

# JGE Special Issue on Diversity: Broadening Participation in the Earth and Space Sciences

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## 2002 Challenge to the AGU Diversity Subcommittee

- Fred Spilhaus, President of AGU, challenged the newly formed Diversity Sub-committee to 'educate' the AGU membership about the issue of Diversity
- Simultaneously (2003) a Joint Society Conference on Diversity among groups (below) drafted a joint policy statement
  - GSA (Geological Society of America)
  - AMS (American Meteorological Society)
  - AGU (American Geophysical Union)
  - AIP (American Institute of Physics)
  - others

[http://www.agu.org/sci\\_soc/education/jsc/](http://www.agu.org/sci_soc/education/jsc/)

# 2003 Policy Statement on Diversity (partial)

- Increased participation and retention of women, minorities, and persons with disabilities is **an essential** component of maintaining a robust and productive scientific workforce in the Earth, ocean, atmospheric, space, and related physical sciences. **The future** health of these disciplines in the U.S. is **threatened** by declining undergraduate and graduate enrollments, loss of degree-granting geosciences programs, and ageing of the current scientific workforce.
- Failure to attract and retain women and minorities in the geosciences is **not well understood**.
- The scientific societies and organizations listed below commit to take an active leadership role in efforts to increase participation of women, minorities, and persons with disabilities in the Earth, ocean, atmospheric, space, and physical sciences workforce. Specifically, these groups agree to:
  - • **Make diversity a priority** in the use of their organizational resources, **educate the members** about the need to become more involved in promoting diversity, and provide access to resources that will enable their members to work productively on this issue.
  - • Endorse and help to implement key recommendations outlined in the Task Force on National Workforce Policies for Science and Engineering report [National Science Board 2003].

For the full statement see: [http://www.agu.org/sci\\_soc/education/jsc/RESOLUTION.final.pdf](http://www.agu.org/sci_soc/education/jsc/RESOLUTION.final.pdf)

# AGU FM 2004

- The Diversity sub-committee convened four sessions at AGU FM 04 in which 79 papers dedicated to the subject of diversity were received.
- Just a few months before at the summer GSA conference (Denver), and the summer AMS conference a similar large number of papers was received on the subject of diversity.
- So much excitement was generated that the consensus was that the emerging list of lessons learned should be written up and circulated.
- The result is a first time collaboration between the AGU and the Nat'l Assn of Geoscience Teachers (NAGT) that will produce a special issue of the JGE dedicated to the issues surrounding Diversity in Geoscience Education.

# What is the underlying issue?

## (2004 proposal for special issue)

Proposal to NSF included the following rationales:

- Lack of exposure to the geosciences. Only a handful of minority-serving undergraduate institutions (MSIs) offer geoscience degrees or have geoscience departments.
- Inadequate teacher preparation in secondary schools serving high minority populations. Earth science teachers are among the least well-prepared of the physical sciences (Weiss et al., 2002)
- Lack of relevance/lack of a clear career path. While the geosciences are highly relevant to all citizens, this message has not gotten through to many minority families whose children may be the first to attend college.
- Isolation and alienation. In those programs that have attracted minority students into the geosciences, the small numbers of participants can create large retention problems for the students and early career faculty.

## What is the underlying issue?

In retrospect, those rationales were pretty simplistic.

- The demographics are critical
- Geoscience departments can do more to both attract and retain students of color, and women, in the geosciences

# Demographics

## **Bachelor's degrees awarded in major fields by race, class of 2000**

	African American %	Hispanic American %	Total Number
Psychology	10.6	7.8	74,060
Computer Science	9.7	5.1	36,195
Business	9.2	5.8	257,709
Chemistry	8.5	6.9	10,390
Mathematics	8.3	5.2	12,070
Life Sciences	7.7	5.2	63,532
Education	7.1	4.5	108,168
Engineering	6.3	5.5	72,299
Physics	4.4	3.8	3,631
Geosciences	1.3	3.1	4,047
All fields	8.7	6.1	1,237,875

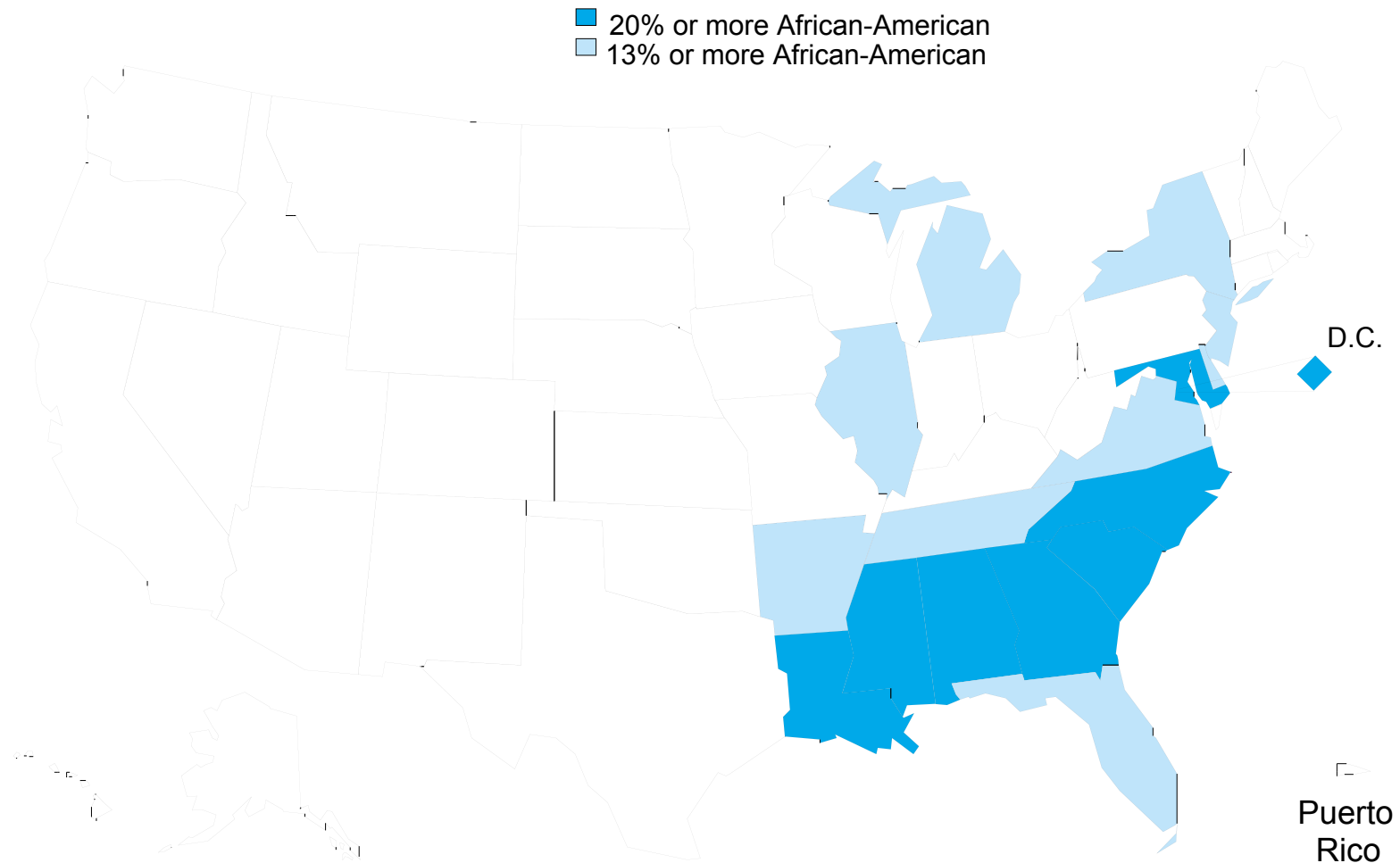
# African-American Bachelor's in the Geosciences

Departments that awarded the largest number of bachelor's over the last five years

## African-American five-year totals

59	Hampton University (VA)
15	United States Naval Academy (MD)
13	Jackson State University (MS)
10	Elizabeth City State University (NC)
9	CUNY City College (NY)
8	Savannah State University (GA)
7	North Carolina State University - Raleigh
6	University of Oklahoma- Norman
346	Total number of African-American geoscientists from all degree-granting departments, five year total

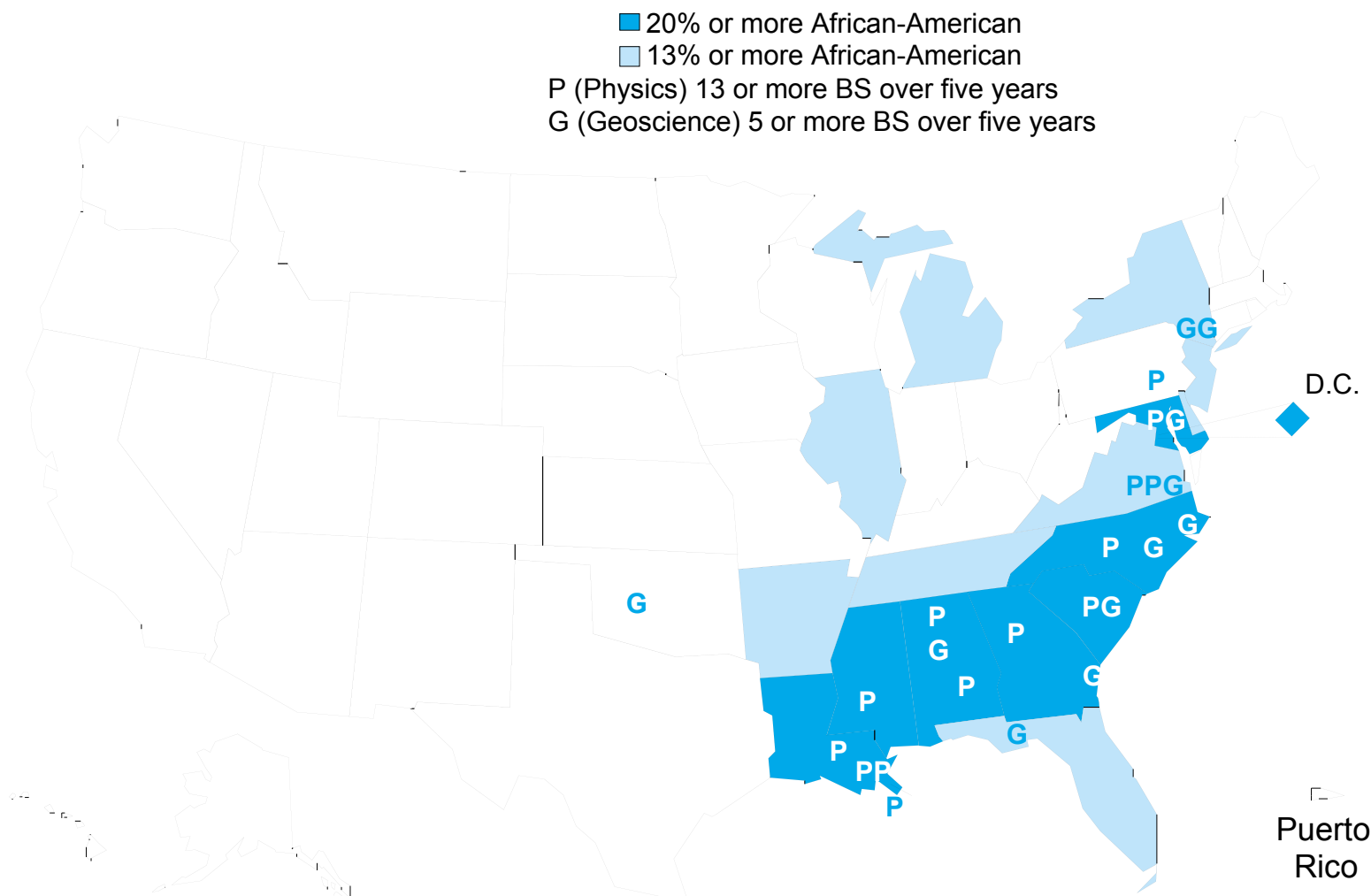
## States with highest concentration of African-Americans, 2000



Source: AIP Statistical Research Center compiled from data collected by the US Census Bureau

## Where did African-Americans earn their bachelor's degrees?

The colleges mapped here represent over 40% of all African-American bachelor's awarded in physics and the geosciences over the last five years



Note: Data are for the academic years ending in 1995, 1996, 1997, 1998, and 2000. Departmental-level data for 1999 are unavailable.  
Source: AIP Statistical Research Center compiled from data collected by the U.S. Census Bureau and the NCES.

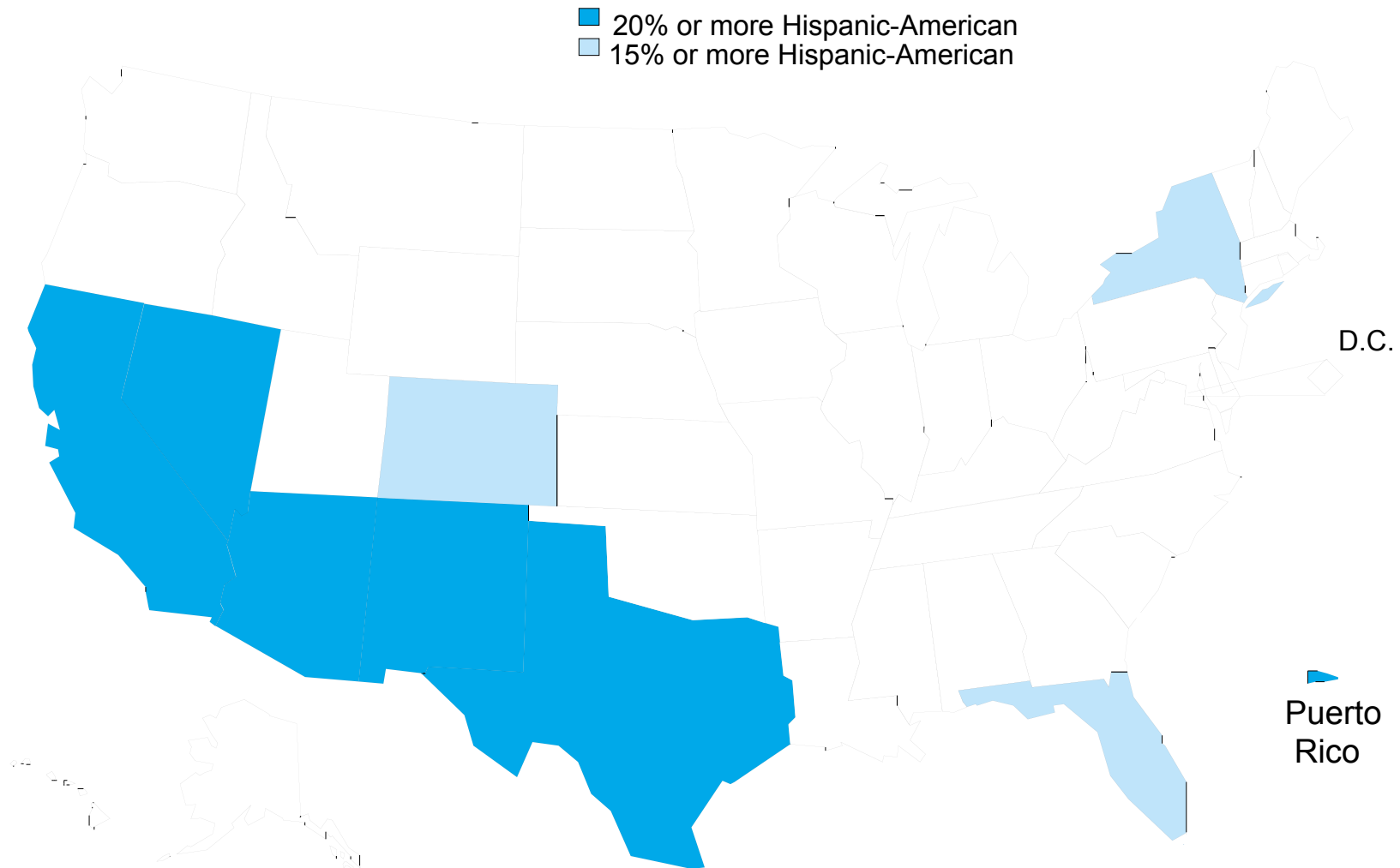
# Hispanic-American Bachelor's in the Geosciences

Departments that awarded the largest number of bachelor's over the last five years

## Hispanic-American five-year totals

43	University of Puerto Rico - Mayaguez
22	United States Naval Academy (MD)
18	University of Texas - El Paso
15	Stanford University (CA)
14	University of Texas - Austin
13	Texas A&M University
11	University of California - Santa Barbara
10	University of Washington - Seattle
9	University of Arizona
9	University of New Mexico
547	Total number of Hispanic-American geoscience bachelor's from all degree-granting departments, five year total

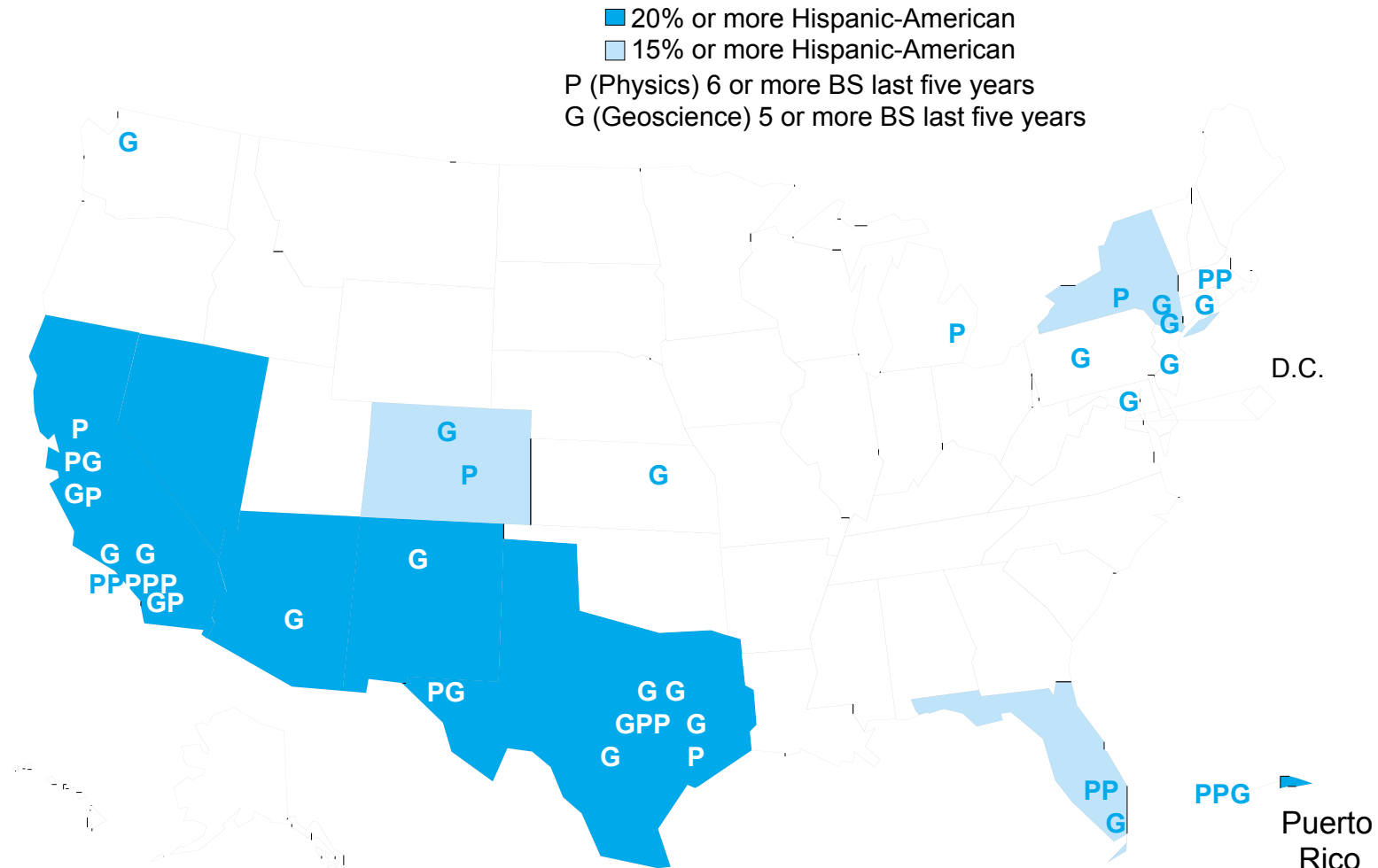
# States with highest concentration of Hispanic-Americans, 2000



Source: AIP Statistical Research Center compiled from data collected by the US Census Bureau

# Where did Hispanic-Americans earn their bachelor's degrees?

The colleges mapped here represent over 40% of all Hispanic-American bachelor's awarded in physics and the geosciences over the last five years



Note: Data are for the academic years ending in 1995, 1996, 1997, 1998, and 2000. Departmental-level data for 1999 are unavailable.  
Source: AIP Statistical Research Center compiled from data collected by the U.S. Census Bureau and the NCES.

# **Geoscience PhDs Awarded in the U.S.**

*1973 through 2000*

19,500 Total Geoscience PhDs Awarded

107 African American PhDs

263 Hispanic American PhDs

## Major findings of JGE special issue

Three main themes emerge in the lessons, features, and management structures of programs successful at enhancing Diversity:

- 1) An educational and recruitment approach that focuses on those aspects of the geosciences most relevant to audiences in their area has high efficacy:
  - E.g. Marine interests, and oil, in the mid-atlantic, where a high concentration of African American students can be found
- 2) Accounting for culturally-specific learning styles, cultural issues with pedagogy, community preferences and priorities.
  - A robust, grassroots connection to underserved communities is very important. Cultural literacy and community familiarity and connections on the part of the geoscientists is critical. Social connections and social sensitivity and awareness are central to success.
- 3) The strongest programs enjoy a local synergy of grassroots, personal, commitment from individual scientists, and the vision and high-level support of the institutions and agencies in which they work.
  - Common failures in programs over the decades have included a lack of synergy between top-down and bottoms-up approaches. The greatest gains and successes consistently emerge where the energy and passion from the grassroots is met with support and encouragement from local institutional administration

# Geoscience Relevance to local area

## Local (not national) solutions

- Immobility of populations of potential students.
  - Students in the mid-atlantic are going to stay in the mid-atlantic for their bachelor's degree
    - students do not pick up and move from one region of the country to another in large numbers, as a general rule.
  - Implies the significance of geoscience topics 'relevant' to a local area
    - The local population wants to know why a career path is relevant, in a language that they can understand
  - This presents a huge opportunity for schools in that region to reach out to a large population of students of color
    - Example - there are significant populations of African Americans in the mid-atlantic getting geoscience degrees in Marine Sciences.

# Importance of Mentoring

## The importance of Mentoring

- Over and over again, in the special issue, authors talked about the efficacy of a strong, robust mentoring program.
- Harkens back to the days, 100 years ago, when scientist were drawn to the field by the personal intervention of someone they knew, like a father or special teacher.
  - Handholding
  - Mentors who are taught the ‘art’ of mentoring and put time into it
  - Mentoring and personal intervention that is culturally-specific
    - Mentors have to be culturally literate. This may be particularly important for Native American populations.
    - You have to know your audience

# Institutional Investment

- Institutional investment (both human and financial) in finding solutions is important.
  - Personal contact can be a critical element of success.
    - Teachers/ councilors working in isolation do not seem to have success at drawing students of color into the geosciences as a general rule
    - Institutions ‘paying’ students of color to come into their programs with stipends do not seem to have success at drawing students of color to the geosciences
  - Top down institutional support; rewards for teachers devoting personal attention to their students; hands-on intervention by individuals, these approaches seem to have a high rate of efficacy.

# Causal Relationships

- A sub-set of the issue is devoted to the causal relationships that may impact populations of color and women
  - A study of ‘critical incidents’ performed by Levine, et.al
  - ‘Contextualized learning’ – keeping geoscience from being too abstract – by Orion
  - An international example, from Israel, of working with a minority population.
- The issue includes quite a few examples of metrics and surveys used by different kinds of programs for evaluation purposes
- The issue contains many examples of lessons learned -
  - in some cases from decades of work
  - including major funding institutions such as NSF.

# Summary of the special issue

- 19 papers
  - Double the normal JGE size!
- Run of 5000
- Distributed *gratis* to:
  - Heads and Chairs of U.S. Geophysics Depts.
  - NASA, NSF, DoE Program Managers
  - Education and Public Outreach leads at research institutions or state and Federal agencies.
- Available late January, 2008.

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