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What is Advocacy? Gender Bias

Women in Academic Geoscience

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Increasing the Recruitment and Retention of Women in Academic Geosciences: Where We Are and Where We Should Be

By Jennifer Glass

**“I have always claimed
that there was no merit
in being the only one of a kind.”**

- **Florence Bascom** (1862-1945). Florence Bascom was the first woman to earn a Ph.D. from Johns Hopkins University, the first female geologist hired by the U.S. Geological Survey, and the first female officer of the Geological Society of America. She was also a professor at Bryn Mawr, founder of the Bryn Mawr geology department and mentor to numerous prominent female geologists. She modeled the geology program at Bryn Mawr after similar programs at male-only or coed colleges and insisted that her female students conduct field work despite women's participation in geology having previously been primarily indoors (e.g., paleontology, cartography). Many women geologists in the first part of the 20th century were followers of Florence Bascom (1).

“A department will have achieved gender parity when every student in it can look at the faculty and see at least one person whose life they wish to emulate.”

-**Mary Anne Holmes**, et al., *Nature Geoscience*, 2008. Mary Anne is the Director of ADVANCE-Nebraska, University of Nebraska-Lincoln's NSF-funded ADVANCE program to increase the number of women faculty in science, technology, engineering, and mathematics. This appointment grew out of her work on finding strategies to reduce the impact of gender barriers for women in the geosciences, which in turn grew out of her serving as President of the Association for Women Geoscientists (2000-2001). In 2008, AWIS honored Dr. Holmes as an AWIS Fellow for her dedication to work toward gender equity. She is a Professor of Practice in the Earth and Atmospheric Sciences Department at UNL. She has sailed on five Ocean Drilling Program cruises to three oceans and studies how past climates and delivery systems determine the type of fine-grained sediment that accumulates on the seafloor and what clays in ancient soils tell us about past climates.

Having just completed a Ph.D. in geological sciences and now preparing to embark on an academic career in geosciences, I am inspired by senior female professors who have

successfully juggled raising families and climbing the ranks in academia. I often wonder how they did it, whether I can do it, why some women don't succeed at it while others do, and what is keeping so many smart and capable young women from choosing this career path.

Earth science is of vital importance to society. Geoscientists strive to predict earthquakes and volcanic eruptions, forecast the effects of global climate change, and understand the evolution of life and global biogeochemical cycles through time, just to list a few research themes. Many women are fascinated by these topics, as illustrated by the fact that nearly 50% of the bachelor's degrees in geosciences are granted to women (2). Although recent statistics are not readily available, the percentage of female graduate students in geosciences is also relatively high, somewhere in the 30-50% range based on extrapolations from data gathered in the early 2000's (2). From personal experience first as an undergraduate student at the University of Washington and later as a graduate student at Arizona State University, I recall equal proportions of male and female peers. This was consistent with my observations when traveling to other departments around the country.

The geoscience gender ratios are changing as I transition into a postdoctoral fellowship and then an assistant professorship. Nationally, I only know a handful of women in my peer group who are actively applying for tenure-track assistant professorships and even fewer applying for them at top research universities. Data point to a large brain drain between graduate school and assistant professorships (2, 3), implying that academic geosciences are a less attractive career choice for female Ph.D.s. (This is a widespread phenomenon in not only geosciences but in many other scientific fields.) I have, on many occasions, heard male faculty cite high numbers of female undergraduate and graduate students as proof that their department is female friendly despite their departments being clearly male dominated at the faculty level. This gap is not closing at anywhere near the expected rate if the problem were simply due to lag time needed for the large numbers of female Ph.D.s to climb academic ranks (2).

What the data show

For this article, I compiled data on tenure-track and research faculty at all ranks for the top 106 U.S. earth science

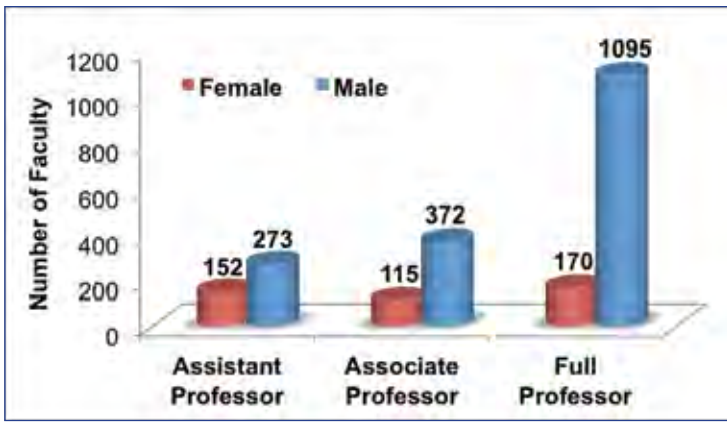


Figure 1. Numbers of female and male faculty members by rank at the 106 top-ranked PhD-granting geosciences departments. Data for 2010-2011 academic year. Credit: Jennifer Glass

Ph.D.-granting programs (2011 U.S. News & World Report), narrowing it down to departments with 5-50 faculty members. These data were obtained by counting the numbers of female and male faculty listed on departmental directories between November 2010 and May 2011. Adjunct and emeritus professors were not counted. I found that 20% (470 out of 2,324) of geosciences faculty were women. Females constituted 36% of assistant professors (33% of assistant research faculty), 24% of associate professors (30% of research associate faculty), and 13% of full professors (10% of full research faculty; Fig. 1). These numbers are up ~10% across the ranks from a 2002-2003 dataset, which found that on average 12% of the total geosciences faculty were female, made up of 26% assistant professors, 14% associate professors, and 8% full professors (2-4). Nevertheless, the 2010-2011 data remain well under the ultimate goal of 50% female geosciences faculty at all ranks.

At the department level, there were large ranges (0-40%) in total percentages of females on faculty (Fig. 2). There were no clear geographic (Fig. 3) or program rank trends; in the two top programs (MIT and Caltech), 22% and 18% of faculty were female respectively, whereas at the University of Alabama and Baylor University, with less popular programs, 27% and 7% of faculty were female. Percentages of female tenured (associate and full) faculty were generally lower than the total percentage of women in the department, with a few notable exceptions (Colorado State University, where 50% of faculty were women, all tenured; University of Nevada Las Vegas, 44%; Georgia Tech, 38%; University of Wyoming, 27%; and University of Wisconsin, 24%; Fig 2). This is important because women (including me) are often attracted to departments where there are already a significant number of senior female faculty members since they may have more family-friendly policies already in place.

In 2010-2011, the top five departments as far as percentages of female faculty were SUNY Buffalo Department of Geology (40%), Louisiana State University-Baton Rouge Department of Geology and Geophysics (40%), University of New Hampshire Department of Earth Sciences (37%), University of Massachusetts-Amherst Department of Geosciences (36%) and Universi-

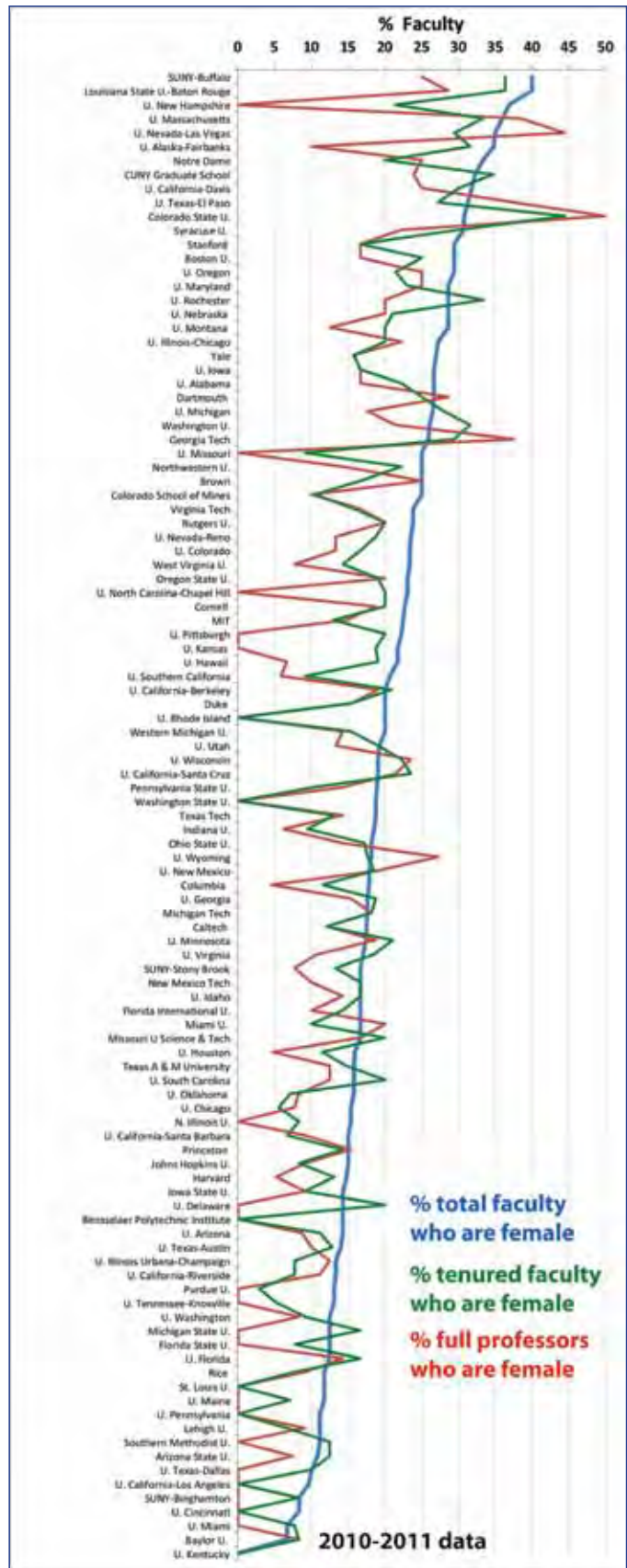


Figure 2. Percentage of female faculty by institution for 106 top-ranking PhD-granting geoscience departments in the U.S. Data for 2010-2011 academic year. Credit: Jennifer Glass



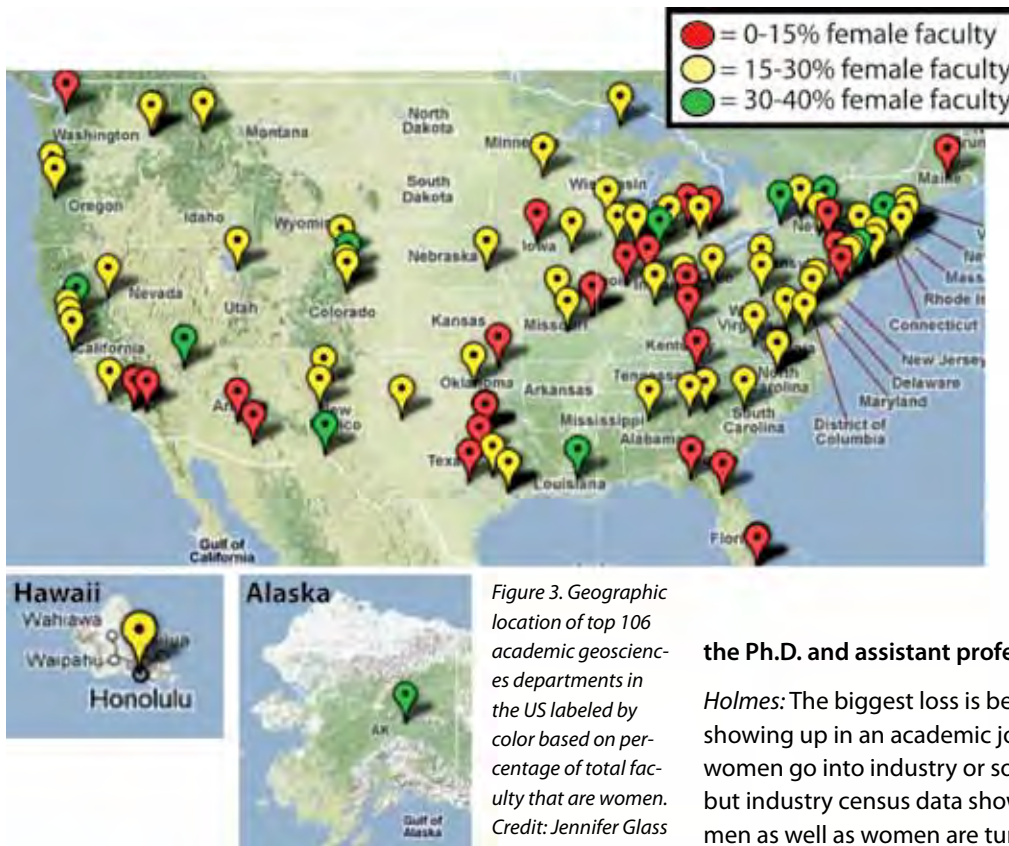


Figure 3. Geographic location of top 106 academic geosciences departments in the US labeled by color based on percentage of total faculty that are women. Credit: Jennifer Glass

cle in the prominent journal *Nature Geoscience* (2). I asked her about the findings she presented in that article and her opinion on improving recruitment and retention of women in academic careers in geosciences.

Based on your research, what are some critical reasons for the exodus of women from academic geosciences between

the Ph.D. and assistant professorship levels?

Holmes: The biggest loss is between receiving a Ph.D. and showing up in an academic job. Many people believe that women go into industry or some other “family-friendly” field, but industry census data show that this is not the case. Many men as well as women are turning away from the academic track because the bar keeps rising, the amount of work expected keeps ratcheting upwards. Mary Ann Mason and her co-workers at Berkeley have shown this. Many academic institutions are, in fact, more family friendly than is widely perceived. Most have some sort of stop-the-clock policy, and more and more people of either gender are using it. The reasons range from childbirth and adoption to coping with child custody issues, caring for elderly, and personal health reasons. “Stop-the-clock” is just the beginning; there are other policies, such as assignment shift (all teaching or all research for a semester) and temporary part-time, tenure-track positions. Academic institutions that do not have or are not exploring the implementation of these policies are going to be left behind in the search for top talent.

Please discuss some of the issues specific to geosciences that contribute to the lower representation of women in geosciences departments than in chemistry and biological sciences (i.e., field work/travel with children) and creative solutions that women and institutions can implement so that these issues do not slow women’s progress.

Holmes: Actually, many women in the biological sciences do field work; if you study tropical, freshwater fishes, you need to go the tropics for extended periods of time, for example. And some women in the geosciences do not do any field work (climate modelers, for example). But field work, especially oceanographic research, is a challenge for women with young families. I did not have this issue, but there are women in “Motherhood, the Elephant in the Laboratory” by Emily Monosson, who describe how they coped. Some women leave the kids with grandparents; some take them to the field. Some kids love going into the field with their parents and are now becoming

ty of Nevada Las Vegas Department of Geosciences (35%). The five departments with the lowest percentages of female faculty were SUNY Binghamton Department of Geological Sciences (8%), University of Cincinnati Department of Geology (8%), University of Miami Department of Geological Sciences (7%), Baylor University Department of Geology (7%), and University of Kentucky Department of Earth and Environmental Sciences (0%). Personally, I have accepted an offer from Georgia Tech School of Earth and Atmospheric Sciences (26% female faculty and female chair). I completed one of my undergraduate degrees at the University of Washington in the Department of Earth and Space Sciences, which now has 13% female faculty, which is lower than when I was there from 2003 to 2006. I did my graduate studies at Arizona State University in the School of Earth and Space Exploration, which has 11% female faculty. The scarcity of female faculty in the geosciences departments at both schools was very obvious to me, particularly at ASU. I believe that the shortage of role models in that department plays a key role in the decisions of many female students to pursue careers outside of academia.

Interview with University of Nebraska-Lincoln Professor Mary Anne Holmes

Many women educated in geosciences are not choosing to continue in tenure-track academic careers. What causes this massive deficit, and what can be done to fix it? To better understand the problem, I interviewed Professor Mary Anne Holmes, Director of ADVANCE-Nebraska, a faculty member in the Department of Earth and Atmospheric Sciences at the UNL, and author of 9 research articles since 2003 on gender imbalance in U.S. geosciences university departments, including a 2008 arti-

field scientists themselves. Others hated it and are heading to non-science jobs. So I think it's a bit hard to come up with a one-size-fits-all solution. I understand that NSF is currently exploring ways to help with childcare funding through grants. So funding agencies and departments might consider childcare costs as part of the cost of doing research.

In your 2008 *Nature Geoscience* article, you introduce three structural issues that influence women's choices to stay or leave academia: family issues, lack of female mentors, and lingering chilly climates in some departments and institutions. Have you observed that these three issues are improving since you have been in academia? What are some ways to speed up these structural changes?

Holmes: It is certainly improving for family issues, and there are more women on the faculty. I did not have one woman science instructor throughout my undergraduate career until my last quarter, when a woman plant pathologist taught 1/3 of the course. I did not have another woman instructor through my master's and my Ph.D. Most departments have at least one woman on the faculty; many have two, and a minority has more than that, so the "mentor" piece is improving.

The family issues are an institutional, structural problem that many institutions have addressed with the policies I mentioned for Question 1. Faculty need to keep hammering the administration to raise the funds to build childcare centers and to adopt policies already adopted by top institutions: stop-the-clock, assignment shift, temporary part-time positions (i.e., you may start out full time, go half-time for a while, and return to full time). The argument for these policies is an economic one: it is MUCH cheaper to mentor and retain the faculty that you have than to let them go, conduct a new search, and pay for the start-up costs of a new faculty member. Faculty can do the math and demonstrate this to the administration. As for chilly climates, these do remain. We need for the people who are sensitive to climate issues to speak up when somebody says something uninformed or thoughtless.

Great Resources:

- Tutorials for Change: Gender Schemas and Science Careers, Available at <http://www.hunter.cuny.edu/gendertutorial/>
- University of Wisconsin's WISELI program, Available at <http://wiseli.engr.wisc.edu/>
- University of Michigan's STRIDE program, Available at http://sitemaker.umich.edu/advance/recruitment__stride_

Please discuss your opinion on the issue of the pipeline ("time will solve the problem") as a reason for low numbers of women in academic geosciences.

Holmes: Time will not solve the problem because the larger numbers of women getting Ph.D.s will not make it all the way to full professor. They will drop out along the way because of lack of family-friendly policies and chilly climates.

Please discuss your goal of "gender parity" vs. critical mass in

academic geosciences. Can you provide examples of departments that have achieved gender parity that can be held up as examples?

Holmes: There are lots of examples, and I'm sure I do not know all of them. UC-Santa Barbara comes to mind, as does University of New Mexico, and at long last, my own department at University of Nebraska-Lincoln. The point I was trying to make with "gender parity" is that we need a wide range of role models, not just a certain proportion of women or number of women. My department had 5 women on the faculty, and none of us had kids. What kind of message did that send to our students? I can tell you: a very negative one, as many women students have come to my office over the years in tears because they thought they had to choose between the science they love and a family. But we're in the midst of a mini baby boom at UNL, with two new women faculty expecting in the next couple of months. It's completely changed perceptions. So whether moms, women married with no kids, unmarried women with a partner, singles...the point being, all can succeed in academia and live the personal life they want. And one person from any group cannot represent all points of view and all manner of living a happy life. ■

Additional Resources for Women Pursuing Academic Careers in the Geosciences

- <http://careerwise.asu.edu/>
- <http://www.mentornet.net/>
- <http://serc.carleton.edu/NAGTWorkshops/careerprep/index.html>
- <http://science-professor.blogspot.com/>

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