

Broadening the Participation of Native Americans in the Earth and Environmental Sciences

ISSUE

How can we increase the number of Native Americans in the STEM fields, particularly in the Earth and Environmental Sciences?

BACKGROUND

Summary of past and or current events that provide a context for the topic or issue, including any policies or past practices

Climate change is not a thing of the future. Indigenous peoples are being affected right now. At the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) conference, October 2008, American Indian and Alaska Native leaders told gathered geoscientists that their people wished to have their voices heard when climate change issues are discussed. One way for Native voices to be heard by the world community is for Native peoples to seek advanced degrees in Earth and environmental science. These fields have significant overlap with areas of expertise in geography and spatial sciences, from which knowledge bases intrinsic to finding solutions to climate change problems also exist.

Native Americans are noticeably lacking in Earth, environmental, geographical and spatial science and other higher education programs. Compared with other science and engineering fields, the geosciences produce the lowest percentage of minority scientists with Bachelor's and Master's degrees. Underrepresented minorities currently comprise 30.5% of the US population, with 15% of the population being non-Hispanic Blacks, 14% Hispanics, and 1.5% American Indian and Alaska Natives. The percentage of geoscience Bachelor's degrees conferred on minority students is much less than 30.5%. In 2004, for example, Hispanics received 3.3% of the BS degrees, Blacks 1.7%, and American Indians 0.8%. For Master's degrees in geosciences, the percentages drop to 2.3% for Hispanics, 1.4% for Blacks, and 0.5% for American Indians. At the Doctoral level, in 2004, the rates stayed about the same as for Master's level degrees, with Hispanics garnering 2.3%, Blacks 1.7%, and American Indians 0.4% of the total Doctoral geoscience degrees conferred (AGI, 2009).

I conducted semi-structured interviews with fifteen Native Americans who had already achieved, or were in the process of attaining, a post-secondary degree in Earth or environmental science. In addition I interviewed ten directors of programs designed to increase the number of Native Americans in Earth and environmental science degree programs. The interviews were analyzed qualitatively following methods outlined in Miles and Huberman (1984). The insights provided in this briefing are largely the result of information obtained through these interviews.

ANALYSIS

Of the 15 Native participants I interviewed, 12 (80%) are female and three (20%) male (See Appendix A Figure 1). The overwhelming majority of female participants in this study could be the result of several reasons. First, there are more Native women than men obtaining degrees in higher education.

According to the U.S. Department of Education report *Condition of Education 2010*, 66.1% of Associate's degrees, 60.7% of Bachelor's degrees, 65.9% of Master's degrees, and 57.7% of Doctoral degrees which were awarded to Native Americans in 2007-2008 were awarded to Native women. Second, the 15 participants who responded to my request for an interview (18.8% of the total) were self-selected, and as I am a woman other women might have felt inclined to help me achieve my degree by providing me with the information I needed. It should also be noted here that only people whom I had been physically introduced to responded to my request. No one whom I e-mailed cold responded. This fact highlights the need to form relationships with Native individuals if you desire to work with them. Third, many of the women who responded had stories to tell, and they felt comfortable enough with me to tell them.

Eleven (73%) of the participants were first-generation college students, while the rest (27%) reported that one or both of their parents had been the first in the family to attend college, making them second-generation college students (Figure 1). Of these remaining four participants, three reported that one or both parents had attended college while they were a child; the fourth had a father who attended college on the GI Bill. None of the parents had graduate degrees. None of the participants had grandparents who were college graduates. Three participants volunteered that their parents, grandparents, or great-grandparents had been removed from their reservation and forced to attend governmental boarding schools. So it is important to remember that this is a population for whom the idea of going to college is very new.

About half (47%) of the participants were traditional students, defined here as starting college within a year of high-school graduation and then continuing or completing their education without a significant break. The other half (53%) were non-traditional students, defined here as someone who found themselves in school twenty years after high school graduation. In each non-traditional student case the student either took an extended period of time off from school to work between degrees (6/8; 75%) or worked full-time while pursuing a degree (2/8; 25%), thereby extending the time required for completion.

Seven out of fifteen participants (47%) started their college education at a public four-year institution; an additional three (20%) began at a private, religious, four-year institution. Five out of fifteen (33%) completed their Bachelor's degree without transferring or taking an extended break, four at public universities and one at a private, religious institution. Three out of the fifteen (20%) participants began college at a local community college, with 2/3 completing their Associate degree at the same institution. Two out of fifteen (13%) began their studies at their local tribal college, with one completing an Associate degree at that institution. Seven out of fifteen (47%) of participants did not complete their initial choice of programs. Three informants self-reported flunking out due to problems associated with alcohol consumption, three quit to work and/or raise a family and one transferred to another institution and program.

Only three of the fifteen (20%) participants started their educational path in a geoscience or environmental Earth science field (See Appendix A, Figure 3). The remaining 12/15 (80%) started their educations in other majors, sometimes earning degrees in two other fields before making the switch to Earth science. Although half of the participants did begin their studies in a science or math field before beginning to study Earth science, the rest studied human service related disciplines such as social work, psychology, health, education, and law, or art.

Factors which impede obtaining a college degree

1. **Financial aid** -- Without **financial aid** resources 80 percent of the participants of my study would not have been able to afford a college degree.

2. **Familial obligations** -- Pressures from familial obligations severely impeded the progress of many of the study participants. Some familial obligations, such as needing to go home for weeks or even a month at a time for funerals or other ceremonial obligations, posed problems for some members of this group, while in other cases students had families which they needed to rush home for, precluding them from taking advantage of programs and opportunities incompatible with the lifestyles of students who are also working parents.
3. **Physical and mental health** -- Health issues were reported, including those related to stress and also the effects of changing diets between foods consumed at home and those available at college. Some mental health issues which arose, like those associated with feelings that a student “wasn’t good enough” to be a graduate student in her Earth Science department, or the depression and feelings of helplessness which occurred when work piled up too high are not strictly conditions of being Native American, but may be considered institutional barriers if the departmental environment is particularly hostile to women, as was reported here by a third of the women interviewed. But a good advisor or other support person was reported to be instrumental in helping the student deal with both physical and mental health issues.

Factors which impede the decision to study Earth Science

1. **Not known as career option** -- Eighty percent of the participants talked about geoscience not being known in tribal communities as either a field of study or a career choice.
2. **Curriculum not practical** -- The Native Americans who I talked to repeatedly spoke of the need for Earth Science knowledge to be **practical** in solving the problems found in their homelands today. An overwhelming percentage (14/15; 93%) expressed a desire to work on environmental geology issues. Particularly for re-entry students who were non-traditional in age, desire to heal the land was a motivating factor in their decision to return to school. But students found that the career they thought they preparing for, where they would be able to use the skills learned to solve environmental problems back home, did not line up with the focus or program of the department.
3. **No access** -- Large segments of the Native population do not have access to Earth Science courses near their homes. The geographic location of Native communities is a result of the effects of colonialism, and the distance to academic institutions is an institutional barrier, as universities are traditionally built near White population centers.

Factors which impeded progress in Earth Science programs

1. **Mathematics** -- Of all the educational barriers Native peoples faced, the one most often expressed was that of inadequate preparation in mathematics (11/15; 73%). But it wasn’t because they couldn’t “do” math – most eventually took Calculus I and Calculus II and passed – but the quality and availability of mathematics instruction that was the institutional barrier in this case, at all levels of the educational system. The biggest barrier this problem poses is the spiraling effect that bad grades in Calculus and Chemistry courses have on a student’s **grade point average**, subjecting

- them to **academic probation** and making them **ineligible for funding**; another institutional barrier.
2. **Inadequate academic counseling** -- Since over half of the Native Earth scientists interviewed were non-traditional students the failure of both Earth Science departments and university counseling systems to provide appropriate guidance for older students was problematic. Non-traditional students reported having to seek out information on graduate school, programs and other opportunities. They were never approached by faculty as potential graduate students, although younger students were. Some non-traditional students felt that student counseling programs in place at the university were not designed to accommodate their needs.
 3. **Intradepartmental relationships** -- Non-supportive departmental professors caused problems for students. Conflicts between sub-fields were especially detrimental to student success when the advisor of a student was in a new, non-traditional field which the other members of the department did not support. Several participants talked about having barriers put in their way during the proposal defense stage of their graduate program.
 4. **Hostile environment for women** -- Women reported harassment by faculty members in Earth Science departments. In several cases the harassment was so intense that it affected the student's relationships with other students and jeopardized their ability to complete their program of study. In two cases the situation was so intolerable that the student moved either to another department or another university. Many Native women are respected leaders within their community and have grown up in the outdoors, often performing the same tasks that men do in White rural societies. On several occasions the women I interviewed expressed surprise to find themselves in a field that was considered to be non-traditional for women because they knew they were capable of doing anything a man could.
 5. **Prevalence of Western scientific perspective in the classroom to the exclusion of all other perspectives** -- No one expected a sole focus on indigenous perspectives in their science classes, however, participants in this study found the complete failure to even acknowledge any indigenous accomplishments reinforced their feelings of subjugation due to colonization. Even in colleges with a high concentration of Native students or built in areas surrounded by Native peoples there was never an acknowledgement of the local peoples or their knowledge of the land. Part of the problem with looking at things from a Western perspective which was particularly troubling to these Native Earth scientists was the tendency of science to break knowledge into small pieces for examination, but then fail to put the pieces back together into a more holistic picture of what is really happening in nature. Eleven out of the fifteen participants (73%) described themselves as thinking holistically when approaching problems. Traditional Native teaching tends to be holistic, experiential, and hands-on. Earth Science can be taught this way at the university level, but often is not.

RECOMMENDATIONS

If we want to attract more people into the Earth Sciences we need to move from an **exclusionary** model to an **inclusionary** model. Pathways need to be built if we wish to broaden the participation of Native Americans in the Earth Sciences, but these pathways must be built

from trusted relationships, and these relationships take time. When working with Native communities usually there are few results the first five years. Building these pathways must be a long term commitment.

Some suggestions from program directors:

1. Build a step wise program which originates at tribal schools, goes through a 4-year college, and ends at a doctoral degree granting institution.
2. Visit schools and community events and bring hands-on experiences to the community. Educate the community on how to become an Earth scientist.
3. Summer Science and Math camps involving the community, university, local teachers and students, science educators, and elders. Make them **ethnocentric, rooted in place, and multigenerational**.
4. Promote and develop science fairs in the community and local school system.
5. Sponsor SACNAS or AISES chapters in your department.
6. Begin a Research Experience for Undergraduates (REU) in conjunction with tribal college partners.

Problems encountered in building programs and working with tribal communities:

1. Building trust relationships takes time.
2. The length of federal grant money programs is often not long enough to provide results. Participants tell us that you do not begin to see results until at least five years into the grant. For real results the grant needs to be ten years in duration.
3. Communication with both partners and students is paramount, but often difficult due to connectivity problems in rural areas and on reservations.
4. Recruiting students to programs is often slow and difficult. Many students have work or familial obligations which do not allow them to participate in standard programs.
5. Dispersing monies under current federal guidelines is often difficult. There are things that cannot be paid for in advance, yet students do not have the funds to pay in advance and then be reimbursed

SOURCES

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- U.S. Department of Education, National Center for Education Statistics. (2010). *Condition of Education 2010*, [Table A-23-2](#),(NCES 2010-028).

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Appendix A

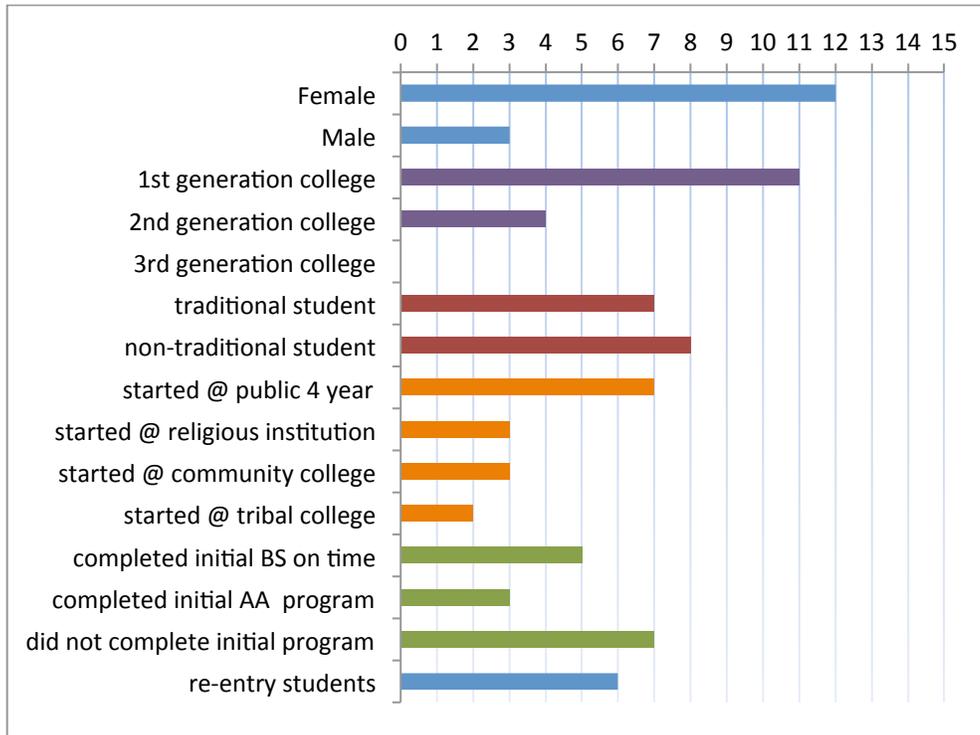


Figure 1. Demographics of Native American Earth scientist participants in study (n=15)

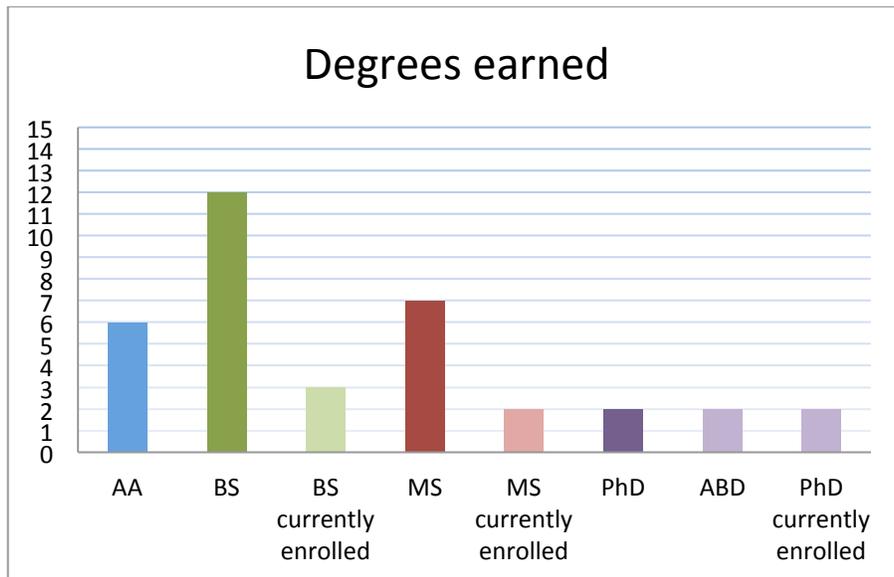


Figure 2. Total number of degrees earned by the fifteen Native American Earth Scientist participants in the study by type of degree

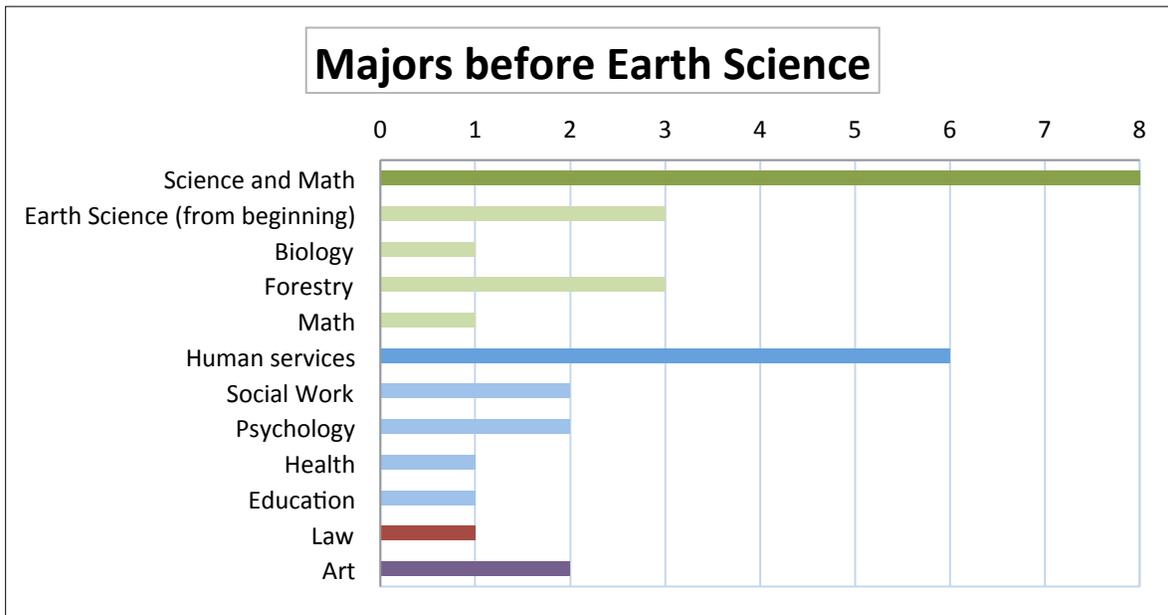


Figure 3. Major of fifteen Native American Earth Scientist participants before entering Earth or environmental science degree program

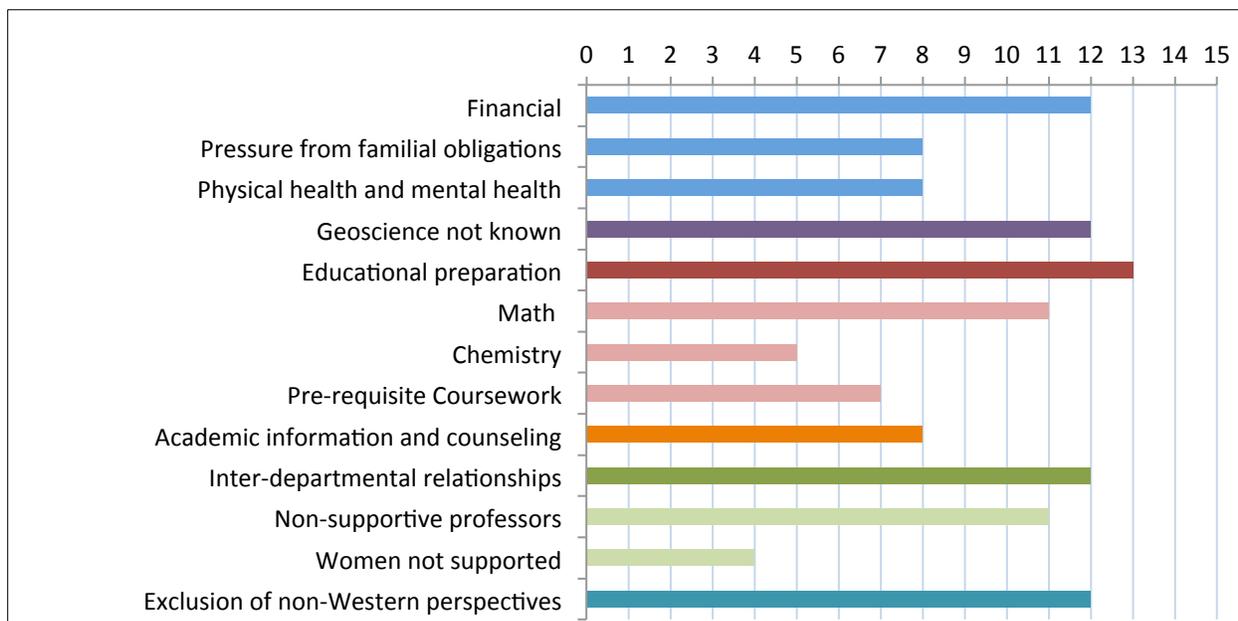


Figure 4. Factors which impeded the successful completion of post-secondary degrees in Earth and environmental sciences by Native American scholars (n=15)