

## EARTH AND ENVIRONMENTAL SCIENCES

### Overview

- The earth and environmental sciences encompass marine and atmospheric sciences in addition to the traditional core of geological sciences and geophysics. The field is small and interdisciplinary.
- Demand is especially unpredictable in the earth sciences. Expansion through the mid-1970s was halted by the OPEC-triggered recession. In 1981, 60 percent of companies reported a shortage of petroleum engineers; 2 years later, the shortage was down to 20 percent.<sup>14</sup> There is currently no shortage.
- There is a surplus of bachelor% and master% earth scientists who began their education just before the current downturn in the petroleum and mining industries curtailed exploration and surveying. Government employment is more stable, but modest. The academic market is poor.

### Employment

- There are between 60,000 and 112,500 earth and environmental scientists employed in the United States.<sup>15</sup> With 90 percent in science and engineering (S/E) positions. Of these, earth scientists outnumber atmospheric scientists and oceanographers combined 4 to 1.<sup>16</sup>

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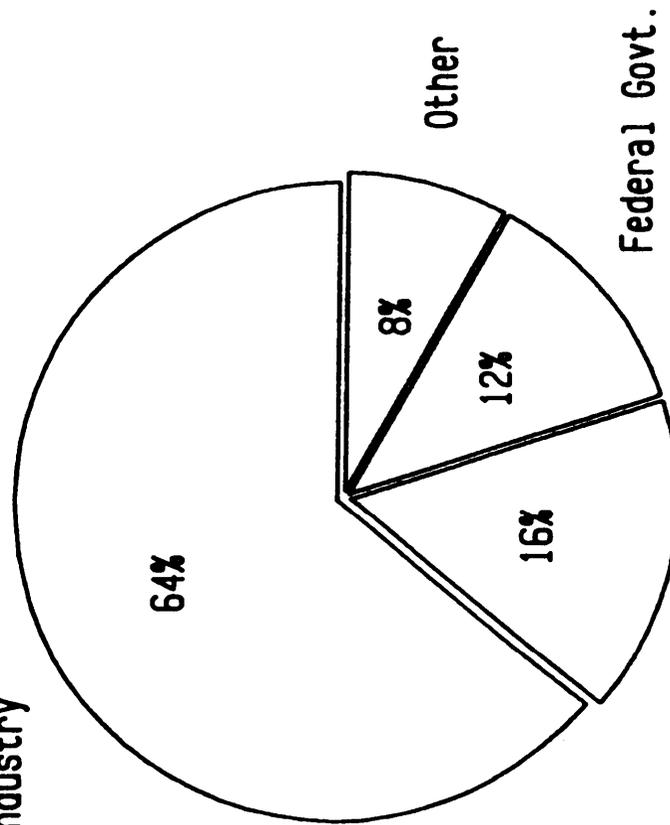
14. Based on 1981-85 tabulations of the Rapid Industry Limited Response Survey Panel on Science/Engineering Personnel Resources, reported in Joel **Barriers**, "Shortages Increase for Engineering Personnel in Industry," Highlights, NSF 85-309 (Washington, DC: March 29, 1985).

15. In 1985, the Bureau of Labor Statistics reported 63,000, which included 58,000 geoscientists plus 5,000 earth, environmental and marine science teachers. The National Science Foundation% preliminary 1986 estimate is 112,500 employed in the U.S. work force. This includes 94,300 earth scientists, 14,400 atmospheric scientists, and 3,700 oceanographers. National Science Foundation, Science Resources Studies Division, op. cit., Table B-1.

16. Ibid., Table B-13.

# Where Earth Scientists Work 1986

Business/Industry



Educational Inst.

Federal Govt.

Other

\*ALL DEGREES

SOURCE NATIONAL

FOUNDATION

- Of the 86,000 earth scientists estimated to be employed in S/E positions in 1986, two-thirds are employed in industry, while the rest distribute almost equally between academia and the Federal Government.<sup>17</sup>
- One-third of the S/E employed earth scientists are engaged in research and development, one quarter are in production activities, less than one-fifth in management. Less than 10 percent are estimated to be primarily engaged in teaching.<sup>18</sup>
- Earth and environmental science Ph.D.s exhibit the lowest mobility of all science and engineering doctorate holders. In 1983, only one in five was employed outside, his/her specialty.<sup>19</sup> In 1985, however, less than 1 percent of Ph.D. earth and environmental scientists were unemployed and seeking jobs.<sup>20</sup>

### Education

- The master's, and to a lesser extent the bachelor's, are entry level degrees. Earth scientists are much less likely than physicists or chemists to have a Ph.D.
- Bachelor's awards in earth science, now about 7,000 per year, have increased steadily since the mid-1960s. About 2,000 master's degrees are conferred each year.<sup>21</sup>
- Earth sciences Ph.D.s have fluctuated around 600-650 per year for the past 10 years, with geological sciences slightly more than half the total.<sup>22</sup> The production

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17. Ibid.

18. Ibid.

19. National Research Council, Office of Scientific and Engineering Personnel, Science, Engineering and Humanities Doctorates in the United States: 1983 Profile, op. cit., p. 18, Table 2-2.

20. National Research Council, Office of Scientific and Engineering Personnel, unpublished data from the seventh (1985) biennial survey of U.S. doctorate recipients.

21. Earth sciences degree data based on surveys conducted by the American Geological Institute, cited in Manpower Comments, vol. 23, No. 5, June 1986, p. 18.

22. National Science Foundation, Science and Engineering Doctorates: 1960-82, NSF 83-328 (Washington, DC: no date), p. 17, Table 1. Data for 1983-85 from National Research Council, Office of Scientific and Engineering Personnel, Doctorate Recipients from United States Universities, op. cit.

of Ph.D.s rose steadily through the 1960s and plateaued in the early 1970s. Recent graduate enrollments have declined, probably in response to the poor job market.

### Women, Minorities, and Foreign Nationals

- The number of female earth scientists has increased rapidly since 1970, but there are still relatively few among professional ranks. Women earn about one-quarter of bachelor% and master% earth science degrees, and almost one-fifth the Ph.D.s awarded. However, they are still only 6 percent of employed Ph.D. earth scientists and at best 10 percent of all such scientists.<sup>23</sup>
- Minorities have not made inroads into the earth sciences. Blacks are less than 1 percent of employed earth scientists, Hispanics and Asians about 2 percent each.<sup>24</sup> Earth sciences attract fewer Asians than do other sciences. Among recent earth science Ph.D.s, 0.5 percent are black, 1 percent Hispanic, and 3-5 percent Asian-American.<sup>25</sup>
- The earth sciences attract fewer foreign students than other physical sciences; even so, one in five 1985 Ph.D.s were foreign students on temporary visas.<sup>26</sup> The proportion of foreign nationals in earth and environmental science graduate

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23. National Science Foundation, "U.S. Scientists and Engineers: 1984", unpublished data, 1984, p. 100, Table B-9; and National Science Foundation, Science and Engineering Personnel: A National Overview, NSF 85-302 (Washington, DC: 1985), p. 116, Table B-12b.

24. National Science Foundation, U.S. Scientists and Engineers: 1984, op. cit., p. 53, Table B-5.

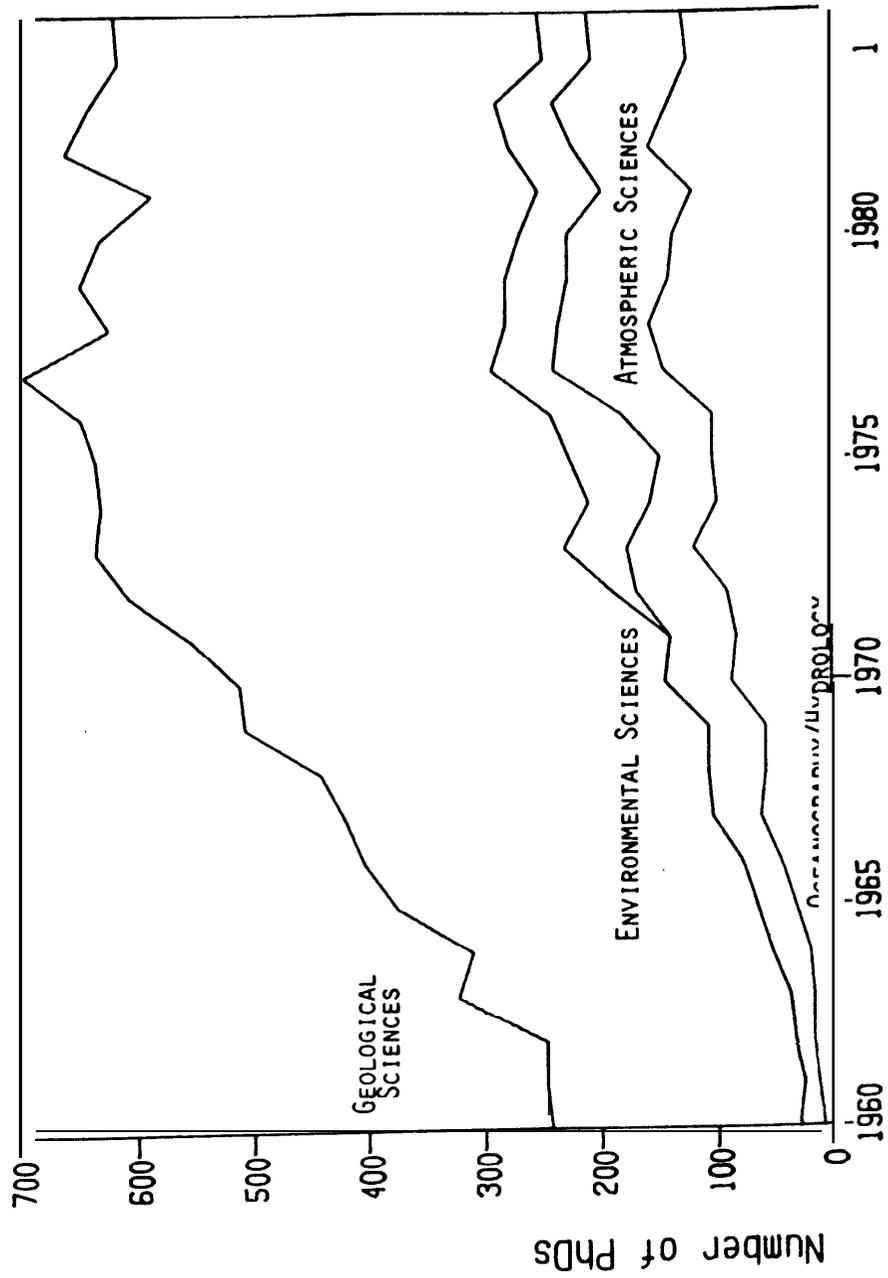
25. National Research Council, Office of Scientific and Engineering Personnel, 'Doctorate Recipients from United States Universities: Summary Report 1985,' unpublished data.

26. Ibid.; data for 1985 are unpublished.

programs increased slightly between 1980 and 1985. In 1985, foreign nationals represented about 15 percent of full-time earth and environmental graduate students.<sup>27</sup>

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27. National Science Foundation, Academic Science/Engineering: Graduate Enrollment and Support: Fall 1983, **op.cit.**, p. 102, Table C-5; and National Science Foundation, Division of Science Resources Studies, Science and Engineering Education Sector Studies Group, 'Selected Data on Graduate Science/Engineering Students and Postdoctorates by Citizenship,' unpublished data, October 1986, Tables B-13 and B14.



SOURCE: NATIONAL RESEARCH COUNCIL