

## Engaging Under-represented Minorities in the Sciences

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**IN MARCH 2010, GILLIAN BOWSER AND MARK BROWN OF COLORADO STATE UNIVERSITY** were awarded a grant from the National Science Foundation to develop the Rocky Mountain Sustainability and Science Network (RMSSN). The overarching goal of the network is to help develop the next diverse generation of globally-minded leaders who are prepared to address future issues related to climate change and environmental sustainability. That goal is grounded in four subgoals for which the network has recruited partners (Table 1) with specific expertise in global leadership, collaborative partnerships, science, and education.

The RMSSN places a significant emphasis on recruiting under-represented students to the sciences. This emphasis is highlighted in network's overarching goal to develop *diverse* leaders. Why the emphasis on diversity? Under-represented minority students have a low rate of entry and retention in science disciplines. Further, the number of under-represented minority students in the *environmental sciences* is alarmingly low, and the number who persist in related careers is even lower. Several studies highlight four priorities for engaging under-represented students in the sciences (Boyd and Wesemann 2009; Taraban and Blanton 2008; Hathaway, Nagda, and Gregerman 2006; Kuh et al. 2005). These include research experiences, professional development, bridging programs, and social networking and support.

The hallmark of the RMSSN is a summer academy which ultimately leads to a certificate in global leadership and environmental sustainability. This academy provides a weeklong, structured experience through which the network addresses the four priorities (highlighted above) and provides a foundation upon which the network builds supporting programs that further those priorities.

The RMSSN held its first academy at the Shortgrass Steppe Longterm Ecological Research Station adjacent to the Pawnee National Grasslands in eastern Colorado. To

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Academic Institutions	
Autonomous University of the Yucatan	Colorado State University
George Washington University	Institute of American Indian Arts
Metropolitan State College of Denver	Salish Kootenai Tribal College
Texas A&M University	University of Colorado
University of Montana	University of Nairobi
University of Northern Colorado	University of Wisconsin, Whitewater
University of Wyoming	University of Wollongong
Utah State University	
Agency Partners	
Bureau of Land Management	National Park Service
United States Geological Survey	
Organizational Partners	
American Museum of Natural History	Association for Advancement of Sustainability in Higher Education
National Phenology Network	Student Conservation Association
Wyoming Conservation Association	

**Table 1.** RMSSN partner institutions, agencies, and organizations.

address the network’s emphasis on developing globally-minded leaders, the RMSSN recruited a broad group of participants, including 32 students from throughout the United States and Mexico (Figure 1). Over 72% of the 2010 academy participants were under-represented minorities. One can imagine the surprise of students coming from New York, Washington, DC, San Diego, or Mexico’s Yucatan—who have this romantic idea of what the Rocky Mountains of Colorado will look like—when they arrived at Denver International Airport and were promptly driven to what looks like a desert in eastern Colorado! However, it was rewarding for the network to see the students’ impression change as they explored the area, and found that even those arid plains of Colorado have a wealth of ecological diversity including bald eagles, prairie dogs, horned lizards, and wide range of grasses and succulents.

The basic format for the RMSSN Academy involved lectures that led into field activities. These are some examples: Dr. Mike Antolin, Director of the Research Station, provided an introduction to the unique ecology, geological and cultural histories of the short-grass steppe ecosystem, followed by a field excursion where he provided real-world examples of the topics from his lecture; Mark McCaffrey from the University of Colorado provided a short lecture on climate literacy, and this was linked to another field activity that made the points in his lecture more tangible. Through these kinds of field experiences, over the course of the week students increased their scientific literacy in climate change, learned biological field protocols, learned how to keep a field journal, and more. Other academy lectures included presentations from the National Park Service, the National Forest Service, the United States Geological Survey, and the Bureau of Land Management.

One requirement for all academy participants was an internship on public lands, or an environmental research experience that summer. Since each of the students would be entering an internship after the academy, Flip Hagood, Vice President of the Student Conservation Association, provided a short workshop (Figure 2) on how the students



**Figure 1.** The 2010 RMSSN Summer Academy included 32 diverse students from throughout the United States and Mexico.



**Figure 2.** Flip Hagood, Vice President for the Student Conservation Association, provides an internship workshop for participants of the 2010 RMSSN Summer Academy.

could get the most from their internship experiences, and how, in turn, they could provide the most to their internship supervisors.

With an emphasis on creating a long-term network among these students, and knowing that following the academy, the students would be scattering in 32 different directions to conduct their summer internships, the RMSSN wanted to provide at least one mechanism through which the participants could all continue to work together on a common project, long after they left the academy. To this end, Jake Weltzin, from the National Phenology Network (NPN), trained the academy participants to make basic phenological observations, and how to report those observations to the national phenology network using the NPN citizen science public interface, *Nature's Notebook*. The NPN uses this data as a mechanism for monitoring climate change across the United States. As part of their certificate, participants were required to make a certain number of observations over the course of their summer internship so that all across the country, at each student internship site, NPN would receive data, and the students would be united in a common effort.

Toward our objectives for developing leaders, the RMSSN had its students learn about, and practice, communicating with diverse audiences. Alice Madden, chief of staff and climate change advisor for Colorado's Governor Ritter, provided a session on how to communicate with politicians, how to communicate with the media, how to communicate with stake holders, and how to communicate with a disbelieving audience. Tara Trujillo (Figure 3), communications director for Senator Udall's office, co-facilitated this session with Alice. Also toward our leadership objective, Dr. Elizabeth Davis from George

**Figure 3.** Tara Trujillo, Communications Director for Senator Udall's office, trains RMSSN Academy participants on the art of communicating with stakeholders and politicians.



Washington University conducted a Myers-Briggs Personality Inventory for each student, and provided a workshop on how each personality type functions as a leader. What was particularly valuable about this session is that Dr. Davis also had the participating faculty, agency representatives, and other presenters take the inventory so the students could observe in the RMSSN partners, examples of personality types in current leaders. To put the participants' leadership skills into practice, the academy spent a day at Colorado State University's Mountain campus on a leadership-oriented challenge course. The participants started on low ropes challenges which taught them to function as a unit and to support one another. In the afternoon, participants moved on to high ropes challenges which taught them to push themselves as individuals, with support and input from their team. The confidence within individuals and the cohesiveness among the group members that these activities generated was exceptionally positive.

To assess the outcomes of the summer academy, the network developed a quasi-experimental research model designed to measure indicators associated with global leadership, cultural awareness, environmental literacy, professional networking, and internship preparation. This model included pre- and post-self-efficacy analyses for academy participants who later conducted an internship, versus students who conducted internships without having participated in the academy. Across all 60 indicators of the study model (e.g., understanding of the concept of sustainability, connectedness to leaders in their discipline, connectedness to peers in their discipline, familiarity with scientific method and field sampling protocols, alternative energy, science of climate change; communication and leadership indicators) on a 10-point scale, the students averaged a 2.8 point improvement. This evaluation was led by Colorado State University and the University of Wisconsin, Whitewater. The RMSSN is currently conducting a student network analysis led by RMSSN partners at Texas A&M University. Finally, all participants agreed to respond to annual surveys to allow the network to gather longitudinal data related to persistence in STEM disciplines and retention to graduation, entry into graduate programs, and career choices.

To facilitate regular communication among participants, the academy website can host student blogs. It also provides contact information for the undergraduate participants, as well as graduate, faculty, and other professional presenters from the academy. The site also includes a page for organizations to post internship opportunities and, by posting on this site, which is restricted to RMSSN Academy participants, these organizations know that there will be a high probability that those positions will be filled by under-represented students. Finally, the RMSSN sends out regular email announcements and has a seasonal RMSSN newsletter in which current activities of the students are highlighted.

As previously highlighted, the National Phenology Network (NPN) provides RMSSN with a common project through which all academy participants remain connected. That activity has been taken a step further by establishing an outreach program through which academy participants are trained to train other students, outside the RMSSN, to collect and report data for NPN. For example, on the weekend leading to the GWS annual conference, several academy graduates worked with NPN to provide training for a group of GWS Fellows. The academy graduates also provide NPN training to high school students in an effort to reach out to the next generation of academy prospects.

Dissemination of our findings has occurred via several mechanisms. A 2010 academy graduate from St. Lawrence University drafted a beautiful description of his experience, which was published in the *Journal of Undergraduate Research and Scholarly*

*Excellence*. That journal has offered to publish a special edition next fall, highlighting the experiences of *all* of the academy participants. As the principal investigators for this network, Dr. Bowser and Dr. Brown have submitted a manuscripts to a journal of assessment and evaluation in higher education, a journal on sustainability, and an international journal of assessment. These are all currently under review.

Regarding next steps, the 2011 RMSSN Summer Academy was to be held in Moose, Wyoming, at the Murie Center, and Grand Teton National Park. To extend our outreach beyond undergraduates, the network received funding from USGS to establish a graduate mentor program. Thus, for the 2011 academy, the RMSSN selected a group of graduate students to arrive two days early, thereby allowing the network to train them to run certain aspects of the academy. This is an invaluable training experience for those graduate students. To provide the graduate students with credentials for their training, the network has coupled that experience with the Graduate Teaching Certificates Program at Colorado State University. In the summer of 2011, the RMSSN will be applying for funding from NSF to establish a Summer Research Experiences for Undergraduates (REU) Program associated with the academy, and to establish an international REU program for academy participants. Dr. Bowser and Dr. Brown are currently waiting to hear back on supplemental funding requested for RMSSN to host International Sustainability Conferences at two of the network's international partner institutions, Autonomous University of the Yucatan, and the University of Nairobi.

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