Where are the jobs?

—by Ilse Genovese

Two-and-half years after the beginning of the current recession, job creation remains a national priority. But to replace the more than seven million jobs lost in the U.S., employers will need to add well over 300,000 jobs a month for four years in a row. There are very few periods in U.S. history when job growth has been that strong, said Harvard University labor economist Lawrence Katz.

This notwithstanding, the U.S. economy is expected to create 15 million jobs by the end of this decade. Where will those jobs be? And, what kind of jobs will they be?

BUREAU OF LABOR STATISTICS PROJECTIONS

In their report "The U.S. economy to 2018: From recession to recovery," Ian Wyatt and Kathryn Byun, economists in BLS' Division of Industry Employment Projections, estimate that real GDP growth will average 2.4 percent annually over the next decade. This is close to the 2.5 percent trend observed between 1998 and 2008.

However, productivity growth is expected to slow by 2018, and people are likely to save more while spending less on personal items.

The BLS projections show a different workforce. More people will have to work longer to retirement, and the pool of gainfully employed people will be ethnically more diverse. One-third of total job openings will be filled by job seekers with post-secondary degree.

According to BLS, the U.S. economy will continue to be shaped as a predominantly services-based economy. "Changes in shares of employment over the decade will result from continuing increases in service-providing sectors, while goods-producing sectors (except agriculture), will lose employment," noted Kristina Bartsch, chief of BLS' Occupational Outlook Division, in the November 2009 issue of the *Monthly Labor Review*.

Among the seventeen major industry sectors in the U.S., health care, financial services, and information are expected to expand. This outlook conforms with the prediction that the highest employment growth will occur in management, scientific, and technical consulting; computer systems design; and employment services.

The major goods-producing sectors—mining, construction, and manufacturing, for instance—are, however, not likely to realize substantial employment growth despite some growth in output.

With more than half of the new jobs in professional service occupations, economists like Katz worry about the "polarization of the labor market"—strong job growth for the high- and low-paying jobs but less growth in the middle of the labor market to replace the well paying manufacturing jobs the U.S. has been losing.

OUTLOOK FOR GEOSPATIAL PROFESSIONS

Bureau of Labor Statistics' *Occupational Outlook Handbook, 2010-11* predicts "favorable job prospects" for surveyors, cartographers, and photogrammetrists with a bachelor's degree and strong technical skills.

Employment of technicians and professionals in these fields is expected to grow by 19 percent from 2008 to 2018, which is "faster than the average" for all occupations. Increasing demand for fast, accurate, and complete geographic information is expected to fuel this job growth.

A 19-percent change over the next decade translates to 174,500 employment opportunities for surveying and mapping professionals and technicians. Of this total, 81,800 will be positions held by professional surveyors, cartographers, and photogrammetrists, according to projection data in the National Employment Matrix.

Employment for cartographers and photogrammetrists will change by 27 percent over the next decade, accounting for 3,300 new positions. The number of professional surveyors is expected to rise from 57,600 in 2008 to 66,200, a 15-percent change. Employment for surveying and mapping technicians will grow by

20 percent (or 15,700 jobs) to a total of 92,700 by 2018. Professionals and technicians involved in the development and application of GIS are expected to benefit most from new employment opportunities.

Opportunities for traditional surveying services "tied strongly to construction activity," may vary, depending on local economic conditions. However, because surveyors can work on many different types of projects, they are expected to have "steadier work than other workers when constructions slows."

SURVEYING

The occupational projections by BLS for surveyors can be compared with data and trends presented in *POB*'s 2010 Salary and Benefits Study (http://www.pobonline.com/Articles/Article_Rotation/BNP_GUID_9-5-2006_A_10000000000000814058). The study was conducted by BNP Media's Market Research Department and is based on a total of 553 returns to a questionnaire sent to 5,448 *POB* subscribers.

The year 2009, which was the focus of the study, was a challenging year for many surveyors. Companies reduced spending, cut salaries, and used furloughs to stay afloat. Those that adapted and used new technology to deliver surveying and mapping services in new markets have coped better with adverse economic conditions.

A comparison by sector indicates that job opportunities for surveyors in the public sector were up by nine percent from the 2008 level, while employment in the private sector fell by seven percent during the same period.

Demand for engineering design and road/infrastructure/transportation surveys increased by six percent each, but surveys conducted for real estate sales and construction projects experienced a slow-down.

Small surveying companies (10-24 employees) continued to struggle in 2009, which is reflected in the 67 percent decrease in full-time employment reported for these companies. Some respondents (31 percent) reported no changes in full-time employment at their companies, while others (8 percent) noted a slight increase. The biggest gains (24 percent) in full-time employment were realized by larger companies with between 250 and 499 employees.

The *POB* 2010 study confirmed a steady trend toward higher education and increasing licensure. As many as 39 percent of respondents reported having a bachelor's degree—an increase of five percent compared with 2008. The number of licensed professionals increased as well.

In 2008, 70 percent of respondents were licensed surveyors;

this number rose to 74 percent in 2009, with most (86 percent) being licensed as Registered Professional Land Surveyor (RPLS), Professional Land Surveyor (PLS), Registered Land Surveyor (RLS), and Land Surveyor (LS). The number of Land Surveyors-in-Training (LSIT) and Surveyors-in-Training (SIT) increased by four percent, and there were incremental increases in GISP and Certified Photogrammetrist certifications.

The average gross salary fell seven percent, to $66,009, in 2009. Slow or no work was the most often cited reason for salary declines. The salary levels reported for new hires differed across sectors and companies, but title, licensure, experience, and region all had an effect.

The technology with most impact on the surveyors' role in the economy continues to be GPS. Other technologies which can make surveying businesses more competitive are laser scanning, LiDAR, GIS, total stations, RTK GPS, and 3D scanning.

Not surprisingly, when asked how surveyors can be successful in coming years, most said that they should keep up with new technology. However, many respondents felt that higher education and more professional training will be as important as technology in increasing their companies' market share in new professional service industries.

GIS AND GISCIENCE

Thirty years ago, geographic information systems were only beginning to be deployed in government agencies, the military services, police departments, private firms, and in higher education. Today, as knowledge of place becomes ever more vital to a vast range of human activity, GIS and GIScience (see sidebar on this page) are central to the ways thousands of government agencies, private companies, and not-for-profit organizations conduct business (*Beyond Mapping: Meeting National Needs Through Enhanced Geographic Information Science,* 2006).

Besides GIS, the global positioning system (GPS), remote sensing, and other information technologies have contributed to the changing nature of work in the mapping sciences and in the professions, industries, and institutions which use them for information management and delivery.

Yet, despite the deep penetration of the mapping sciences and technology into many realms of daily life, "the supply of well trained and well educated GIS/GIScience professionals has not kept pace with the demand for more robust geographic data in the U.S." (Mondello et al. 2004).

An information-based economy where information about place is deemed fundamental to conducting business necessitates a rapid

DEFINITIONS

GIS has been defined as: *"an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information"* [U.S. Fish and Wildlife Service, 2006].

"a computer-based tool for mapping and analyzing feature events on Earth. GIS technology integrates common database operations, such as query and statistical analysis, with maps" [ESRI, 2006].

GIScience has been defined by Goodchild (1992), who coined the term, as:

"a multidisciplinary research enterprise that addresses the nature of geographic information and the application of geospatial technologies to basic scientific questions."

The definition adopted in the 2006 *GIS/GIScience Body of Knowledge* (DiBiase et al., 2006) is:

"the science behind or underlying geographic information systems technologies and their applications."

growth in the GIS/GIScience labor force.

It should therefore not come as a surprise that the U.S. Department of Labor (n.d.) identified geospatial occupations as one of the 12 high-growth employment sectors for the 2000-2010 period.

An article in *Nature* by Gewin (2004) reported that "geotechnology" has become "one of the three most important emerging and evolving fields in the U.S. economy, along with nanotechnolgy and biotechnology. Job opportunities in the field were expected to grow and diversify as "geospatial" technologies proved their value in ever more areas." Labor Department's projections of up to 29 percent growth by 2010 supports this claim.

No hard data are currently available on whether this trend will continue into the next decade. Being considered a high-growth job-creation sector is not enough; we need to know where the jobs are now and where they are likely to be as the geospatial field evolves and uses of its products diversify.

A useful starting point is Mondello et al. (2004) study which reported that 175,000 workers were employed in the domestic remote sensing and geospatial information industries in 2004. Four years earlier, ESRI (Environmental Systems Research Institute) noted that "some 500,000 individuals in the U.S. used GIS software at work, and that 50,000 were full-time GIS specialists" (Phoenix, 2000).

GIS COMPETENCE LEVELS
[IN ASCENDING ORDER]

1. Public awareness of GIS and its uses
2. Basic spatial and computer understanding
3. Routine use of basic GIS software
4. Higher-level modeling applications of GIS
5. Design and development of GIS applications
6. Design of geographic information systems, and
7. GIS research and development

[Source: DiBiase et al., 2006; Marble, 1997]

Ten years later, the employment picture of the geospatial industry remains patchy. Part of the uncertainty is due to the rapid evolution of GIS science and technology. There has also been some discussion as to which occupations should be counted as "geospatial occupations.

The Department of Labor's 12 major geospatial-related employment categories include such traditional occupations as cartographers and photogrammetrists, surveyors, and surveying and mapping technicians. Listed in addition are architectural and civil drafters, civil engineering technicians, mechanical and electrical drafters, electrical and electronic engineers, mechanical and industrial engineering technicians, environmental engineering technicians, and geoscientists.

In terms of employment growth, environmental engineering grew fastest in the past decade (by 29 percent), followed by surveying and mapping (25 percent), and electrical drafting (23 percent).

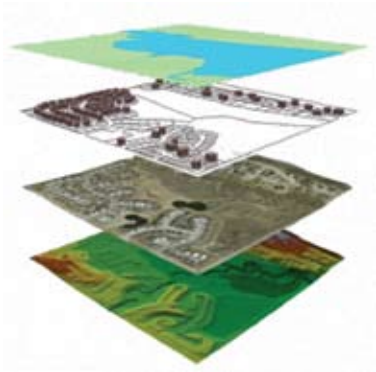
GIS professionals, according to a guide to college majors in GIS, often find work with federal agencies like the U.S. Geological Survey, Bureau of Land Management, Army Corps of Engineers, Forest Service, National Oceanic and Atmospheric Administration, National Imagery and Mapping Agency, and Federal Emergency Management Agency. However, the vast majority of available jobs are with engineering, architectural, and technology firms.

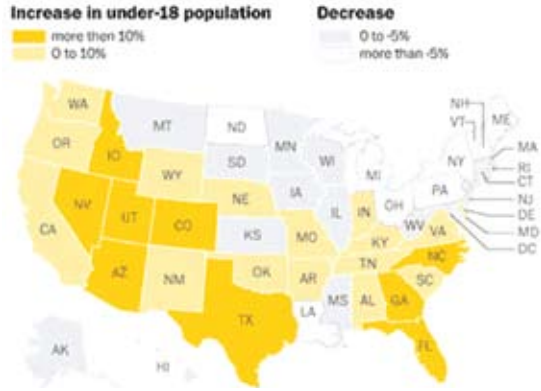
SELECTED EMPLOYMENT OPPORTUNITIES FOR GIS PROFESSIONALS
[IN ALPHABETICAL ORDER]

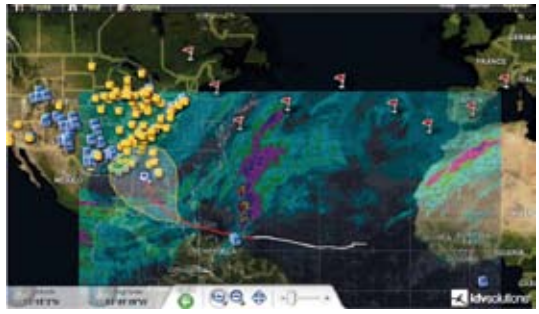
1. Application development
2. Data acquisition, analysis, and interpretation
3. Data management
4. Interorganizational facilitation and communication [Coordination]
5. Marketing
6. Project management
7. Systems analysis
8. Training
9. Visualization

[Source: Gaudet et a;/ 2003, p. 25]

Advanced technologies continue to increase the productivity of GIS workers, and GIS accuracy







should increase with the use of surveying expertise and devices. Because of greater productivity, most of the job openings will occur when workers transfer to other occupations or leave the labor force altogether. However, surveying and mapping technician jobs are expected to grow faster than average, precisely because of the greater emphasis on accuracy in GIS.

The decline in digital technology costs is expected to benefit the employment outlook for geospatial professionals. This service, which was once limited to major companies and federal agencies, has expanded considerably. Now, small companies and government agencies can afford to purchase their own GIS programs and, frequently, bring a GIS professional on board.

Notwithstanding these encouraging trends, the GIS/GIScience labor force may still not be large enough to provide real-time mapping capabilities for informed decision-making about such issues as smart growth, environmental preservation, and adequate water and sewage systems.

Information displayed on GIS maps is part of responses to emergency 911 calls, weather forecasting, air traffic control, crop monitoring, search and rescue, disaster response, anthropology, forestry, genome mapping, and national security. And while the range of disciplines using map products as tools has diversified beyond those investigating geographic phenomena over the Earth's surface, the sources of geospatial information have diversified as well [see sidebar about "logic and convenience" with respect to data sources].

Logic vs Convenience

While increasingly more powerful data gathering and computing capabilities provide new and exciting opportunities for examining geospatial information from a wide array of perspectives, we must understand that the appropriate use of that information is critical. This is especially true as we develop cadastral layers for land parcels. Insuring that the convenience provided by technology and the relatively easy use of positioning tools does not undermine logic in the way we define and locate land boundaries is a critical element of protecting the integrity of our nation's traditional principles of land tenure and ownership rights. — Curt Sumner, ACSM Executive Director

Mobile devices with increasingly more powerful computing capabilities have encouraged "citizen science" where individuals become "sensors" recording location-aware changes in their environment (Ball, 2010) and contributing that information to national and international mapping efforts.

Mainstream geospatial domains where location is used to solve business problems and to increase our understanding of the built and natural world have accelerated demand for geographic information by the commercial, government, and private sectors.

Thus, going forward, the challenge will be to re-examine and refine the levels of GIS/GIScience competence [see sidebars], determine their share in current employment figures, and identify their roles in future workforce development.

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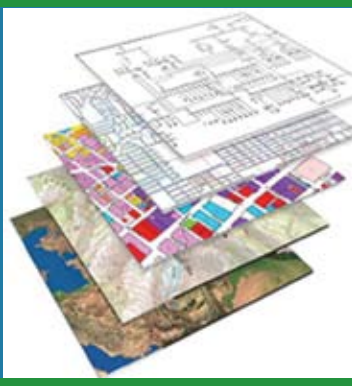

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Surveyors' tools

Rand McNally's IntelliRoute TND 700, a new truck GPS device with a 7-inch state-of-the-art high-definition screen and enhanced software features

Surveyors' tools

Sokkia's Series 50X Total Stations feature increased range, speed and expanded functionality