What Is GIS?

GIS is computer software that links geographic information (where things are) with descriptive information (what things are). Unlike a flat paper map, where "what you see is what you get," a GIS can present many layers of different information.

To use a paper map, all you do is unfold it. Spread out before you is a representation of cities and roads, mountains and rivers, railroads, and political boundaries. The cities are represented by little dots or circles, the roads by black lines, the mountain peaks by tiny triangles, and the lakes by small blue areas similar to the real lakes.

A digital map is not much more difficult to use than a paper map. As on the paper map, there are dots or points that represent features on the map such as cities, lines that represent features such as roads, and small areas that represent features such as lakes.

All this information—where the point is located, how long the road is, and even how many square miles a lake occupies—is stored as layers in digital format as a pattern of ones and zeros in a computer.

Think of this geographic data as layers of information underneath the computer screen. Each layer represents a particular theme or feature of the map. One theme could be made up of all the roads in an area. Another theme could represent all the lakes in the same area. Yet another could represent all the cities.

These themes can be laid on top of one another, creating a stack of information about the same geographic area. Each layer can be turned off and on, as if you were peeling a layer off the stack or placing it back on. You control the amount of information about an area that you want to see, at any time, on any specific map.

**Geography Brings
Success to
Organizations
Everywhere**

Geography is helping people make better decisions in many disciplines. Geographic data can be gathered and organized to support the generation of information products that are integrated in the business strategy of any organization. A geographic information system is not an end in itself. It is used to create useful information products that help organizations run better. It has saved hundreds of millions of dollars through increased productivity and efficiencies. And that's just the beginning.

**Geography Matters
Everywhere**

Geography matters in every business and every discipline. Wherever you turn, geography helps people do a better job and make a difference. GIS is helping thousands of organizations around the world.

GIS is used on the Internet in places such as Sacramento County to organize its government for constituents. Simply touch a parcel on an online map, and the information for that location is available to you. The city of San Diego is helping people find resources by providing maps that allow them to find a job, find a park, or find a day care center and then show them how to get there.

Nashville Electric is using GIS to automate all its electrical facilities for asset management. Florida Power and Light is using GIS to track weather fronts and hurricanes.

GIS is being used to study the effects of global warming, using maps to study the sea level rise inundation occurring off the coast of Delaware and the melt of glaciers in the Himalayas.

In Mississippi, people are using GIS for land use planning. In Kentucky, the northern state's regional planning agency is using GIS to support and update its general plan.

In Canada, Timberline Inc. is looking at sustainable forests and the visual and biological impact of forestry. Nongovernment organizations (NGOs) are looking at saving some of the last unprotected wilderness in California.

GIS is at work in transportation, looking at travel times in Baltimore, Maryland, and environmental impacts of transportation systems in Latvia.

In New Zealand, GIS is being used to automatically generate aeronautical navigation charts. In the United States, the Air Force is defining obstruction zones around all of its major airports.

The National Imagery and Mapping Agency, the largest provider of geographic data in the world, is building databases, automating its charts and mapmaking process, and distributing these charts around the world to its users and customers.

GIS software is also being used for "business geographics." In Norway, GIS is being used to find new sites for stores. In Germany, GIS is assessing markets for new commercial activities. In Ecuador, automated maps are being used to show where milk delivery trucks go, saving millions of dollars in logistical costs.

These are just some interesting things real users of geographic data and GIS are doing. GIS is utilized in every discipline, everywhere. Beautiful and interesting maps are providing better decision making tools and analysis and making a difference in our world.

Archaeology

Archaeologists, as researchers and resource managers, understand the importance of geography. Geographic variables exert a strong influence on human behavior today, and archaeologists are aware of the significance of this influence in the past. Geography also influences the degree of exposure of archaeological sites and the impacts that they face from human activity and natural forces. Management and research decisions are based on geography. Geographic analysis and modeling provide answers to a variety of questions and help users, such as Wisconsin's Historic Preservation Management and many university programs including the University of Haifa and the University of California, Santa Barbara, make informed decisions.

Agriculture

GIS provides the analytical capabilities that form the hub of a successful precision agriculture system. GIS lets farmers perform site-specific spatial analyses of agronomic data. The study of geographic features and the relationship between them can be applied to all agriculture sectors. By better understanding how features within the landscape interact, decision makers can optimize efficiency and improve economic returns. Regardless of scale, whether at the subfield level analyzing crop yield information or internationally assisting government organizations with commodity subsidy programs, organizations such as the United States Department of Agriculture, the Lava Cap Winery, and the Bangladesh Agricultural Research Council benefit from GIS.

Banking

ESRI's GIS technology provides financial users with insight about their customers' purchasing habits, financial behavior, and needs for additional products or services. As a result, banks are able to target their best prospects and not misdirect marketing and advertising resources. GIS also allows financial institutions to fulfill mandatory compliance requirements. Companies such as Metropolitan Life and Chase Manhattan Bank rely on ESRI® software to help them improve operational excellence and profitability.

Cave and Karst

Cave and Karst managers and researchers understand the importance of geography. Geography dictates why and where features exist and how they relate to the surrounding environment. Management and research decisions are based on geography. Geographic analysis and modeling provide answers to a variety of questions and help users make

informed decisions. Using GIS, geographic data from such organizations as the Cave Research Foundation and the American Cave Conservation Association allows study of caves including creating elevations models, doing inventory, and creating 3D scenes.

Defense and Intelligence

GIS is used for every specialization of the defense industry in many nations around the world. Military customers, including several intelligence agencies, the Swedish Armed Forces, the Australian Army, and all branches of the United States military, are among the users depending on the powerful tools and visualization capabilities of GIS.

Electric and Gas

In today's competitive world, a successful utility must take advantage of all its resources from people to equipment and information. Equipment, facilities, crews, customers, and even system events have an aspect that can be associated with a physical location. Integrating GIS to make maximum use of these valuable assets has become absolutely vital. CenterPoint Energy, Inc. (formerly Reliant Energy), in Houston, Texas, uses GIS across its enterprise to save money and manage its assets more efficiently. The Electricite du Liban in Beirut, Lebanon, as well as utility companies in more than 100 countries around the world, also uses GIS to model its electrical systems.

**Engineering—
Pipeline**

Competitive pressure and regulatory constraints are placing increasing demands on pipeline operators to function in an efficient, safe, and responsible manner. Responding to these demands requires accessibility to information regarding geographically distributed assets and operations.

GIS technology facilitates the organization and management of data with a geographic component. It also eases data acquisition and utilization. GIS provides pipeline operators in companies such as Shell International with improved capability to manage pipeline integrity, improved efficiencies in pipeline operations, and improved response to business development opportunities.

**Engineering—
Surveying**

Surveyors and engineers understand the importance of geographic data. Surveyors use precise instruments, procedures, and computations to accurately locate and define geographic features while conducting field surveys that range from cadastral to engineering construction layout. Engineers design and build structures and infrastructures on geography measured by surveyors.

GIS provides the tools to help surveyors in thousands of state and local governments, including Marion County, Oregon, to integrate a variety of data sources and types, maintain and manage inventories, and visualize data and related information using dynamic maps. GIS is also used for real estate litigation support by providing modeling and analysis.

Federal Government

Hundreds of agencies in national governments throughout the world rely on ESRI's GIS solutions to spatially enable their enterprise information technology solutions. GIS allows them to identify problems, respond to them intelligently, and share the results with constituents. GIS solutions provide the tools necessary to help government agencies, including the U.S. Census Bureau, the U.S. Department of Housing and Urban Development, and many national governments outside the United States, reach their agency missions while cutting costs.

Fire/EMS/Disaster/ Homeland Security	GIS is used as an interface for integrating and accessing massive amounts of location-based information in the public safety market. GIS allows public safety personnel to effectively plan for emergency response, determine mitigation priorities, analyze historical events, and predict future events. GIS can also be used to get critical information to emergency responders upon dispatch or while en route to an incident to assist in tactical planning. Customers including SAIC, Federal Emergency Management Association, the National Institute of Justice, and many city and county governments are using GIS to make the world a safer place.
Forestry	Managing forests in today's ever-changing world is becoming an increasingly complex and demanding challenge for forest managers. GIS provides foresters and natural resource managers with powerful tools for better analysis and decision making. GIS gives foresters the "big picture" about resources and lets them perform tasks such as developing long-term supply strategies, forecasting silvicultural stock, determining harvesting system options, and more. Organizations including the United States Department of Agriculture Forest Service, the Bureau of Land Management, Weyerhaeuser, and the Boise Cascade Corporation use ESRI GIS software to manage these assets.
Health and Human Services	GIS software is used extensively throughout the medical community to study epidemiology, look at health care facilities, and map any system that is visual or spatial including inside a patient's body. The United States Centers for Disease Control, the world's premier disease-tracking organization, uses GIS to study how toxic substances affect people's health. California's Kaiser Permanente uses GIS to decide how much funding to allocate to certain centers and where to site new facilities.
Insurance	Many insurance companies have made GIS a central component of their business, using it to visualize, analyze, and distribute risk. Companies such as CHUBB Insurance use GIS software to manage portfolio risk management and more.
K–12, Primary, Middle, and Secondary Education	GIS helps people of all ages grasp the ways in which geography matters. GIS helps students and teachers engage in studies that require and promote critical thinking, integrated learning, and multiple intelligences at any grade level. Schools such as Boulder High School and public schools in Perham, Minnesota, and Seattle, Washington, are using GIS to teach students more about the world around them. Furthermore, the state of South Dakota's Department of Education and Cultural Affairs recently announced that it has licensed GIS software for use with every instructional computer in all of South Dakota's public and private K–12 schools. This is indicative of similar efforts being initiated in classrooms around the world, and there is a strong movement to make geography and GIS part of the core curriculum in K–12 schools and universities.
Landscape Architecture	Landscape architecture is the design, planning, and management of natural and man-made environments. It is a discipline grounded in spatial thinking. GIS is increasingly important as a tool for organizing digital spatial data in an accessible and logical manner. This allows landscape architects to consider more design options and to do so more quickly and efficiently than ever before when designing new communities.

Law Enforcement and Criminal Justice

GIS plays an important role in law enforcement and criminal justice. The ability to access and process information quickly while displaying it in a spatial and visual medium allows agencies to allocate resources quickly and more effectively. In the mission-critical nature of law enforcement, information about the location of a crime, incident, suspect, or victim is often critical in determining the manner and size of the response. Cities throughout the world depend on ESRI's GIS solutions for the effective use of their law enforcement resources.

Libraries and Museums

GIS helps libraries and museums provide a gateway to all kinds of data from census data, zoning, and tax assessment maps to digital aerial photographs and satellite images, providing public access to information that previously was difficult to use. GIS also provides tools for exploring information through maps and images, helping inquisitive minds see things in a new way. Museum exhibits, such as those at the Smithsonian Institute and the Science Museum of Minnesota, teach people about topics, such as natural history and geology, more readily with dynamic maps to illustrate processes and events.

Location Services

As the global community increasingly becomes more mobile, locating people, places, and things while deriving useful information from raw locations has never been more important. Governments and businesses managing enterprisewide spatial data repositories require expedient options to disseminate critical business data to personnel and resources in the field; mobile consumers increasingly demand convenient commercial location services that enhance mobile lifestyles; and legislation in some regions of the world forces solution providers to quickly develop highly reliable, trusted, and always available emergency service applications, ensuring public safety responses for all location-aware mobile devices and entities. Many companies, including AirZip, SignalSoft, and TrafficStation, are assisting ESRI in bringing this technology to businesses and governments throughout the world.

Marine, Coast, and Oceans

From oceanography to hydrography, navigation to defense, the coastal shoreline to the bathymetric bottom, marine GIS has been adapted and utilized to assist researchers and organizations in achieving their goals. In the same way GIS has helped make analysis and mapping of the earth's surface more accessible and powerful, GIS technology allows experts to see the large portion of the planet that is underwater. Issues ranging from mapping the sea floor to tracking the journey of whales and tuna to preserve species in threatened areas and developing new kinds of nautical charts to give mariners a three-dimensional view of their progress through the water are all coming to life through geography and GIS.

Media

GIS is used by media outfits for everything from analyzing circulation and attracting advertisers to creating the maps used in the material itself. Newspapers, such as the *Press-Enterprise* in Riverside, California, use GIS to increase readership. The Associated Press, *USA Today*, and the National Geographic Society all use GIS to create accurate maps quickly for magazines, newspapers, and online news services.

Mining and Earth Sciences	GIS creates efficiency and productivity opportunities in all aspects of mineral exploration and mining. GIS enables mineral geologists and mine operators to mine intelligently, efficiently, competitively, safely, and environmentally. GIS provides the framework to acquire, develop, and interpret the complex spatial and tabular data sets used for mining and the earth sciences. Mapping, spatial concepts, and time/space operations technology are absolutely essential to effective mining.
Natural Resources	At a time when the earth's resources are being taxed like never before, natural resource managers are discovering the power of GIS to help them make crucial decisions. GIS is helping development and conservation communities find common ground by providing a framework for the analysis and discussion of resource management issues. Companies and organizations, including the Nature Conservancy, the Environmental Protection Agency, Chevron, and the Department of Fish and Wildlife, are unleashing the power of GIS to manage natural resources.
Petroleum	Making decisions based on geography isn't new in the oil business. Where to drill, route a pipeline, or build a refinery are all questions that rely heavily on an understanding of geography to make the right business decisions.
Real Estate	The real estate industry has always known geography matters; after all, real estate professionals coined the phrase "location, location, location." Since location is what GIS is all about, ESRI is actively engaged in implementing GIS-based solutions in all segments of the real estate industry from map-based contact management to sophisticated investment analysis in large real estate investment trusts. Companies such as SSR Realty Advisors, Inc., use GIS in commercial real estate, while Homestore.com uses GIS software to bring maps online to people shopping for a new home.
Retail Business	Businesses manage a plethora of information about sales, customers, inventory, demographic profiles, mailing lists, and more. At the very core of this information is a geographic location, an address, a service boundary, a sales territory, and a delivery route that can be illustrated and interactively managed on a map. Business managers, marketing strategists, financial analysts, and professional planners are increasingly relying on GIS to organize, analyze, and present their business data. Companies such as Sears have saved millions of dollars by managing deliveries with GIS. Gold's Gym Enterprises uses GIS to study new franchise locations. Smaller companies, such as Ultra Marine Kayaking out of Santa Cruz, California, find GIS useful and cost effective for creating accurate and attractive maps for promotional materials. GIS applications such as these have assisted companies in realizing significant cost savings from their initial GIS investment for a number of years afterward.
State and Local Government	State and local governments are increasingly required to streamline business practices while adhering to complex political or regulatory requirements. ESRI's GIS provides a flexible set of tools to perform the diverse functions of government by providing the data management tools needed and making it easier to share data among departments.
Telecommunications	GIS technology enables telecommunications professionals to integrate location-based data into analysis and management processes in network planning and operations, marketing and sales, customer care, data management, and many other planning and problem-solving tasks.

Transportation In the transportation industry, geographic analysis is the key to making better decisions. GIS serves three distinct transportation needs: infrastructure management, fleet and logistics management, and transit management. Transportation professionals, such as the New York Department of Transportation, the Maryland State Highway Administration, and the city of Reykjavik, Iceland, use GIS to integrate mapping analysis into decision support for network planning and analysis, tracking and routing, inventory tracking, route planning and analysis, and more.

Universities Geography is an important part of many disciplines such as agriculture, geology, biology, environmental science, mathematics, sociology, economics, and literature. Most problems facing the world today—environmental, economic, political, or social—exist in a geographic context. GIS technology is one of the hottest new research tools in academia today. Students and researchers trained in GIS software will have a competitive advantage in the job market. More than 3,000 colleges and universities, including the University of Washington in Seattle and the University of California branches, have developed excellent courses, certificates, and degree programs in GIS.

Water and Wastewater The majority of water/wastewater utilities use GIS technology to integrate a variety of information and applications with a geographic component into one manageable system. ESRI's GIS is a fully developed automated mapping/facilities management/GIS technology for water utilities to automate and integrate their organization's information processing. Agencies such as the Philadelphia Suburban Corporation use ESRI's GIS to help them manage resources better every day.

Geography Matters to You—GIS and Our Society You don't have to be a college student or a working professional managing mission-critical information to have geography matter to you. Geography is part of our everyday lives. It's part of our neighborhood, our nation, our planet. It's part of the things we come in contact with everyday—weather, traffic, the quality of our water and land, stores, government, the economy, and more. Often overlooked because we see it constantly, geography is everywhere!

Here are some specific ways GIS and geography are improving the world around us.

GIS in Conservation GIS is used by more than 4,000 organizations worldwide that are part of ESRI's Conservation Program. These organizations have received grants in excess of four million dollars' worth of software, hardware, or educational support from ESRI and a network of collaborators such as Hewlett-Packard, Geographic Data Technology (GDT), and IBM. These grants assist conservation organizations to use GIS to improve communications, networking, scholarships, and training. For more information on these programs, please visit www.conservationgis.org.

GIS and Sustainable Development Geography as a science and GIS as a technology can be seen as a framework for what many people are calling "sustainable development."

Sustainability has different meanings for different people. At ESRI it is defined as a concept associated with society's ability to set up systems of human activity that can maintain them. These systems include economic systems, but more and more it includes

strategies that have minimal impact on the environment and do not deplete the resources that support them.

As a global society, people are becoming more aware around the world that many human activities, such as land use and economic development, consume natural resources, such as energy, water, and soils, and can have long-lasting and irreversible effects on our environment including wildlife habitats and biodiversity. The important question for all of us is "can the earth continue to provide and regenerate the resources we need for supporting life and encourage development as we know it?"

To make this real, it is necessary to personalize and localize the question to specific resources and geographies that we are involved in or possibly responsible for—our parcel, neighborhood, community, nation. GIS allows us to measure our assets, understand our patterns of change, better understand the resources we are using, and identify the impact of human-induced geographic change. GIS is also helping us better utilize the resources we have by leveraging geographic information with analysis tools that support planning as well as operational activities.

GIS in Libraries and Museums

Libraries and museums provide a gateway to all kinds of information including GIS information. Making information accessible and easy to understand is the goal of libraries and museums everywhere. A GIS organizes and presents information in ways that spark greater understanding of places and events around the globe and close to home. GIS helps people learn about the world around them, and as public institutions, libraries and museums are open to everyone.

GIS allows libraries and museums to function better and more efficiently. GIS can assist in service area mapping by pinpointing where special services are needed for particular constituents such as ensuring that age-appropriate books are available in branches located near families. GIS can provide information, such as maps and driving directions to nearby facilities, over the Internet.

Libraries don't need to be in map collection to benefit from a GIS. Since so much information has a geographic context, GIS is useful in any department including at a reference desk to answer questions such as "where?" GIS also assists in presenting information by providing tools to be used on museum exhibit floors and as a tool for research.

GIS in Education

Besides learning about GIS as a technology, children and adults alike are using GIS as a tool to learn more about the world around them. GIS lends a hand with powerful visualization tools and functionality to present data in new ways. GIS can open a whole new world of experiences for students.

One initiative that is bringing GIS into thousands of schools internationally is My Community, Our Earth. More than 2,000 students around the world are working with GIS professionals on projects relating to sustainable development.

Learn More About How Geography Matters

There are many ways to learn more about how geography matters to you. Check out these resources and see the world in a whole new way.

GIS Day

Along with the National Geographic Society and the Association of American Geographers, ESRI participates in GIS Day™, a global event in which users of GIS technology open their doors to schools, businesses, and the general public to showcase real-world applications of this exciting technology. More than one million people around the world learn about the benefits and many uses of GIS each year during National Geography Awareness Week in November. For more information about this exciting event, to register your own event, or to receive presentation materials, please visit www.gisday.com.

GIS.com

Thousands are visiting GIS.com each day to find the information they need on GIS technology. Created and maintained by ESRI, this portal to GIS news and information has everything you need, whether you are new to GIS or a GIS professional. If it's happening in the world of GIS, you can find it on GIS.com.

Looking to get started in GIS? Not only is there information on what GIS is and how it is used, GIS.com also offers links to free GIS software products to try. See how mapping and GIS work by visiting one of many mapping sites on the Internet. Visit often—new mapping sites are featured on a regular basis.

Need data? You can find not only a wealth of free and for-sale data but also information on the different types of data and how to select data to suit your needs.

Find the education and training you need whether it is a formal GIS degree program in your area or online classes. Start by finding out about the right kind of training for you depending on your system and needs.

Visit the online library not only to purchase GIS books but also to read reviews and excerpts. Miss a conference? Technical papers from leading GIS conferences, including URISA and the ESRI International User Conference, can be found here as well.

The site also features a news/events/trends section bringing links to online news sources as well as special features available only on GIS.com. Also, industry heavyweights in GIS, including Nancy Tosta and Roger Tomlinson, have been featured. Industry specialists and GIS users regularly submit articles describing how GIS has helped them in their place of business.

Make GIS.com work for you. Use the site to find the information you need as well as provide information for others. GIS.com is a community, and it needs your help bringing news and information to other users. Send your GIS-related announcements, press releases, and news to gisnews@gis.com.

Visit www.GIS.com and take advantage of GIS discussion groups, industry case studies, a virtual library, data and software resources, and more.

The Geography Network

The Geography NetworkSM is a global network of geographic information users and providers. It offers an infrastructure for the sharing of geographic information among data providers, service providers, and users around the world. Through the Geography Network, you can access many types of geographic content including streaming maps, downloadable data, and more advanced Web services.

More than 300 organizations, including DTN Weather Services and the Environmental Protection Agency, are publishing geographic information on the Geography Network. Some organizations use the Geography Network to power their own Internet sites including Homestore.com and National Geographic's Map Machine (www.mapmachine.com). These companies are pioneering the delivery of geographic information services on the Web.

The Geography Network can be used to provide information quickly to organizations that need it. Local governments such as the Cincinnati Area GIS and the New Jersey Office of GIS use the Geography Network to easily disseminate geographic data to government, utility companies, groups, and citizens to make informed decisions.

The Geography Network offers more than geographic information. Because of the popularity of the Geography Network as a way to publish and distribute geographic content, ESRI is providing new technology that makes it possible for GIS users and data providers to implement their own geography networks. ESRI also intends to use the infrastructure of the Geography Network to support the delivery of a new set of GIS Web services that provides easy access to functions such as address matching, routing, mapping, and reporting for a broad set of users on the Internet. The Geography Network is the place where people go to find the most up-to-date, relevant geographic data and services on the Internet.

ESRI's ArcExplorer Software

ESRI's ArcExplorerTM is a lightweight GIS data viewer developed by ESRI. This freely available software offers an easy way to perform basic GIS functions, including display, query, and data retrieval, and is available in both Windows and Java editions. It can be used on its own with local data sets or as a client to Internet data and map servers. Between 4,000 and 8,000 downloads of this software are executed each month from ESRI's Internet site.

Become a GIS Professional

GIS has a special role in today's rapidly changing world. Professionals utilizing GIS will build the information systems and infrastructure needed to guide important activities and projects. GIS professionals are already making their own organizations more successful through strategic planning. They are helping to provide better logistics to cut costs. They are finding the right sites for business locations. They are preserving areas that are hot spots from a biodiversity perspective. Geography can be integrated into any job, whether it is a nonprofit organization, a for-profit corporation, or a hobby. Find out how you can use geography and GIS to improve the way you do things.

*For more information about GIS, please submit the form at www.esri.com/geographymatterswp, and we'll send you a complimentary copy of the best-selling introductory book *GIS For Everyone* from ESRI Press.*