SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed
**PRELIMINARY PROPOSAL NSF INCLUDES: Engaging Local Communities in Geoscience Pathways**

- **PI/PD NAME:**
  - Cathryn A Manduca  PhD  1988  507-222-7096  cmanduca@carleton.edu
  - Donna Charlevoix  PhD  2008  303-381-7636  donnac@unavco.org
  - Anne E Egger  DPhil  2010  509-963-2870  annegger@geology.cwu.edu
  - Barbara W Nagle  PhD  1977  510-642-3891  bnagle@berkeley.edu
  - Rajul E Pandya  DSc  1996  202-462-6900  rpandya@agu.org

- **Department of Geology**
  - Carleton College  Northfield, MN  55057

- **Research - other than RAPID or EAGER**

- **A collaborative proposal from one organization (GPG II.D.4.a)**

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**NOT FOR DISTRIBUTION**

**COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION**

**FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)**

**DATE RECEIVED**  **NUMBER OF COPIES**  **DIVISION ASSIGNED**  **FUND CODE**  **DUNS#**  **FILE LOCATION**

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- **NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE:** Carleton College

- **ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE:**
  - Carleton College  One North College Street  Northfield, MN  550574001

- **NAME OF PRIMARY PLACE OF PERF:**
  - Carleton College

- **ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE:**
  - Carleton College  One North College Street  Northfield, MN  550574001

- **IS Awardee Organization (Check All That Apply):**
  - SMALL BUSINESS
  - MINORITY BUSINESS
  - WOMAN-OWNED BUSINESS
  - IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

- **TITLE OF PROPOSED PROJECT:** Preliminary Proposal NSF INCLUDES: Engaging Local Communities in Geoscience Pathways

- **REQUESTED AMOUNT:** 
  - $0

- **PROPOSED DURATION (1-60 MONTHS):**
  - 0 months

- **REQUESTED STARTING DATE:**

- **SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE:**

---

**FUNDING MECHANISM:**

- **PI/PD DEPARTMENT:**
  - Department of Geology
- **PI/PD POSTAL ADDRESS:**
  - Carleton College  Northfield, MN 55057
- **PI/PD FAX NUMBER:**
  - 507-222-5175

---

**PI/PD NAME:**

- Cathryn A Manduca  PhD  1988  507-222-7096  cmanduca@carleton.edu
- Donna Charlevoix  PhD  2008  303-381-7636  donnac@unavco.org
- Anne E Egger  DPhil  2010  509-963-2870  annegger@geology.cwu.edu
- Barbara W Nagle  PhD  1977  510-642-3891  bnagle@berkeley.edu
- Rajul E Pandya  DSc  1996  202-462-6900  rpandya@agu.org

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**EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN):**

- 410694747

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**FILE LOCATION:**

- 1641619
Certification for Authorized Organizational Representative (or Equivalent) or Individual Applicant
By electronically signing and submitting this proposal, the Authorized Organizational Representative (AOR) or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby certifying that any conflicts of interest (when applicable), drug-free workplace, debarment and suspension, lobbying activities (see below), nondiscrimination, flood hazard insurance (when applicable), responsible conduct of research, organizational support, Federal tax obligations, unpaid Federal tax liability, and criminal convictions as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U.S. Code, Title 18, Section 1001).

Certification Regarding Conflict of Interest
The AOR is required to complete certifications stating that the organization has implemented and is enforcing a written policy on conflicts of interest (COI), consistent with the provisions of AAG Chapter IV.A.; that, to the best of his/her knowledge, all financial disclosures required by the conflict of interest policy were made; and that conflicts of interest, if any, were, or prior to the organization’s expenditure of any funds under the award, will be, satisfactorily managed, reduced or eliminated in accordance with the organization’s conflict of interest policy. Conflicts that cannot be satisfactorily managed, reduced or eliminated and research that proceeds without the imposition of conditions or restrictions when a conflict of interest exists, must be disclosed to NSF via use of the Notifications and Requests Module in FastLane.

Drug Free Work Place Certification
By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification
If answer “yes”, please provide explanation.

Certification Regarding Lobbying
This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements
The undersigned certifies, to the best of his or her knowledge and belief, that:
(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure of Lobbying Activities,” in accordance with its instructions.
(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

Certification Regarding Nondiscrimination
By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance
Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:
(1) community in which that area is located participates in the national flood insurance program; and
(2) building (and any related equipment) is covered by adequate flood insurance.

Certification Regarding Responsible Conduct of Research (RCR)
This certification is not applicable to proposals for conferences, symposia, and workshops.

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II: Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research. The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.
Certification Regarding Organizational Support

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that there is organizational support for the proposal as required by Section 526 of the America COMPETES Reauthorization Act of 2010. This support extends to the portion of the proposal developed to satisfy the Broader Impacts Review Criterion as well as the Intellectual Merit Review Criterion, and any additional review criteria specified in the solicitation. Organizational support will be made available, as described in the proposal, in order to address the broader impacts and intellectual merit activities to be undertaken.

Certification Regarding Federal Tax Obligations

When the proposal exceeds $5,000,000, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal tax obligations.

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, to the best of their knowledge and belief, the proposing organization:
1. has filed all Federal tax returns required during the three years preceding this certification;
2. has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
3. has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Certification Regarding Unpaid Federal Tax Liability

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal Tax Liability:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has no unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

Certification Regarding Criminal Convictions

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Criminal Convictions:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has not been convicted of a felony criminal violation under any Federal law within the 24 months preceding the date on which the certification is signed.

Certification Dual Use Research of Concern

By electronically signing the certification pages, the Authorized Organizational Representative is certifying that the organization will be or is in compliance with all aspects of the United States Government Policy for Institutional Oversight of Life Sciences Dual Use Research of Concern.

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<td><a href="mailto:dmenning@carleton.edu">dmenning@carleton.edu</a></td>
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PROJECT SUMMARY

Overview:
The geosciences lag behind most other STEM disciplines in diversity and are also projected to have a deficit in the workforce in the coming years. We need more geoscientists who come from communities that are more vulnerable to geoscience-related hazards, but there are many gaps in the pathways that could bring middle and high school students from those communities to college and beyond in a way that inspires, maintains, and grows their interests. This project brings together partners who have led successful national efforts addressing pieces of this problem with three regional partnerships to create integrated pathways from middle and high school into college. These pathways will focus on opportunities for students to learn about and address regional environmental hazards while learning geoscience. Experience gained by initial program partners and regional pilots will be used to create national support structures for developing integrated geoscience pathways and a collective action framework for expanded partnerships.

Intellectual Merit:
The project addresses several known barriers to persistence of underrepresented minorities in STEM: 1) low interest in studying geoscience due to lack of perceived relevance to their lives and/or perceived employment opportunities; 2) abstract science instruction devoid of meaningful context delivered with poor pedagogy; 3) lack of continuous pathways and support across transition points.

The project capitalizes on practices that are known from research to enhance persistence and learning: 1) hands-on work with real scientific problems in the classroom, through service-learning, and in undergraduate research programs; 2) effective mentoring, coaching, and support (and professional development of mentors, teachers, and faculty); and 3) opportunities to learn about, prepare for, and envision participation in the workforce. The project will contribute to the research base by studying the impact of integrated pathways rooted in local context that incorporate these practices on entry and persistence in STEM.

Broader Impacts:
In addition to directly increasing inclusion of underrepresented populations in STEM, this project will address two additional national challenges of broad impact: implementation of the NRC Framework for Science Education, and regional capacity to address pressing environmental and resource challenges.

The Framework for K-12 Science Education and the associated Next Generation Science Standards (NGSS) science instruction integrates science knowledge, science and engineering practices, and cross-cutting concepts with a new emphasis on social relevance. Performance expectations in the NGSS at middle and high school levels emphasize the connections between humans and Earth, and will require significant revisions of existing curricula, professional development for in-service teachers, and changes to teacher preparation programs in institutes of higher education.

Many of the socioscientific issues we face today have unequal impacts across society, with greater vulnerability for minority, low socio-economic status, and under-served groups. Marginalized communities are mobilizing: looking for scientific partners to help them address issues related to environmental justice, sustainability, and resilience. This project will serve these communities by engaging citizens, students, and scientific and educational experts in addressing local challenges.
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Cover Sheet for Proposal to the National Science Foundation

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(Include only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)

Appendix Items:

*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.*
Project Description

I. PERSONNEL

PI and co-PIs

Cathy Manduca (Director, SERC, Carleton College) PI
will manage the overall project, lead development of shared vision and metrics, and provide
backbone organizational and infrastructure support.

Donna Charlevoix (Director, Education and Community Engagement, UNAVCO) coPI
will lead development of mentoring and career preparation aspects of pilots and facilitate use of
good dedic data, teaching materials, and research experiences in pilots.

Anne Egger (Director, Office of Undergraduate Research, Central Washington University) coPI
will co-lead development of project interactions and facilitate development of undergraduate and
teacher preparation aspects of pathways.

Barbara Nagle (Director, SEPUP {Science Education for Public Understanding Program},
Lawrence Hall of Science, University of California, Berkeley) coPI
will lead development of K-12 aspects of pathways, including middle and high school curricula
and teacher professional development.

Raj Pandya (Program Director, Thriving Earth Exchange, American Geophysical Union) coPI
will facilitate development of service learning and community-based science aspects of
pathways.

Other senior personnel:

Mark Benthien (Director for Communication, Education and Outreach, SCEC {Southern
California Earthquake Center}, University of Southern California)
will lead development of the Southern California Inland Empire pilot and facilitate engagement
via national earthquake drills.

Felicia Davis (Director, Building Green Initiative, Clark Atlanta University)
will lead development of the Atlanta regional pilot and consult on increasing the capacity of all
programs and pilots to serve African American students.

Norma Neely (Director, American Indian Institute, University of Oklahoma)
will lead development of the Oklahoma tribal nations pilot and consult on increasing the capacity
of all programs to serve Native American Students.

John Taber (Director, Education and Public Outreach, Incorporated Research Institutions for
Seismology [IRIS])
will lead development of undergraduate research aspects of pilots and facilitate use of seismic
data, teaching materials and research experiences in pilots.

To be named: Senior Personnel from pilot programs and evaluation and research leadership
II. PROJECT

Intellectual Merit: Many of the socioscientific issues we face today—such as understanding, predicting, and adapting to the effects of sea level rise on coastal communities—have unequal impacts across society, with greater vulnerability for minority, low socio-economic status, and under-served groups (e.g., Blaikie et al., 2014; Cutter, 2006). These issues require the knowledge, insight, and skills of geoscientists. Unfortunately, the geosciences lag behind most other STEM disciplines in diversity and are also projected to have a deficit in the workforce in the coming years (BLS, 2016-17; Gonzales and Keane, 2010; NAS et al., 2011; NSF/NCSES, 2015). We need more geoscientists who come from communities that are more vulnerable to geoscience-related hazards, but there are many gaps in the pathways that could bring middle and high school students from those communities to college and beyond in a way that inspires, maintains, and grows their interests. Specifically, those gaps include

- Current middle school Earth science curricula are largely disconnected from societal issues and lack relevance for most students;
- Few high schools offer Earth science courses, and those that do typically offer them as alternative science courses for non-college-bound students;
- As a result, few students arrive at college seeing the relevance of geoscience to them and their communities; this lack of relevance is reinforced in most introductory courses in the geosciences that focus on “traditional” geoscience;
- Introductory students (and even students who major in the geosciences) have few opportunities to engage in research that shows how geoscience can help address problems in their communities;
- Communities face pressing challenges related to climate change, vulnerability to natural hazards, and natural resources, but many don’t have trusted, local, culturally-competent expertise they can work with to address these challenges;
- Undergraduate and graduate students in the geosciences have a limited view of options in the workforce, don’t see ways that geoscience research and skills have relevance to themselves and their community, and have few opportunities to develop the skills necessary to work at the community-science interface—even though this is projected to be a growth area for new jobs.

The proposed project brings together partners who have expertise and success in filling one or more of these gaps through engaging local communities around socioscientific issues, but have not previously worked to connect all of the steps along the pathway together.

Goals and measurable objectives

The goals of the proposed work, Engaging Local Communities in Geoscience Pathways, are to

- Create more opportunities for students in geoscience to work on real problems of importance to their community throughout their education and beyond;
- Develop and test pathways rooted in local contexts that lead from early exposure to societally-relevant geoscience through deeper exploration in high school and college to careers where they can use their geoscience expertise to support their communities;
- Develop a scalable model that supports customization of pathways for local relevance and needs;
- Create a community of practice that grows through engagement of individuals and groups engaged in addressing parts of this system;
- Create a national support system that exploits economies of scale while honoring the importance of local context.

To achieve these goals, we will address six objectives, shown as activities in the logic model (Fig. 1):

1. Bring together partners with demonstrated success in connecting geoscience and society at different steps along the pathway with teams from three regional systems to develop a shared vision for geoscience academic pathways that are connected to local goals and aspirations, and develop metrics for measuring successful implementation of those pathways;
2. Design the pathways based on the shared vision and an initial set of socioscientific issues: earthquake hazards, freshwater availability, and coastal hazards, which we have selected because of the availability of data, data tools, and expertise of our research partners;
3. Revise and adapt existing resources and design new ones as necessary to complete the pathways;
4. Test the pathways through implementation in the three regions using the success metrics;
5. Determine the essential components of the pathway support structure and tools needed for other regions to implement pathways locally;
6. Develop scalable ways to support development and implementation of pathways in other regions.

Figure 1. Logic model for Engaging Local Communities in Geoscience Pathways.

In the two-year pilot project, we will complete objectives 1, 2, make initial progress on objectives 3, 4, and 5, and develop an initial scalable model (6). Funding will bring the partners together with the regional teams 3 to 4 times: initially to establish the shared vision, and then to complete the work of designing the pathways. As shown in the list below, the initial partners have experience in scaling their individual projects and bring national networks that support expansion of the program. We will use our experiences with the regional systems to develop a scalable model for increasing partners and topics, supporting the creation of new regional pathways using a collective impact model (Kania and Kramer, 2011).

The proposed regional pilots are chosen for diversity in local populations and impact of natural hazards. They capitalize on existing collaborations and networks among the project leadership and match regional issues to topical program strengths. The diversity of the regional pilots provides the breadth needed to design a generalizable scale up strategy and provides a strong basis for the evaluation of our success metrics (Objectives 5 and 6). In an INCLUDES Alliance, we would anticipate adding additional program partners, regional partners, and expanding the types of data and issues that can be addressed.
Proposed regional pilots

- A team in the Inland Empire of California that includes leaders from K-12 school district(s), community college(s), local CSU and UC campuses, informal education institutions, and workforce representatives (lead: Benthien; primary underrepresented population: Hispanic).
- A team of a selected tribal nations in Oklahoma that have strong relationship with school districts, participates in science camps, have linkages to one or more tribal colleges, the University of Oklahoma, and workforce representatives (lead: Neely, primary underrepresented population: Native American).
- A team from the Atlanta Metro area that includes K-12 school districts, historically black colleges, a natural history museum, other colleges and universities, several STEM enrichment programs, and workforce representatives (lead: Davis, primary under-represented population: African American).

List of partners

- SERC/InTeGrate: The InTeGrate STEP Center in the Geosciences increases opportunities for undergraduate students to learn about the Earth in the context of resource and environmental issues, both within geoscience programs and across the undergraduate curriculum. Teaching materials developed by inter-institutional teams of faculty have been used in courses enrolling more than 9,500 students and 16 pilot programs are testing models for effective practices in supporting the success of diverse students. InTeGrate developed a community of transformation that extends the one developed by On the Cutting Edge (Manduca et al., 2010), which includes over 2,000 geoscience faculty and graduate students from over 850 institutions and has produced measurable shifts in teaching practice (Manduca et al., in revision; Teasdale et al., in revision). InTeGrate uses a complex social system approach to the design, implementation, and evaluation of the project (Kastens and Manduca, 2016).
- Lawrence Hall of Science/SEPUP: The Science Education for Public Understanding Program (SEPUP) is a secondary science curriculum development group. SEPUP materials integrate disciplinary concepts with science and engineering practices in the context of personal and social issues related to science. Scott (2000) found that students in Los Angeles Unified School District who used a two-year high school sequence of Integrated/Coordinated Science classes that were substantially based on SEPUP’s Science and Sustainability course showed significant gains on the SAT9 (Stanford Achievement Test) science test, and that higher numbers of students, and in particular underrepresented minority students, enrolled in advanced science courses after taking ICS.
- Southern California Earthquake Center (SCEC): SCEC coordinates research on earthquake science at more than 70 research institutions nationwide. SCEC leads California’s Earthquake Country Alliance (ECA), a public-private partnership that created the Great California ShakeOut. With support from FEMA, SCEC has expanded ShakeOut across the country and worldwide (43.5 million participants in 2015). SCEC/ECA coordinate the EPICenter (Education and Public Information Center) Network of museums, parks, and other venues that host ShakeOut activities, develop educational materials, and share best practices. SCEC also provides educator professional development, installs Quake Catcher Network (QCN) sensors in schools and museums, develops curricular resources, and coordinates two undergraduate intern programs with more than 30 students each summer.
- UNAVCO: UNAVCO supports geodesy workforce development and education (Bartel and Charlevoix, 2015; Phillips et al., 2015; Wdowinski and Eriksson, 2009), including the development of curricular materials for 6-12 educators and higher education. The GETSI (GEodesy Tools for Societal Issues) project provides curriculum at both the geology-majors and introductory levels (Douglas et al., 2014; Pratt-Sitaula et al., 2015). UNAVCO prepares and props under-represented minority undergraduate students into geoscience careers and graduate programs through a combination of work and research experiences along with professional development and training through intentional mentoring (Charlevoix and Morris, 2014, 2015; Fifolt and Searby, 2010; Morris and Charlevoix, 2014).
- IRIS: The IRIS (Incorporated Research Institutions for Seismology) Consortium, with over 120 university members and 20 educational affiliates, provides educational resources, workforce development support, and access to seismic data and equipment for a wide range of audiences (Taber et al., 2015), including citizen science (Cochran et al., 2009). IRIS’ commitment to workforce...
development includes a distributed REU program which has provided mentored research experiences for over 155 undergraduates (Hubenthal and Taber, 2014); introducing underrepresented minorities to geophysics via a field experiences program; developing data-rich activities for the undergraduate classroom (Taber et al., 2014); and supporting early career investigators via mentoring, webinars, and workshops (Colella et al., 2015; Hubenthal et al., 2015).

- **Thriving Earth Exchange (TEX):** This program helps all communities, including historically underserved communities, leverage relevant science and work with scientists to advance their priorities and address their challenges related to climate change, natural hazards, and natural resources. TEX has established over 20 collaborative local partnerships and working relationships with groups such as the International County/City Managers Association to develop strategies for project identification, team building and collaboration, and scaling science-community interaction.

- **American Indian Institute:** The American Indian Institute (Aii) at the University of Oklahoma is a nonprofit American Indian training, research, and service organization. Aii’s primary goals include promotion and support of Indian education; health promotion and disease prevention; art, culture, and language preservation; and tribal leadership and organizational development. Aii offers workshops, seminars, conferences, onsite training, and consultation on tribal, state, regional, and international levels on a variety of topics and issues that affect the Indigenous peoples of North America.

**Broader Impacts: Improving inclusion in STEM**

The design of the pathways will build on opportunities to catalyze changes that are in alignment with effective practices while providing opportunities for further research. First, the Next Generation Science Standards (NGSS Lead States, 2013) and the Framework for K-12 Science Education (NRC, 2012) have been adopted by 16 states, with many more likely to follow. Performance expectations in the NGSS at middle and high school levels emphasize the connections between humans and Earth, and will require significant revisions of existing curricula, professional development for in-service teachers, and changes to teacher preparation programs in institutes of higher education (e.g., Wysession, 2014). We will address this need and facilitate local implementation, strengthening geoscience early in students’ education.

Societally-relevant geoscience curricular materials are being adopted in introductory undergraduate geoscience courses across the country (e.g., Gosselin et al., 2015; O’Connell et al., 2015). The contextualization of science instruction is believed to increase interest and learning particularly for students from underrepresented groups (Scott, 2000) and instructors report that students are more engaged when they use these materials than they are with other content (Kastens et al., 2014). We will extend the contextualization of science by creating multiple opportunities for students to engage in addressing real-world local problems throughout their education, an unstudied extension of the established best practice.

Outside of academia, marginalized communities are mobilizing, looking for scientific partners to help them address issues related to environmental justice, sustainability, and resilience. They are looking for partners who can share relevant knowledge and work with them to advance their capacity to integrate science into planning and decision-making, and open career pathways related to science and technology. We will capitalize on this need by engaging students in locally-based real-world problem solving that brings together principles of community-based science, citizen science, and service learning.

**Effects on the nation’s geoscience workforce**

If we are successful in our efforts, we expect to see (1) more qualified middle and high school teachers who are prepared to teach geoscience in the context of societal issues of relevance to diverse communities while meeting the spirit of the three-dimensional framework of the NGSS (e.g., Ellins and Olson, 2012; Ellins et al., 2013); (2) increased matriculation into geoscience programs and persistence to degree moving geoscience demographics toward national averages; (3) more and more diverse graduates who enter the workforce to use their geoscience skills and expertise, within and beyond what is traditionally considered the “geoscience workforce”; and (4) more and more communities, including historically underserved communities, who are actively using geoscience to become more resilient and sustainable.
References Cited


References Cited – 2
Biographical Sketch

Cathryn Allen Manduca
Science Education Resource Center, Carleton College, Northfield, MN 55057 emanduca@carleton.edu

Professional Preparation
Williams College, Williamstown, MA Geology B.A., 1980
California Institute of Technology, Pasadena, CA Geology M.S., 1982
California Institute of Technology, Pasadena, CA Geology Ph.D., 1988

Appointments
2007- Director, Science Education Resource Center, Carleton College, Northfield, MN
2002 - Executive Director, National Association of Geoscience Teachers
1999-2001 Asst. Prof. of Physics, St. Olaf College
1999-2001 Asst. Prof. of Science, Rochester Community College

Products


Other significant


Synergistic Activities

1) Supporting inclusive excellence in undergraduate education: As Executive Director of the National Association of Geoscience Teachers, PI of the On the Cutting Edge professional development program for
geoscience faculty, and PI of the InTeGrate STEP Center in the Geosciences, I have developed professional development programs that allow faculty, department leaders, K-12 teachers, and others to learn from each other and from experts about research, principles, and practices that support effective inclusive education; led development of materials teaching about the Earth in a societal context; and managed pilot programs fostering improvement in success for all students by focusing on mentoring, a sense of community, and motivation to succeed. These activities have led to: the development of an extensive collection of on-line resources used by more than 4 million visitors per year, and measurable impacts on teaching in the geosciences. I have worked with consortia of undergraduate liberal arts colleges to document and share effective program models and to initiate collaborations or collective action. I have overseen the evaluation of Carleton’s programs to broaden participation in science.

2) Developing large scale communities of transformation: The Cutting Edge program successfully engages geoscience faculty in professional development activities with more than 850 institutions participating and with measurable impact on teaching practices. The program is now self-sustaining moving from stand alone workshops to an annual conference with multiple workshops and a travelling workshop program. The four-year old InTeGrate STEP Center now involves more than 1000 educators in teaching science in a societal context, and has produced more than 1000 pages of online content supporting this goal. Materials published by the project have been used in courses enrolling more than 9500 students to date. This community was developed using principles for design, implementation, and evaluation of complex social systems to produce a desired emergent phenomenon, in this case an increase in the number and diversity of students studying about the Earth and prepared to engage in interdisciplinary activities to address resource and environmental challenges for a sustainable global society.

3) Supporting STEM-wide transformation: I am a member of the Board on Science Education of the National Academies of Sciences, Engineering and Medicine, and former President of the AAAS Education Section. I developed the Pedagogies in Action website linking research on effective pedagogy to examples of its use across the disciplines, and have engaged in research on effective professional development practices and their impact on teaching and learning. SERC supports the For Higher Ed resource portal, the Accelerating Systemic Change Network focused on bringing DBER into use, the Network of STEM Education Centers, and the Integration of Strategies that Support Undergraduate Education in STEM (ISSUES) profiling the work of STEM professional societies in this arena.

4) Managing large projects with backbone infrastructure: I have managed large grants for national consortia since 1991. I oversaw the development of SERCkit, a platform for distributed website authoring, workshop support and project management. Used by more than 100 projects to produce over 31,000 pages of content, SERCkit combines digital library content management and discovery tools with wiki-like collaboration tools. As PI for InTeGrate, the NSF STEP Center for the Geosciences, I put in place a management system that scaled to support project leadership distributed across 14 institutions; authoring, collection of student data from pilots, and publication of teaching materials developed by over 40 teams involving 100 faculty; and support for 16 implementation pilots.

A. Professional Preparation

University of Wisconsin  Milwaukee, WI  Atmospheric Sciences  B.S. 1993
University of California  Davis, CA  Atmospheric Sciences  M.S. 1996
University of Illinois  Urbana, IL  Science Education  Ph.D. 2008

B. Appointments

UNAVCO  Director, Education and Community Engagement  2012 - present
Boulder, Colorado
University of Illinois  Adjunct Professor, Dept. Atmos. Sciences  2009 – present
Urbana, Illinois
The GLOBE Program  Director, Science & Education Division  2009 – 2012
Boulder, Colorado
University of Illinois  Director of Introductory Courses  2004 – 2009
Urbana, Illinois
University of Illinois  Lecturer, Dept. Atmospheric Sciences  1997 – 2009
San Francisco State Univ.  Lecturer, Dept. Geosciences  1996 – 1997
San Francisco, California

C. Products

(i) Closely Related


Tomkin, J.H., & Charlevoix, D.J. (2014). Do Professors Matter? Using an A/B Test to Evaluate the Impact of Instructor Involvement on MOOC Student Outcomes, ACM: Learning @ Scale, Atlanta, GA. http://dl.acm.org/citation.cfm?id=2566245


(ii) Other Significant


**D. SYNERGISTIC ACTIVITIES**


**Curriculum and Instruction.** Developed first large-lecture (>200 students) hybrid/blended learning course at the University of Illinois serving as a model for the Provost’s office and large-scale campus implementation (2007). Inaugural member of faculty of Online Global Campus Initiative, Environmental Sustainability major (now online certificate in Environmental Sustainability) and developer and instructor of Societal Impacts of Weather and Climate (2006). Creator of the Hands-On, Minds-On Meteorology curriculum integrating interactive technologies into introductory courses resulting in enrollments increasing ten-fold (2003).

**International collaborations.** Created GLOBE International Scientist Network, a network of scientists engaged in Earth System Science research interested in enhancing K-12 education and engaging directly with teachers and students; Within 6 months the network grew to over 55 scientists from Greece, India, The Netherlands, Tanzania, Thailand, and the United States. (2010-12). *GLOBE representative to: WMO (World Meteorological Organization, Education and Training) International GEO (Group on Earth Observations), ACRE (Atmospheric Circulation Reconstructions Over the Earth), and ASTC (Association of Science & Technology Centers) (2009-2012).*

**Mentoring.** Mentor and science education researcher for UCAR, SOARS and (former) H.I.R.O programs. Mentored graduate student in science education and researched effectiveness of pre-college internship programs in terms of science self-efficacy. (2010-11)
Biographical Sketch

Anne E. Egger

Geological Sciences and Science Education • Central Washington University
Ellensburg, WA 98926-7418 • 509-963-2870 • annegger@geology.cwu.edu

Professional preparation

Yale University New Haven, CT Geology and Geophysics BA 1995
Stanford University Stanford, CA Geological & Environmental Sciences MS 2001
Stanford University Stanford, CA Geological & Environmental Sciences PhD 2010

Appointments

2011-present Assistant Professor, Central Washington University
2004-2011 Undergraduate Program Coordinator, School of Earth Sciences, Stanford University
2004-2011 Lecturer, Geological and Environmental Sciences, Stanford University
2002-2004 Instructor of Geology and Geography, San Juan College, Farmington, NM

Products

Most relevant


Additional products


Synergistic activities

1. **Leading professional development activities:** I serve in a leadership capacity in the National Association of Geoscience Teachers (NAGT), both in the presidential line and as chair of the Professional Development Planning Committee, and I am co-PI on the InTeGrate project, NSF’s STEP Center in the Geosciences. Much of my work in NAGT and InTeGrate has focused on leading workshops for faculty and graduate students, including a series of workshops on teaching introductory courses. In the past two years, I’ve offered a full-length workshop and several webinars entirely online for the first time. I am currently one of the leaders of NAGT’s Traveling Workshop program, which solicits applications for us to travel to institutions to offer a workshop on improving student learning. I am particularly interested in understanding how these workshops affect faculty in their teaching, and have developed a survey to be administered one year after the workshop.

2. **Facilitating, expanding, and supporting undergraduate participation in research:** I am the Director of the Office of Undergraduate Research (OUR) at CWU, focused on expanding the reach of the OUR and growing the program through providing more opportunities for preparation for, support during, and pathways throughout the research process. Previously, as the Undergraduate Program Coordinator in Earth Sciences at Stanford University, I grew a small, departmental undergraduate research program that funded about 6 students a year into a school-wide, interdisciplinary program that funded about 30 students a year. I served as a Geoscience Councilor on the Council on Undergraduate Research from 2011 to 2013, and am currently PI on an interdisciplinary REU Site: Hazards and Risks of Climate Change in the Pacific Northwest (EAR 1559862), which will bring students from regional community colleges to CWU to conduct research projects related to regional climate change while also working collaboratively to communicate those hazards and risks to their communities.

3. **Interdisciplinary teaching relating geoscience and societal issues:** I co-teach an interdisciplinary course in the Douglas Honors College called *Hazards, Risk, and Resilience in the Pacific Northwest*. Through this course, students conducted an earthquake risk assessment of Ellensburg through developing a survey about risk perception and screening hundreds of buildings in town with a FEMA-approved procedure. They analyzed all of their results and made a presentation to the Ellensburg city council with several recommendations for improving earthquake preparedness. I will modify this course for teaching in the REU program. This course is an ideal example of research that was (1) interdisciplinary, (2) integrated into regular classroom teaching, and (3) beneficial to the community.

4. **Developing high-quality, freely available resources for teaching and learning:** As an author, editor, and co-project director for Visionlearning (http://www.visionlearning.com), my focus is on developing peer-reviewed readings for learning about science in a way that focuses on how we know what we know, the data that support our scientific explanations, and the people behind the science. Our recent work has involved developing profiles of practicing scientists who are from under-represented groups and readings about math in science, helping students transfer what they’ve learned in math classes and use math in scientific applications. We also work with literacy specialists to ensure that these readings are accessible. Through InTeGrate, I’ve led the development of teaching materials that highlight the role of Earth literacy in societal issues in teacher preparation and interdisciplinary settings.

5. **Facilitating curricular improvement:** At CWU, I led efforts to revise three undergraduate degree programs in Geological Sciences and one in Science Education; this work followed on my experience leading curriculum revision efforts at both Stanford University and Nanyang Technical University. In Geological Sciences, I helped develop and implement programmatic assessment through use of the Geoscience Literacy Exam and a revised quantitative skills test. At the university level, I am a member of the General Education Committee, which has been in the process of fully revising the Gen Ed program.
Biographical Sketch

Barbara W. Nagle
SEPUP Director, Lawrence Hall of Science, University of California, Berkeley, CA 94720
bnagle@berkeley.edu

A. PROFESSIONAL PREPARATION

<table>
<thead>
<tr>
<th>Institution</th>
<th>Location</th>
<th>Field</th>
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<tr>
<td>Wellesley College</td>
<td>Wellesley, MA</td>
<td>Molecular Biology</td>
<td>A.B., 1972</td>
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<tr>
<td>University of Pennsylvania</td>
<td>Philadelphia, PA</td>
<td>Biology</td>
<td>Ph.D., 1977</td>
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<td>University of California</td>
<td>Berkeley, CA</td>
<td>Cell Biology</td>
<td>1977–1981</td>
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<tr>
<td>California State University</td>
<td>Hayward, CA</td>
<td>Teaching Credential</td>
<td>1986</td>
</tr>
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B. APPOINTMENTS

1/2003-present Director, Science Education for Public Understanding Program (SEPUP), Lawrence Hall of Science, Berkeley, CA

7/1996-12/2003 Co-Director, Science Education for Public Understanding Program (SEPUP), Lawrence Hall of Science, Berkeley, CA

9/1990-6/1996 Teacher Associate, Science Education for Public Understanding Program (SEPUP), Lawrence Hall of Science, Berkeley, CA (On loan from the Oakland Unified School District)

9/1985-8/1991 Chemistry Teacher, Science Department, Fremont High School, 4610 Foothill Boulevard, Oakland, CA 94610

7/1981-8/1985 Assistant Research Physiologist, Department of Physiology-Anatomy, University of California, Berkeley, CA

C. PRODUCTS

Related Products


**Other Significant Products**


**D. SYNERGISITIC ACTIVITIES**

1. **Contributor to science curriculum and teacher professional development for NGSS**
   Is currently Co-PI for NSF-funded *Moving Next Generation Science Standards into Practice: A Middle School Ecology Unit and Teacher Professional Development Model* (NSF DRL-1418235, $1,728,035, 9/1/14–8/31/18, PI James Short, Co-PI Suzanne Wilson.). For this project, Nagle leads the curriculum team, which has completed development of the first field-test edition of *Disruptions in Ecosystems: Ecosystem Interactions, Energy, and Dynamics*, a middle school curriculum unit to support the NGSS. This course was field-tested in New York City during the 2015–2016 school year, and will be revised based on feedback from teachers and an expert panel and tested again in 2016–2017. Nagle also contributed to professional development for the field test teachers.

2. **Developer of SEPUP secondary science curricular materials and professional development**
   Contributed to proposal development, leadership, and authoring teams for SEPUP’s NSF-funded three-year issue-oriented middle school program (*Issues and Earth Science, Issues and Life Science*, and *Issues and Physical Science*) and high school courses (*Science & Sustainability and Science and Global Issues: Biology*). Served as the PI for NSF-funded grant that developed *Science in Global Issues* (NSF DRK–12 0352453, $2,668,188, 3/1/04–11/30/11). This project produced a yearlong high school biology curriculum. Each *Science and Global Issues* unit uses a socioscientific issue related to sustainability as the context for high school biology. Served as PI and co-author for U.S. Department of Energy-funded *Hydrogen Technology and Energy* (HyTEC) curriculum (DE-FG36-04-GO14277, 9/1/04–8/31/12). This project produced and disseminated a high school curriculum unit titled *Investigating Alternative Energy: Hydrogen & Fuel Cells*. Has also delivered numerous professional development sessions to support these programs and related to a variety of topics in science education, including science instructional materials, the NGSS, assessment, inquiry, differentiated instruction, and literacy in science.
Biographical Sketch

Rajul E. Pandya
Thriving Earth Exchange • American Geophysical Union (AGU), Washington, DC • rpandya@agu.org

Professional preparation

University of Illinois Urbana, IL Physics BS 1991
University of Washington Seattle, WA Atmospheric Sciences PhD 1996

Appointments

2013 - Present Program Director, Thriving Earth Exchange, American Geophysical Union
2011 - 2013 Director, Spark: UCAR Office of Education, University Corporation for Atmospheric Research
2004 - 2011 Director, Significant Opportunities in Atmospheric Research and Science, University Corporation for Atmospheric Research
2002 - 2004 Outreach and Community Relations Liaison, Digital Library for Earth Science Education (DLESE) Program Center
1999 - 2002 Assistant Professor of Meteorology, West Chester State University
1996 - 1998 Post-Doctoral Fellow, National Center for Atmospheric Research

Products

Most Relevant
Pandya, R., J. Galkiewicz, B. Williams, H. Furukawa, K. Berry, 2014: Using the Thriving Earth Exchange to advance community science. The Leading Edge 33, 12, 1330-1334. DOI: 10.1190/tle33121330.1

Additional products

Synergistic activities

I. Advancing community science. Community science is a participatory approach to science research and education that emphasizes close collaboration between scientist and community leaders in all scientific
processes -from identifying scientific questions that are community relevant through collecting and analyzing data together to applying results to produce local impact. As Program Director for AGU’s Thriving Earth Exchange, Pandya uses community science to leverage geoscience, produce impact, and support AGU’s mission of discovery for the benefit of humanity. Under Pandya’s leadership, TEX has developed and implemented a model for launching and advancing locally-focused community science partnerships that produce impactful solutions, built partnerships with a diverse set of community-serving organizations, created and refined processes for matching scientists and community leaders, and mined knowledge from a variety of disciplines to coach and mentor community-science project teams. TEX has launched nearly 30 unique projects, which range in scope from a pilot project to help 20 residents in a diverse low-income Denver neighborhood pilot new low-cost sensors to identify harmful chemicals entering their home to an international project to work with villagers in Afghanistan to adapt their traditional agricultural calendars to a rapidly changing climate.

2. Growing a community of practice around community science. In the geosciences, community science connects with geoscience education and outreach, citizen science, actionable science, service learning, efforts to broaden participation, and environmental justice. Pandya is active participant in these communities and has held leadership positions in some of those communities. He has developed and led sessions, workshops, and symposia exploring how community science connects to these topics at professional society meetings and for smaller groups, and authored articles or given invited talks on community science. As part of TEX’s long term plan, it will convene and advance a community of practice around community science, this proposal is one of several efforts toward that end.

3. Launching and leading multidisciplinary research. Pandya assembled, led, and secured funding for a multidisciplinary and multinational team that developed new tools to inform the distribution and timing of meningitis vaccines in sub-Saharan Africa. This project, funded by google.org, used community input and new data to uncover the link between meningitis transmission and relative humidity and worked with public health workers to design a straightforward tool to provide relative humidity predictions that was used to inform vaccination production. In addition, over 15 papers were published based on this research, which was also part of the graduate work of 3 students: 1 from the US and 1 from Africa. This work was also a springboard for additional work in the region, funded by NSF and other agencies.

4. Broadening participation in the geosciences. As part of DLESE, Pandya was part of several efforts to engage diverse communities as partners in developing the digital library. As director of SOARS, he expanded the program to recruit and support LBGTQ students and students with disabilities and introduced collaborative research with communities. He led the UCAR Africa Initiative, which increased scientific collaborations between African scientists and UCAR, and introduced “listening conferences” that launched several productive collaborations between UCAR scientists and educators and indigenous leaders. Working with schools in Denver and Puerto Rico, he launched a summer internship program for high-school students at NCAR. With AMS, Pandya facilitated the launch of an organization for LBGTQ members, led the team that drafted the first policy on harassment and professional conduct at meetings, and created numerous venues for people to learn about and tackle issues of disability, gender, and diversity. As a board member for the Citizen Science Association, he helped guide the establishment of the Integrity, Diversity and Equity Working Group. The Thriving Earth Exchange uses community science to advance the priorities of diverse and historically underserved communities.

5 Management experience. Pandya has managed large grants and programs since 2004 when he became the director of the SOARS Program, a multi-year REU program with comprehensive mentoring that broadens participation in the geoscience. As director of Spark, Pandya managed a staff of 20, provided strategic leadership on NCAR and UCAR’s education portfolio, and led teams that produced teacher educations, student internships, and educational and curricular materials for formal and informal education. Pandya has served on the board of the “I Have a Dream Foundation of Boulder,” including 5 years as chair, which helps children in underserved communities advance academically - from 2nd grade to college - through mentoring, scholarships, and academic enrichment. He is also on the board of Directors of the Citizen Science Association and serves as the Commissioner for Human Resources with the American Meteorological Society, where he manages 3 boards and numerous committees.
Mark Lee Benthien
Southern California Earthquake Center, University of Southern California, Los Angeles, CA 90089 benthien@usc.edu

PROFESSIONAL PREPARATION

University of California, Los Angeles Los Angeles, CA Geophysics BS, 1995a
University of Southern California Los Angeles, CA Public Policy MPP, 2003

APPOINTMENTS

2001–present Director for Communication, Education, and Outreach, Southern California Earthquake Center, University of Southern California, Los Angeles, CA
1999–2001 Assoc. Director for Outreach, Southern California Earthquake Center, University of Southern California, Los Angeles, CA
1996–1999 Outreach Specialist, Southern California Earthquake Center, University of Southern California, Los Angeles, CA
1995–1996 Graduate Research Assistant, California Institute of Technology, Pasadena CA

PRODUCTS RELATED TO THIS PROJECT

Jones L.M. and Benthien, M.L. Putting Down Roots in Earthquake Country, Special Publication of the Southern California Earthquake Center, University of Southern California, 32 pages, 2011 (available online at www.earthquakecountry.org/roots)
Benthien, M.L. and Pearce, I., Seven Steps to an Earthquake-Resilient Business, Special Publication of the Southern California Earthquake Center, University of Southern California, 16 pages, 2008 (available online at www.earthquakecountry.org/roots)

OTHER SIGNIFICANT PRODUCTS

Field, N., L. Jones, T. Jordan, M.L. Benthien, and L. Wald, Earthquake shaking; finding the “hotspots” USGS Fact Sheet 001-01, 2001
SYNERGISTIC ACTIVITIES

2008–present  Great ShakeOut Earthquake Drills, *Global Coordinator*
2003–present  Earthquake Country Alliance, California, *Executive Director*
2006–2007    Network for Earthquake Engineering Simulation, *EOT Committee Member*
2004–2010    Earthquakes and Megacities Initiative, *Los Angeles Academic Representative*
2004–2011    Emergency Survival Program, *Coordinating Council Member*
Biographical Sketch

Felicia M. Davis

a. Professional Preparation
Howard University  Washington, DC  Political Science  BA 1980
Howard University  Washington, DC  HUD Grad Fellow  1980-82

b. Appointments
2013-present  Director, Building Green Initiative at Clark Atlanta University, Atlanta, GA
2010-2013  Director, UNCF Building Green Initiative, Atlanta, GA
2006-2010  Vice President, Women Flying High LLC, Atlanta, GA
2004-2006  Director, Mothers & Others for Clean Air, Atlanta, GA
2000-2006  Director, GA Airkeepers, Atlanta, GA

c. Products

Most Closely Related


3. Felicia M. Davis, Director; Rick Horowitz, Editor; Rebecca Caine, Editor. MSI Green Report in collaboration with Mark Orlowksi & Sustainable Endowment Institute (2010). http://icb.uncf.org/LinkClick.aspx?fileticket=BAPXRJwYa8I%3D&tabid=160&mid=511

Other Significant Products

d. Synergistic Activities
1. As the Director of the HBCU Green Ambassador Program, I trained and supported student sustainability leaders on 27 HBCU campuses providing introduction to climate science, environmental justice, and campus stewardship. Ambassadors were nominated by faculty members that served as mentors or advisors. Students worked in teams to foster collaboration across campuses. A team effort was essential to successfully complete the training curriculum. Strong team bonds were formed and over time students increasingly turned to their colleagues for support. This was significant because teams were comprised of students from a range of majors each representing a different major. They met in person only once and communicated via Internet and conference call after the training. A collaborative
learning model was key to the success of the Green Ambassador program with enhanced student achievement based on grades, retention, and student-driven green activity on campus.

2. As Director of the Building Green Initiative I promote campus-wide sustainability (buildings and infrastructure, curriculum development, renewable energy, and student engagement for Historically Black, Hispanic Serving and Tribal colleges and universities. Since transitioning from UNCF to Clark Atlanta University the focus has narrowed to HBCUs while maintaining relationships with other MSIs. The program provided small grants to a range of institutions to implement innovative projects with an energy reduction and educational requirement. The Initiative is credited with increasing and supporting environmental sustainability on diverse MSI campuses and building a vibrant network of faculty and administrators committed to sustainability goals. We conducted the first MSI campus sustainability surveys with participation from more than 50 institutions, provided training for faculty to advance interdisciplinary environmental studies, and coordinated sustainability conferences targeting minority-serving institutions.

3. As a national director of Project Preserve designed to rescue engineering and computer science students performing poorly in the most competitive universities (collaboration between CUNY, CSUN and Xavier-New Orleans), I identified and recruited Black and Latino engineering and computer science students that were failing in the nation’s most competitive engineering and computer science programs. These students had comparatively strong backgrounds for the new campus environments and quickly began to thrive. Two additional student success factors were “time on task” and collaborative learning. Mandatory active study sessions and competitive team projects with faculty sponsors helped to transform the culture changing faculty expectations for minority students. It was determined that institutional fit is a critical factor in STEM student success. The program also provided financial aid and we introduced multi-cultural studies in summer bridge programs involving several of the Preserve students as tutors.
Biographical Sketch

Norma J. Neely, Ed.D.
Director, American Indian Institute

Professional Preparation
Central Missouri State University, Warrensburg, MO Education B.S. 1968
Central Missouri State University, Warrensburg, MO Education, Science emphasis M.S. 1973
University of Texas, Austin, TX Educational Administration Ed.D. 2001

Appointments
June, 2012 – Present Director, American Indian Institute; University of Oklahoma; Norman, OK
September, 2011—May, 2012 Assistant Professor; Oklahoma State University; Stillwater, OK
August, 2006 – August, 2011 Regional Instructional Facilitator for Science; Truman State University; Kirksville, MO
November, 2005 – July, 2006 Science Specialist, Austin ISD; Austin, TX
June, 2004 – October, 2005 Educational Consultant; Designing Success for Educators; Austin, TX
June 1999 – June 2004 Associate Director for Regional Projects; Texas Rural Systemic Initiative; Texas A&M University; Canyon, TX
June 1996 – May 1999 Texas Coordinator of Building a Presence for Science; National Science Teachers Association; University of Texas; Austin, TX
June 1994 – May 1996 Graduate Student/Research Associate; Educational Administration; The University of Texas; Austin, TX
September 1993 – May 1994 District Resource Teacher/Department of Instruction K-12; Kansas City, MO; The School District of Kansas City, MO
September 1988 – May 1991 K-5 Environmental Science Resource Teacher; Academy of Environmental Science; Kansas City, MO; The School District of Kansas City, MO
September, 1987 – May 1988 Language Arts Resource Teacher; Southwest Middle Magnet School; Kansas City, MO; The School District of Kansas City, MO
September 1986 – May 1987 Coordinator of College for Kids and Teens; Longview Community College; Lee’s Summit, MO; Longview Community College
September 1968 – May 1973 Fourth Grade Teacher; Lee’s Summit Elementary, Lee’s Summit, MO; The School District of Lee’s Summit, MO

c. Products

Most Closely Related
d. Synergistic Activities

1. **Educator and service provider to groups underrepresented in STEM.** As a member of the Citizen Potawatomi Nation and Director of the American Indian Institute within the division of Public and Community Services at the University of Oklahoma (OU), Dr. Neely oversees the Institute’s goals to support training and research, along with health promotion/disease prevention, art/culture/language preservation, and tribal leadership and organizational development. Prior to coming to OU, Dr. Neely served as Coordinator of “Building a Presence for Science” at the National Science Teachers Association, Associate Director of the NSF-funded Texas Rural Systemic Initiative, Science Instructional Facilitator for the Northeast Regional Professional Development Center at Truman State University. Additionally, she taught science to pre-service teachers at Oklahoma State University. She served as Professional Development Director on the board of the National Science Teachers Association, Education Committee Chair on the Board of SACNAS (Society for the Advancement of Chicanos and Native Americans in Science); and on numerous boards and advisory committees including Science Teachers of MO, American Royal Advisory Committee, MO Governor’s Task Force on Environmental Education, Scholastic’s Magic School Bus Advisory Council, and EarthScope’s Education and Outreach Committee. Previously, Dr. Neely authored a grant to take teachers to the Peruvian Amazon in order to develop curriculum materials. She has also participated in several other grants, including an NSF-funded research expedition to Antarctica, a state-funded learning experience in the Galapagos, and archaeological digs in various locations in the United States and in Zaire. She began her career as an elementary teacher and in 1990 received a Presidential Award for Excellence in Science Teaching.

2. **Leader in organizations addressing education needs and education research.** Currently Dr. Neely is the district director for Region 13 (TX, OK, NM) of the National Science Teachers Association (NSTA), and chair of the advisory board for AIR’s (American Institutes for Research) REL Southwest (Regional Educational Laboratory Southwest).

3. **Creator of learning activities and curriculum,** including contributions to these publications: “Project Zoo”- a third grade curriculum guide for using the Kansas City Zoo; “Rain Forest Rendezvous”- K-6 Lessons/Activities on tropical rain forests; “Ecosystems Made Elementary”- K-6 Lessons/Activities comparing/contrasting the ecosystems of Missouri and the Galapagos Islands; “Belize Curriculum” for the JASON Project; “Measurement” section of the Math/Science Connection of Summer Interface 1992; Mentoring Handbook for Austin Independent School District. She also wrote copy for two science-related video games produced by Sega/Genesis.

Biographical Sketch – Norma Neely - 2
Professional Preparation
Swarthmore College       Swarthmore, PA       Physics       B.A. 1977
University of Washington  Seattle, WA       Geophysics       Ph.D. 1983

Appointments
2010 – Present       Director, IRIS Education and Public Outreach program
2001 – 2010       IRIS Education and Outreach Program Manager
1994 – 2001       Earthquake Commission Fellow in Seismology, Victoria University of Wellington
1991 – 1994       Research Fellow, Victoria University of Wellington
1989 – 1991       Post-doctoral Fellow, Victoria University of Wellington
1984 – 1989       Associate Research Scientist, Lamont-Doherty Geological Observatory of Columbia University

Five Products Related to the Proposal

Five other Significant Products


**Five Synergistic Activities**

**Earth Science Literacy and workforce development**
As Co-PI of the Earth Science Literacy Initiative (2008-2009), helped develop and disseminate a set of Earth science literacy principles that have become widely referenced in Earth science education and outreach and that helped form the basis for the Earth science elements of the Next Generation Science Standards. Co-PI for distributed summer undergraduate research program reaching over 155 students (2002- ), Co-PI on workshop to encourage collaboration between early career geoscientists and geoscience education researchers (2015).

**Development of educational tools that highlight the use of data**
Leadership of software engineers and educational specialists in the development of a range of tools designed to allow students and the general public to explore and interpret seismic data (2002- ). Products include software for streaming real-time seismic data into the classroom (*jAmaseis*), Web applications reaching millions of users (*Seismic Monitor, IRIS Earthquake Browser and 3D Viewer, Seismic Waves*) and public displays in museums with millions of visitors (*Earthquake Channel and its predecessors, Active Earth Monitor*).

**InTeGrate Leadership team**

**National and international collaborations**

**Professional society activities**
Current and Pending Support

This item is *NOT to be included* in the NSF INCLUDES *Preliminary Proposal* for Design and Development Launch Pilots.
Facilities, Equipment and Other Resources

This item is *NOT to be included* in the NSF INCLUDES *Preliminary Proposal* for Design and Development Launch Pilots.
Data Management Plan

This item is *NOT to be included* in the NSF INCLUDES Preliminary Proposal for Design and Development Launch Pilots.