ground water

Issue Paper/

An Imminent Human Resource Crisis in Ground Water Hydrology?

by Daniel B. Stephens

Abstract

Anecdotal evidence, mostly from the United States, suggests that it has become increasingly difficult to find well-trained, entry-level ground water hydrologists to fill open positions in consulting firms and regulatory agencies. The future prospects for filling positions that require training in ground water hydrology are assessed by considering three factors: the market, the numbers of qualified students entering colleges and universities, and the aging of the existing workforce. The environmental and water resources consulting industry has seen continuous albeit variable growth, and demand for environmental scientists and hydrologists is expected to increase significantly. Conversely, students' interest and their enrollment in hydrology and water resources programs have waned in recent years, and the interests of students within these departments have shifted away from ground water hydrology in some schools. This decrease in the numbers of U.S. students graduating in hydrology or emphasizing ground water hydrology is coinciding with the aging of and pending retirement of ground water scientists and engineers in the baby boomer generation. We need to both trigger the imagination of students at the elementary school level so that they later want to apply science and math and communicate the career opportunities in ground water hydrology to those high school and college graduates who have acquired the appropriate technical background. Because the success of a consulting firm, research organization, or regulatory agency is derived from the skills and judgment of the employees, human resources will be an increasingly more critical strategic issue for many years.

Introduction

Does it seem that it has become increasingly difficult to find well-trained, entry-level ground water hydrologists to fill open positions? This is my experience, and I hear the same from many of my colleagues in other firms and regulatory agencies.

Not long ago in this Journal, Professors Schwartz and Ibaraki (2001) published a thought-provoking article, suggesting that the ground water hydrology field had reached a mature stage, at least at the research level (although this proposition was later contested by Belitz [2001] and Miller and Gray [2002]). More recently, I (Stephens 2008) addressed this issue from the perspective of the consulting industry by examining trends in the ground water hydrology profession in about the past 50 years and concluded, too, that in many respects, the field did appear to be mature; that is, the rapid growth in the environmental industry (e.g., water, waste water, and especially remediation sectors), which includes ground water hydrologists, that characterized the late 1970s through mid-1990s had since slowed by comparison. That article, which was based on data collected mostly before 2005, also suggested that there is still a very high demand for well-qualified ground water hydrologists, which is currently not being met.

The purpose of this article was to assess the future prospects for filling the wide range of positions that require training in ground water hydrology. To examine the future demand vs. supply for professionals in our field, I consider three factors: the market, the numbers of

Daniel B. Stephens & Associates Inc., 6020 Academy Rd. NE, Suite 100, Albuquerque, NM 87109; (505) 822-9400; fax (505) 821-2313; dan.stephens@dbstephens.com

Received June 2008, accepted August 2008.

doi: 10.1111/j.1745-6584.2008.00507.x

qualified students entering our colleges and universities, and the aging of the existing workforce.

The Employment Market

Business leaders in environmental, infrastructure, and consulting firms have seen continuous internal revenue growth over the past two decades, although the rate has been variable during this time. Internal growth rates (in contrast to external growth, which includes mergers and acquisitions) were in the double digits in the late 1980s and slowed to about 3% in 1996 before climbing to more than 10% by the end of the 1990s (Figure 1). After dropping to 5% in 2003, growth rates have returned to about 10%. Business leaders project continued growth in the future (Environmental Financial Consulting Group 2007), but the rates no doubt will be significantly less than the internal growth rates of 15 to 25 years ago. Current revenues of firms engaged in this business total nearly $300 billion annually, including construction and equipment revenues (Environmental Business Journal 2008).

No market growth analysis specifically for ground water hydrology and related aspects of our industry apparently exists. However, a separate survey of the top 200 environmental consulting firms, a subset of the group included in the aforementioned revenue estimate, reveals double-digit growth and an upward trend in the past 4 years (Rubin et al. 2007). This group includes several sectors where ground water hydrologists are likely to be employed, including hazardous waste, water, and environmental science.

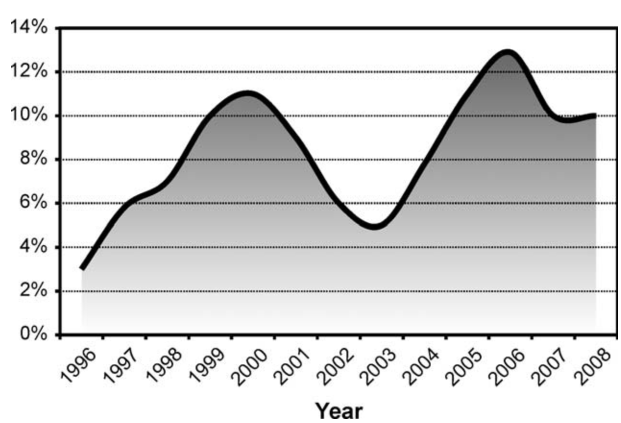

Figure 1. Internal revenue growth rate for environmental, infrastructure engineering, or consulting firms. Source: Environmental Financial Consulting Group Inc. (2007).

The U.S. Department of Labor's Bureau of Labor Statistics (2007a) has found that over the next 8 years, the demand for environmental scientists and hydrologists should increase significantly (Table 1). (The same is true for petroleum and mining geologists, but these are tracked separately.) Environmental scientists and hydrologists would include ground water hydrologists (also known as hydrogeologists, geohydrologists, and ground water engineers), among a wide range of others such as surface water hydrologists, environmental chemists, risk assessors, climatologists, oceanographers, and fisheries biologists, for example. The Bureau of Labor Statistics (2007b) notes that:

> Employment of environmental scientists is expected to increase by 25 percent between 2006 and 2016, much faster than the average for all occupations. Over the same period, employment of hydrologists should increase by 24 percent, also much faster than the average. Job growth for environmental scientists and hydrologists should be strongest in private-sector consulting firms. Growth in employment of environmental scientists and hydrologists will be spurred largely by the increasing demands placed on the environment and water resources by population growth. Further demand should result from the need to comply with complex environmental laws and regulations, particularly those regarding ground-water decontamination, clean air, and flood control.
>
> In addition to job openings due to growth, there will be additional demand for new environmental scientists and hydrologists to replace those who retire, advance to management positions, or change careers. Job prospects for hydrologists should be favorable, particularly for those with field experience. Demand for hydrologists who understand both the scientific and engineering aspects of waste remediation should be strong. Few colleges and universities offer programs in hydrology, so the number of qualified workers may be limited.

We examine some of these points a bit further in this article.

Table 1
Projection Data from the National Employment Matrix

Occupational Title	SOC Code	Employment		Change, 2006–2016	
		2006	Projected 2016	No.	Percent
Environmental scientists and hydrologists	—	92,000	114,000	23,000	25
Environmental scientists and specialists, including health	19-2041	83,000	104,000	21,000	25
Hydrologists	19-2043	8,300	10,000	2000	24

Note: Data in this table are rounded. Modified from Bureau of Labor Statistics (2007a).

Colleges and Universities

We may look to the colleges and universities to supply this anticipated faster than average growth. Enrollment in hydrology and water resources programs, which typically include students in both surface and ground water fields, grew rapidly in the 1970s and 1980s. This growth was likely fueled in part by widely publicized graphic portrayals in the media of contamination in the burning Cuyahoga River, Love Canal, and the Valley of Drums, among others. Rapidly evolving regulations during this period, such as the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also created many career opportunities. At the same time, many earth science and engineering students recognized that to take advantage of the attractive opportunities in this emerging field, they would have to complete graduate degree training in ground water programs, even if they could not obtain an assistantship or a scholarship. To meet the demand, there seemed to be a rapid proliferation of new graduate programs in ground water throughout the country during the mid- to late 1980s. Subsequently, regulatory compliance became part of the corporate culture, and remediation of some of the worst contaminated sites appeared to be coming under control. Consequently, student enrollment in hydrology and water resources programs reached a peak in the early to mid-1990s.

Since then, students' interest in some of these programs overall has waned at both the undergraduate and the graduate levels, as illustrated in Figures 2 through 4. Student enrollment in some cases has fallen by more than 40% over the past decade or so, and perhaps some of this decline in the larger programs can be attributed to increased offerings at more graduate schools closer to home. At present, the population of students enrolled in hydrology programs appears to be fairly stable, although at a lower level, but there are likely many exceptions. Interest in ground water hydrology by students majoring in hydrology and other disciplines, as reflected by enrollment in the introductory ground water hydrology course at the University of Wisconsin–Madison, seems to follow a similar pattern, that is, peak enrollment in the mid-1990s followed by a sharp decline to a steady level for nearly the past 10 years (Figure 5).

Some graduate programs in ground water hydrology, especially small ones of an applied nature such as at Cal State Fullerton, in southern California where ground

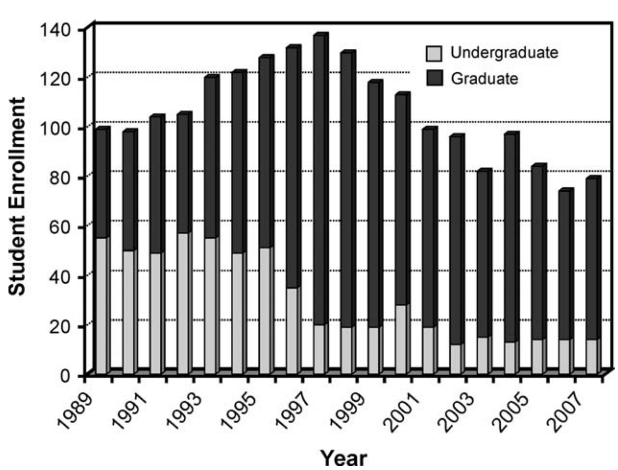

Figure 2. Hydrology and water resources department student enrollment, University of Arizona.

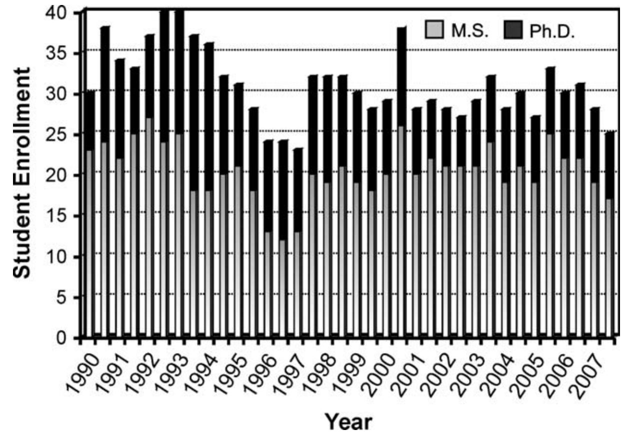

Figure 3. Hydrology program graduate student enrollment, New Mexico Tech.

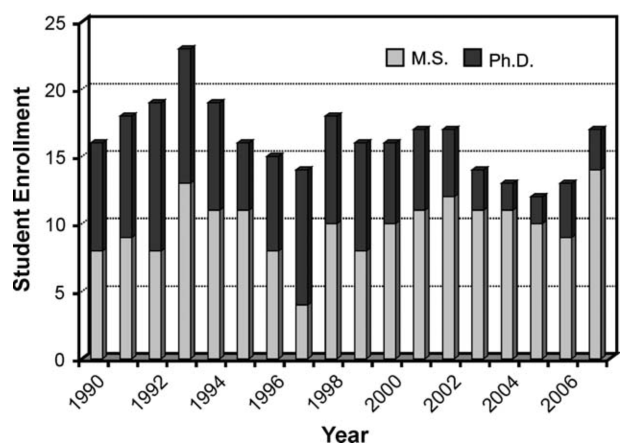

Figure 4. Hydrogeology graduate student enrollment, University of Wisconsin–Madison.

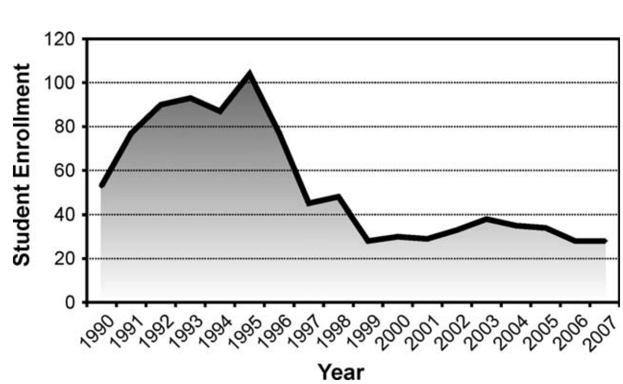

Figure 5. Hydrology core course enrollment, University of Wisconsin—Madison.

water is vitally important, seem to have no difficulty recruiting and have a stable enrollment (Laton 2008). Other programs, however, are having to work harder to maintain student enrollment. To attract prospective students today, the nationally recognized program at New Mexico Tech invites potential graduate applicants to campus for a reception with faculty and current students, which is in sharp contrast to prior years when the problem was finding enough faculty advisors and funding for the multitude of talented applicants.

Although the enrollment of students in hydrology and water resources programs may have waned and now has reached a steady state, the interests of the students within these departments appear to have shifted in some schools. This semester, I had the opportunity to teach a graduate course in hydrologic modeling at the university where I had taught 20 years earlier. Of the eight students in the class, only two have an interest in subsurface hydrology; the others are focused on surface water hydrology and surficial processes such as climate change, rainfall runoff, and evapotranspiration. When I taught 20 years earlier, almost all the students had their primary training and research in ground water hydrology. Similarly, in at least one program in Europe, Dr. Maas (2008), editor of the Dutch hydrological journal *Stromingen,* informed me that "… the Department of Water Management at the Faculty of Civil Engineering and Geosciences of Delft University of Technology … is thriving, but its focus is shifting away from the ground water hydrology, which has been its core for many decades."

Hydrology students in this generation are much more likely to have been attracted to our field by issues of global climate change, flooding, and drought than by ground water contamination. Large federal research programs, such as SAHRA (Sustainability of semi-Arid Hydrology and Riparian Areas), support interdisciplinary research at a number of institutions with students in hydrology and water resources programs. To undertake research of this nature usually necessitates course work beyond the core courses required for a degree, which some programs leave little room for. The necessary student training is much more interdisciplinary and may include more elective courses in biology, chemistry, and atmospheric sciences, for example, rather than electives in aquifer test analysis, hydrogeochemistry, contaminant transport and remediation, vadose zone hydrology, or numerical methods.

Many recent ground water program graduates, particularly at the master's level, do not seem to have the same depth of skills as in prior decades. The increased cost of education may partially explain why graduate students are reluctant to take additional electives (e.g., advanced ground water hydrology courses) to expand the depth of their education beyond what is required for their basic degree requirements and interdisciplinary research. Additionally, inasmuch as the preparation for quantitative work may not be as strong for students entering graduate school in recent years, some students may not elect to take advanced courses in ground water because the limited funding they had available was consumed taking prerequisite classes.

Education of students is a key mission of many federal and state organizations that sponsor hydrologic research. However, one professor in surface water hydrology recently indicated to me that there seems to be a serious disconnect between the research funding, which is primarily available in surface water and surficial processes, and the job market, where most of the student opportunities are in ground water (Vivoni 2008). Apparently, the National Science Foundation has recently shifted more funding emphasis from two-thirds in surface water research to two-thirds in subsurface hydrologic research. However, at the same time, there has been new funding for research programs in atmospheric sciences, ecohydrology, and climate change (James 2008). Not surprisingly, some earth science departments have recently added faculty in these areas to compete for research funding focused on climate change, such as in carbon sequestration.

Thus, not only are there far fewer students graduating with degrees related to hydrology compared to a decade or more ago, there appear to be fewer hydrology graduate students who emphasize ground water hydrology. Furthermore, the breadth and depth of course work the hydrology students complete may not prepare them as well for the job opportunities in ground water hydrology. If current conditions continue, we should expect increasing competition for less qualified graduates from hydrology programs in comparison to 10 or more years ago. Perhaps, this is already happening in the Netherlands, where Dr. Maas (2008) indicated that "new students seem to prefer interdisciplinary thesis topics like water management, rather than more fundamental subjects." Nevertheless, he goes on to note that in the Netherlands, "employment opportunities for hydrogeologists are good, as the amount of work to be done stays at its usual level, while hydrogeologists tend to become scarce."

No doubt the current undergraduate and graduate hydrology programs do an exceptional job at teaching students to think and solve problems in general. But owing to diminished academic training in ground water hydrology, solving the diverse nature of ground water problems with confidence and competence will require longer periods of on-the-job training. This additional cost for training in hydrogeology, as well as the increased salaries graduates may command in this new market, will need to be passed on to customers and clients and ultimately the public.

Although global climate research has recently attracted the interest of many hydrology students away from traditional subsurface hydrology, there appear to be other forces that draw students away from the field of hydrology entirely. For example, the increasing earth science enrollment from the mid-1960s through the mid-1980s seems to correlate with the increasing price of commodities, such as gold and oil, as shown in Stephens (2008). In the past few years, the prices of oil and metal commodities have ramped up again and appear to have contributed to increased student interest in these fields, perhaps at the expense of courses and careers in hydrology and water resources. One professor recently indicated to me that students with bachelor degrees in petroleum fields are offered entry-level salaries roughly two or more times those offered to master's degree students in the environmental and water resources fields (Sharp 2008). A recent salary survey of geoscientists (Martinez 2007) bears this out (Table 2).

Demographics

The baby boomer generation appears to have entered college and chosen careers at a time of heightened awareness of environmental issues in the United States. Figure 6 shows the age distribution of the U.S. population in 1970 and 2005. The median age of U.S. citizens has clearly increased, from 27 in 1970 to 36 in 2005, at a rate of about 2.8 years per decade (U.S. Census Bureau 2008). Likewise, the age of ground water scientists and engineers at the national level also appears to be increasing. Based on an informal survey of a limited number of Association of Ground Water Scientists and Engineers (AGWSE) members, in 1989, most members were in their late twenties to early thirties, but in 2001, most members were in their early forties (Figure 7). Similarly, Figure 8 shows an example of the age distribution and growth of a small environmental and water resources consulting firm. Based on these data, the average age of ground water professionals appears to have increased at roughly 4 to 8 years per decade. The greater rate of aging in the population of ground water professionals is most likely attributable in part to the reduction of young graduates entering the field and the retention and advancing age of mid- to senior-level personnel.

A 2003 forecast indicated that about 20% of USGS science staff and nearly 30% of the U.S. EPA's environmental protection specialists are now eligible for retirement (Durant 2003; Renewable Resources Journal 2003). I suspect that similar percentages of senior ground water hydrologists in many universities and consulting firms are eligible for retirement as well.

Table 2
Starting Salaries for Geoscience Master's Degree Graduates, 2007

	Starting Salary ($)	
Industry	**Average**	**Median**
Oil and gas	81,300	82,500
Environmental firm	47,500	45,500
Government	46,200	45,000

Source: Martinez (2007).

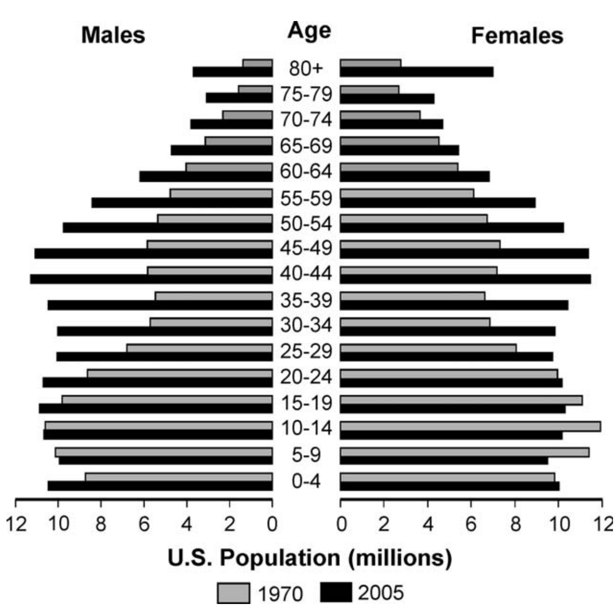

Figure 6. U.S. age population 1970 vs. 2005.

Discussion

The result of a conceptual "mass balance" analysis of incoming ground water scientists and engineers against the number of retiring professionals is clear: one would expect a decline in the number of ground water scientists

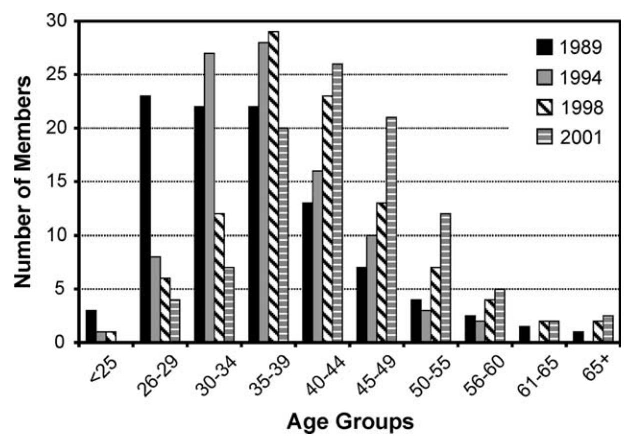

Figure 7. NGWA AGWSE division age of membership.

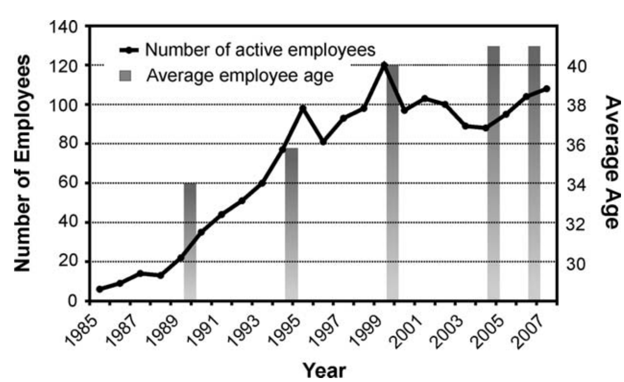

Figure 8. Example growth and age profile of a small environmental and water resources consulting firm.

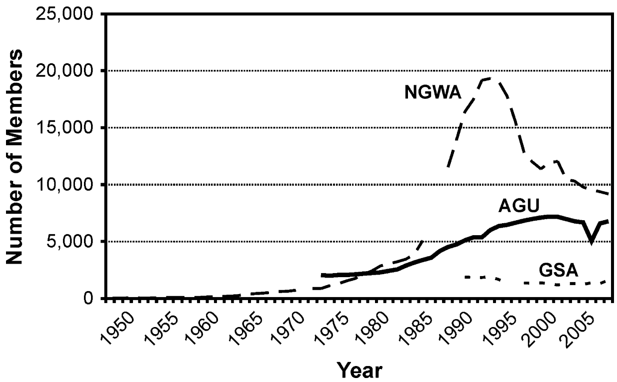

Figure 9. Membership in AGWSE-AGU Hydrology Section-GSA Hydrogeology Division.

and engineers. No data are available on the exact number of these ground water professionals, but this expected trend is supported by data given in Figure 9, showing membership trends in the National Ground Water Association (NGWA) and its AGWSE, the professional organization most strongly associated with the nonacademic practitioners of ground water hydrology. Figure 9 also illustrates that membership in some organizations more associated with employees of academic and research institutions, such as the Geological Society of America (GSA) Hydrogeology Division, has recently increased, and membership in others, such as the American Geophysical Union (AGU) Hydrology Section, is stable. However, there is no indication that the declining membership in NGWA/AGWSE has been simply absorbed by other organizations.

Although some of the rapid decline in NGWA/AGWSE membership after the mid-1990s was in part due to changes in state and federal cleanup programs, what one reviewer referred to as the "bursting of the remediation bubble" (Bredehoeft 2008), the subsequent and continued slow decline may be partially due to the reasons discussed earlier. That is, with fewer students entering the profession and more senior people retiring, the obvious question is this: by 2016, when the Bureau of Labor Statistics indicates that the demand for hydrology and environmental professionals will be well above average, will the labor force be sufficient to address the ever-increasing need for sustainable water supplies and water quality protection?

We may also see that with the recent downturn in the economy and housing market, more ground water hydrologists who are eligible to retire will remain employed longer. This would be a welcome relief to some organizations, but it would not provide a long-term solution. And this would not address the critical need for entry-level staff who bring the latest expertise and their enthusiasm to the field at an affordable cost.

One might think that there will be relief from foreign students, and in fact, currently for our quantitative positions, such as ground water modeling, applicants are mostly from foreign countries. About one-third of those receiving doctorates in science and engineering from U.S. universities are foreign students (Frauenheim 2006). Unfortunately, there are indications that fewer of the top foreign students are coming to the United States for training, perhaps in part because of increased restrictions on immigration and greater opportunities elsewhere (Frauenheim 2006) but also because of the proliferation of excellent subsurface hydrology programs at universities in or closer to their home countries, for example, in Spain, Israel, Switzerland, Japan, and China (Neuman 2008). Conversely, some traditionally strong academic programs in ground water hydrology, such as in the Netherlands, that formerly provided foreign workers to the United States appear to be in decline. And of the foreign students who do come here for education, more are apparently returning to their countries to work.

I recently spoke about this issue with a professor in ground water hydrology who noted that the problem extends beyond just hydrology. Professor Neuman (2008) stated, "[T]he problem appears to stem from national economic, educational and cultural trends; engineers have never been highly valued in the U.S. in comparison to Europe, China, Japan and India and our educational system, not only in the sciences, has been failing. I expect the trend to continue, the vacuum to be filled by foreign nations, and U.S. standing in our as well as in other areas of science and engineering, to gradually diminish." Unfortunately, a recent article indicates that now there is a very serious shortage of engineers in Japan, and they too will be looking to foreign countries to fill their needs (Fackler 2008). One of the reviewers of this manuscript who is employed by a ground water resources consulting firm in California says, "Our firm's attempts to hire qualified engineers for water resources work seem to have been an order-of-magnitude greater difficulty than hiring a qualified hydrogeologist. I also foresee the future deficit in qualified water resources engineers as being equal to or greater than ground water hydrologists" (Kretsinger 2008). Regardless of the value this country places on engineers, there seems to be agreement that ground water and water resources engineers are also in short supply.

In the United States, part of the problem obviously lies with the K-12 educational system and the lack of interest in science and engineering fields among high school graduates. Earth and environmental science training in some school systems stops at the middle-school level. Our first challenge is to improve our primary and secondary education systems to create an environment that encourages potential student interest in science and engineering careers.

We may need to just trigger the imagination of students at the elementary school level so that they later want to apply science and math. For example, Sputnik and the race for space may have been that impetus for many grade school students like me from the late 1950s and early 1960s, and perhaps today's grade school children will be motivated by the challenges of sustainable energy or global climate change issues. A key will be to continue to kindle this enthusiasm through middle and high school by continued exposure to science and math through stimulating curricula taught by motivated teachers and parental involvement in their child's educational choices (e.g., if a student does not take math in the ninth grade, they most likely will not be considering a career in science or engineering). Project Lead The Way (http://www.pltw.org) is one example of a national nonprofit effort designed to better prepare secondary school students for engineering careers. The NGWA and other organizations have recognized the importance of promoting earth science education and suggested outreach programs and other approaches to move forward (http://www.ngwa.org/govaffairs/statements/earthscience.aspx). At this time, it is probably too soon to assess how effective these initiatives have been or will be, but most likely these are long-term projects.

For those high school and college graduates who have acquired appropriate technical background, the career opportunities in scientific and environmental fields, and ground water hydrology in particular, must be better communicated to students, their parents, and their school counselors; a recent newspaper article describing environmental science, including hydrology, as a recession-proof field (Loeb 2008) sends the appropriate message. And for undergraduates in geology, soil science, civil and environmental engineering, and related fields, we need to do a better job of encouraging them to take a course in ground water hydrology and to consider the career opportunities in applications of science and engineering to ground water. The NGWA has recently developed an online career mentorship program and conducted a major initiative to introduce ground water careers to high school guidance counselors, but to be successful, the outreach might require more direct involvement in public awareness by ground water professionals.

Increasing numbers of students may return to ground water hydrology after the personnel resource shortage becomes widely known among student guidance counselors and the public and/or after salaries rise markedly. In the past, a downturn in the price of oil and metals led many geoscientists to ground water careers (Stephens 2008), but this is not likely to occur soon, if the Bureau of Labor Statistics forecasts are correct and the demand for geoscientists remains as great as that for hydrologists through 2016. In the meantime, to better serve our clients and the public in the future, we, as an industry and profession, should do all we can now to avoid a more serious shortfall in our nation's expertise in ground water science and engineering in the future. There is no doubt that expanded investments in science and math education in U.S. K-12 schools are sorely needed to benefit many fields, including ground water hydrology, over the next decade and beyond.

Conclusions

For many organizations, whether a consulting firm, a research organization, or a regulatory agency, their success is derived from the skills and judgment of the employees, that is, their human resources. Maintaining a team of quality staff to meet client needs is thus a strategic human resources issue in any such organization. Based on the information and trends available at this time, it appears that human resources will be an increasingly more critical strategic issue for many years. Unless the analysis is incorrect or the trends change, the following future conditions, in comparison to a decade or more ago, may be expected: (1) employers of ground water hydrologists may find, on average, fewer applicants; (2) the applicants are likely to have less depth of training in ground water hydrology; (3) additional on-the-job training may be required of entry-level personnel; and (4) the salaries of all hydrology professionals are likely to be substantially greater.

Environmental and water resources businesses have experienced good growth and expect this to continue, especially as there is an increasing public focus on water sustainability in a changing climate. To generate more interest in science and engineering will require outreach, most appropriately at a national level, to primary and secondary schools, parents, and students. And to attract the young scientists and engineers to ground water professions will require those of us now in this field to more aggressively communicate to students the excellent current and future career opportunities in ground water hydrology and mentor them in pursuing these careers.

Acknowledgments

I give credit to Professor Mary Anderson for encouraging me to write this article and thank the many people quoted and cited here for sharing their invaluable insights with me. I also appreciate the helpful input from Terri Thompson at the University of Arizona. I am very grateful for the cooperation of Professors Mary Anderson, Tom Meixner, Mary Poulton, and Rob Bowman, and their staff for kindly providing enrollment data. I also acknowledge the many helpful comments from reviewers of earlier versions of this manuscript, including John Bredehoeft, Tom Meixner, Nicole Sweetland, Shlomo Neuman, David Hargis, and Jimmie Jiao, as well as suggestions from the formal reviewers Vicki Kretsinger, Bill Alley, and Richard Laton. I especially thank Kevin McCray at NGWA for providing numerous reference materials. And finally, I acknowledge the assistance of staff at Daniel B. Stephens & Associates, Inc. for helping to prepare the manuscript, including Ellen Torgrimson (technical editor), Michael Bitner and Deb Salvato (compilations and research assistance), and Mark Wing (graphic arts).

References

Belitz, K. 2001. Ground water is alive and well—It just keeps shifting. *Ground Water Journal* 39, no. 4: 481.

Bredehoeft, J. 2008. Telephone communication, May. Albuquerque, New Mexico.

Bureau of Labor Statistics. 2007a. 2006-16 national employment matrix, detailed occupation by industry. http://www.bls.gov/emp/empoils.htm (accessed May 2008).

Bureau of Labor Statistics. 2007b. Occupational outlook handbook, 2008–09 edition, environmental scientists and

hydrologists. http://www.bls.gov/oco/ocos050.htm (accessed May 2008).
Durant, R.F. 2003. Demography as destiny? "Greening," "graying" & human capital challenges facing environmental management. *Renewable Resources Journal* 21, no. 2: 6–11.
Environmental Business Journal. 2008. Environmental industry overview: 2007 state of the industry. Zweig White webinar presented by Grant Ferrier, *EBJ* editor, 28 March.
Environmental Financial Consulting Group. 2007. Growth (internal): Historical perspective. Graph included in handouts for EFCG CEO Conference 2007, 17–19 October. New York.
Fackler, M. 2008. High-tech Japan running out of engineers. *New York Times*, May 17. http://www.nytimes.com/2008/05/17/business/worldbusiness/17engineers.html?scp=5&sq=Fackler&st=nyt (accessed June 3, 2008).
Frauenheim, E. 2006. Face of the future: The aging workforce. NetAssets, November 30, 2006. West Hollywood, California: HR Management Services Inc. http://www.hrms-netassets.net/templates/template.asp?articleid=2138&zoneid=63 (accessed June 2008).
James, D. 2008. E-mail correspondence, March 27. Albuquerque, New Mexico.
Kretsinger, V. 2008. Written communication, August. Sacramento, California.
Laton, R. 2008. Personal communication, April. Memphis, Tennessee.
Loeb, M. 2008. Want job security? Pick from these recession-proof fields. *The Sunday Journal*, June 15. Albuquerque, New Mexico: Albuquerque Publishing Company.
Maas, K. 2008. E-mail correspondence, May 5. Albuquerque, New Mexico.
Martinez, C. 2007. Competitive starting salaries for geoscience graduates. *Geoscience Currents*, no. 3, December 14. American Geological Institute. http://www.agiweb.org/workforce/Currents-003-StartingSalaries.pdf (accessed June 2, 2008).
Miller, C.T., and W.G. Gray. 2002. Hydrogeological research: Just getting started. *Ground Water* 40, no. 3: 224–231.
Neuman, S. 2008. E-mail correspondence, March 11. Albuquerque, New Mexico.
Renewable Resources Journal. 2003. Emerging demographic trends and responses. *Renewable Resources Journal* 21, no. 4: 9–16.
Rubin, D.K., E.M. Powers, P. Hunter, and T. Ill. 2007. Top 200 market analysis. *Engineering News Record*: 32–59.
Schwartz, F., and M. Ibaraki. 2001. Hydrogeological research: Beginning of the end or end of the beginning? *Ground Water* 39, no. 4: 492–498.
Sharp, J. 2008. Personal communication, April. Memphis, Tennessee.
Stephens, D.B. 2008. Recent trends in hydrogeology and environmental consulting and perspective on maturing of hydrogeology profession. *Journal of Hydrologic Engineering* 13, no. 1: 20–27.
U.S. Census Bureau. 2008. Population pyramids for United States: 2005. http://www.census.gov/ipc/www/idb/pyramids.html (accessed April 15, 2008).
Vivoni, E. 2008. Personal communication, March 7. Socorro, New Mexico.