New Mexico EPSCoR

RESEARCH INFRASTRUCTURE IMPROVEMENT (RII 4)
PROPOSAL DEVELOPMENT PROCESS

EDUCATION & OUTREACH WHITE PAPER

FOR DISCUSSION
December 15, 2011

TITLE: WATER, ENERGY, AND ENVIRONMENT OUTREACH WORK SESSION (MULTIPLE PAPERS)

LEAD AUTHORS: CHARLES WALTER (NMMNHS), EILEEN EVERETT (SFWA), KARL BENEDICT (EDAC-UNM), CARLOS OCHOA (NMSU), RAMESH SHAKAMURI (NMT), DARCY BUSHNELL (UNM)

Water, Energy, and Environment
Outreach Work Session

The outreach breakout group put together several ideas for activities that a) communicate EPSCoR science into user communities and the public, b) leverage relevant NM resources, and c) will contribute to a successful NSF proposal. Following the session, five participants prepared papers describing four broad categories: an inventory of resources; communication of EPSCoR research; delivery of content; and a learning community infrastructure.

The four pieces contribute are a part of the over-arching goal of delivering research results in appropriate modes to the NM population at large. Charles Walter's (NMNH) paper recommends the creation of an Informal Science Education Network which might be described as a structure or umbrella for the delivery of this information.

Eileen Everett's (SF Watershed Assn) paper calls for an inventory of existing resources, programs, people, institutions and infrastructure so that this outreach component of the next five year EPSCoR program can benefit from the challenges, successes and experiences of those who have worked on outreach tools before and so that the program can move the dialog forward.

Eileen Everett and Karl Benedict (EDAC-UNM) recommended the development of a data and information bi-directional portal as a collection and delivery system mechanism.

Carlos Ochoa(NMSU) and Ramesh Shakamuri (NMT) illustrated methods for getting local involvement and delivery of content through local demonstration plots/fields and wikis.

Work session participants brought to the group's attention the following resources which illustrate the points:
- 27 gateway sites located across the state which offer 64" screens with 3-D capacity, cameras and other equipment
- An Extension Program project for school children on the scientific value of acequia systems
- A collaborative decision making model developed by Sandia Corporation
- Master's programs such as Master Gardeners who could incorporate related science into their curricula

The work session participants also recommended considering:
- Bridging science and cultural narratives, giving place a voice, and incorporating environmental aesthetics in the development of outreach programs
- Using Google earth type display for the portal to increase accessibility
- Appropriately increase the level of transparency of scientific data/information
- Provide cultural sensitivity training to those who develop and deliver information
- Develop a fellows program to create liaisons with native and historic communities
- Create a space for scientists, educators and community leaders to communicate.

EDUCATION & OUTREACH WHITE PAPER

FOR DISCUSSION
December 15, 2011

TITLE: CREATING A STATEWIDE INFORMAL SCIENCE EDUCATION NETWORK TO DEVELOP INSTITUTIONAL CAPACITY AND PUBLIC PROGRAMS FOCUSING ON EPSCOR RESEARCH ON THE ENERGY-WATER-ENVIRONMENT NEXUS

LEAD AUTHOR: CHARLES H. WALTER (NMMNHS)

CONTRIBUTING AUTHORS: N/A

Creating a Statewide Informal Science Education Network to Develop Institutional Capacity and Public Programs Focusing on EPSCoR Research on the Energy, Water, Environment Nexus

Author: Charles H. Walter, Executive Director,
New Mexico Museum of Natural History and Science

Description of Activity
Building upon lessons learned through past and current networks of informal science institutions, the development of a New Mexico Informal Science Education Network (NM ISE Net) would support the educational outreach of the EPSCoR project by 1) Building statewide capacity within the informal science community to understand the current science being generated through research on the energy, water, environment nexus, 2) Develop programs that will reach across the state and inform the public on the current science generated through the project, and 3) Build bridges and create a learning community across research and informal science institutions to learn from each other.

Rationale for this approach can be found in a number of projects funded by the National Science Foundation including:

- The Nanoscale Informal Science Education Network (NSF# 0532536 and 0940143). NISE NET was funded "…*to foster public awareness, engagement, and understanding of nanoscale science, engineering, and technology through establishment of a Network, a national infrastructure that links science museums and other informal science education organizations with nanoscale science and engineering research organizations.*"

- Texas Network for Exhibit-based Teaching and Learning (NSF#0337354): *The TexNET project* was designed to increase the capacity of staff at member museums to provide high-quality learning experiences for their visitors.

- Portal to the Public Project (NSF-063921). The Portal to the Public project was designed to assist informal science education (ISE) institutions as they seek to bring scientists and public audiences together in face-to-face public interactions that promote appreciation and understanding of current scientific research and its application.

In particular, evaluation the TexNET model is recommended as an approach to NM ISE Net*: The model that emerged in the last phase of the TexNET project has the potential to be valuable to other statewide networks. In summary, the model consisted of: 1) providing group-wide high-quality professional development…which created shared experiences, vocabulary, and a shared culture…. and 2) providing relatively small amounts of funding to each site to create customized… activities, purchase materials, and provide professional development.* (Inverness Research 2010).

The specific steps recommended to develop NM ISE Net are 1) Contact informal science institutions across the state (museums, zoos, nature centers, botanic gardens, state/federal parks,

university outreach programs, …) and invite them to have an initial conversation(s) about EPSCoR and possible work together, 2) From this group create an action team to research past ISE networks and projects to build group capacity as to what could be possible, 3) Create a shared vision for work together, 4) Build capacity around the new science emerging from EPSCoR, 5) Create a learning community where research scientists and informal educators can learn from each other, 6) Create programs for public audiences at NM ISE Net sites across the state, 7) Evaluate effort.

The goal of creating a learning community will be informed by management theory. Peter Senge writes, "Just as an architect and contractor of a house must develop mechanisms to get the right building materials and bring them to the site, builders of learning organizations must develop and improve infrastructural mechanisms so that people have the resources they need: time, management support, money, information, ready contact with colleagues, and more." Management Writer Margaret Wheatley writes about the importance of creating strong systems by creating stronger relationships. "My colleagues and I focus on helping a system develop greater self-knowledge in three critical areas. People need to be connected to the fundamental *identity* of the organization or community. Who are we? Who do we aspire to become? How shall we be together? And people need to be connected to *new information*. What else do we need to know? Where is this new information to be found? And people need to be able to reach past traditional boundaries and develop *relationships* with people anywhere in the system. Who else needs to be here to work with us? The learning community and its work will develop and grow as new research as it emerges from EPSCoR and the field of informal science.

Relevance to the Energy, Water, Environment Nexus
As noted above, the main goals of this effort are to build capacity within the state's informal science education community and to develop public programs about the research underway as part of EPSCoR. As a learning community, the specific outcomes will emerge as does the science through this effort. Specific programs could include lectures, small exhibits, education programs offered to adults and/or children, teacher professional development activities, school field trip offerings at informal institutions or field sites, web resources or other activities. As a network, programs efforts, successes and failures will be shared to all members, with each organization utilizing its own skills and culture to mold its final programs.

Target Audiences include professionals in the informal science education field, research scientists, public and K-16 formal education audiences.

Evaluation of the effort will look at such issues as
   1) the value and functionality of the network and its support activities
   2) the quality and value of the professional development offered to the network
   3) the contributions to local staff and institutions, and
   4) the quality and value of the resources and activities produced at the local level, and the resulting experiences of the visitors.
An initial conversation with Inverness Research Associations, which has extensive experience evaluating informal science networks, indicated their willingness to work with the effort. Dr. Mark St. John and Becky Carroll would support formative development of the network, and summative evaluation if needed.

Budget Impact on the EPSCoR project would be less in the first years of the effort as the group forms and builds capacity (meeting/travel costs), and more in the latter years as funds would be needed to develop programs.

EDUCATION & OUTREACH WHITE PAPER

FOR DISCUSSION
December 15, 2011

TITLE: OUTREACH RESOURCES INVENTORY

LEAD AUTHORS: EILEEN EVERETT (SANTA FE WATERSHED ASSOCIATION)

CONTRIBUTING AUTHORS: N/A

Author(s) with Affiliation – *Eileen Everett (Santa Fe Watershed Association)*

Description of Activity (1-2 paragraphs)

A web-based data portal would serve to provide a link of communication between the researchers and other outreach efforts, and the general public during NM EPSCoR RII4. This web-based data portal would be designed to be accessible, understandable, and adaptable to its users and serve as the clearinghouse for all public information related to the grant. The first step in developing a web-based portal for use by all audience groups would be completing an inventory of available resources. To date, there have been a variety of relatively small-scale attempts of identifying and cataloguing science-related activities, curriucula, program information, and science papers written for the general public. This would be an opportunity to inventory these assets on a statewide scale that would be accessible by the public, K-12 teachers and students, post-secondary institutions, businesses, and government.

The first step in this process would be to gather information completed in previous inventory attempts. This would include gathering information from programs like the New Mexico Public Education Department's "My Standards" and resources gathered from the Watershed Education Network, which would aid in developing a network for formal and informal science education for New Mexico. In addition, time should be allocated to visiting other similar statewide data portals such as those in Colorado and North Carolina, and researching the successes and challenges of these other systems. Lastly, this effort could collect upon the current NM EPSCoR RII3 grant by consolidating the education and outreach efforts along with capturing the scientific activities related to climate change and mountain sources of water. This would also encourage an effort to take the science completed under the NM EPSCoR RII3 grant and begin translating this information into a format that is accessible and understandable by the general public.

Relevance to Energy-Water-Environment Nexus

Development of a web-based data portal would build upon the science efforts related to climate and water during the current iteration of NM EPSCoR. Additionally, the web-based data portal would allow for a focus on collecting already useful and successful activities developed for all audiences related to the topics of energy, water, and the environment rather than putting energy into developing new activities. This inventory could allow for exploring information related to energy, water, and the environment on a global down to a local scale and provide for an opportunity to take the scientific research and translate it into a format that is readable by the general public.

Target Audience(s): K-12, Undergrad/Grad, Outreach, Workforce Development

K-12, Undergrad/Grad, Outreach, Workforce Development

RESEARCH INFRASTRUCTURE IMPROVEMENT (RII 4)
PROPOSAL DEVELOPMENT PROCESS

EDUCATION & OUTREACH WHITE PAPER

FOR DISCUSSION
December 15, 2011

TITLE: COMMUNICATIONS PORTAL & PLATFORM

LEAD AUTHORS: KARL BENEDICT (EDAC-UNM)

CONTRIBUTING AUTHORS: N/A

EPSCoR Track 1 Planning White Paper
Education and Outreach - Planning Meeting #3
Outreach and Workforce Development

Communications Portal & Platform
Karl Benedict - 12 December, 2011

The potential end-users of the scientific data and knowledge at the environment-water-energy nexus fall into a diverse set of communities that include k-12 and post-secondary educators and students; policy makers and regulators; researchers; non-profits and NGOs; and private sector businesses. The information access and presentation needs of these communities are as diverse as the populations that they consist of, and developing a system that can support these diverse needs presents a significant challenge, particularly given the "traditional" approach of developing information "portals" that are optimized for delivery to only one specific end user community - e.g. Researchers, Geospatial data professionals, k-12 educators. The concept proposed here differs from this traditional approach in that it is based upon a model in which a single information platform is deployed that enables a drill-down approach to information and data access that supports the diverse needs of different communities, *and* enables *bi-directional* information *exchange.*

1. *How innovative and potentially transformative is the activity?*
This activity is innovative and potentially transformative in that it is based upon an information and access model that is based upon progressive delivery of detailed information and related data through a "drill-down" model where users are not distinguished from each other by type, but instead by the level of detail that they are interested in viewing. This alternative method of partitioning users has the advantage of providing a unified interface through which novice users can enter for basic use, but as their experience with the presented information and data grows, they can satisfy their increasingly complex needs (spurred through the development of new research questions or through intellectual curiosity) through experimentation with tools that allow for intuitive drill-down into more detailed content.

The second innovative aspect of this portal is a fundamental design that enables bi-directional information exchange where system users can provide feedback about the usability and quality of the available data, services, and interface for their particular applications. Given that different users will have different uses and data and information requirements, the provided feedback will need to be assessed and presented in the context of user-defined uses, where the resulting quality information will likely vary from use to use.

2. Are there existing programs that can be leveraged?
The current EPSCoR data management system and related services platform may be used as the initial system upon which new data services and may be built. Given the common platform for the NM Resource Geographic Information System (RGIS) and the NM EPSCoR data portal, the capabilities of both systems will both contribute to and benefit from the development of the enhanced system capabilities proposed for this portal. With the tiered services oriented architecture of both RGIS and the EPSCoR data management system, the new communications-enabled drill-down interface can be developed while taking advantage of previous investments in the development of the underlying data management and publication services of the RGIS/EPSCoR platform.

3. How well does the activity relate to the energy---water---environment nexus?
While the capabilities described for this activity are not specific to the energy-water-environment nexus, the drill-down data and information model and bi-directional information collection capability are well positioned to enable the inherently multi- and trans-disciplinary characteristics of the research and applications activities that will be taking place within the nexus. Domain-specific researchers and educators can potentially focus within the portal on data access and assessment relevant to their particular domain while trans-disciplinary activities can also work very effectively in the developed environment within which data from multiple sources can be integrated using the common access model and interfaces.

4. How well does the activity focus on secondary school teachers and minority---serving two---year and four---year institutions?
The inclusion of high-level access methods that are simple to use and access provide a low barrier to entry for entry-level researchers and educators - encouraging exploration and experimentation with the science products and services published by the system. As the students and teachers gain experience with the tools, data and access methods they may dig deeper into the system through tools that enable more complex multi-variate analysis and visualization of the same data and information products that they are already familiar with through their earlier exploration. This incremental access model allows for effective self-paced exploration of data and tools.

5. Does the activity contribute to the development of a diverse, well---prepared, internationally competent, and globally engaged STEM workforce and a more scientifically literate public?
Through the publication of scientific information and data with related quality feedback from users, the above described communication portal will ease access to key data and information that both the public and STEM workforce need to evaluate arguments made regarding the costs and benefits of new energy resources, particularly in reference to their potential impacts on New Mexico's environment and water resources. The availability of a common collection of data that may be used both for public presentation and analysis will support the communication of science outputs in a more consistent manner to multiple stakeholder and research audiences.

![New Mexico EPSCoR]

RESEARCH INFRASTRUCTURE IMPROVEMENT (RII 4)
PROPOSAL DEVELOPMENT PROCESS

EDUCATION & OUTREACH WHITE PAPER

FOR DISCUSSION
December 15, 2011

TITLE: METHODS FOR LOCAL INVOLVEMENT AND DELIVERY OF CONTENT THROUGH LOCAL DEMONSTRATION PLOTS/FIELDS AND WIKIS

LEAD AUTHORS: CARLOS OCHOA (NMSU), RAMESH SHAKAMURI (NMT)

CONTRIBUTING AUTHORS: N/A

Author(s) with Affiliation - *Carlos G Ochoa (NMSU)*

Description of Activity (1-2 paragraphs)

The proposed activity calls for using demonstration plots/fields as a way to connect with local producers, students, and public in general and show them research activities related to the Energy-Water-Environment Nexus. Ongoing acequia-hydrology research can be used as leverage by expanding research activities to include the energy component. For instance, demonstration fields can be established in the NMSU-Sustainable Agriculture Science Center in Alcalde, NM and other facilities to show different crop varieties with potential for generating biofuels (i.e. sunflower seed for biodiesel) and that are irrigated using traditional irrigation systems (acequias). A different example is to establish a demonstration site for showing small and/or micro hydropower generation using acequia water flow. These demonstration plot activities can be complemented with on-site workshops and short-courses related to the topic.

Relevance to Energy-Water-Environment Nexus

In both of the demonstration plots mentioned above, clean (environment-friendly) energy is generated using water that is gravity-driven into the acequia systems, thus no additional energy from fossil fuels is required.

Target Audience(s): K-12, Undergrad/Grad, Outreach, Workforce Development

Outreach and Education

Author(s) with Affiliation – Ramesh Shakamuri (NMT)

Description of Activity

The proposed demonstration by Carlos Ochoa, using plots/fields as a way to connect with local producers, students, and public in general and show them research activities related to the Energy-Water-Environment Nexus can be further augmented and made interactive and immersive by integrating the field work and experiments with a Wiki.

Use of a Wiki alongside the field work provides the following benefits:

- Enables extremely flexible content rich collaboration that has shown significant positive motivational consequences for active participation in a peer setting.
- Using a blend of Lab book wiki and a Collaborative wiki allows students to keep notes online with the added benefit of allowing a team to collaborate and allow the output to be peer reviewed and changed by fellow students. The Wiki will also be the de facto knowledge repository for the participants dispersed geographically across the state.
- Wikis stimulate writing ('fun' and 'wiki' are often associated);
- Wikis provide a low-cost but effective communication and collaboration tool
- Promote active interactions between students by challenging them to think independently and creatively.
- Finally, using a Wiki gives a broader exposure to scientific thinking and writing to all the students that participated in such activities.

This Wiki can be set up and managed at minimal cost by EPSCoR.

Target Audience(s): K-12, Undergrad/Grad, Outreach, Workforce Development Outreach and Education