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WHO RECEIVES A GEOSCIENCE DEGREE?

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ABSTRACT

To match applicant pools for faculty positions, and ultimately, faculties with the available pool, the student population, we need data on who gets a geoscience degree. The National Science Foundation (NSF) provides these data; they reveal that in the past 10 years, 35–40% of geosciences bachelor's and doctoral degrees are awarded to women; yet, less than 30% of geoscience assistant professors at doctoral-granting institutions are women. The principal leak in the academic pipeline, then, occurs at the entry-level hiring stage.

How many women should be on geoscience faculty? We propose that the proportion of women on the geoscience faculty should approximate the proportion who earn geoscience degrees. An analysis of NSF data on gender and race/ethnicity of STEM degree recipients in the U.S. in the last 10 years reveals that 35% to 40% of geosciences bachelor's and doctoral degrees were awarded to women. Yet less than 30% of geoscience assistant professors at doctoral-granting institutions are women.

1.1. Bachelor's Degrees

The National Science Foundation and the American Geosciences Institute collect data on who receives what degree in STEM and earth and atmospheric sciences (EAS) fields, respectively (http://www.nsf.gov/statistics/sestat/; http://www.agiweb.org/workforce/). NSF's data extend from 1967 to the present (no data were supplied for 1999). Undergraduate degrees awarded to women in

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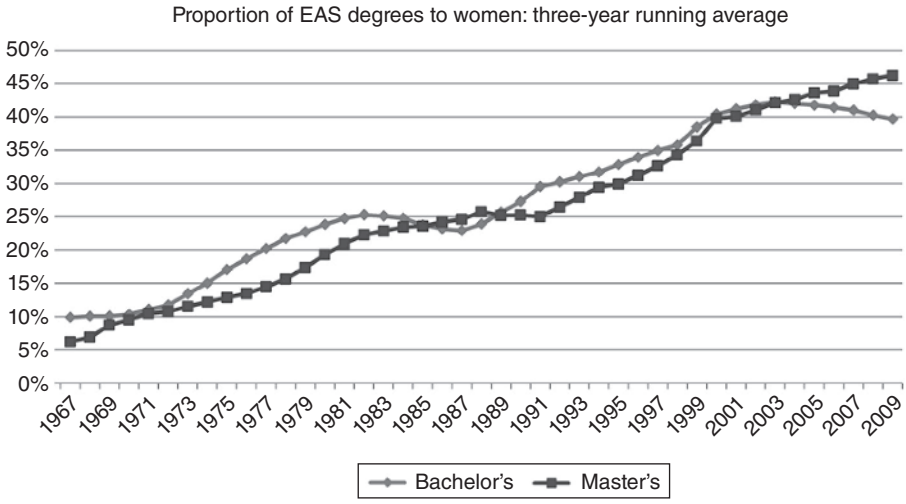

Figure 1.1 Proportion of Bachelor's and Master's degrees in EAS awarded to women. Data from *NSF*, 2013. For color detail, please see color plate section.

EAS fluctuate from 1967 to the present, but there is an overall upward trajectory, from 10% in 1967 to around 40% in 2010 (most recent data available; [*NSF*, 2011, 2013]) (Figure 1.1). Fluctuations appear to coincide with perceptions of the job market; that is, when the "oil bust" occurred in the mid-1980s, enrollments in geoscience programs declined rapidly. The decline was steeper for women than for men as indicated by the decrease in percentage of bachelor's degrees awarded to women during the oil bust (Figure 1.1). We have no explanation for why women would disproportionately not choose or would leave EAS when the oil job market declined. No studies of this phenomenon exist to date.

With time, the downward trend of the mid-1980s reversed. However, the proportion of women receiving EAS bachelor's degrees reversed again from its peak of 43% in 2002 (Figure 1.1). We know of no data that explain the current decline. In general, EAS underrecruits women to the field: since 1981, more than 50% of earned bachelor's degrees have been awarded to women; since 2000, more than 50% of earned STEM bachelor's degrees have been awarded to women [*NSF*, 2013]. The higher percentages are in the life sciences; the physical sciences and engineering continue to underrecruit women even more than does EAS.

Why would women not be attracted to EAS as a major? We asked focus groups of students for their ideas on this question, and both men and women cited their appearance, their clothing, as a turn-off to some portion of the student body. "We wear Carhartts and hiking boots and don't wear makeup" were the sorts of comments the students made. They told anecdotes of their roommates in other disciplines noticing our appearance and sometimes making disparaging or humorous remarks of the "field look." This phenomenon deserves more and better study; we

suspect that there are additional explanations for the underrecruitment that our research did not reveal. Positive things we can do to increase recruitment of the underrepresented are to focus on "critical incidents" in the geosciences pipeline, as detailed in *Levine and others* [2007].

1.2. Graduate Degrees

The proportion of women who receive a master's degree in EAS closely tracks the proportion receiving a bachelor's until the mid-2000s, when a greater proportion of women receive master's than bachelor's degrees in EAS (Figure 1.1). These data demonstrate that until the mid-2000s, EAS did a great job of equably recruiting students by gender from bachelor's programs into master's programs. This is not true of the physical or biological sciences: both disciplines lose women from their pipelines after the bachelor's degree [*NSF*, 2013; see chap. 1 for discussion of using the pipeline metaphor]. Why men are now being disproportionately lost from bachelor's to master's programs needs further study. Unless they are heading straight to PhD programs, this trend is cause for concern.

The proportion of women who receive a PhD in EAS declines from the proportion who receive a bachelor's or master's degree (Figure 1.2). As for most STEM disciplines, women leak from the pipeline disproportionately between the bachelor's and the PhD. When asked to explain this decline, geoscientists in focus groups in 2002 provided gendered responses: men mentioned "societal pressures"

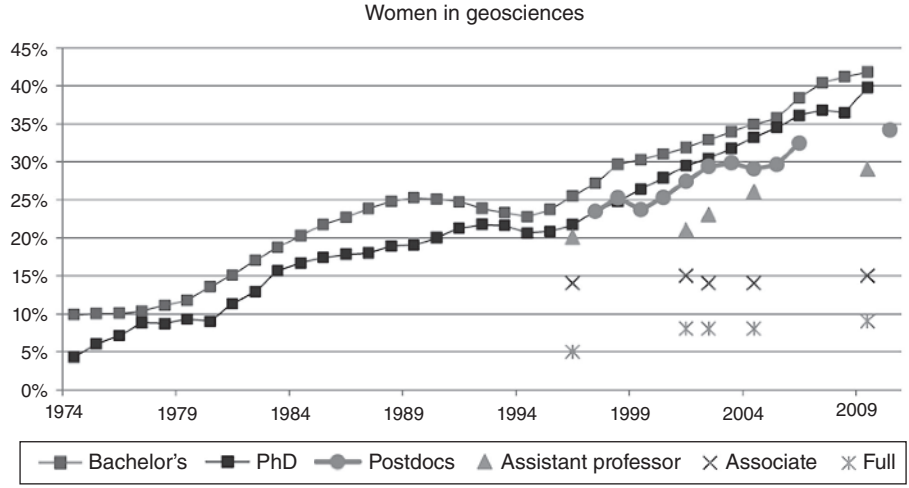

Figure 1.2 Proportion of women at various stages in the geoscience workforce pipeline. Student and post-doc data from *NSF*, 2013. Bachelor's degrees are forwarded by seven years to compare with PhD recipients. Faculty data from *AGI*, 1996–2012, for PhD-granting institutions. Bachelor's and Master's granting institutions have 3–5 higher percentage points of women faculty than doctoral granting institutions. For color detail, please see color plate section.

on women to have families, while women cited chilly department climates and the lack of structural support, such as daycare facilities [*Holmes et al.,* 2008].

1.3. On to the Profession

The proportion of women in postdoctoral positions closely matches the proportion who receive a PhD, indicating no or a small loss in the pipeline between PhD and postdoc [Figure 1.2; *NSF*, 2013].

The greatest leak (off-ramping) leading to academic positions occurs at hiring women into assistant professor positions (Figure 1.2). Research demonstrates that women feel both "push" factors for leaving the field between PhD and faculty position, and "pull" factors. "Push" factors are external factors such as implicit bias (see chap. 3), pressure from family or society to leave, lack of mentorship and encouragement to proceed in her career, lack of structural support for child care, and immobility due to partner's position, to name a few of these factors. "Pull" factors are those in her own life, personal circumstances that preclude her ability, interest, or desire to stay on an academic track. These might be a desire to care for family members (elders, siblings, or other family) or the overwhelming sense of a need to focus attention on a newborn.

Based on these data, applicant pools for faculty positions, and ultimately, the faculty itself, should have around 30% to 40% women in them to match the supply produced at the PhD and postdoc levels. We suggest strategies to increase the diversity of applicant pools in chapter 10.

The next chapter analyzes the faculty of the top 100 geoscience graduate programs in the U.S. as a sort of scorecard to see how we are progressing in creating a faculty that looks like our student body.

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