

International Students in Geoscience Graduate Programs

American Geophysical Union Survey of Geoscience Graduate Departments

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HIGHLIGHTS

- Since 1985, the number of PhDs granted in the geosciences has risen 30% to 780 in 2002. Almost all of this increase may be attributed to international students coming to the US to earn their graduate degrees.
- Some fine fields within the geological sciences may be more susceptible to problems with new visa regulations, as a larger proportion of their graduate students come from abroad. Only about one-quarter of Atmospheric Science PhDs are non-US citizens; 40% of Earth Science PhDs were non-US citizens in 2002.
- Almost half of all graduate departments in the geosciences who responded to our survey indicated that at least one international student experienced a visa problem in at least one of the last three years that resulted in the student missing the beginning of the academic term.
- Based on data of first-year graduate students by the National Science Foundation, we can make a rough estimate that approximately 16% of foreign students who applied to US graduate programs in the geosciences did not make it here at all due to problems gaining admittance to the country.

Introduction

The Survey of Geoscience Graduate Departments was designed to capture change in the number of graduate students coming to U.S. institutions to study. New regulations may be leading to fewer student visas. Graduate departments in the geosciences have a substantial number of foreign students and this study investigates the effect on these departments.

Data from the National Science Foundation's Survey of Earned Doctorates show that over one-third of geoscience PhDs granted in the U.S. in 2002 were awarded to non-U.S. citizens. If a change in U.S. visa policies results in fewer graduate students from abroad, then the potential for impact in the discipline is substantial.

A recent article in *The Chronicle of Higher Education* (Arnone, 2004) cites findings from a Council of Graduate Schools survey that show a sharp drop in the number of applications from abroad for the Fall 2004 semester. About one-third fewer international applications were received compared to last year. If the geological sciences find a similar drop in the next academic year, then the impact will be especially hard on master's-granting and smaller PhD-granting departments. The impact on the number of international students accepted into graduate programs and earning degrees is unclear at this point.

Much of the data for this report comes from a survey conducted by the Statistical Research Center of the American Institute of Physics for the American Geophysical Union. The goal was to evaluate the impact of the documented decline in foreign graduate students studying in the US on the geological sciences in particular. The survey was administered to chairs of graduate departments in the Earth, atmospheric, and ocean sciences. See the final

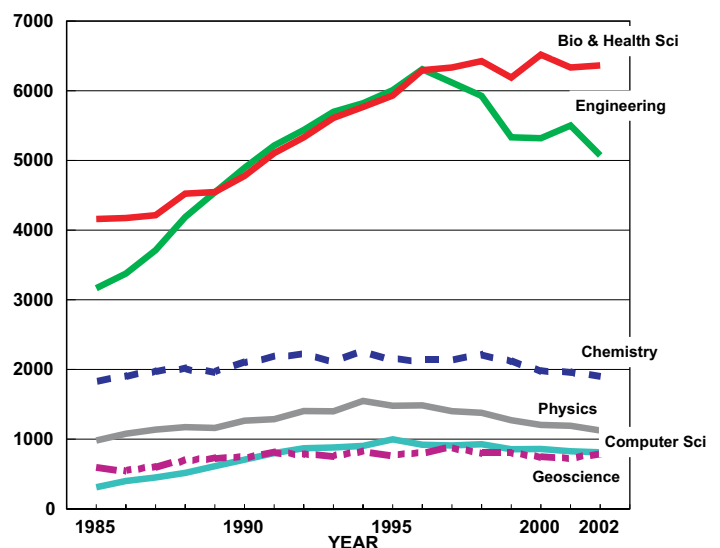
section of this report for background information on the survey design. We also utilized data collected by the National Science Foundation and National Center for Education Statistics to show trends in degree production over time in the geological sciences and other scientific disciplines.

This report is divided into two parts. The first describes the trends in degree production in the geosciences and related fields as a means of comparison. The second part describes our survey of graduate programs and its results.

Background on degree production

Figure 1 shows the number of PhDs awarded in various disciplines over the last 18 years. The number of PhDs granted has increased in all of these fields since 1985. There were about 600 PhDs in the geosciences in 1985. In 2002, 780 were awarded (National Science Foundation, 2003). This is an increase of 30%. Other disciplines showed gains of 160% (Computer Science), 60% (Engineering), 53% (Biological Science), 15% (Physics), and 5% (Chemistry).

Figure 1. Total number of PhDs granted by discipline, 1985 to 2002



Source: AIP Statistical Research Center compiled data from NSF WebCASPAR Database System, Feb 2004

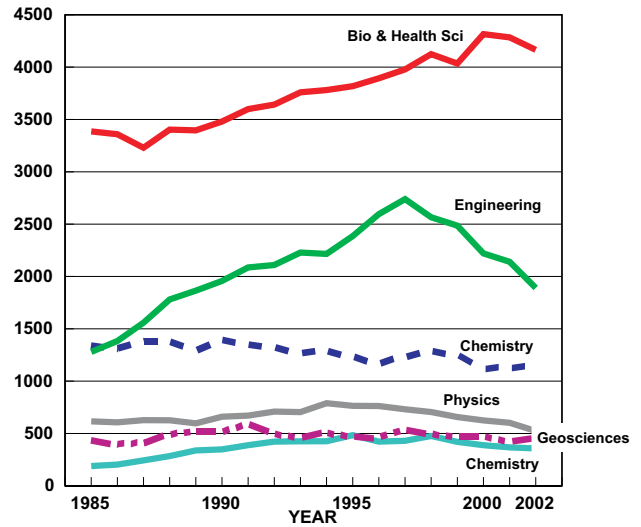
If we look at the number of PhDs awarded only to U.S. citizens, we see a different story (**Figure 2**). The increase in the number of these PhDs is not as large. While the biological sciences grew 53% overall, there was an increase of only 23% in the number of U.S. citizens earning PhDs.

In examining the number of geoscience PhDs awarded to citizens, we find the number holding steady. There were 435 PhDs in the geosciences to US citizens in 1985; 456 in 2002. This is an increase of almost 5%. Virtually all of the increase in overall PhD production in this field has been due to the increase of foreign citizens earning degrees from US institutions. **Figure 3** clearly displays this trend over the past three decades.

While the proportionate increase in foreign PhDs awarded is very high compared to that of US citizens, US citizens still earn a larger number of degrees in the geosciences. Foreign citizens comprise one-third of all PhDs awarded in the geosciences in the US. In 1966, their proportion was only 13% of the total. While this increase has taken over thirty years, much of the increase has taken place in the last ten years (**Figure 3**).

The geosciences are comprised of several distinct disciplines in Earth, ocean, and atmospheric sciences. It may be important to note whether some fine fields are disproportionately comprised of non-US citizens. This may be particularly relevant to graduate departments offering degrees in only one of these fine fields.

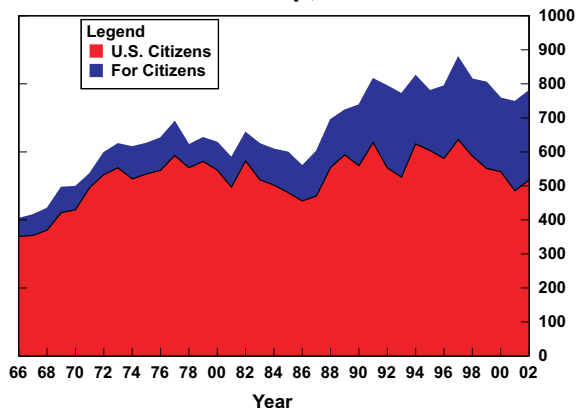
Figure 2. Number of PhDs awarded by discipline, US citizens only, 1985 to 2002



Source: AIP Statistical Research Center from data compiled from NSF WebCASPAR Database System, Feb 2004

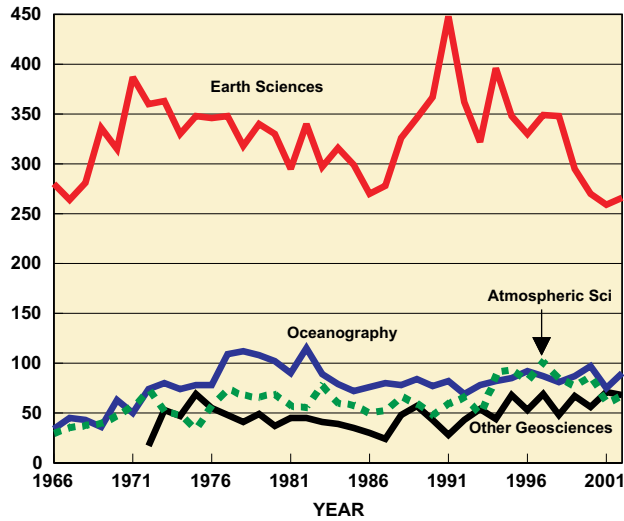
Figure 4 shows the number of US citizens earning PhDs by subfield. Earth sciences, the largest field within the geosciences, showed some substantial increase in PhDs to US citizens in the 1980s. However, by 2002, the number awarded was approximately the same as that for 1966. During that same period, the number of foreign PhDs in Earth sciences had more than tripled (**Figure 5**).

Figure 3. Number of geoscience PhD recipients by citizenship, 1966-2002



Source: National Science Foundation Survey of Earned Doctorates, compiled by AIP Statistical Research Center

Figure 4. Number of US citizens earning geoscience PhDs from US institutions by fine field, 1966 to 2002



Source: National Science Foundation Survey of Earned Doctorates

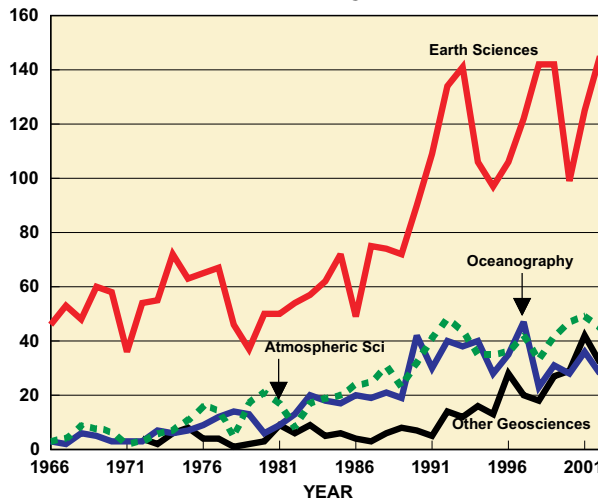
Both the atmospheric and ocean sciences experienced an increase in the number of domestic PhDs granted in the last thirty years. Atmospheric science PhDs to US citizens had doubled between 1966 and the late 1990s, only to level off in recent years to fewer than 70 US PhDs in 2002.

While this modest increase may be encouraging, we find that the real increase in PhDs in this subfield has been to foreign

citizens. Their numbers are 15 times higher now than they were in 1966 when only 3 people from other countries earned a PhD in atmospheric sciences in the US.

Similarly, in oceanography, domestic PhDs have increased modestly by about 65%, whereas there were 9 times as many foreign PhDs in oceanography in 2002 compared to 1966.

Figure 5. Number of foreign citizens earning geoscience PhDs from US institutions by fine field, 1966 to 2002



Source: National Science Foundation Survey of Earned Doctorates

Table 1. Percentage of departments that reported visa problems preventing at least one international student from arriving for the start of the academic year			
	Fall 2003 %	Fall 2002 %	Fall 2001 %
No	80	54	57
Not Sure	8	17	35
Yes	32	29	8
Number of Respondents	133	133	133

Survey Results

Table 1 shows the percent of responding graduate departments that had at least one international student missing the beginning of the semester due to visa problems. Some number of department chairs were unsure if their department had experienced this problem, particularly when asked to think back to two years ago (35% were unsure about the 2001 academic year).

More than half of all departments have indicated that they have not had this problem in each of the past three academic years. However, almost half (47%) had a student who experienced a visa problem in at least one of the last three years. Only two responding

departments had students with visa problems in all three years.

While **Table 1** shows that almost one-third of departments had an international student who experienced a delay due to visa problems for the start of the current academic year, **Table 2** shows that about one quarter of departments had international students who never made it to the US at all. This appears to be less of a problem for current graduate students who visit their home country during a break in the semester and find they are unable to reenter the US. Only 11% of departments reported that this happened to one of their students. Of course, it is possible that some foreign students did not return home for short visits because of the fear of not being able to re-enter the US.

Table 2. Percentage of departments reporting incidents where visa problems prevented a student from coming to the US at all in academic year 2002-2003		
	New students planning to enroll %	Current students who left US & tried to return %
No	60	73
Not Sure	15	16
Yes	25	11
Number of Respondents	133	133

Table 3. Percentage of departments reporting specific reasons for students' visa problems	
	%
Insufficient ties to home country	34
Insufficient documentation	10
Security-related concerns	12
Other	28
Don't Know	43
Number of respondents	73

Note: Department Chairs were asked to check all that apply

Table 3 shows the most common reasons that student visas were denied, as reported by department chairs. A large proportion (43%) indicated that they did not know the reason why a student's visa was denied. The most often named cause of denial was "insufficient ties to home country."

Of the departments who reported that at least some international students had been affected by new visa regulations, 76% said that the affected students were predominately from a single country. The country cited most often was China.

When asked if they have altered their approach to admitting international students, most (88%) department chairs said that they have not. For some not making a change, this issue was not relevant to their department. Eleven percent of departments did report that they now accept fewer foreign students due to the unpredictability of their arrival. Only 2% of departments said that they now accept more foreign students.

Postdoctorate researchers from abroad

Visa regulations appear to have less of an impact on PhD recipients from abroad who wish to come to the US to work as postdoctorates. **Table 4** shows that only 7% of PhD departments reported such a problem in the 2002 academic year.

Among responding departments, this resulted in a total of ten individuals who experienced a problem entering the US in 2003 to begin their postdoctoral appointments on time. In 2001, four postdocs experienced problems at responding institutions. While this does not include the numbers affected at the 89 geoscience PhD programs who did not respond, we can see that the scale of this problem is small compared to the issues affecting graduate students in this and other scientific disciplines.

The reader is reminded here that the source of the data is responses by geoscience department chairs. These chairs may not be the most knowledgeable about postdoctorates in their department, as postdocs typically work for a single professor rather than as an employee of a department. This may be particularly relevant of larger institutions.

Table 4. Percentage of PhD departments reporting incidents where visa problems prevented a postdoctorate from abroad from coming to the US to work		
	Fall 2003 %	Fall 2001 %
No	72	69
Not Sure	21	28
Yes	7	3
Number of Respondents	107	107

Table 5. Average number of graduate applications to geoscience PhD departments, by academic year and citizenship

	Foreign applications	Total applications	Number of Responding Departments
2003	30	73	91
2002	28	69	88
2001	27	67	72

Table 6. Average number of graduate applications to geoscience master's departments, by academic year and citizenship

	Foreign applications	Total applications	Number of Responding Departments
2003	77	115	24
2002	75	112	22
2001	73	105	21

Tables 5 and 6 show the average number of graduate applications received by geoscience departments over the last three academic years. **Table 5** shows the numbers for PhD departments; **Table 6** for departments where a master's is the highest degree offered.

Applications from foreign students account for the large majority (67%) of all applications received by master's-granting departments. By contrast, they account for a much smaller proportion (40%) of applications received by PhD-granting departments. As mentioned earlier, about one-third of PhDs in the geosciences were granted to non-US citizens in 2002.

Despite recent reports that graduate applicants from abroad are declining, these tables show that the number of applicants has remained stable. Perhaps figures on the incoming class of 2004 will show a different story. The impact would be felt particularly by master's departments that rely on a larger number of foreign citizens to fill teaching and research assistantships.

Table 7 shows the total number of individuals affected across all responding departments. Just as in Tables 5 and 6, it is clear that the number of international graduate applications has not decreased. In fact, the number of applications from abroad has increased about 13% in two years.

Table 7. Overall trends for all responding departments

The data below reflect the number of individuals affected in the 133 responding departments and not for all 277 geoscience graduate departments

	Fall 2003	Fall 2002	Fall 2001
New students not arriving for start of term	111	114	18
New students who <u>never</u> arrived		75	
Current students who left & could not return		14	
Foreign PhDs unable to make postdoc	10		4
Total students admitted	2359	2227	2171*
Foreign graduate applications	4547	4272	4019*
Total graduate applications	9507	8886*	8329*

* includes imputed data to account for item nonresponse

The table also indicates that the total number of students admitted (domestic and international combined) has increased over the last three academic years. This increase may be due to previously accepted international students who were unable to enter the country during the term they were expected. These students may have matriculated into the graduate program later, appearing as "admitted" in 2003 when they actually applied for the 2002 term, for example.

This increase also may be a reflection of departments increasing the number of applications accepted in order to compensate for anticipated problems with foreign students, but resulting in a larger number of students due to higher acceptance rates. Alternatively, this increase could have nothing to do with new visa regulations. The reason for the increase is not clear.

How the survey was conducted

Roman Czujko and Megan Henly of the AIP Statistical Research Center collaborated with Peter Folger of the American Geophysical Union in designing a questionnaire that would assess the effect of new visa regulations on geoscience graduate departments. To evaluate this, the questionnaire obtained the number of graduate applications and degrees awarded over the last several years, as well as questions specifically about visa problems experienced by potential students and scholars from abroad.

In December 2003, email notices were sent to 196 PhD-granting and 81 master's-granting departments in the Earth and space sciences. The emails directed department heads to an online questionnaire. Follow-ups to nonrespondents were conducted in January and February. At the end of the data collection period, responses from 133 of those departments, or 48%, were received.

	PhD %	Masters %	Overall %
Responded	55	32	48
Did not respond	45	68	52
Number of Departments	196	81	277