tures of humans and felines, also featured an aqueduct that delivered spring water, plus a 100-square-meter "palace" with basalt drains. This might have been a seat of government, says archaeologist Kent Reilly of Southwest Texas State University in San Marcos. A survey of sites in the surrounding 800 square kilometers suggests that Olmec power extended far beyond the capital. For example, a site strategically located near the confluence of two rivers has thrones that are smaller than those at San Lorenzo but decorated in a similar fashion. "The way the settlement works on a regional level, we really think it was an incipient state," says Cyphers.

Despite this apparent concentration of political power, opinions remain divided on the Olmec share of influence. Scholars who favor the "sister culture" view note that the Olmec borrowed pottery styles from elsewhere, and that there was a bustling trade in goods such as obsidian tools and jade ornaments throughout ancient Mesoamerica. Grove of the University of Florida agrees that many cultures were active. And the new writing fragments are not enough to change the views of these scholars. Even if the glyphs are ancient, Grove, for one, isn't convinced that the La Venta area was necessarily the first site of writing. "I don't think it shows the Olmec invented it. It could have originated anywhere around that southern region," he says, especially because the seal and plaques were easy to transport.

There's also evidence that other Mesoamerican cultures were experimenting with writing, possibly at about the same time. Joyce Marcus and Kent Flannery of the University of Michigan, Ann Arbor, excavated a monument from San José Mogote, made by the Zapotec culture centered in Oaxaca, about 300 kilometers from La Venta. But although Marcus dates this monument at 600 B.C. to 500 B.C., Pohl and others are skeptical of that age. Archaeologist Javier Urcid of Brandeis University in Waltham, Massachusetts, says the Zapotec monument contains a day-name glyph, which he considers writing. He thinks the greenstone plaques from San Andrés are writing too, and they might have been invented independently. "Even if writing did originate in a single spot, I don't think we'll ever be able to find it," he says.

Whatever its origins, Mesoamerican writing flourished in the centuries after these early inscriptions began to appear. Even defeat did not stop the scribes, at least for long. Eleven years after the defeat of 18 Rabbit, for example, a new ruler of Copán tried to wipe away the bitter memory with a grand history of his city's warrior kings—the longest hieroglyphic text known from the New World.

–ERIK STOKSTAD

DIGITAL INFORMATION SYSTEMS

Mapping the Future

With its topographic maps falling rapidly out of date, the U.S. Geological Survey has begun drafting an ambitious National Map—online

It wouldn't have stopped the wildfires that swept the western United States last fall. And it certainly wouldn't have prevented the crash of United Airlines Flight 93 into a Pennsylvania field on 11 September 2001. But a digital topographic map of the United States would have given firefighters fresh information about new neighborhoods threatened by the blazes, and it would have helped relief workers identify the plane crash site more quickly. That's the idea behind the fledgling National Map program at the U.S. Geological Survey (USGS), which aims to put such up-to-date, high-quality topographical data at the fingertips of anyone who wants it.

An online National Map promises to deliver continuously updated data—from elevations to rivers to geographic boundaries—for all the roughly 3000 counties across the United States. So far, eight pilot projects are under way; USGS officials hope to assemble the entire map with local partners over the next decade.

But although industry insiders say that the map is a smart idea, collecting and maintaining all these data are daunting tasks. "The real challenge is doing this in any extensive way, in a country as large and diverse and changing as the U.S.," says James Plasker, a former USGS executive and now executive director of the American Society for Photogrammetry and Remote Sensing in Bethesda, Maryland. "That's a huge organizational challenge," says Plasker, who is not alone in wondering if USGS can pull it off.

A new direction

USGS is an old hand at topography. Soon after its founding in 1879, pioneering cartographers fanned across a rugged landscape, mapping the horizon on portable drawing boards called plane tables. Over the years, the survey incorporated the latest mapmaking tools, such as aerial photography.

Surveying the scene. Early USGS mappers used plane tables and alidades to get the lay of the land.

CREDIT: USGS

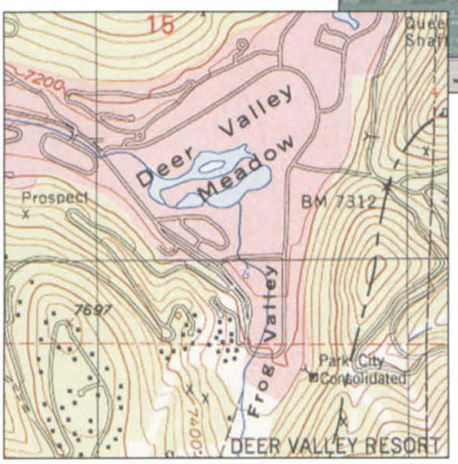
By the late 1980s, when USGS finished mapping the entire country at an estimated cost of $1.6 billion and 33 million work hours, the survey's 55,000 "topo maps" had become standard tools for hikers, urban planners, and relief workers such as the Red Cross, among other consumers. As USGS's priorities shifted toward scientific research, however, its mapping program languished. As a result, while towns went boom and bust and landmarks such as airports, buildings, and parks spread and dwindled, the topo maps lagged further and further behind the landscape they represented. Today, the maps are only sporadically updated, and some are 57 years old.

"We just don't have the money to maintain a robust revision program," says William Flynn, chief of USGS's Mapping Partnership Office in Austin, Texas. In the early 1990s, USGS tried a foray into electronic mapping, with a project to collect basic geographic information for governments and land developers to share, but the computer networks then available weren't up to the job. "They've been wandering in the desert for a decade or so, trying stuff that didn't quite work," says Donald Cooke, founder of Geographic Data Technology Inc., a map database developer in Lebanon, New Hampshire. "Now, somehow

Barb Ryan has pulled it together."

Ryan, a 28-year USGS veteran, joined the survey's geography staff in 1994 and took over its mapping program in 2000. Eager to breathe life into the effort, Ryan put together a National Map team, which began brainstorming ways to combine existing digital data on elevations and hydrography at USGS with the high-resolution maps emerging at local levels across the country. "Most of the local communities maintain current Geographic Information Systems (GIS) data sets at very high resolution for their own purposes, anyway," says Flynn, head of Texas's National Map pilot. "Someone simply needs to develop the partnerships with those communities and take on the technical challenges of integrating the variety of data and formats into a standard set of products for distributing over the Web."

Ryan envisions the National Map as a seamless, continuously updated map



Change in direction. USGS hopes its classic paper topo maps (*left*) will pale beside the data richness of the online data sets it is assembling at pilot projects in Colorado (*above*) and seven other test sites.

with seven layers of geospatial data for every U.S. county. The data include topographic features from aerial photos and satellite images; surface elevations; locations of water bodies, transportation, major buildings, and public land boundaries; road names; and land-cover types, such as open water or high-density residential.

To build and maintain this ambitious map, Ryan says, USGS will partner with federal, state, and local agencies that either already collect such data or would like to have it. "It's a national map, and that requires governments and agencies and private sectors to come to the table," Ryan says. Those at the table will reap the benefits of a grand geographic template that could be overlaid with more specialized information, from floodplains to census demographics to disease and fire patterns. "This will be a platform of data that can be used creatively," Ryan adds. Private companies, too, could contribute National Map data and then adapt them to sell more specialized maps, Cooke says.

To kick-start the National Map, USGS has launched eight pilot projects, including a Landsat satellite project and local efforts in Delaware, California-Nevada, Missouri, Pennsylvania, Texas, Utah, and Washington-Idaho. Those pilots, some completing their first year this fall, hint at both the problems and promises that lie ahead.

A mixed bag

The sheer amount of labor will be the biggest hurdle, predicts Vicki Lukas, head of the Lake Tahoe pilot along the California-Nevada border. "We thought that in a well-known and highly studied environment like Lake Tahoe, there would be a wealth of core data," Lukas says. "We were surprised to find a lack of any kind of regional data sets."

Instead, Lukas says, the team found a "mixed bag" of geography: excellent GIS measures in some agencies, poor ones in others, and, in one county, unusual computer software that required painstaking translation. That took more time and work than anticipated. "There's a lot of data there, but the integration is a huge effort," says Lukas. William Schenck, a scientist with the Delaware Geological Survey and a member of the Delaware pilot team, agrees: "Even for our group, with considerable technical expertise, getting the framework data to an accurate scale is a lot of work." Storing, communicating, and automatically updating nationwide digital geographic data pose daunting problems of their own.

Ryan estimates that delivering the full-scale National Map in 10 years would require $150 million a year—roughly twice the current budget. She hopes that successful pilot projects will build support for funding a nationwide map.

Regional digital maps from some pilots are already proving their usefulness. For instance, Tricia York, an environmental scientist with the Tahoe Regional Planning Agency, says that area's pilot is already improving efforts to track environmental changes in the Lake Tahoe watershed. "The geospatial layers in the map are far more accurate than what we had before, and that allows us to make more sound scientific decisions," York says.

National security also stands to benefit from the map-in-progress, Ryan says. Long before "homeland security" entered the public lexicon, USGS had teamed up with the National Imagery and Mapping Agency in Bethesda, Maryland, to start updating maps of 120 key urban areas vulnerable to terrorist attack. Since 11 September 2001, the survey has brought that effort under the umbrella of the National Map project and increased the number of cities to 133. "Whether we're talking about a natural disaster or a terrorist disaster, the need for information is the same," Ryan notes. In addition to printing up-to-date paper maps, USGS will develop a digital database of the cities, including critical infrastructure such as power and water utilities. Although the basic geography will be open to the public, some data layers will likely be classified.

The next milestone for the National Map is a report from a National Academy of Sciences committee, due out in the spring. Ryan hopes that the panel will endorse the work to date and affirm the need for additional funding. Meanwhile, other countries have started considering electronic national maps of their own. The United Kingdom, Canada, and Australia are publicly debating the need for similar digital geographic databases. Should their plans go forward, a few neighborhoods of the global village could soon become familiar territory.

–KATHRYN BROWN

CREDITS: USGS