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Where Are the Women? Accounting for Discrepancies in Female Doctorates in U.S. Geography

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Although there have been noticeable improvements in recent years, geography continues to be a predominantly male discipline. The percentage of women receiving PhDs in geography has tracked lower than the U.S. average of female PhDs. Previous studies of women's contribution to geography have focused on personal accounts or on the study of some of the most prominent practitioners, with a few studies using basic data on PhDs awarded and Association of American Geographers membership to determine trends. This article provides a comprehensive overview of doctoral degrees in geography by gender, over time, and across all universities in the United States by examining an alternative database, that of doctoral dissertations. The analysis yields three separate types of results. First, historical and contemporary variations among U.S. universities are examined. Second, data indicate that male and female doctoral students differ in the sex of their advisor. Third, a simple regression model explains some of the discrepancies in the proportion of female doctoral students by department. In sum, this article provides a comprehensive empirical study of the factors that might contribute to the continued disparities in female doctoral students in geography.

Key Words: dissertations, gender, history of geography, women.

地理学儘管在近年来有了显著的改进，但仍然是一门由男性主宰的学科。根据记录，女性获得地理学博士学位的百分比，仍然低于美国女性博士的比率。过往针对女性对地理学的贡献之研究，多半聚焦个人记述，或是对几位最为著名的学者之研究，仅有少数研究运用博士学位授予的基本数据和美国地理学家学会的成员资格来判定趋势。本文透过检视替代性的数据集——博士学位论文，提供依照性别、时间历程以及美国所有大学的地理学博士学位综览。本分析生产出三种不同的研究结果类型。首先是对美国大学的历史性及当代变异之检验。再者，数据显示男性与女性博士生的指导教授性别具有差异性。第三，简明的回归模型部分解释了女性博士生就学所而言的比例差异。简言之，本文对于可能导致地理学中女性博士生的持续悬殊差异之因素，提供了综合性的经验研究。 **关键词:** 学位论文, 性别, 地理学的历史, 女性。

Si bien es notoria la mejoría ocurrida en años recientes, la geografía sigue siendo una disciplina predominantemente masculina. El porcentaje de mujeres que reciben el PhD en geografía ha marcado por debajo del promedio de los PhD femeninos en general. Estudios anteriores sobre la contribución de las mujeres a la geografía, para determinar tendencias, se han centrado en recuentos personales o en el estudio de las practicantes más destacadas del campo, con mínimos estudios que utilicen datos básicos sobre los PhD otorgados y membresía en la Asociación de Geógrafos Americanos. Este artículo provee un resumen comprensivo de los títulos doctorales en geografía por género, a través del tiempo y en todas las universidades de los Estados Unidos, examinando una base de datos alternativa, la de las disertaciones doctorales. El análisis produce tres diferentes tipos de resultados. Primero, se examinan las variaciones históricas y contemporáneas entre las universidades norteamericanas. Segundo, los datos indican que los estudiantes doctorales masculinos y femeninas difieren en el sexo de su consejero. Tercero, un simple modelo de regresión explica algunas de las discrepancias en la proporción de las estudiantes doctorales por departamento. En suma, este artículo provee un estudio empírico comprensivo de los factores que podrían contribuir a las perseverantes disparidades de las estudiantes doctorales en geografía. **Palabras clave:** disertaciones, género, historia de la geografía, mujeres.

Geography was an overwhelmingly male discipline in the early 1970s. Only 10 percent of all doctoral degrees had been awarded to women, fewer than 7 percent of women were employed as professors at colleges and universities, women constituted only one out of eight members of the Association of American Geographers (AAG), and only a few women figured prominently in the annals of the field. It was still, as Hart (1979) reflected back to geography in the 1950s, a field that “had little interest in recruiting anyone who was not eager to become one of the boys” (111). Twenty years later, it did not appear that much had changed. Another male

geographer, Zelinsky emphatically decried these gross disparities. “Ours is a lopsidedly male profession,” he wrote, “in which women are most conspicuous by their absence or rarity” (Zelinsky 1973a, 101). The few women who persisted were far less likely to attain the jobs, status, and salary of their male colleagues (Zelinsky 1973a; Zelinsky, Monk, and Hanson 1982).

In the forty years since Zelinsky and Hart's rebukes, organizations, commissions, panels, and studies have been established to promote the status of female geographers, and there have certainly been remarkable strides. At the same time it would be foolish to think

that we have achieved a position of parity. Major gaps continue to exist along all of the key criteria mentioned by Zelinsky and others since (Lee 1990; Holmes and O'Connell 2003; Pandit 2004; Solem, Lee, and Schlemper 2009). Although several studies document these disparities through more qualitative measures, we believe that the exact contours of such gaps benefit from a comprehensive, quantitative approach. This enables a test of some of the assumptions underlying the underrepresentation of women as discussed in the literature and might point the way to further quantitative and qualitative research on the topic.

In this article, we offer insights into the changing presence of women in geography by looking at their representation among all doctoral completions in the United States by university and identify persistent differences between PhD-granting departments. First, we use doctoral dissertations from 1888 through 2012 to chart the growth of women in geography in general and in separate departments. Second, we focus on contemporary differences among departments and try to account for these substantive disparities. This can provide some key insights into how women have fared and continue to fare in the field and in the subtle and not so subtle differences by gender.

Research on Women in Geography

Women have long been at the periphery of academia, primarily due to the "male career model" in which women were expected to stay at home and raise a family (Wolfinger, Mason, and Goulden 2008). As more women entered the workforce, numbers of female academics increased as well (Chiswick, Larsen, and Pieper 2010). Yet women remain underrepresented in the science, technology, engineering, and mathematics (STEM) fields and as faculty (Carr 2013; National Science Foundation 2013a; National Student Clearinghouse Research Center 2015). These data suggest that disciplinary-scale research such as ours sheds light on both inter- and intradisciplinary gender disparities.

Taken in its largest sense, the overall research on women in geography is voluminous. Feminist geography as a methodological approach enjoys a rich literature and a robust presence in several academic journals (for some good overviews, see Oberhauser et al. 2003; Johnson 2008). The discussion of women as contributors to the discipline of geography is more scattered, though. We can discern two research strands here. On one hand, there is a chronicling of the experiences of women in various departments and geographic societies. On the other hand, there are reports of the status of women in the discipline, evidenced by numbers and proportions of women as students, professors, and professional members. Although distinct from feminist geography, the presence and experience of women in the field certainly shapes geographic research. As Hanson (2004) pointed out, research questions emerge from who is doing the

asking and where they are positioned. Questions raised by female geographers might be different from those raised by their male colleagues even if they are engaged in similar research.

Our understanding of the experience of women, particularly in the earlier periods of geography, comes from archival research as well as the personal reflection of women in geography. Many of these pioneers came of age at a time when geography was almost exclusively male, and their stories shed light on the early prejudices and barriers faced by women who were trying to become professional geographers. Monk (2003, 2004, 2006) documented many of the earliest barriers that kept women from entering fully into the field. For example, entry into the AAG was initially by invitation only and women were discouraged from becoming members. Gender bias was manifest in women's employment in academic departments. Many women had difficulty securing jobs even as they provided the necessary credentials, because they could not overcome a prejudice toward male professors. Berman (1984) recounted the midcentury period when most college women were expected to take a secretarial job and then find a husband. Her account details a multitude of slights and inequities: men who were promoted over women because they were starting families, women who were expected to spend much more time on teaching than research, and clear discrimination in regard to tenure and promotion. One professor at Eastern Michigan commented that she was "urged to by all of the outstanding geographers to 'keep going back to school, but don't worry about a Ph.D., it won't help a woman'" (Leffler 1965, 35).

At the same time, we can trace the histories of those women who were able to overcome the obstacles to specialize in geography. Monk (2004) showed that there were a large number of women who found opportunities in normal schools where they were able to teach teachers as well as in some of the associations and agencies outside of academic departments. She also discussed how some departments did have a far more welcoming environment toward women (Monk 1998). Women's colleges such as Mount Holyoke hired several female instructors during the early and mid-twentieth century (Enggass 1988). Beyond the academy, Tyner (1999) discussed the large cohort of women who found jobs as professional cartographers, beginning with the war years of the early 1940s but extending beyond this.

The second research strand of women in geography relies on surveys and large institutional data sets. The first comprehensive account came from a master's thesis written at the University of Oklahoma. Here Lefler (1965) presented the results of a survey that she sent to 500 women, all but a few of whom were graduate students or held a graduate degree. Half of the women in this sample had stopped at a master's degree. In the 1960s, colleges did not necessarily require a doctorate and several survey respondents

wondered whether a PhD would have any value. Despite Leffler's conclusion that the problems encountered by women were similar to those of men, her actual survey results indicated that women who wanted marriage and families had to run a gauntlet of obstacles that placed significantly more pressure on them.

By the 1970s, institutional attention was slowly turning to the low number of female geographers. Beginning with Zelinsky (1973b), there was an effort to examine the numbers of women in geography, how these changed over time, and how this compared to other disciplines. Zelinsky probed differences in the professional work of male and female geographers and the numbers who published in the leading journals at the time. In all of these cases, there was some evidence of progress but not nearly enough and not as clear as it might have been. Here is one telling data point: There were only five women among the 306 faculty in the twenty-one leading doctoral programs. Nearly twenty years later, Lee (1990) showed evidence of slow improvement with most departments having at least one female professor but often no more than that.

A survey conducted in 1998 found that women comprised a very small number of tenured faculty and an increasing number of graduate students and representation in journal articles (Brinegar 2001). At the same time, the number of doctoral degrees earned by women in geography in the 1990s was lower than that of social sciences as a whole and of all higher education institutions (Chiswick, Larsen, and Pieper 2010). Pandit (2004) looked at the percentage of women with graduate degrees in geography, as well as their membership in the AAG, and concluded that the trends in female representation were somewhat encouraging, although challenges remained.

What accounts for these disparities? Brinegar (2001) argued that it reflects geography's male orientation, which emphasizes positivism and competition as opposed to a female tendency toward cooperation and an interest in feminist and gender studies. She also highlighted a number of "micro-inequities" that can continue to divide the male and female collegiate experience. Providing a less essentialist analysis, Schlemper and Monk (2011) delved into various elements that influence the departmental climate, including a history of inclusion, the structural diversity of the department, and psychological and behavioral dimensions that can be quite pertinent. Based on interviews with faculty and focus groups with students, they found that many female graduate students look for female faculty who can act as mentors or role models. According to Schlemper and Monk, there is also an impression that the topical emphasis of a department could affect the gender balance. The nature of the geography department compels female graduate students to challenge some of the existing power dynamics, develop networks, open up lines of communication, and find the appropriate advisor or mentor (Hansen et al. 1995).

Accounts of women's experiences suggest why academia in general and geography in particular have been inhospitable. Surveys and focus groups provide some of the answers to these questions, as well as potential avenues for advancement. Yet, we still lack a more comprehensive overview that can measure (1) the concrete disparities between different departments in regard to the percentage of women who receive doctorates and (2) what factors account for these disparities. These were questions posed by Monk (2004) at the conclusion of her essay on women in U.S. geography. Our dissertation database allows us to answer the first question fully, noting differences as they exist now and over time. We can begin to answer the second question by looking at clear measures that qualitative research suggests account for these disparities, notably the percentage of women on department faculties and the topical specialization of each department.

Creating the Databases

For this project, we first assembled a comprehensive database of all dissertations in geography, limited to the United States. The vast majority of our dissertations came from Dissertation Abstracts International, filled in with information from the AAG *Guide to Programs in Geography* and *The Professional Geographer*. Gender is not a field in any of these sources, so we determined gender based on a series of steps. First, we identified easily gendered names, such as Norman or Susan. We believe that misidentification of gender was possible but minimal due to gender standards of most U.S. names. Second, we used the Web site www.genderchecker.com, which identified the gender of names based on the UK census and crowdsourcing. Third, we used Google's search engine to find each of the remaining 1,000 individuals to ascertain his or her gender using images and personal pronouns. Only 1.7 percent of dissertations were unassigned after these steps.

We also identified the advisor for each of the dissertations produced after 1990. In the Dissertation Abstracts International records, the advisor is typically listed, but there are several dissertations where this information is missing. Therefore, we searched the content of the remaining dissertations to find advisor names. This allowed us to fill in most of the blanks, so that 97.5 percent of dissertations produced since 1990 were assigned an advisor. The addition of advisor information also allowed us to trim our overall database further by removing those dissertations advised by individuals clearly outside of geography departments. From here, we added a further field for the gender of the student's advisor, following the same process as the larger database. In a coadvising situation, we considered the advisor to be female if either of the coadvisors was female.

We compiled additional data on departments by taking the number of faculty for 1990–1991, 1995–1996, 2000–2001, 2005–2006, and 2011–2012 listed in the AAG *Guides to Programs in Geography* and averaging the results. These data gave us information on the gender makeup of the faculty at various points in time, as well as the percentage of faculty specializing in human geography, physical geography, geographic information systems (GIS)/cartography and human and environment. There were clearly a few judgment calls in assigning faculty to one of the categories, but we tried to be as consistent as possible. Where mixed interests were listed, we tended to defer to the first stated interest unless it seemed clear that the interests lay in another area. (An example of the latter would be where a faculty member mentioned remote sensing first but her remaining interests were clearly in the realm of physical geography.) In assigning faculty, we counted only permanent faculty listed as assistant professor or above. High-ranking administrators—provosts, deans, and so on—were not counted, nor were adjuncts or faculty on regional campuses if that information was provided. In hybrid departments—especially where another academic field like geology or anthropology was clearly represented, we made a decision to separate out the geography faculty from the rest to not distort the topical distribution.

Gender in Geography PhD Production

Earlier work showed that the overall number of PhDs in geography increased tremendously over the course of the twentieth century (Kaplan and Mapes 2015). In the same light, the number of female geography PhD students also increased, both in absolute and proportional terms. The first geography PhD written by a woman did not occur until 1917: the future *Geographical Review* editor Gladys Wrigley's "Roads and Towns of the Central Andes" at Yale University. Following this, there were thirteen doctorates published in the 1920s, twenty-three published in the 1930s, and another eighteen in the 1940s. These constituted about 10 percent of all dissertations. Figure 1 demonstrates the proportional rise in female PhDs from 1950 until the present day. During the 1950s and 1960s, there were more female PhDs overall but the proportion to all PhDs remained the same. It was only after the mid-1970s that the proportion of women getting a doctorate in geography increased; by 2002, it was about 40 percent of the total. By 2012, women constituted 45 percent of doctorates received. As a point of comparison, this is less than the 50 and 55 percent averages for social sciences and life sciences, respectively. Geography far surpasses the physical science average of 29 percent but remains close to the geology and earth science average of 43 percent and behind the environmental science average of 53 percent (National Science Foundation 2013b).

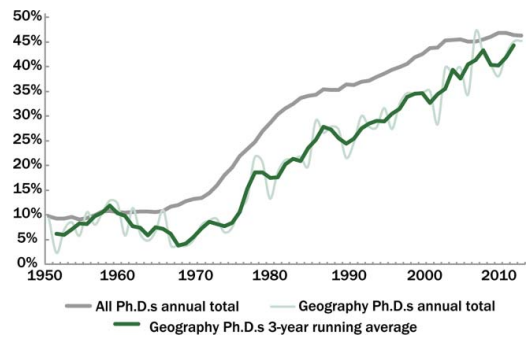


Figure 1 Female percentage of completed doctorates, by year, 1950–2012. Source: Authors' database; Chiswick, Larsen, and Pieper (2010). (Color figure available online.)

Historically, the presence of women in geography has been lower than what is found in all academic fields together and much lower when compared to social science, humanities, and especially education doctorates (Chiswick, Larsen, and Pieper 2010). To be sure, some geographers consider themselves to be natural scientists, but many geographers also consider themselves a better fit with social science or the humanities. So why are the proportions of women low when comparing geography with some other fields? This larger question is difficult to answer, but it might be possible to make some headway in identifying differences between geography departments in regard to their female representation.

Figure 2 shows some of the changes in twelve leading departments of geography since before the mid-twentieth century. The first point is that all of these departments evidence higher proportions of female doctorates with each passing decade. Previous research showed which departments were dominant at different points in time, and unfortunately some of the more prominent departments no longer produce geography PhDs. As shown in Figure 2, the University of Chicago graduated its last doctorates in the early 1990s. Yet, before the 1960s, when it was the single largest producer of PhDs, it also graduated a significant number of women compared with other universities. Other schools, such as Clark University, have long had a small but persistent proportion of women among their PhDs. Contrast this with departments like Berkeley and Washington, which were almost exclusively male until the 1970s.

Demonstrating the differences between departments is made a bit easier by examining the percentage of female PhDs in the last couple of decades. For instance, Chicago would not fare well if all years were taken because it produced so many of its PhDs at a time when there were few women graduating. Table 1 shows the case for most geography PhD programs (those that graduated over thirty-five total PhDs) since 1990. Women constituted half or more of doctorates at four universities, headed by Rutgers, and another twelve were over 40 percent. In most cases the

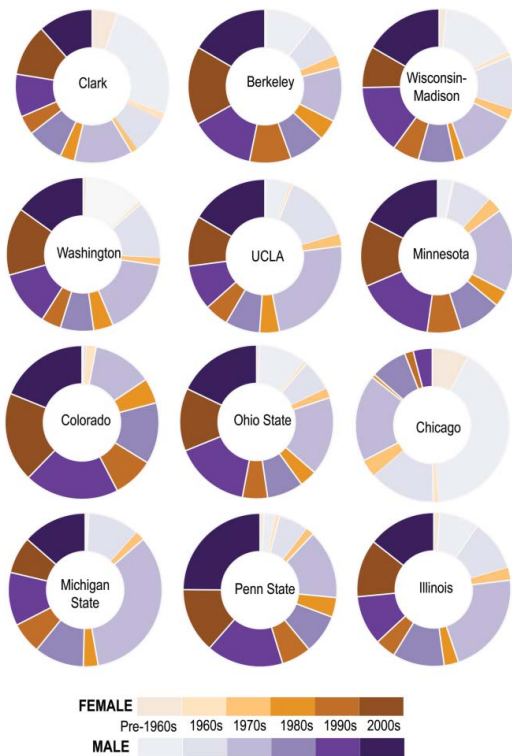


Figure 2 Production of PhDs by the twelve leading geography departments, by decade and gender. Source: Authors' database. (Color figure available online.)

proportions of women grew during this period; taking the data between 2000 and 2012, seven universities were at or above parity. At the other end, there were fully twelve universities where women doctorates were 30 percent or less, among them such large PhD generators as Penn State, Buffalo, Kansas, and Georgia. These differences between departments are substantial enough that it seems unlikely to occur by chance alone.

Examining differences between universities allows a testing of several assumptions about why women might or might not enroll in certain PhD programs. Previous research in geography has been either much more general, showing overall trends often based on numbers provided by the AAG, or qualitative case studies regarding departmental climate.

What Might Account for Differences by Department?

There has been a fair amount of speculation as to some of the factors that might affect the proportion of women enrolling in PhD programs. One notable assertion is that there is a relationship between the presence of women on the faculty and female PhD students. Studies in other disciplines have suggested

this relationship is important (Hoffmann and Oreopoulos 2009; Carrell, Page, and West 2010; Ceci et al. 2014). One recent study in economics looked at the factors accounting for the proportion of female doctorates among elite programs and did find strong evidence that the proportion of women in economics faculty affected the proportion of female doctoral students six years later (Hale and Regev 2014). This is mediated through the influence of female faculty on admissions decisions, reducing prejudice against women, and a preference of graduate students for working with female faculty. Within geography, this is a view long held by many in the field (Oberhauser et al. 2003). Lee (1990) suggested that a small number of female faculty would prove problematic for female graduate students inasmuch as it would be difficult to establish a mentoring relationship with male advisors. Schlemper and Monk (2011) reported how both faculty and student interview subjects thought that faculty composition was an important criterion to having a more diverse student body.

Another view is that the proportion of female graduate students is related to the subdisciplinary mix of the department: Some areas are more attractive to women, whereas some areas are less so. An older article by Brunn (1995) noted the different types of manuscripts submitted by men and women to the *Annals of the Association of American Geographers*. During the period of investigation (1987–1993), no women submitted articles on models or in the GIS field, except for cartography.

Another aspect that has been less mentioned recently but could still be important is relative departmental prestige. This could cut both ways. Very early work indicated that women were more likely to go to a university closer to home than were men (Lefler 1965), which could translate into attending less highly ranked departments. Alternatively, if departments had a preference for female applicants, as a means of increasing gender diversity, that could lead departments to admit a higher proportion of female students.

Gender in Advising Relationships

One plausible reason why more women on a faculty might be important is because it provides a greater pool of potential advisors for female graduate students (Neumark and Gardecki 1998). The more qualitative treatments of this topic mentioned that some women feel more comfortable working with a professor of the same gender. To test this hypothesis with our data, we determined the gender for each doctoral student's advisor. If gender was unimportant, one would expect that both male and female students would be equally likely to choose a male or a female advisor or, because this is often a two-way street, that female and male professors would choose male and female students in equal proportions.

Table 1 *Percentage of female doctoral graduates by department*

1990–2012			2000–2012		
University	Female %	Total	University	Female %	Total
Rutgers University	56.4	101	University of Texas at Austin	60.0	46
University of Oregon	52.9	68	Rutgers University	58.8	68
Syracuse University	50.0	83	University of Oregon	57.1	49
University of Texas at Austin	47.4	79	University of Florida	55.8	43
Texas State University	46.7	75	University of Delaware	52.4	21
University of Delaware	46.5	43	University of Washington	50.5	94
California, Berkeley	45.1	165	Colorado at Boulder	49.1	108
North Carolina at Chapel Hill	44.6	95	University of Hawai'i	48.8	44
University of Washington	43.5	132	Clark University	48.7	115
Oregon State University	42.9	56	North Carolina at Chapel Hill	46.9	65
Colorado at Boulder	42.3	182	Texas State University	46.7	75
University of Florida	42.3	78	University of Illinois	46.7	45
Clark University	42.2	182	Syracuse University	45.7	35
University of Cincinnati	40.0	49	California, Berkeley	45.5	100
University of Illinois	40.0	70	University of Minnesota	43.6	95
Boston University	39.8	92	University of Utah	43.2	39
University of Hawai'i	39.0	79	Wisconsin–Milwaukee	42.9	28
Southern California	38.9	37	University of Maryland	41.9	66
Florida State University	38.6	44	Southern California	41.9	32
Michigan State University	38.0	79	Ohio State University	41.2	89
University of Minnesota	37.6	152	Boston University	41.0	64
Louisiana State University	36.4	125	University of Arizona	40.0	76
Ohio State University	36.2	144	UCLA	40.0	81
University of Utah	36.2	61	University of Kentucky	39.5	38
UCLA	36.1	120	Oregon State University	39.4	33
Wisconsin–Milwaukee	35.8	53	University of Iowa	39.4	33
University of Maryland	35.3	89	Louisiana State University	38.5	69
Arizona State University	34.6	106	Arizona State University	36.9	67
University of Tennessee	34.0	50	Florida State University	36.6	41
University of Kentucky	33.9	62	University of Tennessee	36.4	33
University of Nebraska	33.8	70	Michigan State University	36.2	47
University of Arizona	33.3	107	University of Cincinnati	35.3	36
Wisconsin–Madison	32.7	113	Indiana University	34.5	30
West Virginia University	32.4	37	West Virginia University	34.4	32
California, Santa Barbara	30.1	173	Wisconsin–Madison	33.9	64
Pennsylvania State	30.0	122	Pennsylvania State	32.9	80
University of Iowa	29.7	64	California, Santa Barbara	32.7	110
University of Georgia	29.3	100	University of South Carolina	32.7	57
Indiana University	28.9	46	University of Georgia	30.2	54
University of South Carolina	28.4	90	Texas A&M University	29.5	49
University of Oklahoma	27.8	55	University of Nebraska	28.9	46
SUNY Buffalo	27.3	157	SUNY Buffalo	27.6	112
Texas A&M University	26.8	77	University of Oklahoma	26.3	38
Kent State University	25.0	52	George Mason University	25.0	51
George Mason University	24.0	53	Kent State University	25.0	28
University of Kansas	18.4	101	Indiana State University	17.2	30
Indiana State University	16.0	54	University of Kansas	16.7	67

In fact, our results show that this is not true. We considered data on female faculty alongside advisorship and found that rates of female faculty advisorship of PhD students are far less than the total female faculty and that, in fact, this divergence has not improved (Figure 3). We then considered the percentage of female students with female advisors and compared this to the percentage of male PhD students with female advisors. The percentage of female students with female advisors tended to be on par with the percentage of female faculty overall. Between 1990 and 1999, 20 percent of female students worked with female advisors; in 2001, 21 percent of faculty were female. Between 2000 and 2012, 30 percent of female students worked with female advisors; in 2012, 29 percent of faculty were female. The percentage of male students with female advisors, however, tends to

be far lower than then would be expected given the rates of female faculty. Between 1990 and 1999, 9 percent of male students worked with female advisors, and between 2000 and 2012, 18 percent of male students worked with female advisors. This gap decreased in size over time, however, with a 76 percent difference between male student advisorship and female faculty percentage in 1990 to 1999, versus only a 48 percent difference in 2000 to 2012.

Factors Affecting Percentage of Female Doctoral Students

So which of these factors seem to best account for the percentage of female PhDs by department? After examining a number of possible models, we decided

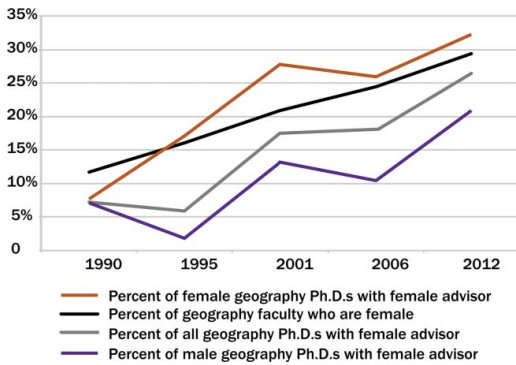


Figure 3 Percentage of geography PhDs with a female advisor compared to percentage of female geography faculty, 1990–2012. Source: Authors' database. (Color figure available online.)

on a fairly straightforward regression model that considered the percentage of female PhDs produced by each department between 2000 and 2012 as the dependent variable. Although our database goes further back, we felt as if there has been enough recent progress to focus on the most contemporary period. In addition, because the average doctorate in social sciences takes just under eight years to earn and the average for those in physical sciences about seven years (Hoffer and Welch 2006), this variable captures those students who began their graduate degrees between the early 1990s and the mid-2000s, which is important when considering the dependent variables.

To explain the percentage of female PhD students, we began with several variables that we then reduced.¹ Female faculty percentage measured the average percentage of female faculty for all the years scanned between 1990 and 2012 for each department. Female faculty change measured the absolute percentage change between the average female faculty percentage between 1990 and 1996 compared with the average female faculty percentage between 2006 and 2012. If the percentage of female faculty rose from 10 percent to 20 percent this registered as a +10 percentage point change. If it declined from 10 percent to 7 percent, this registered as a –3 percentage point change. For each department over the five sample years shown earlier, we categorized the faculty into four domains. For these models, we employed the percentage of faculty in GIS/cartography and the percentage of faculty classified as human and environment faculty. The percentage of regular human geography and physical geography faculty did not correlate highly and so were omitted. Finally, we included the percentage of female doctorates between 1990 and 1999 with the notion that a higher proportion of women within a department might spur more female applicants, which would be reflected in future doctorates.

Our results are shown in Table 2 under "First Model." This initial model indicated that only two variables are significant in predicting female PhD

Table 2 Factors affecting percentage of female doctoral graduates, by department

	Dependent variable: Female PhD % 2000–2012			
	First model		Second model	
	B	Sig.	B	Sig.
Female faculty %	0.316	0.161		
GIS/cartography faculty %	–0.363**	0.034	–0.389**	0.016
Human/environment faculty %	0.358**	0.026	0.315**	0.040
Female faculty change	0.034	0.839	0.065	0.650
Female PhD % 1990–1999	0.195*	0.090	0.212	0.057
Students with female advisor %			0.272**	0.042
Model summary	R^2		R^2	
Model	0.40		0.44	

Note: *Variables at 90% significance level; **Variables at 95% significance level. GIS = geographic information systems.

production and both measure the subdisciplinary composition of each department. Female PhDs are negatively affected by the GIS composition of the faculty and positively affected by the human and environment composition. (Earlier analyses had demonstrated a negligible effect of the two omitted variables of human geography and physical geography faculty.) Although there has not been any empirical work done on doctorates and subdisciplines per se, these findings corroborate other information. Data from the AAG in 2002 show that among the specialty groups with the highest proportion of female membership were qualitative methods, human dimensions of global change, environmental perception, and cultural ecology (Monk 2004). Although Monk's research does not specify specialty groups with the lowest proportion of female membership, earlier research (Goodchild and Janelle 1988) found the lowest rates of female membership to be in transportation and political geography, as well as climatology, modeling, and some regional specialty groups (China, Canada, and the Soviet Union).

The surprise in these results is that the female percentage of the faculty is not statistically significant, despite quantitative research in other fields and a fair degree of qualitative research in geography that suggests that it would be important. A simple bivariate correlation shows $r = 0.29$ between proportion of female PhDs between 2000 and 2012 and female faculty percentage between 1990 and 2012, but this is washed out when other variables are considered. In addition, the percentage of female doctoral students between 1990 and 1999 is not significant at the 5 percent threshold, but it is significant at the 10 percent level. This suggests that female graduate applicants might react somewhat to the existing proportion of female students in the department.

Given the discrepancy between the qualitative studies that suggest the significance of female faculty for female graduate students and the statistical

insignificance of the variable we employed here, we decided to develop a different variable. We suspected that a better proxy would be to examine actual graduate advisorship by female faculty. This was constructed by measuring the percentage of all students between 1990 and 2012 with a female advisor, broken down by department. The “Second Model” in Table 2 shows that when this variable was substituted into the equation, it was indeed significant, along with the two sub-disciplinary measures. The revised model is fairly robust, with $R^2 = 0.44$.

Although the model does explain a substantial amount of the variation, there is still much that is unexplained. This is likely a combination of attributes and chance that cannot be measured with objective variables. Hurtado et al.’s (2008) discussion of departmental climate mentions several potentially important items relating to support networks, quality of interactions, and the overall psychology of a place. On an ad hoc basis, there might be opportunities to point to particular departmental practices that create a greater or lesser sense of welcome. Is there anything that the schools with more women than expected are doing that the other schools are not? Relatedly, it would be difficult to see how the schools with fewer than expected female students are putting up additional barriers compared to the other universities. As more research is conducted, perhaps new measures can be constructed that help lead to some best practices.

Conclusions

The discipline of geography has changed considerably in the last century, in the topics it studies, the methodologies it employs, and the way it considers the world. Its practitioners have also changed. The discipline has become increasingly diverse in every way but probably more so in relationship to the number of women who have entered the field and who earn the doctoral degree. Still, geography lags behind many other disciplines in the percentage of female doctorates and has yet to reach gender parity. Why this is the case has been the subject of much speculation, some general observations, and several good qualitative analyses related to departmental climate.

Up to this point, we have lacked a more systematic examination of gender disparities. One source of variability is geography PhD programs. Some of these have already achieved gender parity, whereas others have less than one out of four female graduates. These department differences allow for the testing of some potentially important variables, notably the percentage of women on the faculty and the subdisciplinary specialization of existing faculty. We find that at a larger department level, faculty specialization makes a big impact. Fewer women tend to earn PhDs from programs with a higher preponderance of GIS and cartography; instead, more attend programs with

specialization in human and environmental relations. As a rule, we categorized cartography and GIScience together, but it is interesting to note that midcentury women were quite active in cartography (see Tyner 1999) and that the cartography academic specialization has always had a large proportion of female members. Here, the GIScience aspect probably is determinative. The overall percentage of female faculty did not make a significant difference in the proportion of female doctoral students by department. When this construct was specified differently, however, by examining the female presence in graduate advising, it did prove statistically significant.

Although overall female representation on faculty does not appear to influence the proportion of female doctoral students, there is clearly a relationship at the advisor–advisee level. Further analysis demonstrates that women are much more likely to work with female advisors than are male students. This is true for all types of programs. Ultimately we cannot possibly measure all of the factors that could be significant, and we are not comfortable making the claim that departments with a higher than expected proportion of women might be more welcoming for women than those with a lower than expected proportion. This analysis, though, does open the door to understanding which factors might be contributing to departmental differences and how best to explain the current lag in female doctoral students. ■

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Note

¹ We initially worked with some other variables that turned out to be less effective. For example, the National Research Council’s ratings of doctoral departments on research effectiveness from 1995 were used as a proxy for departmental prestige. These were actual ratings utilized by the National Research Council as a prelude to ranking the departments. We also tried some regional dummy variables to see whether the broad location of universities might make a difference. Finally, we examined total faculty change as a measure of departmental growth. None of these variables proved statistically significant.

Literature Cited

- Berman, M. 1984. On being a woman in American geography: A personal perspective. *Antipode* 16 (3): 61–66.
- Brinegar, S. 2001. Female representation in the discipline of geography. *Journal of Geography in Higher Education* 25 (3): 311–20.
- Brunn, S. 1995. Geography’s research performance based on Annals manuscripts, 1987–1993. *The Professional Geographer* 47 (2): 204–15.

- Carr, R. 2013. *Educational standards, teacher preparation, and metacognition instruction for elementary students: Studies in pre-college engineering education*. Doctoral dissertation, Purdue University, Lafayette, IN.
- Carrell, S. E., M. E. Page, and J. E. West. 2010. Sex and science: How professor gender perpetuates the gender gap. *Quarterly Journal of Economics* 125 (3): 1101–44.
- Ceci, S. J., D. K. Ginther, S. Kahn, and W. M. Williams. 2014. Women in academic science: A changing landscape. *Psychological Science in the Public Interest* 15 (3): 75–141.
- Chiswick, B., N. Larsen, and P. Pieper. 2010. Production of Ph.D.s in the United States and Canada. IZA Discussion Paper No. 5367. <http://www.gradstudies.york.ca/files/2014/06/chiswick-phd-canada-usa.pdf> (last accessed 16 October 2015).
- Enggass, P. 1988. Geography at Mount Holyoke Female Seminary and College, 1837–1984. In *Geography in New England*, ed. J. Harmon and T. Rickard, 25–29. New Britain, CT: New England-St. Lawrence Valley Geographical Society.
- Goodchild, M., and D. Janelle. 1988. Specialization in the structure and organization of geography. *Annals of the Association of American Geographers* 78 (1): 1–28.
- Hale, G., and T. Regev. 2014. Gender ratios at top PhD programs in economics. *Economics of Education Review* 41:55–70.
- Hansen, E., S. Kennedy, D. Mattingly, B. Mitchneck, K. Monzel, and C. Nairn. 1995. Facing the future, surviving the present: Strategies for women graduate students in geography. *Journal of Geography in Higher Education* 19 (3): 307–15.
- Hanson, S. 2004. Who are “we”? An important question for geography’s future. *Annals of the Association of American Geographers* 94 (4): 715–22.
- Hart, J. F. 1979. The 1950s. *Annals of the Association of American Geographers* 69 (1): 109–14.
- Hoffer, T., and V. Welch. 2006. Time to degree of U.S. research doctorate recipients. National Science Foundation Report NSF 06–312. <http://www.nsf.gov/statistics/infbrief/nsf06312/nsf06312.pdf> (last accessed 16 October 2015).
- Hoffmann, F., and P. Oreopoulos. 2009. A professor like me: The influence of instructor gender on college achievement. *Journal of Human Resources* 44 (2): 479–94.
- Holmes, M. A., and S. O’Connell. 2003. Where are the women geoscience professors? *Papers in the Geosciences* 86: 1–40.
- Hurtado, S., K. Griffin, L. Arellano, and M. Cuellar. 2008. Assessing the value of climate assessments: Progress and future directions. *Journal of Diversity in Higher Education* 1 (4): 204.
- Johnson, L. 2008. Re-placing gender? Reflections on 15 years of gender, place and culture. *Gender, Place and Culture* 15 (6): 561–74.
- Kaplan, D., and J. Mapes. 2015. Panoptic geographies: An examination of all U.S. geographic dissertations. *Geographical Review* 105 (1): 20–40.
- Lee, D. 1990. The status of women in geography: Things change, things remain the same. *The Professional Geographer* 42 (2): 202–11.
- Leffler, K. 1965. *The role of women in geography in the United States*. MA thesis, University of Oklahoma, Norman, OK.
- Monk, J. 1998. The women were always welcome at Clark. *Economic Geography* 74 (1s): 14–30.
- . 2003. Women’s worlds at the American Geographical Society. *Geographical Review* 93 (2): 237–57.
- . 2004. Women, gender, and the histories of American geography. *Annals of the Association of American Geographers* 94 (1): 1–22.
- . 2006. Changing expectations and institutions: American women geographers in the 1970s. *Geographical Review* 96 (2): 259–77.
- National Science Foundation. 2013a. Doctorate recipients by sex and subfield: 2013. Science and engineering doctorates. <http://www.nsf.gov/statistics/sed/2013/data/tab16.pdf> (last accessed 16 October 2015).
- . 2013b. Women, minorities, and people with disabilities in science and engineering. <http://www.nsf.gov/statistics/2015/nsf15311> (last accessed 16 October 2015).
- National Student Clearinghouse Research Center. 2015. Science & engineering degree attainment: 2004–2014. <http://nscrcresearchcenter.org/snapshotreport-degreeratainment15/> (last accessed 16 October 2015).
- Neumark, D., and R. Gardecki. 1998. Women helping women? Role-model and mentoring effects on female Ph.D. students in economics. *The Journal of Human Resources* 33 (1): 220–46.
- Oberhauser, A., D. Rubinoff, K. De Bres, S. Mains, and C. Pope. 2003. Geographic perspectives on women. In *Geography in America at the dawn of the 21st century*, ed. G. Gaile and C. Willmott, 736–58. Oxford, UK: Oxford University Press.
- Pandit, K. 2004. Geography’s human resources over the past half-century. *The Professional Geographer* 56 (1): 12–21.
- Schlemper, M. B., and J. Monk. 2011. Discourses on “diversity”: Perspectives from graduate programs in geography in the United States. *Journal of Geography in Higher Education* 35 (1): 23–46.
- Solem, M., J. Lee, and M. B. Schlemper. 2009. Departmental climate and student experiences in graduate geography programs. *Research in Higher Education* 50 (3): 268–92.
- Tyner, J. 1999. Millie the mapper and beyond: The role of women in cartography since World War II. *Meridian* 15:23–28.
- Wolfinger, N., M. A. Mason, and M. Goulden. 2008. Problems in the pipeline: Gender, marriage, and fertility in the ivory tower. *The Journal of Higher Education* 79 (4): 388–405.
- Zelinsky, W. 1973a. The strange case of the missing female geographer. *The Professional Geographer* 25 (2): 101–05.
- . 1973b. Women in geography: A brief factual account. *The Professional Geographer* 25 (2): 151–65.
- Zelinsky, W., J. Monk, and S. Hanson. 1982. Women and geography: A review and prospectus. *Progress in Human Geography* 6 (3): 317–66.

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