Maintaining Undergraduate Geoscience Education Excellence in a Climate of Emerging Research Institution

Tania Anders, Texas A&M University-Corpus Christi

Texas A&M University Corpus Christi (TAMUCC), a Hispanic-serving Institution, is currently seeking status of Emerging Research Institution. As part of this effort, more and more programs are developing graduate programs and newly hired tenure-track faculty are expected to develop strong research projects. As part of this effort, our Geology Program is planning on offering a Masters Program within the next two to three years. Currently our College offers graduate studies in Environmental Sciences (M.S.) and in Coastal and Marine System Sciences (Ph.D.). Geology faculty are currently advising nine Environmental Sciences M.S. students and five CMSS Ph.D. students.

The desire for a graduate program in the geosciences at our school has been expressed by students as well as the local industry in the past years. Offering a graduate program in "only" Environmental Science has led to a reputation of being "tree huggers" among many members of the local petroleum industry. A majority of our current graduate students have geology background (B.S.) and would have chosen a geology graduate degree if offered.

So how can and is our undergraduate program in geology supporting this move towards more research and advanced degrees?

Step 1 has been opening our students eyes in regards to the potential importance of a graduate education. Our Undergraduate Seminar, for which guest speakers with various geoscience backgrounds are invited, has made many of our students realize that to move ahead in their future careers to levels they are envisioning, a graduate degree may be essential. Internships have often led to the same realization among our students.

Step 2: Offering undergraduate research opportunities for our students. Geology faculty are currently supervising nine geology undergraduates working on research projects. Faculty receive no release time or other financial support for their efforts which keeps the number of students exposed to research lower than we would like. Programs such as McNair and S.U.R.E. (see TAMUCC geology program description) help to some degree by e.g. supporting student travel to conferences.

Step 3: Writing intensive courses. Being proficient in written and oral expression is essential to all students, not only geoscience majors. In our geology program we emphasis writing beginning in the first year of studies, e.g. within the learning community for geology and environmental sciences majors. Report writing, small research projects, poster presentations, etc. are standard in our upper level geology courses. Students are made aware of the importance of these skills by their faculty as well as internship mentors and are learning to embrace the opportunities given to them.

Step 4: The future – what we need to work on. With "only" five full-time geology faculty, of which four have substantial release time for other duties (administrative or research), serving over 80 undergraduate geology majors and over 500 non-science majors yearly, our program feels stretched to its limits. Growing the number of high impact practices as proposed by LEAP (Liberal Education and America's Promise) is highly desired by our program. In January 2014, Texas became the tenth LEAP state partner. As stated in the LEAP Texas bylaws, "the mission of LEAP Texas is to provide a structure through which Texas public and private institutions of higher education can communicate, organize, and develop plans and policy recommendations that address their common interests of student success and the improvement of higher education in Texas." (http://www.aacu.org/leap/texas.cfm). We would like to tap into resources that may become available within the LEAP initiative in Texas. Priorities include: a) growing undergraduate research on our campus. We would like to broaden the scope and also include students from our local community college in this endeavor. This will help attract new students from that institution as well. b) offer more travel opportunities for our students, including studies abroad. As any geologist will tell you, applying classroom knowledge in the field and simply being exposed to geology in the real world is what hooks students for life. A large number of our courses come with field trips for that reason. But, due to the size of Texas, we have been limited in our offerings that take students outside the state. In particular minorities tend to stay local. By offering more travel, we hope to help or students grow not only at an academic level but maybe more importantly also socially and intellectually.

Title: An Urban University's Approach to Broadening Participation in Geoscience Training Programs

Georgia State University's campus is situated in the heart of downtown Atlanta, adjacent to the state capital. GSU has an extremely diverse student body in terms of race, economic background, and academic preparation. We have the highest graduation rate of African American students of any university in the United States, including the HBCUs. By contrast, only a short drive out of Atlanta in any direction, Georgia becomes very rural, very quickly. All of this presents both challenges and opportunities for the Department of Geosciences.

The state of Georgia offers a wealth of geologic opportunities for our students to study. From the eastern coast to the northwestern Appalachian Mountains, our students can observe many different geologic processes all across the state. Our department is home to four student-body organizations (Geo Club, GTU, SGE, and AIPG student chapters), which all team together with state and local practitioners to provide practical field experiences for geoscience majors. Through these active clubs, students gain a broad understanding of the science away from faculty and course requirements. Many of our graduate students have developed research projects based on their involvement and experiences with the student organizations.

The Department of Geosciences at GSU is a combined department of Geology and Geography. As a result, many of our students are involved in using geospatial technologies across the disciplines. Aside from our undergraduate and graduate degrees in Geosciences focusing on geology and geography, we offer a GIS certificate that is becoming extremely sought-after by Atlanta-based geoscience companies, and beyond. Through these programs, we are able to provide distinct relevance to the geographic diversity we are situated in, focusing on the earth system in both urban and rural settings. Additionally, with most major cities in the United States, we are able to offer our students practical experience in the area of environmental impact as a result of major community development.

The academic programs and student organizations within the department provide a wealth of opportunities for our students to succeed in geoscience workforce. We work to prepare our students with faculty mentoring and several senior-level seminars that help prepare them for moving beyond the undergraduate programs into internships, graduate school and the workforce. Although we are well situated in a diverse university community, we struggle to attract a diverse student body to our programs. However we have several programs through which we try to improve our diversity. A few of these programs include:

The IAGD

Although more of a global network community, the International Association for Geoscience Diversity (IAGD) has a strong impact at GSU. The IAGD is charged with identifying current research opportunities and instructional best practices for underrepresented students with disabilities, while seeking to raise awareness of improving access and exposure to the geoscience disciplines for students and geoscientists with disabilities. The GSU Department of Geosciences has been home to several members of the IAGD, some of which are also involved in many campus-wide committees focused on access and inclusion. While the Department of Geosciences does not currently have any students with disabilities as geoscience majors, several courses have been directly impacted by the IAGD network, and benefit from the resources and experiences found within.

The REU site

Provides intensive, community-based research experiences for 12-15 students per year in Atlanta, including a specific aim to develop new researchers from underrepresented groups. It engages undergraduates in action-oriented, community-based research related to social and environmental disparities with neighborhood organizations and underrepresented populations in Atlanta neighborhoods.

GGA

The Georgia Geographic Alliance (GGA) is a non-profit organization of individuals who believe that geographic knowledge is essential to the success of our state and nation. Our mission is to enhance geographic education and research through the development and promotion of place-based learning opportunities for Georgia K-12 teachers and students across all disciplines especially in Science, Technology, Engineering, and Math (STEM) fields. With this mission, the GGA seeks to ensure that Georgia students, teachers, and community members are global thinkers, geographically-minded problem solvers, and internationally competitive workers.

To broaden participation, the organization's objectives are to:

- Emphasize the power of community geography and place-based learning in local settings to connect core geographic concepts with local/regional issues
- Broaden participation of underrepresented populations in geography and all related disciplines, especially STEM infused disciplines

ACMRC:

The Atlanta Community and Mapping Research Center (ACMRC) is dedicated to working with residents and other neighborhood level stakeholders in unique community-university partnerships to utilize spatial thinking and geographic methods (e.g. mapping, Geographic Information Systems or GIS, participatory action research, field data collection, focus groups, and interviews) to cooperatively address the needs and desires of community groups, neighborhood institutions, and residents.

**Making Environmental Science Relevant to a Diverse Student Body at ASU West**

*Becky Ball, School of Mathematical & Natural Sciences,*
*Arizona State University at the West Campus*

The School of Mathematical & Natural Sciences at the West Campus of Arizona State University serves a very diverse population of students, with ~40% of our majors from Hispanic, Asian-American, American Indian, and African American ethnicities, and half female. Most of our students come from the local Phoenix area, and their urban background may influence their perception of the relevance of environmental science to their every-day lives. Environmental science courses can maintain their relevance to students that do not feel a strong connection with their natural world by being taught from a human-oriented perspective. In many of our courses, we highlight the relationship between the environment and human well-being. For example, one upper-level course in the Environmental Science concentration is called The Human Environment (LSC 362), which explores human beings' interactions with the biophysical world, particularly how we are changing our world and our world is changing us. Earth system and environmental science topics, such as climate, biogeochemical cycles, and water, are covered by explaining how humans rely upon and influence these environmental properties, and therefore how environmental science shapes humans' past and future.

To maintain societal importance, we leverage our place in the Sonoran Desert, focusing often on local environmental issues and involving students more in the meaning of socioenvironmental issues in their Sonoran Desert home. For example, in the Fundamentals of Ecology laboratory (LSC 322), many of our lab exercises study the impacts of urbanization and human management decisions on environmental properties (e.g., soils). We aim to have students investigate the impacts of human activity on ecological interactions in the Sonoran Desert beyond basic natural history of the geology, plants, and animals.

Beyond the overall "slant" of our courses, several other methods are used within many of our courses. Many of our faculty use recent news articles and main-stream media clips in lecture to engage students in the societal relevance of environmental issues to economics, public policy, and current political issues. Our classes are relatively small in size (ranging from 10-50 students in our environmental science courses), so seminar-style discussions further are feasible to develop the students' understanding of the material as well as its societal relevance.

We also emphasize excellence in undergraduate research in environmental science. Science is inherently a hypothesis-inspired, research-driven field, but students often have little or no experience with generating their own hypotheses and conducting question-based research beyond formulaic classroom activities (Nilson, 2010). This is particularly true in classroom settings if they lack a forum to discuss student ideas and questions (Mazur, 2009). Students learn and retain more when they are given the opportunity to conduct hands-on, impactful research (Hofstein *et al.*, 2005, Kuh *et al.*, 2008). Incorporating environmental science research, rather than just state-of-knowledge, in our curriculum builds a population of students that are connected with the environmental science of their region. Our faculty actively mentor undergraduates in our research labs. These students have completed meaningful research, with their data being presented at professional meetings and published in peer-reviewed manuscripts. They graduate with a much more in-depth understanding of the principles and relevance of environmental science.

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**Creating a Thriving Geoscience Program at a Small, Minority-Serving Public University**

California State University, Bakersfield (CSUB) is located in Kern County in the southern San Joaquin Valley of California. It is the only comprehensive 4-year university within a radius of over 100 miles with a mandated service area the size of West Virginia that also includes parts of the Mojave Desert, the Sierra Nevada mountains, and the Great Basin. This is a rapidly growing area of California, generally characterized by low educational attainment and low income. It has a large and fast-growing minority population from groups underrepresented in the sciences (mostly Hispanic) and a low college-going rate. The vast majority of CSUB's students are from this region and the student body reflects its demographics. With about 8,500 students, CSUB is one of the smallest campuses in the 23-campus California State University system.

The economy of CSUB's service region is based primarily on petroleum and agriculture in the San Joaquin Valley, as well as military bases and research facilities, and the emerging alternative energy and private aerospace industries in the eastern desert areas. The low educational attainment and the lack of a well-trained science, engineering, and technology workforce is a serious impediment for these industries and the region's economy. Career opportunities for geoscientists in the region are excellent.

Our students, especially those from underrepresented groups, often have substantial responsibilities outside of their college career. Many are supporting families, others are single parents, and almost all work to pay for their education. As a result, students tend to be very pragmatic about their education and want a degree that will lead to professional employment in their chosen field. Due to the lack of rigorous geology classes at high schools, students enter the university unaware of the field and the excellent career opportunities it provides. If they have an image about geologists, it is usually that they work outside in hot and dusty places. This is exactly what our first-generation college students whose parents and grandparents are often field laborers want to get away from. Recruiting geology majors from our student body is therefore a challenge.

CSUB's Department of Geological Sciences has stepped up to this recruiting challenge in a number of ways: 1) We work with area high schools to offer rigorous geology classes that attract college-bound students (Gillespie et al, 2013). 2) We changed our promotional materials which used to highlight field trips and field work to a focus on job opportunities and geology students working on sophisticated analytical instruments or on computer models. 3) We provide scholarships that make it easier for students to succeed and complete their degrees in a timely manner. 4) We use students, alumni, and professionals from the community as role models in K-12 outreach efforts.

As a result, the department now has well over 100 undergraduate majors with demographics similar to the university as a whole. In 2012/2013, 18 students graduated, 8 from underrepresented groups. In Fall 2013 we had 33 new freshmen geology majors.

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Geology at NOVA: Important ideas that are failing to reach everyone

**Part I: No plan for minorities, and the data show it**

At Northern Virginia Community College's Annandale campus, we have no department-wide (or discipline-wide, or division-wide) approach to specifically addressing the recruitment and retention of students from under-represented backgrounds. That said, our STEM faculty are a diverse group, as befits the diversity of our region of the country. There are plenty of role models of every stripe for minority students to look up to.

Geology, I'm sorry to say, is the exception to this rule. It's hard to be fully diversified when your program is as small as ours, however the percentages are still stark: As of spring 2014 on our campus, 3/3 full time geology faculty members are white, 2/3 are male. Our lone geology staff member is a white male. Among our campus's adjunct instructors, 4/4 are white, and 3/4 are male. Among all full time geology faculty (at all campuses) across the college, 7/8 are white, and 7/8 are male. College-wide geology adjunct data are not available to me at this time, though I suspect they would look very similar.

Our society does not match this pattern. Our students do not match this pattern. Table 1 shows the demographic breakdown of science, engineering, and mathematics students at NOVA, broken out by discipline:

| | *Geology* | *Engineering* | *Math* | *Biology* | *Chemistry* | *Physics* |
|---|---|---|---|---|---|---|
| Male | 55.0% | 85.8% | 52.6% | 38.6% | 46.3% | 65.4% |
| Female | 45.0% | 14.2% | 47.4% | 61.4% | 53.7% | 34.6% |
| **% of total STEM** | **4.3%** | **3.3%** | **52.8%** | **29.4%** | **9.2%** | **4.3%** |
| White | 58.8% | 43.0% | 45.6% | 45.0% | 44.4% | 45.0% |
| Black | 10.1% | 13.2% | 14.9% | 16.9% | 15.9% | 12.8% |
| Native American | 0.7% | 0.4% | 0.4% | 0.5% | 0.4% | 0.4% |
| Asian | 13.1% | 22.5% | 18.3% | 17.8% | 22.9% | 24.9% |
| Hispanic | 11.2% | 14.1% | 14.9% | 13.9% | 10.1% | 10.5% |
| Other | 6.2% | 6.7% | 5.9% | 6.0% | 6.3% | 6.5% |

**Table 1:** *Demographic statistics (race, ethnicity, and gender numbers) for Geology vs. Math, Biology, Chemistry, Physics, and Engineering for the past five years at 5 NOVA campuses (Annandale, Alexandria, Loudoun, Manassas, and Woodbridge; The Medical Education campus not included, since they do not teach non-medical courses). 274,818 total student course enrollments included, spanning Summer 2008 to Spring 2013. Data compiled by NOVA's Office of Institutional Research in February, 2014.*

A few comments on these numbers:

- Geology at NOVA is male dominated, but it's more equitable than physics and engineering. The math numbers likely reflect a more standardized sample of the College's population, since every degree-seeking student is required to take some math classes, and geology's gender ratio is not too far off (~2.4%) the math distribution.

- Geology, like physics & engineering, is a pretty small piece of the pie. Math & biology dominate.
- Geology at NOVA is dominated by white students, and these numbers are not only far off the math ratios, but they are also the least diverse of any of the STEM fields for which data is shown. Geology has the smallest percentage of black students and Asian students. Geology's proportion of Hispanic students is below the base proportion of the population (as indicated by the math numbers, mirrored by engineering & biology), but it's marginally better than chemistry or physics.

**Part II: But geology is important!**

The prompt for this essay is about how our "programs" help connect students' learning Earth science to the issues they care about. While that sounds like a noble goal, I'm not sure I can speak to our "program," *sensu lato*. Instead, I can relate information about what happens in my own classroom, and readers should recognize that my colleagues at the Annandale campus (or at the four other NOVA campuses where geology is taught) may be doing something different.

So, with that caveat in mind: I heartily endorse the assumption behind the essay prompt: that learning about the Earth is important, and that learning is easiest when it's tied to pre-existing understanding, particularly when that understanding is of great personal importance to the students. Earth science literacy is a primary goal for my own teaching. Every human being in the world deserves the opportunity to learn what science has to say about their place in the Earth system, and indeed the universe, not to mention space-time itself. I'd argue, in fact, that every human has a responsibility to seek out the scientific learning that informs this perspective. I invoke the reliance of our existence on geological processes and products at every opportunity. This takes many forms, big and small, tangible and esoteric: the miraculous transformation of a flammable metal and a poisonous gas into halite, a mineral that makes French fries taste good, or the cycling of carbon dioxide and oxygen between producers and consumers, or the fireproofing ability of vermiculite, or the best way to cope with volcanic hazards, how ancient photosynthesis drives modern power plants, or why diving under breaking ocean waves is a good strategy to avoid getting clobbered. Examples are endless. Not only does every human depend on geologic resources and actions in every moment of every day, with every meal, transaction, and breath, but it's never going to change, for every human alive today is going to spend the rest of their lives living on this planet, this oblate spheroid whirling in the Goldilocks Zone, an isolated and beautiful prison with 7.1 billion fellow inmates.

So how do I help students understand this? I point it out to them. I remind them of it. Their minds come to me focused on family and friends (other people), wrapped in the gauzy distractions of pop culture, and with a sense of material entitlement and a lack of curiosity into the ultimate origins of things. I find very few who naturally ask questions like, Where did my iPhone come from? Why is that mountain there? Where did people come from? Where did life come from? Once I crack the shell of their calcified perspective, I find they sparkle as new realizations come shining in.

As for "relevance" and "societal importance," there are the obvious answers about geological issues in the news: energy sources, perturbation of the carbon cycle and attendant warming-induced ecosystem

stress / cryosphere destabilization, and hazards, not to mention "stuff" (geologic resources: that which the Earth provides through harvesting and mining). But there's also relevant material in geology beyond what the television talking heads consider important. I'm talking about a sense of place, a sense of connection to epic ancient events, a sense of kinship with organisms long extinct, as well as their modern descendants, both charismatic and insidious. Geology's great contribution to human intellectual thought is its revelation of deep time, and when we tap into that, we attain a sense of the grand sweep of history, and what our time looks like from the perspective of other times. We get a sense of what's a big deal from the planetary perspective, and how that differs from what's a big deal to the gang of self-aware primates with their tremendous dependence on technology for survival.

Probably the greatest single intellectual enhancement we can impart to students is critical thinking. Whether they end up taking a second geology class (or not), majoring in geology (or not), or embarking on a geological career (or not), they need to be citizens capable of independent thought. Being able to recognize the value of data-driven decisions, of the pitfalls of ideology and dogma, is of paramount importance. I particularly emphasize the recognition of logical fallacies in my Environmental Geology course, and it's a major theme in the carbon cycle unit that colleagues and I are writing for the InTeGrate project. Our society would benefit from less jingoism, tribalism, & spin. It would benefit from more rigorous thinking, creativity, & honesty. Science embodies the latter, & pares aware at the former.

As to how all this feeds into the geology program's work throughout the cycle of attracting new students, supporting them through the major, and preparing them for careers, I'm afraid I don't have any great answers. We attract the majority of our students through three principle routes that I'm aware of: Students either have (a) a perception that geology will be easier than some other science option, or (b) an attraction to environmental issues (subcategories include "sexy" hazards like volcanoes or earthquakes and issues related to sustainability of human civilization: climate change, etc.), or (c) a positive experience with geoscience at the high school or amateur hobby level. All of these are external: that is to say, we don't do anything specific to attract students, but this is why they come to us. We don't have a 'major,' so we can't support them through their major, but more broadly, we do offer them additional opportunities (field trips, conferences, research projects, Honors course options), and in many ways, this is how we craft future GMU, JMU, or William & Mary majors from the multitude of students taking geology courses as part of their general education requirements. We mentor them and give them opportunities to push themselves further, and we advise them about where to go for their B.S. degree (mainly Virginia schools, since tuition is so low), and looking beyond for strategies and approaches to jobs and graduate school.

All told, I feel like our department-wide approach is:

- a 'status quo' historical artifact that is neither deliberate nor well thought-out,
- ineffective at capturing a diversity of students that matches the general population, & therefore,
- failing to impart key perspectives from Earth science into the larger community.

We are open to change. It is my hope that the Broadening Access workshop will allow me to bring back new strategies which will catalyze a more inclusive efficacy in our mission.

# Importance of role models, introductory courses, and outreach to increasing the number of majors in geosciences

Lawrence Braile, Purdue University-Main Campus

Many of us have likely had experience with the following ideas and strategies for increasing the number of geosciences majors in our programs and increasing the diversity of our undergraduate students. Although I don't have hard data to demonstrate effectiveness, I believe that the strategies described below "make sense" and can have significant impact; and there is some anecdotal evidence of their effectiveness.

Importance of role models: The faculty of the Department of Earth, Atmospheric, and Planetary Sciences (EAPS, http://www.eaps.purdue.edu/) at Purdue University currently consists of 39 professors (12 are joint appointments with other departments on campus) of whom six are women, two are Native American, and one is African-American. A little over a decade ago, the department had (temporarily) no women faculty members. The impact of role models has been important in attracting women undergraduate and graduate students and is evident in the number of students who choose to work with the women professors. Also, the department's percentage of women undergraduate students has increased from 27.2% in 2009 to 39.1% in 2014. The impact is also evident in students who work with the other URM faculty members in the department. The University has had Sloan Foundation funds for many years to attract and support Native American graduate students and several have completed programs or are currently enrolled in our program. We have also observed that the existence of a "critical mass" of URM faculty is important in recruiting new URM students and faculty members to the department. The university has been very receptive to dual career hires, and eight EAPS professors (current or recent faculty members) have been hired, including a spousal hire, within our department or in other areas of the university. The dual career hires have been important in attracting URM faculty members in EAPS. Another area of impact of role models in our department (which is likely similar to many other programs at other colleges and universities), is that we have an alumni advisory committee that meets with the department about twice each year. In addition to the important feedback and recommendations from committee members, the committee membership, with a diverse group of former students, is an opportunity to highlight the success of minority alums which impacts our current students who also help the department recruit future students.

Introductory geosciences courses: Another program characteristic that can attract geosciences majors is effective introductory courses. Almost all geosciences programs at U.S. colleges and universities include introductory courses. Some of the introductory courses are intended for majors and some are courses (we describe them as service courses) that help larger numbers of undergraduate students meet a science course degree requirement, or that simply attract undergraduates as an elective of interest in their academic program. Generally, a very small

percentage of students in the service courses are attracted to the department as majors. This situation is often due to the fact that most students in these courses have already selected a major (some enroll as juniors or seniors because they delayed taking their science requirement, and have selected the geosciences in preference to physics, chemistry or biology), and are enrolled in the course to complete a science course requirement. This result (very few majors recruited from introductory courses) can be discouraging to faculty teaching these courses and to the department (and to deans). However, there are significant benefits to having quality introductory geosciences courses that enroll large numbers of students. Firstly, the courses are an opportunity to engage a large number of students who, as members of the public and future leaders, will be responsible for important decisions and policymaking related to societal issues that are fundamentally geosciences – including energy, resources, environment, and natural hazards. Using these and other topics, we can illustrate that the geosciences are interesting and an important part of their daily lives. Also, public understanding, knowledge and appreciation of these subjects, and other areas of the geosciences, are important to the world and to the future of the geosciences. Secondly, if these courses are effective and relevant, the students that are currently enrolled may recommend the courses to their fellow students resulting in increased impact and greater potential for attracting future majors. Thirdly, some of the students in these courses will likely be future teachers, so providing them with geosciences background and knowledge may impact their future teaching and eventually lead to increased interest in geosciences and numbers of majors in our programs. Finally, the large introductory service courses often include significant numbers of international and minority students (may be a reasonable "cross section" of the student population at our institutions), so the courses are an important opportunity to engage these students in the geosciences and attract majors.

Of course, outreach to students, K-12 teachers and the public through formal outreach programs, attractive displays and museum content within our departments, and Internet home pages are useful in enlarging the audience and enhancing our message.

# St. Anthony Falls Laboratory and the National Center for Earth-surface Dynamics—Supporting Broadened Participation through Networking, Mentoring, Team Building, and Institutional Change

Diana Dalbotten, St. Anthony Falls Laboratory/National Center for Earth-surface Dynamics, University of Minnesota-Twin Cities

For a decade and more, the National Center for Earth-surface Dynamics (NCED) has been headquartered at the St. Anthony Falls Laboratory (SAFL), University of Minnesota. This has allowed us to pursue a sustained approach to increasing diversity across our partner institutions, and to develop an approach to broadening participation in the geosciences that is informed by current research on diversity and inclusion, directed by an ongoing strategic planning process, and supported by a strong network of collaborative partner institutions.

SAFL/NCED Diversity programs take advantage of the best research on promoting and supporting STEM participation by underrepresented groups. Our diversity programs are focused on broadening participation of Native Americans in the geosciences. The proximity of Native American reservations to the University of Minnesota was the initial impetus for collaboration with a tribal college as a specific focus of our diversity programming efforts. Northern Minnesota is spanned by Ojibwe (Chippewa) reservations, including the Fond du Lac Band of Lake Superior Chippewa , which lies just southwest of Duluth, Minnesota. The Fond du Lac Tribal and Community College has been an NCED institutional partner since our inception. Since that time, we have demonstrated the extent to which a research center with an Earth focus can have a strong connection with Native American communities, which have a cultural tradition of observing and caring for environments across this continent and an ongoing interest in improving natural resource management on reservations and in areas where reservations have rights based on treaties with the US government.

A report by the American Indian Science and Engineering Society gives guidelines for improving STEM education for American Indians: “provide students with the opportunity to develop themselves as whole persons: emotionally, spiritually, physically, and mentally and include a needs analysis of student learning styles and cultures” (AISES, 1995). However, there has been very little research done to show exactly how one can take a holistic approach that strives to teach to the whole student and incorporate different learning styles. In order to implement these guidelines in a practical form, we developed the “Seven Elements of STEM Learning,” to promote learning in Manoomin Science Camps that is both holistic and individualized and incorporates the “needs analysis of student learning styles” called for by AISES. In order to ensure that the activities develop the whole student in preparation for STEM undergraduate work, Dalbotten identified these Seven Elements that are essential to meeting the academic needs of the student. Dalbotten developed these ‘Seven Elements’ by synthesizing information from research on American Indians and STEM learning, particularly that from AISES, as well as research on college-readiness for STEM majors, and articles from government and industry outlining the STEM employee of the future and needed skills. NCED’s gidakiimanaaniwigamig program developed a systemic approach (the Seven Elements) to informal education that encourages the student to: See,

Describe, Tinker, Quantify, Understand, Relate, and Grow, accommodating participants' individual learning styles. In addition, working with tribal elders, we have articulated the *Circle of Learning*, a conceptual framework that emphasizes trust- and relationship-building between researchers, teachers, students, and American Indian community members. More information can be found in the paper "NSF-OEDG Manoomin Science Camp Project: A Model for Engaging American Indian Students in Science, Technology, Engineering, and Mathematics" which will be published in the upcoming (May 2014) Journal of Geoscience Education Special Issue on Place-Based Education.

Our strategic approach towards supporting diversity in the geosciences has four main elements:

1. *Creating a network of supporting researchers and establishing trusted, long- lasting partnerships is a first step in mentoring*.

Fig 1. NCED PI Chris Paola (on bucket) at an informal mentoring session with REU and Faculty-to-Faculty participants at the St. Anthony Falls Laboratory, University of Minnesota.

At SAFL, mentoring is part of the laboratory culture, and is planned into every program, as well as supported and acknowledged. Positive outcomes in mentoring relationships are particularly dependent on clearly articulated expectations for both mentors and participants. Effective mentoring begins long before mentor and student meet. To support this, active listening sessions with stakeholders and target audiences are an important part of program design and evaluation. Particularly, in support of the work of SAFL/NCED partner institutions towards broadening participation, existing mentoring structures were reviewed, weighing their potential for maximizing student success and mentor satisfaction.

2. *Every student has the ability to reach their potential if they feel part of a community and are presented with engaging opportunities.*

At SAFL, we know that there are many capable students who have the capacity to participate in STEM careers but are failing to be identified and recruited through normal operational channels. Barriers to success are often found more in circumstances than in abilities. For example, there are a large number of non-traditional undergraduate students who fail to be recruited into research programs or other academically enriching activities because they have barriers to their participation such as: spouses, children, jobs, aging parents, checkered academic careers, etc. Our philosophy is one of meeting the student at least half way. For example, recent statistics on community college students show that the

Figure 2: NCED recruits and supports non-traditional students as participants in our programs. Carla, who is working on an Environmental Science degree at Lac Courte Oreille Tribal College is the first grandmother to participate in the Research Experience for Undergraduates on Sustainable Land and Water Resources, but she was joined by six other parents who were REU participants in summer 2012.

average age is 29, 59% are part-time, and 27% are parents (http://www.aacc.nche.edu/AboutCC/Trends/Pages/enrollment.aspx). These colleges, along with other Minority-Serving Institutions (MSIs), such as tribal colleges and universities, are the starting point, academically, for the majority of students

from underrepresented groups. By designing our programs such that they are flexible, located where the students live, and take into account students' academic challenges during the admissions process, we have the best ability to break barriers that keep students from achieving academic success in STEM careers. We try to meet our mentees halfway, figuratively as well as literally, by working hard to find out what motivates and interests our students, and where they find relevance in their lives. We have place-based and community-inspired research projects central to all of our programs that support broadened participation in the geosciences. By involving students in research projects that are directly related to their community we reach out to students and help them see the relevance of science, engineering, and mathematics to their lives and their communities.

3. A team approach can improve the student mentoring experience.

At SAFL, our team mentoring structure is enhanced by the highly interdisciplinary and collaborative nature of SAFL research. SAFL diversity programs all incorporate mentoring teams of students on topics where a team effort and a diverse disciplinary expertise is needed (e.g., the REU on Sustainable Land and Water Resources has teams working on groundwater, stream restoration, and wild rice history interpretation from lake cores). There is also value in having a team of mentors, as opposed to one advisor, so students have a variety of people with whom to interact. We also believe that a structure which allows all of our mentors and participants to both teach and learn is satisfying to both participants and mentors. Mentoring teams at NCED include faculty members, graduate students, and other specialists who guide students in acquiring skills in communication, writing, metacognitive processes, and life skills to support academic excellence. NCED mentor teams often include Native American faculty, elders and community members, who support us in creating culturally-responsive mentoring policies and processes and in offering culturally-aware mentor training. Peer mentoring and near-peer

mentoring are encouraged; students who continue in any NCED program beyond their first year become leaders among their peers and are encouraged to take on a mentoring role themselves. Graduate students are encouraged to act as mentors to undergraduates and K-12 students.

Fig. 3. Students and faculty and team mentors from one of our earliest NCED Undergraduate Summer Internship Program cohorts in Summer 2005 at the end-of summer University of Minnesota Research Symposium.

*4. Support institutional change at the University of Minnesota and nationally.*

After a decade of NSF support through NCED, SAFL embraces the responsibility of taking leadership within our institution, and on a national basis, for supporting broadened participation in STEM. By continuing to advance our network of collaborators and partners through alliances such as the Geoscience Alliance, SAFL works to promote new approaches and collaborations towards this end. Permanent change in the representation of the whole population in the STEM enterprise requires a focus on system-wide barriers and new methods for addressing these barriers. Existing and new networks and ongoing collaborations will be nurtured as part of the essential mission of SAFL to promote broad participation in all SAFL enterprises. SAFL alumni who are now faculty at institutions across the country, nurtured in an environment that promotes better broader impacts, will be supported by SAFL as they work on developing new education, engagement and public outreach programs. SAFL will continue to play a central role in the College of Science and Engineering to promote diversity at the University of Minnesota and support STEM learning across the state and the nation. .

**References:** American Indian Science and Engineering Society (AISES). 1995. Educating American Indian/Alaska Native elementary and secondary school students: Guidelines for mathematics, science, and technology programs, in Proceedings of a conference on the educational needs of American Indian/Alaska Native students in science, mathematics, and technology (Boulder, CO, May 19-22, 1994), published by AISES.

**Sustaining an Undergraduate Research Program that Serves as a Bridge Between 2YC and 4YC**

*Diane Doser, Professor, University of Texas at El Paso*

For the past ~4 years the University of Texas at El Paso (UTEP) has been working with El Paso Community College (EPCC) to help ease the transition of underrepresented students in geoscience and environmental science between our institutions. One of most successful activities has been the establishment of cross-institutional research projects with EPCC students. Support for the projects originally came from WAESO (Western Alliance to Expand Student Opportunities) and later an NSF OEDG grant to EPCC, but continuation of the research program requires it to become self-sustaining. In the past year we have focused on a variety of research projects that can be conducted in agricultural fields located with ~300 m of the Mission del Valle campus of EPCC. The projects primarily focus on geochemistry, geophysics and sedimentology and how these factors affect agricultural crop yields. This has decreased or eliminated transportation costs for EPCC students to work on projects. Many UTEP undergraduates participating in the program also live a short drive from this field site. We have found that although the small stipends (~$1000/semester) we were originally able to pay EPCC participants were appreciated, they considered the opportunity to work on research valuable even if we were unable to pay them. Several of the UTEP students who helped mentor and direct EPCC students in the field this year have been able to find support through competitive research grant programs administered by the UTEP's Provost's Office and UTEP's Campus Office for Undergraduate Research Initiatives. EPCC students are initially introduced to the field area in introductory geology courses and short field trips are made to the site. As research work continues at the site we plan to involve other UTEP faculty with specialties in geochemistry, sensor design, remote sensing and ecology. In fall 2013 ten EPCC students (the majority from underrepresented groups) transferred to UTEP's BS programs in geology or environmental science. Most transferred as a direct result of the mentoring and research opportunities they received while still at EPCC, and all are returning to UTEP for the spring 2014 semester.

# CUAHSI Education and Outreach Programs

Emily Geosling and Jennifer Arrigo, CUAHSI

As a university consortium operating on a national scale, CUAHSI has a unique role to provide our university community members with support and opportunities to integrate their research with highly effective teaching and communication of water science to a broader audience. Thus, while CUAHSI is not directly delivering STEM education programs, our Education and Outreach programs aim to provide resources to those who do. Our offerings include courses, topical modules, laboratory exercises, and videos, which incorporate new research and encourage broad interest in environmental science.

Many of these resources are based around the premise that students will be motivated and learn best when earth science and systems concepts are connected to tangible relevant places, experiences, and issues for those participating students. CUAHSI hosts and organizes learning materials that can be used to convey these concepts through an examination of the role of water in the earth system. Two key programs that we use in order to develop and disseminate these resources are the NSF-funded Water Data Center and our ongoing partnership with university community to produce "Let's Talk About Water" events.

CUAHSI operates the "Water Data Center" (WDC), a facility that provides public-access data services to the hydrologic science community and other critical-zone science communities that requires access to various sources of water data to perform research on fundamental challenges in hydrology and earth system science. We enable the water research community by supporting data access, data publication, software development, and curation, in addition to the development of technology standards that ease data discovery, access, and sharing. In addition to supporting basic and applied research, these data are valuable resources for creating place- and problem-based learning.

The CUAHSI Water Data Center (WDC) supports educators in creating and sharing innovative approaches to using real data in the classroom using CUAHSI data services. Working with our university members who both deliver undergraduate education and work with K-12 educators, we have found that educators who want to employ real data and tailored content face significant barriers, including: finding the correct data products; linking the data to software that can view, process, and interpret results; and being able to effectively use "big data" products in a classroom environment. Our tools for data discovery, access, and analysis allow students and educators to search for data in their "own backyard," discover data related to local issues, and, in some cases, even contribute data back to the system. CUAHSI has partnered with several of our university members to explore and disseminate best practices for bringing real data into the classroom and maintains and solicits new materials for STEM education modules at: http://wdc.cuahsi.org/WDC/Education.html.

CUAHSI also produces ongoing outreach programs that are meant to stimulate student interest in environmental science and careers in water science that we execute in conjunction with our university community. Our "Let's Talk About Water" (LTAW) program is the primary program targeted toward an

undergraduate audience and again uses the concept of tapping in to local issues and personal experiences to make science interesting and relevant to the audience. LTAW focuses on water issues through a format that consists of viewing the documentary with a carefully selected (and prepared) panel and holding a question-and-answer (Q&A) session following the film. Several "Let's Talk About Water" events have been successfully presented on multiple college campuses thanks to this easy-to-follow formula, which serves to maximize the effectiveness of Q&A sessions after films. CUAHSI developed this approach after attending many events where the Q&A formats after movies generally did not work well. Panelists often gave extended speeches that did not directly address topics raised by the film and failed to connect the dots between events depicted in the film and issues relevant to the audiences' lives.

The "Let's Talk About Water" format addresses these problems with thoughtful preparation and careful execution of the event and specifically targets lower division undergraduates to teach them about the importance of water science and attract them to water science careers. For example, a multi-campus event in Boston involving the University of Massachusetts Boston, Northeastern University, and Tufts University rotates annually among the campuses to expose undergraduates to these different campuses and their graduate programs. For the past 6 years, CUAHSI staff has worked with instructors in entry-level earth science, engineering, and public health courses to offer extra credit to students who attend the "Let's Talk About Water" events. This has helped to attract audiences of about 200 students to each film viewing and subsequent discussion. CUAHSI works with university hosts to craft a program with an appropriate film that connects to local issues and a panel that includes local experts and a mix of academics and practitioners. As the science discussion winds down, moderators have segued into discussion of their own career experiences and future career options for students in a range of water-related careers, including consulting, research, resources management, policy, and law. Using this approach, CUAHSI has sustained lively discussions for more than 90 minutes at all events. Students rated the events highly and some even found internships with the panelists at the event. We've documented this formula and the resources we offer to hold events in an EOS article and on our website.

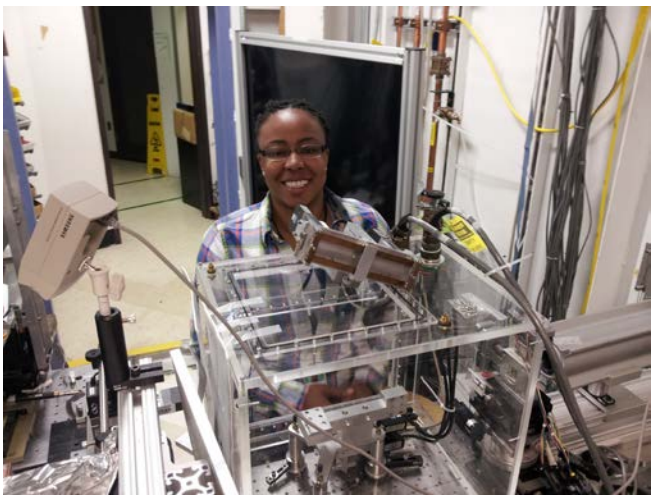
These two programs represent the role CUAHSI can play in supporting our university members and stimulating student interest in STEM careers. When we hear from our community of a need ("We need help with data-based problem sets," "It's too difficult to develop real-data based lessons," "We want to do more effective campus outreach events,"), CUAHSI staff works with university partners to develop and pilot programs. These ideas and resources can then be disseminated to the broader university community and, if successful, sustained as education support services. CUAHSI is continually looking for new partners and ideas, with the idea that the Consortium's role is to support development of innovative, successful approaches to education and outreach that can be supported, shared, and replicated for community benefit.

# A Career Path for African-American Students from HBCUs to National Laboratories

Robert C. Liebermann and Gabriel Gwanmesia

This program was funded effective Sept. 15, 2011 by the Directorate for Geosciences of NSF, and is also supported by matching funds from the Photon Sciences Division of the Brookhaven National Laboratory and the Graduate School of Stony Brook University.

We have already had great success in recruiting students to this 2-year program leading to a MS degree in Geosciences instrumentation at Stony Brook and positioning them for employment as Science Associates in national user facilities of the DOE, such as the National Synchrotron Light Source at Brookhaven.



Ashley Thompson from Delaware State University with a major in Physics and Engineering arrived January 2012 (photo right). She conducted her internship research with Professor Ehm at the NSLS which focused on development of an environmental chamber for conducting experiments on the X17B3 beamline supported by COMPRES, with the objective of contributing to techniques for carbon capture and storage. She also presented a poster on this work at the Annual Meeting of COMPRES in mid-June 2013. In December 20013, Ashley successfully defended her M. S. thesis and was awarded a Master of Science degree by Stony Brook University at a graduation ceremony on December 19.

Melissa Sims from the University of South Carolina, with a major in geophysics/seismology, arrived in September 2012 to begin her graduate study. She is pursuing a research project at the NSLS under the supervision of Professor Lars Ehm; the goal of her project is the development of improved computational techniques to analyze Debye-Scherrer X-ray diffraction patterns. She presented a poster on this work at the Annual Meeting of COMPRES in mid-June. We anticipate that Melissa will graduate with her M. S. degree in May 2014.

Photo of Ashley Thompson, Melissa Sims and Adairé Heady at the NSLS of Brookhaven National Laboratory.

Adairé Heady from Delaware State University with a major in Physics and Engineering arrived in September 2012 to begin her graduate study. She is pursuing a research project at the NSLS under the supervision of Professor Lars Ehm; the goal of her project is development of a new furnace for internal resistive heating in a diamond-anvil cell. She presented a poster on this work at the Annual Meeting of COMPRES in mid-June. We anticipate that Adairé will graduate with her M. S. degree in May 2014.

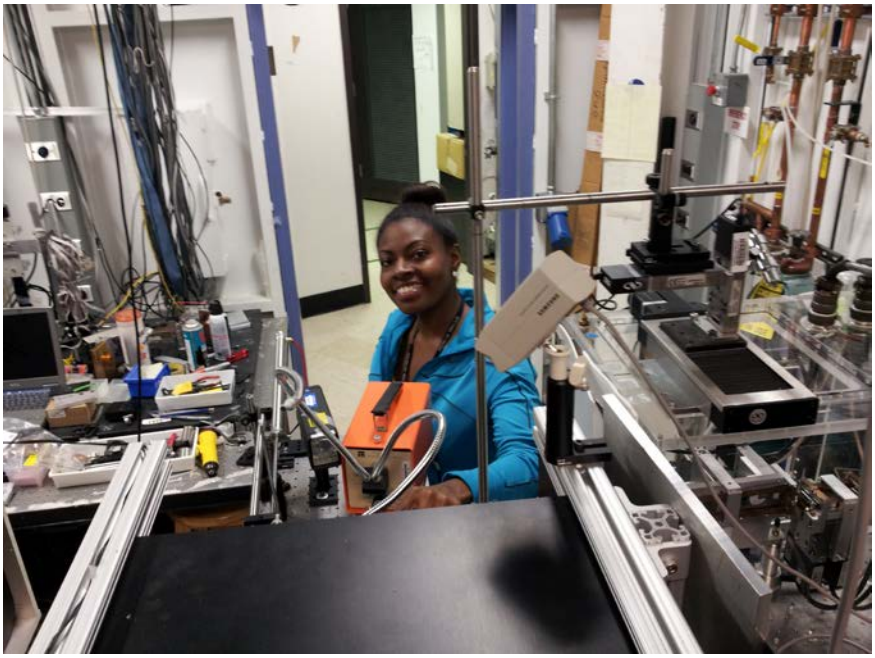


Photo of Adairé Heady at the X17C beamline of the NSLS at BNL.

In the summers of 2012 and 2013, Brandon Rhymer, and undergraduate student from the University of the Virgin Islands in St. Thomas, participated in the SULI program at the Brookhaven National Laboratory. He conducted research projects at both BNL and in the Stony Brook High Pressure Laboratory under the supervision of Gabriel Gwanmesia and Lars Ehm. Brandon has applied for admission to our MS program in Geosciences Instrumentation for Fall 2014.

In July 2013, Brittany McGregor, an undergraduate student from Florida State University. will arrive for a 6-week summer program. She will be working in collaboration with Lars Ehm and the other OEDG students and we hope to be able to recruit her to our graduate MS in Geosciences Instrumentation in the near future.

In developing this new program, we built on the evolving relationship between professors from Historical Black Colleges and Universities [HBCUs] and the NSLS at BNL. An outcome of this relationship has been the creation of an Interdisciplinary Consortium for Research and Educational Access in Science and Engineering [INCREASE], a consortium of Minority-Serving Institutions (MSIs) whose mission is to promote the research and education of faculty and students at MSIs and of minority faculty and students at non-MSIs, especially as regards facilitating their access and utilization of national user facilities, thereby increasing the numbers of those from historically underrepresented groups who pursue science and engineering careers.

We are continuing to build on our relationship with faculty from INCREASE, involving utilization of national user facilities, such as the NSLS at BNL. On April 18-19, 2012 we attended a Workshop at Brookhaven of this organization; see group photo below.

On June 6, 2012, Liebermann and Gwanmesia attended a one-day workshop at Stony Brook to host faculty from the Department of Energy Visiting Faculty Summer Program of Brookhaven National Laboratory. This workshop was co-sponsored by the Center for Inclusive Education and the Graduate School at Stony Brook and 18 faculty from HBCUs and MSIs from the metropolitan New York area and throughout the southeastern U. S.

Rebecca Haacker-Santos
January 30, 2014

# The SOARS Program - Engaging Minority Students through Geoscience Research Experiences

Significant Opportunities in Atmospheric and Related Sciences (SOARS) combines a summer internship with year-round mentoring, conference travel, and publishing support. During their ten week internship at the National Center for Atmospheric Research (NCAR), SOARS protégés get to choose a research topic and will explore it with the help of their scientific mentors. They also attend a weekly scientific communication workshop, seminars about graduate school and career choices, and complete end-of-summer poster and oral presentations. Topics of research span the broad field of climate and weather, including computing and engineering in support of the atmospheric sciences.

Mentor Julie Caron, protégé Manuel Hernandez and mentor Joseph Tribbia (left to right).

SOARS aims to help increase diversity in the atmospheric sciences by serving as a bridge between undergraduate studies and graduate school for students from backgrounds typically underrepresented in these fields. Studies have shown that students from traditionally underrepresented groups tend to shy away from the geosciences, in part because they don't see them as a field that has a direct positive impact on their communities (Seymour and Hewitt, 1997; Bembry et al., 2000). However, for some of our students, 'societal relevance' is a big part of their motivation in studying meteorology, atmospheric sciences, chemistry, physics, computing, engineering or environmental science, as environmental changes and the impacts of severe weather and climate events are becoming very relevant. Underserved communities already disproportionally feel the impacts of a changing environment, with poorer urban areas being susceptible to heat waves, poorer semi-rural areas frequently being devastated by tornados, or Native American lands suffering from drought. SOARS recognizes that our science needs students from these communities to participate at the highest level, in research and academia, and is committed to helping students find their place in this field.

Our approach is three-fold: 1) Provide students from underrepresented communities with relevant, hands-on experience in atmospheric and climate research, giving them a feel for what a career in academia and research could look like for them, and the resources to allow them to follow this path; 2) Provide them with the skills and opportunities to communicate their research to both scientific and non-scientific audiences and 3) To support them in identifying and carrying out research that is engaging and important to them.

The core of the SOARS program is the summer internship. This builds on the apprenticeship model common in academia, expanding it through an individualized team of mentors who teach essential research, communication and networking skills. SOARS protégés complete an authentic research project, which they present in written, oral and poster forms by the end of the 10 week experience. While their research is guided by a team of scientist/engineer mentors, SOARS also provides a comprehensive communication workshop to develop the skills needed to effectively communicate their research, and opportunities for outreach. These skills include media training, blogging, working with K-12 students and podcasting. By the end of the summer, protégés have the ability and skills to 'think and work like a scientist' and have been exposed to a wide range of career possibilities within the atmospheric and related sciences. In addition, they have become part of a strong peer-mentoring network and have developed the beginnings of a professional network that, in many cases, remains an important part of their future careers. After the summer, SOARS continues to support and engage protégés as they continue their studies, providing ongoing mentorship, guidance for funding and graduate school applications, and travel support for attending and presenting their research at national conferences.

We have learned that increasing the participation of students from traditionally underrepresented groups in the geosciences will be more successful if we invite students from these communities to bring their own research questions to the program. Instead of prescribing a project, opening up a dialogue about what the student is curious about will greatly enhance the student's experience and increase the chances they will be retained in the geosciences (Sloan and Haacker-Santos, 2012). As such, SOARS works with our protégés to propose and carry out research that follows their own line of inquiries (e.g. see https://www2.ucar.edu/atmosnews/research/ 7721/mapping-hurricane-vulnerability). Some of our students have even gone a step further, doing field work to learn more about climate change impacts already felt by local communities. In 2012 and 2013 protégés studied community viability in the face of environmental change with local Native American and Cajun communities in Southern Louisiana. Protégés worked directly with the communities to define research problems and integrate physical science, geospatial technology and traditional ecological knowledge. These off-site research opportunities are limited to advanced protégés and often lead to graduate thesis work and publications.

SOARS carefully tracks their alumni, the vast majority of whom go on to excel in graduate school and move on to careers in atmospheric science or related STEM fields. Many of our alumni have entered academia as post docs, junior faculty, or as researchers at national research labs. Others are employed at federal intuitions such as FEMA, or the EPA. A few alumni serve as K-12 teachers or are employed in the private sector for consulting firms, the re-insurance industry or private weather companies. They remain connected to the SOARS community, committed to the SOARS mission of increasing diversity in the sciences, and play an important role in increasing the strength and diverseness of the STEM workforce.

SOARS Cohort 2013

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The SOARS Program is managed by the University Corporation for Atmospheric Research and is supported by the National Science Foundation, NCAR and partnering universities.

# The International Boundary and Water Commission: Serving the Nation and Society in Minority, Veteran and Disability Recruitment in Water Management, Engineering and Environmental Issues for Today and Tomorrow.

Mark Howe, Environmental Management Division, US State Dept, International Boundary and Water Commission

The United States Section, International Boundary and Water Commission (USIBWC) have helped to promote internal and external hiring of individuals with disabilities and minorities for many of our positions at the Headquarters Office and our Field Offices across the U.S – Mexico borderlands. As part of our mission, we strive to hire individuals with education and experience in Hydrology, Environmental Sciences, Business Administration, Engineering skills and non-technical skills. These positions are the dominant science and engineering careers we have at the USIBWC, but many other positions include those that are predominantly field related in scope. The USIBWC uses position outreaches by governmental websites but also through individuals in our various Departments at schools, universities and one on one contact for dissemination of upcoming hiring. We look to recruit more people with disabilities, veterans, minorities and others who are not in the regular workforce due to many of these factors. We have hired people with disabilities but would like to have more and are compliant with reasonable access for several of our employees and have a high standard of Equal Opportunity for positions.

The Commission is a leader in working with Mexico on international issues dealing with the border, water management, the people and communities along it. Our area of work ranges from the Pacific Ocean at San Diego, California to El Paso, Texas and ending at the Gulf of Mexico near Brownsville, Texas. We strive to be environmentally active in what we do for ourselves and future generations in all forms of government management and our management of finite resources.

A large portion of our employees are graduates of the University of Texas at El Paso (UTEP) or come from other major universities and schools across the country. We have a wide range of minority employees and actively recruit for new individuals to join our staff. As part of our work here we work with other local, state and federal agencies on projects that require a highly trained skill set. As part of our employee expertise, several have disabilities in one form or another but this does not hinder them in their work but shows others how well they can do their job. A portion of my time is spent in helping students with disabilities to show them that they can secure a job in the Federal service after graduation. As part of this I work with our Equal Employment Officer on actively recruiting people to work for the USIBWC.

As our employee workforce retires or moves on, we look forward to hiring new employees in changing work capacities. We use various earth sciences, geosciences and engineering in our work each day. Many of the employees actively engage students at the universities in undergraduate and graduate levels of education. With this engagement, we are able to show

students with or without a disability that working at the USIBWC and the Federal service is rewarding and productive and will continue in the future.

Integrating Undergraduate Research into the Geosciences at a Two-Year College

Kaatje Kraft, Mesa Community College

Research supports that undergraduate research (UGR) is critical for preparing students to be successful in STEM domains. In addition, there is evidence that participating in UGR can lead to greater persistence and can also result in an increase in STEM majors, particularly underrepresented minorities (Espinosa, 2011; Brandt & Hayes, 2012). It should not be a surprise that the Presidents Council of Advisors on Science and Teaching (Holdren & Lander, 2012) have identified UGR at the two-year college (2YC) as an important initiative in possibly broadening the participation of STEM majors. The challenges to integrating UGR at 2YC's are not ones to be taken lightly. Students may not be prepared for the rigor that is entailed in authentic research. For example, more than 50% of all students entering MCC require at least one developmental course in English, reading and/or math. Geology at MCC does not have any prerequisites, and as such, many students are co-enrolled in developmental courses and geology courses. This is mixed with students who are high achieving honors students looking to have a cheaper education for their first years prior to transfer. In addition, research often requires equipment that is expensive and time outside of the classroom that may not be available to commuter students. Finding creative ways to provide quality UGR experiences for students is an important challenge to tackle, but one that requires creativity and tenacity by the faculty member.

Kaatje Kraft (geology) and Niccole Cerveny (physical geography) have both found creative ways to implement UGR for their students. Dr. Cerveny was awarded an NSF grant (#0837451) to develop a curriculum and do research on the rock art stability in the Petrified Forest National Park. She brought students up multiple times during the semester as extra credit opportunities, offered a field course in the summer for those students who wanted to spend more extended time periods and used partnerships with colleagues at ASU and CSU for student who chose to pursue deeper research opportunities. Each trip, students were trained in assessing the risk of the rock art using the Rock Art Stability Index (RASI), developed by Dr. Cerveny and students were gathering data for a larger research assessment. So while no one student did all of the research, each student was able to experience what it means to collect real data in the field. Several of these students are now completing their undergraduate and/or graduate degrees in the geosciences.

Dr. Kraft used a serendipitous encounter with erosion problems on campus to develop a course-based undergraduate research opportunity for students. She brought a case of differential weathering into her geologic disasters lab and asked them to determine the cause of the erosion patterns. Students worked in teams to develop hypotheses, collected data and presented their findings, including recommendations for remediation to the administration on campus. Students used the tools available, which at times were extremely rudimentary (e.g., used a junior Brunton compass to measure the slope of the parking lot in 10 foot increments), but each group was able to answer their own hypothesis. Different groups had different levels of complexity with their research projects based on their own background knowledge and capabilities, which allowed for

differential instruction. All of the student successfully completed the lab course and two students collaborated with Dr. Kraft to present their findings at the annual GSA meeting in Denver. Only one student from that class is pursuing the geosciences as a major, however, the skills the students developed in that project are the kinds of soft skills employers are looking for with all students and prepares them to be successful in future courses.

Pursuing UGR at a two-year college takes time, energy, and creativity, but in the end students learn skills beyond the content, they are more likely to persist and we can prepare students to make successful transitions to four-year institutions so they can pursue their passion and be successful doing so.

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Espinosa, L. L. (2011). Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. *Harvard Educational Review, 81*(2), 209-240.

Holdren, J. P., & Lander, E. (2012). *Engage to excel: Producing one million additional college graduates with degrees in science, technology, engineering, and mathematics*. President's Council of Advisors on Science and Technology.

# A Relevant and Applicable Geography

Adriana Martinez, Geography, Southern Illinois University Edwardsville

Geography as a discipline combines the study of physical landscapes with examinations of culture and society, weaving together influences and outcomes to enable a more nuanced understanding of the world around us. It asks student to critically examine why certain phenomenon happen in one location and not another. Through this study, students begin to ask questions across a broad range of subjects that begin with the concept of place.

For example, the human-environment aspect of our program weaves two distinct sub disciplines together in a way which builds students' understanding of how society influences the landscape around us and how that landscape influences our actions. Geography trains students to be successful in many fields that look at aspects of our world with the human-environment lens. In particular, our program emphasizes Development Studies, Globalization Studies, Regional Geography, Sustainability, and Urban Studies. Each of these in their own way allows students to understand how their lives are impacted by the environment and society surrounding them. For example, one Area of Specialization (AOS) here in the Geography Department at SIUE, Sustainability, requires students to gain a breadth of knowledge in Geography-bridging Biogeography (GEOG 316) with the Geography of Food (GEOG 405) and Global Climate Change (GEOG 430) with the Geography of World Populations (GEOG 300). In addition, the University encourages Interdisciplinary Studies (IS) courses where two faculty members from departments across campus come together to teach a melded topic with cultural and environmental significance. The Sustainability AOS suggests Natural Resources: Issues and Conflicts (IS 334), Global Problems and Human Survival (IS 336) and Living Ecologically (IS 363). Through the Geography program and the Areas of Specializations available to students, students discover new ways to understand the world around them and gain the knowledge and skills to change that world for the better. Students see that Human-Environment relationships are important and the systems they have studied can affect lives. Through their geography courses, students learn about the impacts that complex human-environment relationships have and how these interactions impact their everyday lives.
Geography's strength, its breadth, is also sometimes a hindrance for minority students in that while a geography major is widely applicable, one career path is not always apparent. A small study conducted by a colleague of mine in the Geography Department at SIUE revealed that minorities in particular, including women students, were less likely to choose geography as a major because a career path was not clear. However, as a department, we have the opportunity to circumvent these misconceptions. For example, after taking our courses, students learn that previous graduates have gone on to use their geographic skills working at the Army Corps of Engineers, GeoEye, Missouri Botanical Gardens, the National Park Service, Census Bureau, Laclede Gas Company, Monsanto, Tetra Tech, the City of Belleville, Metro Transit St. Louis, and the National Geospatial-Intelligence Agency. Therefore, I believe that our program contributes to success in that once a direct career path is expressed to the students, it is clear that employment within the St. Louis area and elsewhere is attainable. In addition, the number of minority faculty members has a direct relationship with the number of minority students. For example, approximately 10 years ago multiple women were hired as faculty members and there was a

distinct increase in the number of female majors. Increasing minority faculty numbers will have an effect on minority student numbers as well.

Our Geography program also provides students with much needed skills in the workforce that make our graduates readily employable. One such skill is the ability to use geospatial technologies like GIS (Geographic Information Systems) to address problems and devise solutions. Many employers in the St. Louis area and elsewhere are in need of students that possess these skills. Our geographers also learn critical thinking skills throughout their coursework and particularly when conducting their capstone course-the Senior Assignment (SA). During SA, students work one on one with a faculty member to address a problem, which includes data collection, processing, and analysis. The department as a whole gathers at the end of each semester so students can showcase their final product. Here the students learn to examine a problem, devise methods and present their work to a broad audience, all skills required by employers. In addition, students learn technical skills during their project, such as data analysis, and work one on one with a faculty member, building their skills to work in groups and with colleagues. While often under appreciated by students, "soft skills" such as problem solving and working well with colleagues are highly valued by potential employers.

**Infusing Relevant, Community-Based Learning into Introductory Environmental and Geoscience Curriculum,**

Julie Maxson, Metropolitan State University, Saint Paul, MN

Because the majority of Metropolitan State University students are adult residents of the Twin Cities (Minneapolis and Saint Paul) they are strongly place-based, having roots in the urban area and/or the region. They are also far more aware of local and regional events and issues than are most traditional-age students. These are distinct advantages for engaging students in geoscience and environmental content, particularly where it relates to a local event, issue, or phenomenon.

There are abundant, rich opportunities to relate course content to local examples. These include:

- Mississippi River – the river is one of Minnesota's greatest assets, aesthetically, economically, recreationally, and pedagogically.

  The geologic history of the river provides a complex and dramatic story that explains the physiographic features of the Twin Cities, and thereby provides a context for initial settlement of the region by Native American tribes as well as the locations of Saint Paul and Minneapolis. The cities are situated at the uppermost navigable point along the river prior to river engineering (St. Paul), and at its only waterfall (Minneapolis).

  The river is prone to flooding, and many students will remember "the big ones" of the 90's, and 00's. Urbanization has increased both flood frequency and magnitude in the region, as has the installation of tile drainage throughout southern Minnesota. A combination of this affect with current and projected climate trends toward more intense precipitation events in the Upper Midwest alarms many students, who then become interested in the efficacy of home-, campus- and municipal-scale changes to storm water management.

- Geologic resources – historically, a major component of Minnesota's economy has derived from mining on the Iron Range in the northern part of the state. Although the economic importance of iron ore has fluctuated significantly in the past few decades, it continues to be an active industry. In the past few years, mining has focused on a very different resource in the southern part of the state: frac sand, or proppant sand, is

abundant in near-surface layers of Paleozoic strata. Regulation of frac sand strip mining is currently developed at the county level; this provides a rich source of comparison for student investigations.

Students in introductory geoscience courses research the environmental impacts of iron mining, frac sand mining, or quarrying of glacio-fluvial gravel deposits around the state

-Groundwater—two neighborhoods in the cities have been directly contaminated by industrial pollutants. In one case, residents are directly affected by VOC vapors seeping through their foundations; in the other, an inner ring suburb where many homes have wells, residents receive bottled water from the company found responsible for the contamination. In a given class of 24 students, several will either currently live in one of these neighborhoods or will have friends or family who live there. A lab investigation for an Environmental Geology course involves student mapping of one of these contaminant plumes.

Additional student investigations focus on lake level drops due to groundwater withdrawal, water quality in deep aquifers, rates of waterfall retreat, and slope instability in the Mississippi River valley.

# Trans-disciplinary undergraduate marine science research experience in Puerto Rico

Ruby A. Montoya-Ospina, Sciences, Inter American University of Puerto Rico-Bayamon

Despite the enormous variety and socio-economic importance of marine resources in Puerto Rico, opportunities to conduct marine science research for undergraduate students are limited due to several factors, including few marine related university programs and limited infrastructure and resources at non-research institutions. Establishing collaboration among marine science research and teaching institutions from U.S. and Puerto Rico was identified as a potential way to bring marine science research opportunities to more undergraduate students and faculty from different STEM and social science (anthropology, sociology, economy) fields in Puerto Rico to develop a more inclusive trans/interdisciplinary marine science research agenda. A pilot intensive REU program was developed to support early stage (sophomore and junior) students from STEM and social sciences conducting research at a bioluminescent lagoon in Puerto Rico, in collaboration with the University of Maryland Center for Environmental Sciences.

Puerto Rico has three of the 10 most famous bioluminescent bays in the world, and are an important socio-economic resource for local communities. Puerto Rican students feel proud of these resources and concerned by its protection. This program offer the opportunity to conduct research on these environments, helping students to understand how they could contribute to protect them, how their learning is relevant for the future sustainability of Puerto Rico, feeling connected and engage with real world situations.

Many students are exposed mainly to traditional careers, such medicine, law and business administration through family, public media and society at large. Environmental related careers are perceived as oppose to "progress" or with lower relevance. In our program we focus on a trans-disciplinary approach to help the students understand the contribution and responsibility of science to society progress, using as a framework the use of a poorly studied bioluminescent lagoon by local community as a tourist attraction, analyzing challenges faces for all stakeholders.

Although this program is new and had been conducted only during the last two summers, we tested and refined a number of teaching-learning techniques that had been share with faculty from different institutions in Puerto Rico. Participation of faculty from other STEM field, such as Molecular biology, allowed to attracted more students to marine science careers. The model used of a supportive community which include from senior undergraduate students to scientists, was effective to develop self-confidence and skills that would help student through their major.

**Research Experiences in Solid Earth Science for Students (RESESS): Engaging and Supporting Historically Underrepresented Students in the Geosciences**

Over the past 9 years, UNAVCO supported 44 interns through Research Experiences in Solid Earth Science for Students (RESESS), an NSF-funded multi-year, geoscience research internship, community support, and professional development program. Upper-division students from underrepresented groups spend 11 weeks in Boulder, Colorado during the summer conducting an independent, authentic research project under the guidance of a research mentor and the support of a communications mentor. RESESS interns are also mentored and supported after the summer program, and throughout the academic year by RESESS program staff. The primary goal of the RESESS program is to increase the number of historically underrepresented students entering the geosciences. The alumni of RESESS are 55% Latino/Hispanic, 27% African American/Black, 11% Native American, and 7% Asian American. Of the 30 interns who have earned a BS or BA, 13 are enrolled in a Masters program, and 8 are currently enrolled in a doctorate program. Nine RESESS alumni are working in private industry, five of those in the geosciences.

**RESESS and Enhanced REU Elements**

RESESS includes traditional research experiences for undergraduates (REU) elements including conducting scientific research under the guidance of a science mentor, training to develop research and scientific communication skills, and social opportunities for building community. RESESS interns have at least one science mentor who guides the scientific research and career exploration as well as a communication mentor to guide development of written and oral communication skills. Working with diverse students requires programmatic elements not necessarily found in a traditional REU. To that end, RESESS also includes focused mentoring, social support systems, and additional financial support.

Students admitted to the RESESS program remain in the program until they graduate with their Bachelor's degree, provided they stay academically eligible. RESESS interns spend the first summer of participation working in Boulder, Colorado; returning interns have the option of working at another institution. These students spend the first and last week of the summer program in Boulder with the other interns developing leadership skills and sharing research results, respectively. After graduation, students are a part of the RESESS Alumni network. During their year(s) of participation, their RESESS experience is designed to support students beyond their summer research experience. Program elements contributing to student success include personalized mentoring, a Macbook and key software, academic scholarships, full financial support for scientific conferences, Graduate Record Examination preparation course and exam fees, membership to professional societies, and, in some cases, graduate school application fees.

UNAVCO, the NSF facility that manages the RESESS program, provides year-round support to the RESESS program staff. The Business Affairs staff provides all financial and employment related support including scholarships, recruitment, application processing, summer payroll, housing contracts, and budget support to the RESESS program Director. UNAVCO IT support all computing resources for interns and program staff and a broad spectrum of the UNAVCO staff assist with review of applications, coordination of networking activities during the year at conferences and meetings, and exposure to the instrumentation and data UNAVCO manages as a part of its role as a facility.

**Professional mentoring and support of RESESS interns**

Our experience shows that RESESS interns benefit from additional support structures and mentoring throughout the academic year. RESESS program staff provide year round support to students on how to navigate fellowship applications, graduate school applications, networking with professionals, facilitating meetings and making them aware of opportunities that could further their academic and professional careers. Additionally, RESESS staff provide information and support to parents and guardians of interns to inform them about the experience, answer questions, and address concerns they might have about their student participating in a research program in Boulder, Colorado.

**Summary**

Through a combination of professional development, financial support, mentoring support, and independent, authentic research experiences, the RESESS program has successfully supported 44 interns over the past 9 years. Our experiences support the importance of quality mentoring and authentic research experiences (Hensel, 2012; Johnson & Ridley, 2008). The program has demonstrated that multi-faceted, multi-year support of students from historically underrepresented groups facilitates the success of alumni in graduate school and professional geoscience occupations. Emphasis on professional development in addition to development of research skills enables students to excel in diverse professional environments, and provides the students with the confidence to pursue opportunities they may not have previously considered, leading to broadened participation and engagement of well-trained geoscientists.

**References**

Hensel, N. (Ed.) (2012), *Characteristics of Excellence in Undergraduate Research*, 72 pp., Council on Undergraduate Research, Washington D.C.

Johnson, W. B., and Ridley, C.R. (2008). The Elements of Mentoring, Revised Edition, Palgrave Macmillan; 176 pages.

**Biological and Environmental Science (BES) Scholars @ AAMU: Pathway for Demonstrating Excellence and Strengthening Training in the Environmental Sciences at Alabama A&M University**

Elica Moss, Natural Resources and Environmental Sciences, Alabama A & M University

Environmental issues have created a critical global need for highly educated scientists, professionals, and government officials to develop and implement procedures, policies and regulations. Unfortunately, under-represented minorities, especially African-Americans and Hispanics, lag behind in employment within the bio-environmental sciences. In 2012, of the 105,000 people employed as environmental scientists, only 7% were African-Americans (Bureau of Labor Statistics, 2012). Forecasted demographics suggest that the U.S. needs to increase racial and ethnical diversity in scientific professions in the next 50 to 100 years because its economic viability depends on a diversified work force. If African-Americans, women, Hispanics and other minority races are to account for a significant number of new entrants into the labor force, those groups have to be adequately trained to fill this gap. Although minorities are seriously underrepresented in science, technology, engineering, and mathematics (STEM), Alabama A&M University (AAMU), a historically black college and university (HBCU) has been at the forefront of efforts to train minority students to assume leadership roles in the environmental, biological and natural resource disciplines. This is evident by the undergraduate composition of the College of Agricultural, Life, and Natural Sciences (CALNS) with 91% African-Americans and 1.5% Hispanics. These demographics provided the solid foundation for the newly initiated BES Scholars program @AAMU, which **aims** to:

1. *Strengthen the capacity and quality of programs in the Department of Biological and Environmental Sciences (BES) through intensive recruitment and retention efforts and effective academic advising and assessment.*

Underrepresented minorities are recruited from Huntsville City Schools in Madison County, AL (northern section of state) and underrepresented minorities from the impoverished Black Belt area of Alabama, which includes Sumter, Greene, Choctaw, Marengo Counties, and others (central section of state) as well as other high schools and community colleges throughout the state and country. The BES Scholars application has the following requirements: target students with high scholastic aspirations who have a **GPA of 3.0 or better**; **ACT score**; **academic transcript**; a **250-word essay** describing their interest in biological and environmental and geosciences and subsequent career goals; **two letters of recommendations**; and be willing to participate in various mentoring and support activities offered by the program. Ten (10) incoming freshmen are selected as BES@AAMU scholarship recipients. Each scholar receives $2,500 each semester of their first two years here at AAMU ($10,000 total) and works with assigned mentors to find additional supplemental funding for the remaining two years. This will make long-range progress in biological and environmental education at AAMU and enhance institutional capability to increase the flow of under-represented ethnic minorities in these STEM careers. It will also enhance the partnership between AAMU and the various high schools and community colleges involved.

2. *Cultivate academic competitiveness by engaging in rigorous curricula and extracurricular activities in the Department Biological and Environmental Sciences (BES).*

Departmental faculty have identified rigorous, yet diverse current course clusters that will be included for interactive environmental enhancements through the purchase of software, such as Environmental Science Interactive with RAMAS eLab (web-based);
Electronic Texts with RAMAS EcoLab; EcoSim, An Ecological Simulation Program125;
Environmental Health and Safety Freeware; and arcGIS, and used in smart classrooms with current online resources, which help in managing interactive student learning through:

1) Environmental science and environmental health
2) Soil and plant sciences/soil microbiology
3) Hazardous waste management and environmental toxicology
4) Soil and water pollution, soil chemistry and fertility, hydrology and watershed management and soil/water conservation
5) Remote Sensing of the Environment/Introduction to Geographic Information Systems (GIS); GIS Spatial Analysis and Modeling
6) Applications of Geostatistics
7) Climate and Global Change
8) Aerial PhotoInterpretation

Students enrolled in the course clusters will also take study tours to enrich their course and laboratory learning. Some of the locations will include: Oakridge National Laboratory, Chemical Waste Management Lab, Tennessee Valley Authority (TVA)-Air Quality Monitoring Facilities, Centers for Disease Control (CDC), EPA Region 4 office and the Bankhead National Forest.

3. *Provide experiential learning opportunities for BES Scholars through training to utilize advanced and emerging instruments and techniques performed in biological, environmental and geosciences, which will inevitably enhance workforce diversity*

BES Scholars are given the opportunity to train and learn all aspects of emerging technology and instrumentation, including novel imaging techniques, genomics, proteomics, nanotechnology, and rapid DNA sequencing through bi-weekly/work-study appointments in various labs throughout the Department. BES Scholars, with the aid of mentors, seek domestic and international experiential learning opportunities sponsored through AAMU (the National Science Foundation sponsored Research Experiences for Undergraduates (REU) and Undergraduate Research and Mentoring (URM) programs, REU-China, and Experiential learning opportunities in Ghana and Brazil), as well as various other internships at universities and agencies to gain practical skills.

The successful execution of this program will expand the educational value beyond the confines of AAMU and train African-Americans and other minorities for employment in a discipline in which they are grossly under-represented.

U.S. Bureau of Labor Statistics. *Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity*. Washington, DC. 2012

Outreach, Diversity, and Education at LacCore and the Continental Scientific Drilling Coordination Office, University of Minnesota

Amy Myrbo, University of Minnesota

For our student interns and researchers to feel that they and their work are "societally important" and "relevant," they need to see the big picture. Most of them already appreciate the importance of research to save the planet or advance understanding; they also need to see how the scientific endeavor works (e.g., collaboration, scientific meetings, grant proposals, publications, academia, teaching, state and federal agencies), and how science interacts with other realms such as policy, law, art, literature, sociology, history, human geography, natural resource management, and for some (especially some Native students), spirituality. We must help students make connections. Not only the critical intellectual connections between seemingly disparate realms of science, but also connections with new mentors and programs. Our roles include those of cheerleader, publicist, fairy godmother, and border collie.

Many students resist the real and perceived academic pressure to focus their studies and especially to specialize in a relatively small area of research. Although each scientist has to specialize more than he or she would probably like (in stark contrast to the multifarious interests that usually get us caught up in becoming scientists in the first place), we are still able to work in the other fields, and collaborate with specialists therein. We also need to emphasize that there are many different ways to be a scientist, including different career paths with varying levels of intensity (it changed my life when a fellow grad student told me "we don't all have to be Jim Russell," another grad student in our cohort who was clearly destined for a top tenure-track job). You can change your path along the way, rather than, say, dropping out of science. In short, we need to demystify the business of being a scientist.

"Relevant" does not have to mean "applied," but it often does at least in some sense. Students want to change the world, and they want to be able to explain to their grandmas what they do. For some (especially Native) students, "relevant" means related to cultural and natural resources that are important to their communities, such as wild rice and other plants, water, animals, and lands. Science can clash with culture in these cases if (1) the entities to be studied are sacred or otherwise off limits to outsiders; (2) they are seen as having an intrinsic wholeness that should not be taken apart for the purpose of study. So one needs to pay attention to others' rules, which is another way to help underrepresented minority students – by treating it as patently obvious that their culture is as important as the dominant one. In tribal work, and in all community outreach efforts, one must let the tribe or community lead in the determination of what to study and which questions to pursue.

The future of our facility includes expansion and formalization of Outreach, Diversity, and Education activities as part of the new NSF-funded Continental Scientific Drilling Coordination Office. We are

proposing a new model for outreach activities associated with major NSF continental drilling projects: each endeavor should have an outreach *research* component that is established and developed very early in the project, as part of the initial workshop if not sooner. The focus of these projects should be community-driven, i.e., determined based upon what the Tribes, DNRs and other agencies, museums, schools, indigenous peoples, and other members of the public want to know about. These scientific questions may not be the same as those the PIs have proposed to answer, but they should be addressed by the CSDCO or another institution, and this research funded and undertaken as part of the project. Such research would represent only a small percentage of the total funding for a project and would have the potential to form a powerful intellectual bridge for the community to better understand and appreciate the more esoteric proposed scientific project. It's a new concept that will require a bit of a different funding model, and it may very well fail and disappoint, but we feel that if researchers are operating with federal funds, they are compelled to act in accordance with Treaty rights and other less tangible respect-based norms. When these operations occur in international projects, collaboration with in-country scientists, agencies, and local people is critical and must begin years before drilling operations are scheduled. International work has the potential to entrain students from collaborator countries, which in itself is good and can also form a great basis for diverse teams including international and US underrepresented minority students.

**Learning about the Earth at the University of South Alabama**

**Carol F. Sawyer**

With the University of South Alabama being a primary region-serving institution, students are most concerned about all aspects of the coastal environment in which they live and grew up, especially hurricanes and other coastal hazards when looking at Earth's processes. Incoming majors have a poor understanding of issues considered by Earth scientists to be societally important. High schools in Alabama are not required to teach the earth sciences so students do not know the potential that these fields offer them when they are interested in a career concerning the environment. Once introduced to these topics, they become interested in them and will take that interest from course to course. In our freshman-level Atmospheric Processes course, we introduce students to the processes that create tropical storms and hurricanes, why they come ashore where they do, and what affects their damage potential. For the coastal environment, we teach an introductory course on landscape processes, in which we cover depositional and coastal environments. We also briefly introduce them to coastal issues like erosion, climate change and sea level rise, and hazards. The program offers upper level courses on natural hazards and environmental geography, both of which continue our study of the coastal environment; the courses also branches out into the study of natural processes and issues that are important to them and are important to society. We have introduced a course on medical geography to study the interface of the environment, humans, and disease, in continuation of our focus on the connection between geography and the environment. Overall, our majors want to learn about issues related to professionals in environmental and emergency management and will seek classes that will fulfill that goal. These courses have high enrollment and students from these courses seek careers in industry or government.

# Recognizing the Advantages of an Endemic Diverse Population at Mesa Community College

Joanna Scheffler, Mesa Community College

Diversity within the Physical Sciences Department at Mesa Community College (MCC) benefits from the diversity of the college population in general. We do not have a specific strategy that targets underserved populations, perhaps because we do not perceive ourselves as having a lack of diversity in our classes. I say "perceive" since I do not have unbiased data and only have my own unofficial observations to work with. I speak in reference for the main campus where most of my teaching occurs, and for the physical geology classes that comprise the majority of my teaching load. Demographic figures from NSF (2013; data from 2010) clearly show that underrepresented minorities (URM) in national statistics are less underrepresented at MCC. Note: when I think of diversity in my classes compared to many four-year schools I also include veterans, parents, single parents, working students, working students with families, students with disabilities, and other groups that do not always appear in the demography lists. All sorts of people populate my classes!

The apparent diversity in these classes is probably a function of the fact that since most people at MCC need to meet a lab science requirement, students across all demographics opt for what is still perceived as a non-intimidating science. Therefore, our physical geology class populations are a microcosm of the general student body. In my experience the diversity of my classes is one of the most appealing aspects of teaching. The flip side of the demographics is that we may be complacent about encouraging minority groups to pursue the geosciences. Furthermore, as result of so many students taking our classes because they "needed a lab science and this one sounded easier than chemistry or physics" (paraphrased from my students' feedback), we assume too often that hardly any of our students are interested in earth science majors anyway.

One could summarize the situation in our department as this: most of us instructors are happy if we nurture a STEM tendency in any of our students, but maybe we should start looking more at encouraging URM to pursue the geosciences. We forget that while we have plenty of diversity in our classes, the nationwide science population is not so heterogeneous. At MCC it is currently up to individual instructors to consider the possibilities and exercise their own plan of action in encouraging diverse people to continue in our field. I think we are fortunate that we do not have to work hard to fill our classes with students of all stripes; however, rather than coasting on status quo we should consider how we encourage them to continue in the geosciences.

http://www.nsf.gov/statistics/wmpd/2013/tables.cfm

http://faculty-staff.ou.edu/N/Donna.J.Nelson-1/diversity/Faculty_Tables_FY07/07Report.pdf

http://www.maricopa.edu/about/?demographics

# Recruiting and graduating a rapidly diversifying student body at Humboldt State University

Brandon Schwab, Humboldt State University

The Humboldt State University Geology Department has an opportunity to dramatically increase the diversity of its undergraduate population as campus demographics rapidly change to better reflect that of the state of California. In Fall 2013, HSU became eligible for recognition as a Hispanic Serving Institution. In the same semester, 17% of declared Geology majors self-identified as Hispanic/Latino. This is significantly above the 7% of US bachelor's degrees granted to Hispanic/Latino students in 2010 (GSA Today, v. 24, no 1, doi: 10.1130/GSATG176GW.1). Our challenge is not only to continue to recruit these students to our majors, but to close the achievement gap and increase graduation rates for these students. This is a significant issue for the University and will eventually be tied to system funding models.

The Geosciences Option was established in 2011/12 to provide a solid Earth science background to prepare students for a wide range of geoscience-related careers and intentionally emphasizes major human issues such as natural disasters, Earth resources, and climate change. The Geosciences Capstone provides an opportunity to integrate course work into a project that engages the broader community in some way either through public education or by interfacing with a government agency. This experience involving close interaction with a public agency provides meaningful engagement and communication with a broad constituency.

Recruiting efforts engage students in introductory courses where career opportunities are highlighted. Undergraduate students help in recruiting and community building within the department. Pedagogic reform and hands-on field and laboratory work are meant to achieve inclusive success for all students.

Geology majors at Western Kentucky University (WKU) have a deep connection to the Earth, either through personal experience having grown up in a rural setting or by concerns for the environment and the increasingly fragile state of the planet. Students come into the major often to fulfill a science requirement through an introductory geology class only to find that the topics and concepts covered fascinate them more than their other classes. Students are often surprised at how 'hooked' they get on geology. Like many programs, WKU geology majors are a close-knit group, united by their love of the Earth and, surprisingly, the rigors of the curriculum.

The four geology concentrations at WKU (two BS, two BA) explicitly cater to students' connection to the Earth and their fascination with Earth materials, fossils, and Earth resources. Through early exposure to field geology and analytical techniques, students quickly move beyond being earth enthusiasts to budding earth scientists eager to learn about the breadth of geology and its relevance to societal concerns and their lives after graduation. In addition to the foundational courses found in most geology programs (mineralogy, petrology, sedimentology/ stratigraphy, etc), Geology at WKU prides itself on advanced special topics courses that range from Basin Analysis to Optical Mineralogy, field experiences in the Bahamas and Mojave Desert, and research opportunities with all program faculty. The program's close association with WKU's Advanced Materials Institute gives students hands-on experience with a wide range of analytical instrumentation. It is through these experiences and majors-level courses that students connect their learning to broader issues in the geosciences and future employment opportunities.

The geology program at WKU has approximately 70 majors; over 50% are first-generation college students. These students are academically supported by engaged advising involving all program faculty throughout their entire college career. Students are provided with opportunities to attend professional conferences, go on field trips, and interact with practicing professionals thanks, in part, to gifts and financial support from program alumni. All program majors take a capstone Professional Preparation course (Geol. 499) where they develop a résumé and cover letter, give a professional presentation, and interact with alumni and practicing professionals who gladly visit the Department.

The program is proud of its graduates, most of whom find gainful employment at the bachelors level. The program is also proud of those students who have gone on to Master's and PhD-level graduate programs. These students are making a difference and have turned their enthusiasm for the Earth into substantive contributions to geology and society.

**Geoscience Community College Programs of Societal Relevance and Importance in the Wind River Basin and Range**

*Suki Smaglik, Professor of Earth and Environmental Science*

Central Wyoming College, Fremont County, WY, is in a unique situation: being within the boundaries of the Wind River Indian Reservation (WRIR), having the National Headquarters of the National Outdoor Leadership School (NOLS) in one of our towns, surrounded by ranches and mountainous wilderness, and home to many mineral resources (oil, gas, uranium). Despite these divergent interests we are able to find common ground: in the education of our citizens. All of these populations have a deep connection to the land, whether as spiritual homeland, backcountry playground or resource/land use management. This makes CWC the perfect crossroads of American cultures.

It is not difficult to recruit the younger generation of Indians *into* our programs, especially the Environmental Technician program. Our problem is in *retaining* these students in a program that is not well tuned to their culture and who lack essential training in composition, mathematics and problem solving. On top of the education issues are the cultural issues with parents or grandparents not trusting the government institutions and not supporting their younger adults in academic pursuits. We have all of the government Trio programs, dedicated to helping this generation of students survive and thrive in American higher education, but even this does not seem to be enough. Our recent collaboration with the new University of Wyoming EPSCoR program which has created the Wyoming Center for Environmental Hydrology and Geophysics (Wy-CEHG) has given us the opportunity to bring our students into the field with local and regional experts, and get them to do science and understand why it is important – right in the field. This makes the pursuit of understanding our planet societally important and relevant to our student's lives. It has attracted several new minority students into our programs. EPSCoR is making a concerted effort in growing interest in STEM fields on the reservation and we are optimistic that our programs will benefit from this collaboration.

For over 30 years NOLS existed in Lander and CWC existed in Riverton, with no connection to each other. In 2000, someone finally saw the advantage of bringing our programs together. From an initial program, cobbled together from both catalogs, a new generation of outdoor leader has emerged. We know have two pathways for students: Outdoor Education and Leadership, and Environmental Science and Leadership. The difference between the students in the two programs is obvious – those that like to work hard with their brains as well as their bodies, and those who only want to live outside and be immersed in the culture of nature. There are the occasional crossovers or dual-major students. Adding a stand-alone course in Environmental Science (originally for the EHS program) has enhanced our recruitment efforts for both majors. The students who come through NOLS or have a NOLS course as their target already

have that sense of societal importance and relevancy with nature in their lives and they are a good fit at our college. Because they come from all over the country, and a few from foreign lands, they bring a bit of diversity to our campus life.

In response to the high cost of a NOLS course to students with a definite interest in Earth science, a transfer program in Earth and Environmental Science (EES) was initiated. Knowing the swings in the traditional geology profession, we thought it wise to combine Earth science (geology) with a field known for employing folks on a steadier basis. And seeing that we, as a country, are becoming more aware of environmental issues, and with employment opportunities in environmental science increasing during the 1990s and 2000s, it seemed a good combination. The EES degree provided a solid physical science and mathematics background and introduced students to basic earth science concepts. Over the years, our program offerings have grown, now to include Earth system science (biogeochemistry), meteorology, climatology and environmental science. Once we developed our Environment, Health and Safety (EHS) program and the University of Wyoming founded the School of Energy Resources (SER), it made sense to expand our degree to cover topics in the energy fields as well. Hot off the curriculum highway is our new Earth, Energy, Environment (E^3) AS degree, which will begin educating students in energy programs in the fall of 2014.

The EHS program is the result of community focus groups and a Department of Labor workforce grant. With the help of a community advisory committee, we decided to have two tracks within the EHS program: Health & Safety and Environmental Technician. With our grant, came funding for two new faculty positions and a program director, and well as scholarships to cover tuition, fees and textbooks for our students. Both of these options require an internship with an agency or industry. Through this program, we have developed steady partnerships with our local energy industries. With the success of this program, especially in attracting the WR Indian members, CWC has committed to ongoing support of this program, beyond the life of the grant, also supported by an industry-contributed foundation endowment. After several years of prodding, we were finally able to get the administration to support adding Geographic Information Systems (GIS) to our programs. We now have certificates and credentials under the EHS-Environmental Technician Program, a transfer option in our E^3 AS program, and are currently preparing the request to the Wyoming Community College Commission for an AAS in GIS. Given the mineral-rich land that Wyoming, and especially the WRIR is, these GIS-centered programs should be attractive to those looking for societally important employment that is relevant to their lives.

In addition to our above programs, CWC has a robust undergraduate research program. Three dedicated faculty currently run programs that are

focused on questions of local significance: West Nile Fever, the microbial life in Thermopolis hot springs (analogs to early life on Earth), and climate change evidence in glaciers of the Wind River Mountains. Majors of all abilities are encouraged to participate in our research projects. Indeed, several are imbedded into our freshman lab science courses. We feel it is important not to restrict access to this learning program to those with high GPAs. We see that sometimes what a student needs to take their studies seriously and improve, is a connection to why what they are leaning in class is important. We have had several success stories of low-performing students pull up their studies and their lives, as the result of doing undergraduate research. Our research projects are currently supported by funding from the IDeAs Network for Biomedical Research Excellence (INBRE), Wyoming EPSCoR (Wy-CEHG), the Community College Undergraduate Research Initiative (CCURI) and Wyoming Space Grant (NASA). This financial support allows us to pay our student researchers as interns and allows us to purchase supplies that we otherwise could not afford. What is more relevant than actually collecting and interpreting data from local research questions?

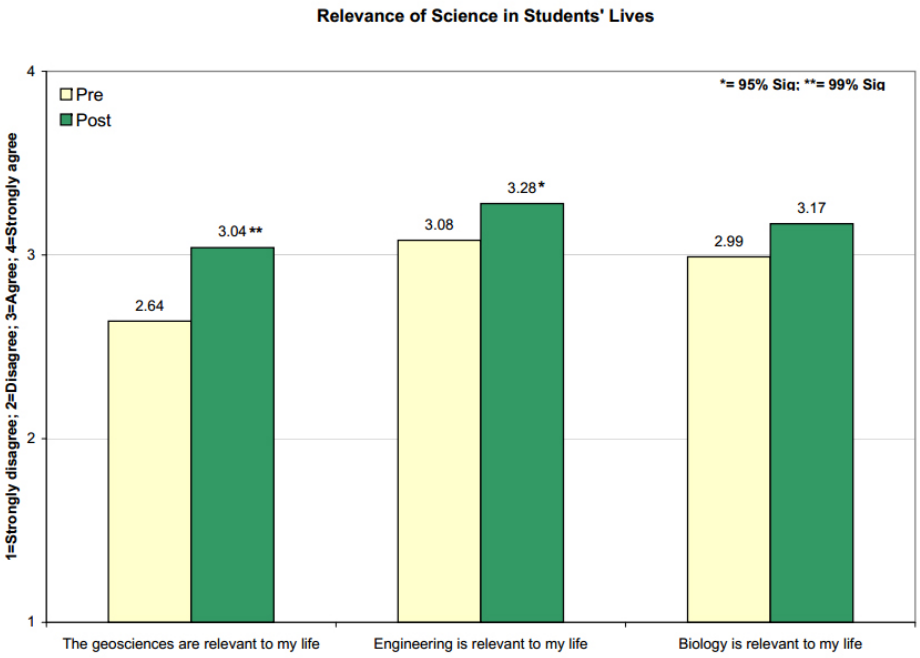
We know that we have some awesome programs at CWC but we suffer from lack of enrollment in our classes. This year's focus is on getting out the word of our existence. The University's geoscience program is over-flowing but their main focus is on graduate research. Why not come to a small place like CWC where you can still get that quality education plus get intern and/or research experience opportunities that are available only to upper-class students at the University? Oh, you didn't know we had those programs? Well, now you do. And, oh yeah, even our out-of-state tuition is lower than most state universities. Come and check out what we have to offer you!

# Making geoscience more relevant: A game of catch up

Philip Stokes, Geosciences, The University of Arizona

To learn more about public attitudes towards geoscience, we collected data from 92 local middle school students who attended a geoscience-themed outreach event on the University of Arizona campus in 2010. The event included a short lecture from a Department of Geosciences professor on careers in science, several hours of hands-on science activities, a raffle for geological prizes, and a demonstration of a volcanic eruption using a trashcan. During the 5-hour event, we talked about climate change, weather, flash flooding, groundwater, soils, and dendrochronology. Identical surveys were administered before and after the event, and we used non-identifying information to connect the pre- and post-outreach surveys to individuals. Our audience self-identified as approximately 48% Hispanic/Latino, 35% Native American, and 17% white or other. Fifty nine percent (59%) self-identified as males, 35% as females, and 6% provided no response. Approximately 80% of the students indicated that they planned to attend college after graduation.

We asked the participants to gauge how much they agreed with specific statements (see figure). We found that, prior to our event, the participants were mostly neutral towards the statement of 'The geosciences are relevant to my life.' But, they generally agreed with the statements 'Engineering is relevant to my life' and 'Biology is relevant to my life.' In other words, they valued engineering and biology but had little opinion towards the relevance of geology.



We found that, after the event, students generally agreed that 'The geosciences are relevant to my life.' And, the students more strongly agreed with the statement that 'Engineering is relevant to my life.' There was no significant change for the biology statement, and this was not expected since there was little focus on biology during the event.

Besides providing useful evaluation data, this study told us a lot about our audience. Our audience was obviously interested in geoscience to begin with; otherwise they would not have attended the event. But, prior to the event, they did not generally view geoscience as relevant to their lives as other popular STEM fields. Afterwards, the survey responses indicated that geoscience had more or less 'caught up' to these other areas in terms of personal relevance. Though we did not collect long term data, we observed that several students, parents, and teachers attended our subsequent outreach events.

What does this mean for our recruiting efforts? While we cannot generalize this small sample to represent the Tucson community, we can make a few interpretations. First, we know that 80% of the students were planning to attend college. And, based on their participation in the Arizona Mathematics, Engineering, Science Achievement (MESA) program, we know that these students were leaning towards pursuing degrees in STEM fields. We suggest that, had these students not attended our event, they would have continued to possess a relatively weak awareness of geoscience. While it is still too early to know if any will become geoscience majors, we use information like this to justify our continued outreach presence in the Tucson community.

**Attracting Students to the Geosciences with a First-Semester Dune Research Experience**

Deanna van Dijk, Department of Geology, Geography and Environmental Studies, Calvin College

For the past three years, the First-Year Research in Earth Sciences (FYRES): Dunes project has been inviting first-semester Calvin College students to try out the sciences with a dune research experience. Each fall, up to 24 first-year undergraduate students take a course that nurtures them through an authentic scientific research experience focused on the coastal dunes of Lake Michigan. Both science and non-science students are attracted to the atypical science-course format. Participation is limited to first-semester college students to foster a sense of shared experience as well as provide an early opportunity for some students to discover an Earth science major.

The students who take the FYRES course gain both an undergraduate research experience and general education science credit by the end of their first semester. The research focus on the nearby Lake Michigan coastal dunes provides the setting, purpose and motivation for student learning. Students begin by learning skills in research, field methods, and the practices of science through semi-guided, inquiry-based experiences at dune sites. Students finish the semester with a substantive team research project focused on an original research question of interest to local dune managers or the scientific community. The first-year students are mentored throughout their experiences by upper-level Earth science students who are majoring in geology, geography, environmental studies or environmental science.

Each research team presents their research results in two formats: a conference-style research poster presented at a campus/community poster session and a conference-style oral presentation to an audience which includes classmates, local dune managers, and campus/community members. After the semester ends, the FYRES Mentors continue each research project to complete a presentation at a regional conference and a written report. The first-year students have co-authorship on these results of their team research, and they are invited to attend the regional conference to see their results presented.

To date, 56 first-year students mentored by 15 upper-level Earth science majors have completed 13 original research projects. Students who participated in the first FYRES course in Fall 2011 are currently in their third year of college, so we do not yet have graduation data to report. Anecdotally, we can describe FYRES students who later changed their major to geology or environmental studies, who successfully obtained a summer research position after their first year of college, or who became FYRES Mentors in subsequent years. Preliminary results from FYRES project evaluation include increased enrollment in geoscience and STEM majors by student participants, increased enthusiasm and science literacy among student participants, and increased visibility for the relevance of Earth system science in answering questions that are important to west Michigan communities.

A continuing challenge of the FYRES project is recruiting students from groups traditionally underrepresented in the sciences. Female students are well-represented and constitute roughly half of the student participation. Students with disabilities and students from underrepresented ethnic and racial groups have lower rates of participation. Because most FYRES students are recruited after they have already made a decision to attend Calvin College, the recruitment pool is constrained by the overall diversity of the student body. Calvin College is a faith-based 4-year liberal arts college, with strong ties to a particular denomination that has a

strong ethnic (Dutch immigrant) heritage. In the 2013 Fall Day 10 report, the Calvin College student population was 75% white, 13% AHANA (African-, Hispanic-, Asian-, and Native-American) and 10% international students[1]. The number of AHANA and international students coming to Calvin College has been increasing in recent years, but progress is remains slow.

More information about the FYRES project and its student participants is available from the website at www.calvin.edu/go/fyres/. The FYRES project has been funded by the National Science Foundation (Grant #0942344) and the Michigan Space Grant Consortium.

[1]Multicultural Affairs Committee (2013). *2013-2014 State of the Campus Report*. Calvin College (Grand Rapids, MI). Available online at www.calvin.edu/admin/comm/mac/. 40 p.

**Increasing Participation in the Geosciences at El Paso Community College**

Joshua Villalobos, Department of Geological Sciences. El Paso Community College, Mission del Paso Campus.

Community Colleges currently serve 44% of all undergraduate students and 45% of all of all first time freshmen in the US[1]. The combined low cost and flexibility of community colleges has also meant that they accommodate a large percentage of minorities entering higher education. Hispanics now constitute 15% of the general population and 19% of college population in the US[1]. This increase has led to more Institutions being designated HSI (Hispanic Serving Institutions) by the federal government, where at least 25 percent of the full-time-equivalent students are Latino.

These facts illustrate the potential community colleges hold to encourage STEM (Science Technology Engineering and Math) majors to minorities as well as non-minorities. But the reality is the number of STEM degrees awarded at CC has not followed the same trends in enrollment[1]. Student research is the key to having students participate in STEM fields. This, unfortunately, is a simple task with a complex solution.

Having students involved in hands on research is fundamental in having them understand the potential of what a particular STEM field can provide. Regrettably, unlike our university counterparts, community colleges do not have the financial, administrative, or infrastructure support needed for research.

Like many community colleges, El Paso Community College (EPCC) is experiencing a stage of rapid and exciting growth. EPCC currently enrolls 27,000 students with 85% of the student body being Hispanic. More than 130 programs of study are offered including an Associate of Science degree in Geological Sciences. In our effort to increase majors in Geology at EPCC, we have taken several small steps over the past three years.

El Paso Community College is often used as a “stepping stone” for students to prepare for a four-year college (primarily the University of Texas at El Paso or New Mexico State University), gain credit, or to test the waters of higher education. Many times, our students leave EPCC and start a four-year institution without ever receiving their Associates. Many of these students do not realize they have either earned enough credit to receive their Associates, earned enough to get multiple Associates, or are simply lacking one or two classes to complete their Associates.

State funding in Texas, as in most states, is based on graduation rates, not class enrollment. Therefore, once a student leaves EPCC without receiving their Associates and transfers to a four-year institution, EPCC receives no credit for federal aid from the State of Texas for that student. Therefore, the four-year institution will receive state recognition once the student receives their Bachelor Degree, even though EPCC is responsible for up to half of the college credit the student earned.

In order to increase the number of students receiving their A.S. in Geological Sciences at EPCC, we implemented a “2+2” program. Working closely with the Curriculum Offices at EPCC and UTEP and the Geology Department at UTEP, we developed a Degree plan that would:

- Allow a student to complete their basics (up to 65 credit hours) and therefore complete the first two years of a four-year degree while getting their AS degree at EPCC.
- Allow the student to then spend the last two years of their BS taking upper level courses at UTEP and only pay the higher tuition rates for these last two years.
- Ensure all courses taken in the AS degree plan for Geological Sciences at EPCC would count for credit in the BS Geological Sciences Degree plan for UTEP.
- The format and style of both the EPCC and UTEP degree plans were identical to minimize confusion, redundancy, and anxiety of transferring students.

The simplicity of the degree plans allows EPCC geology instructors to easily mentor students interested in becoming geology majors at EPCC and illustrates a path for a BS degree at UTEP. Since the introduction of the 2+2 program, we have gained over 65 geology majors at EPCC. The large majority of or students who are in our geology program at EPCC continue their education at UTEP with great success. Based on feedback from students attending UTEP from EPCC they felt that the skills they learned by taking "Capstone Courses" in their AS degree prepared them for courses at UTEP. The course we offer as "Capstone Courses" for geology majors at EPCC are:

**GEOL2407 Geological Field Methods**- Collection of field data, interpretation and construction of geologic and topographic maps, and examination of petrologic systems in a field setting.

**GEOL2411 Mineralogy and Petrology**- Study of mineral crystallography, chemistry, classification, identification, and occurrence. Includes the genesis, classification, and identification of igneous, sedimentary, and metamorphic rocks.

**GEOL 2389 Research Techniques in Geology**-An instructional program designed to integrate on-campus study with practical hands-on work experience in the physical sciences. In conjunction with class seminars, the individual students will set specific goals and objectives in the scientific study of inanimate objects, processes of matter and energy, and associated phenomena.

**GEOL 1305- Environmental Geology**- The earth as a habitat. Interrelationships between humans and the environment. Geologic factors in urban and regional land use planning.

[1] Quality Education for Minority (QEM) Network Follow-up Workshop to HSI-STEM Outreach Forum Overview of NSF Programs and Proposal Opportunities. Las Vegas, NV. 2009.

**Building context for Students in Environmental Sciences**

Gary Weissman, University of New Mexico

Preamble to essay: This work represents only one opinion and set of observations about the Environmental Sciences degree program in the Department of Earth and Planetary Sciences at the University of New Mexico. This may not be a representation of the consensus opinion of faculty in the Department. In this essay, I focus on students in the Environmental Sciences degree program, excluding the more standard geology degree program since this was the focus of the informational website content.

Essay:

Students at the University of New Mexico come from a broad range of experiences and backgrounds; therefore we have a diversity of student views on what aspects of Environmental Science are relevant for society. A student's primary view of societal issues of significance may focus primarily on local environmental concerns, including building an understanding of impacts of uranium mining on tribal and surrounding lands or gaining an understanding of contaminant movement at a fuel spill in Albuquerque. Yet others may see the global issues of warming and other associated changes as driving their interest in environmental sciences. Others are interested in aspects of both local and global issues. One common link between all students, however, is that they view building scientific knowledge about how the environment 'works' is critical for society as we move forward into this world of uncertainty due to global-scale anthropogenic change. In that way, linking societal relevance into an Environmental Sciences curriculum is relatively straight-forward since the students usually come primed with this understanding. Our challenge is to link these diverse views on significance of Environmental Sciences to fundamental basics of Earth systems while training students on how science is accomplished.

Presently, we address this challenge through various exercises in our classes and through student involvement in undergraduate research activities. In several courses, we use data collected from local sites as exercises. For example, in our hydrology courses have exercises that evaluate contaminant movement in groundwater systems. We use these exercises as a stepping stone to assessing maps and data from local environmental cleanup sites, like the fuel spill at the Kirkland Air Force Base. Other courses spend time assessing the findings of the Intergovernmental Panel on Climate Change (IPCC). In our capstone field-based course, students learn to collect and interpret data from local sites. Through these exercises, we work to directly link the 'book' learning science to societally-relevant issues that can be informed by the science they are learning.

Student involvement in research projects allows the student to dig deeper into the science and follow aspects of Environmental Science that are of direct interest to that individual student. Though not all of our students are involved in research, those that participate in research work on projects ranging from basic understandings of aspects of the Earth system to applied projects in Environmental Science. Some of the applied research projects include water quality measures of springs in the region or geothermal resource assessment. Others have evaluated aspects of climate that impact water resources in New Mexico. Our students have presented work not only at national meetings such as GSA, but some have

presented their findings to local stakeholders. Additionally, all students involved in research and those in the capstone course present their findings to the Department in our end of year seminar, thus reaching students who are earlier in their program and showing how involvement in undergraduate research can lead to studies relevant to New Mexico. When such research opportunities exist, the direct link to societal relevance is clear.

Though our current program in Environmental Sciences presents information and provides exercises that explicitly tie societal relevance to the Earth science they are learning, at present this is mostly done on an ad hoc basis by individual faculty members in their classes. We are currently working on revising the Environmental Sciences curriculum and an aspect of this curriculum change is focused on formalizing the societal relevance into the program. Part of this may be accomplished through a service learning capstone course. Additionally, the committees who are developing objectives for new courses are looking for opportunities to directly link aspects of the learning to issues directly affecting New Mexico and beyond. We are working to also link these concepts between several courses, using data sets collected and assessed in earlier classes to evaluate new aspects from these data. Though this is in the development phase, we plan to explicitly incorporate societal relevance into the new core courses and may use data sets that show this relevance.

Teaching Environmental Science from an Earth science perspective allows our department to directly tie into students' predisposed interest in how science links to society. The integrative approach that we take and the ties to societal needs resonate with a diverse population of students. A high-context approach, where linkages between various aspects of science and links to society are explicitly articulated, tends to attract a different student population than the typical low-context, silo approach to science (where individual topics, such as chemistry or biology or geology, are taught without articulating links between each topic). Thus, through this approach, we tend to attract a very diverse student population. The department is keeping this in mind as we redesign our curriculum, and we see this as an opportunity to broaden access to science for a culturally and ideologically diverse student population.