

## NM EPSCoR RII3: Climate Change Impacts on New Mexico's Mountain Sources of Water

Climate change is affecting natural environments around the world. NM EPSCoR RII3 addresses a key challenge that is of worldwide significance—understanding and forecasting the effects of climate change on water supply and sources in arid regions, as well as the socioeconomic implications. The overarching vision for the NM EPSCoR Program is to enable:

*“An environment in which New Mexico scientists and educators are fully competitive in climate change research and education.”*

NM EPSCoR RII3 is designed to enhance research competitiveness through investment in three strategic areas: (1) *critical Research Infrastructure*, (2) *Cyberinfrastructure*, and (3) *Human Infrastructure*. These investments will help establish NM as a laboratory for climate change research, and as a model for science-based public policy. The multi-disciplinary, multi-scale effort is envisioned to transform climate change science and policymaking in NM by providing the tools required for quantitative, science-driven discussion of difficult water policy options facing the State in the 21st Century. These goals are articulated in the NM EPSCoR mission:

*“Provide the critical gap infrastructure, computational support, and education and outreach opportunities to foster excellence in climate change research and education.”*

EPSCoR research infrastructure investments support development of watershed-scale observational databases and coupled atmosphere-land surface-hydrology models needed in NM for water supply forecasting and water resources decision support. RII3 also supports research on the socioeconomic impacts of basin-scale hydrologic changes to *acequias* - the traditional water supply system for agriculture in small communities that has been an integral cultural feature of NM for centuries. New cyberinfrastructure will facilitate the rapid delivery of climate change data and information to scientists, educators, decision-makers, and the public. EPSCoR investments in outreach and communication will create an informed citizenry that is aware of climate change impacts on natural resources. In addition, education and diversity investments are closely integrated to increase impact on the critical student population at NM's non-PhD granting institutions. Innovative elements of the outreach, education and diversity programs reach a large and diverse population with an emphasis on involving and supporting the State's 'majority minority' population of Native Americans and persons of Hispanic descent.

Through novel projects and partnerships that are facilitated by NM EPSCoR Research Infrastructure Improvements, scientists and educators contribute to serving the needs of science, education, and the public. In order to achieve the broadest impact, New Mexico RII3 participants met in October, 2008 and defined the scope of what they do, the stakeholders they serve, and how they intend to achieve the NM EPSCoR mission. The resultant strategic and implementation plans delineated 14 specific strategic objectives and key actions to achieve these objectives, and guide the NM EPSCoR program. The objectives are grouped by major focal area for the investment: (1) research infrastructure; (2) cyberinfrastructure; and (3) human infrastructure. Key accomplishments in each of the 12 objectives targeted for action this year (year 1) are detailed below.

### NM EPSCoR Key Accomplishments in Year One

Research Infrastructure Improvements

Objective 1: Enhance climate and hydrology research infrastructure (from data acquisition through modeling).

- Significantly upgraded climate and hydrology observing networks in northern New Mexico through acquisition of equipment and materials for meteorological, SNOTEL and SCAN stations. Completed site selection and began station installation.
- Completed Landsat TM data acquisition for study area and initial research on remote snow mapping techniques. Completed parameterization and are currently running Snow Runoff Model (SRM) on 25 most important sub basins in the Rio Grande headwater drainage.
- Joint UNM and NCAR research on improving mesoscale climate models has resulted in sub-routines for more accurately simulating convective extremes in mountainous terrain.

Objective 2: Improve water quality monitoring in high altitude stream environments.

- Two snow-melt dominated watersheds and specific stream sites were selected for deploying autonomous water quality sensors for monitoring the quality of surface water.
- Testing and training is ongoing to evaluate new real-time in-situ optical water quality sensors adapted to freshwater systems and high altitude environments.
- Developed a cohesive yet diverse group of interdisciplinary and multi-institution collaborators concerned with understanding stream water chemistry dynamics that met in May at the Valles Caldera and includes UNM, NMT, NMHU, and Dine' College.

Objective 3: Develop interdisciplinary socioeconomics and acequia research capacity.

- Completed 5 study site visits by interdisciplinary teams to select study watersheds and intensive study site locations on the Rio Hondo and Rio Truchas rivers.
- Purchased hydro-meteorology equipment to characterize acequia system flow distribution and surface-groundwater hydrological interactions.
- Held first Acequia Focus Group meeting at Rio Truchas with community members, water managers, and the Acequia Association.

Objective 4: Provide critical gap infrastructure for New Mexico Highlands University.

- Purchased and installed equipment for a significant upgrade to the aquatic chemistry laboratory at NMHU for state-of-the-art water quality analysis: Ion Chromatograph, Total Organic Carbon Analyzer and Graphite Furnace Absorption Spectrometer
- Provided training in the use of the instrumentation for 2 graduate and 1 undergraduate students.

Objective 5: Use Innovation Working Groups (IWG) to address key scientific, education, diversity, and workforce development challenges.

- Developed a Call for Proposals and solicited proposals to support IWGs that address challenges in the climatological, hydrological, and socioeconomic sciences, as well as education, communication and outreach, and diversity.
- Funded 2 IWG proposals: one on acequia interdisciplinary research and one on improving the STEM pipeline for higher education in New Mexico.
- Developed a new IWG program for the Tri-State NSF EPSCoR IWGs for Nevada, NM and Idaho that will promote regional and inter-jurisdictional collaborations. Completed a Call for Proposals and will fund 2 IWGS: one in new optical temperature sensing technologies for high-altitude streams, and one in climate change impacts on water resources in Native American and Hispanic communities.

### Cyberinfrastructure Improvements

Objective 7: Enhance scientific data and model output generation, management, discovery, and use through cyberinfrastructure.

- Developed a project tracking and evaluation database for the NM EPSCoR RII 3 program.
- Developed and deployed a new website for the RII 3 project.
- Coordinated the cyberinfrastructure team at the Tri-State annual meeting, gained consensus on critical issues of interoperability standards, and established working groups for Architecture, Data Policy and Data Formats and Instrumentation Systems Connectivity.

### Human Infrastructure Improvements

Objective 8: Enhance diversity in all elements of the EPSCoR Program.

- Initiated a new program with the American Indian Higher Education Consortium and conducted 2 workshops with tribal college faculty on development of an undergraduate curriculum in climate change science.
- Completed two activities to increase the number of incoming students into STEM disciplines from underrepresented groups: offered a summer UROP program that recruited exclusively from non-PhD granting schools, and funded an IWG on developing a STEM pipeline to improve diversity in NM higher education.

Objective 9: Enhance professional teacher development for STEM areas in northern New Mexico.

- Created a new partnership with The Northern Network, a non profit cooperative for improving education in rural schools of northern New Mexico.
- The Northern Network coordinated and offered a five-day field-based Teacher Summer Institute at the Valles Caldera National Preserve for 8<sup>th</sup> and 9<sup>th</sup> grade math and science teachers.

Objective 10: Develop an Undergraduate Research Opportunity Program that increases the exposure of students at non-PhD granting institutions to high quality, relevant, hypothesis-driven research.

- Successfully engaged 10 undergraduates, recruited from institutions serving large populations of Hispanic and Native American students, in nine weeks of summer research with faculty mentors from the 4 NM EPSCoR universities.
- Developed an initial week of workshops and short courses on climate change, hydrology, and water quality, which were taught by EPSCoR-supported faculty, and prepared the new UROP students for their summer research assignment.

Objective 11: Design and develop graduate research training group opportunities.

- In partnership with Los Alamos National Lab, supported a three-day summer workshop in regional climate modeling, entitled: *“Simulating the Spatial-Temporal Patterns of Anthropogenic Climate Change: A Workshop in the Bridging Disciplines, Bridging Scale Series”*.

Objective 13: Enhance leadership skills for faculty via a Faculty Leadership Fellowship Program.

- Offered a week-long training workshop for 19 early-career faculty from 5 higher education institutions in New Mexico.
- Offered a series of hands-on activities designed to enhance competitiveness and leadership skills from New Mexico and nationally-prominent scientists and experts.

Objective 14: Create a citizenry that is informed about climate change and its impact on NM's natural resources via public outreach and communication.

- Conducted planning and coordination for a new Climate Change Exhibit at the New Mexico Museum of Natural History and Science. Hired a Guest Curator and began initial design of the installation.
- Hired a Climate Change Educator at the Museum who is developing public outreach education programs on climate change impacts in New Mexico.

### **Project Changes During Year One of the Award**

The project had no significant changes in scope or priorities since the NSF funding award.

There were, however, initial delays in initiating many of the project activities. In particular, strategic planning efforts and the delay in initial receipt of funds required that we delay the purchase and installation of equipment until summer and fall of 2009 since the study sites are largely inaccessible during the winter months. In addition, departmental and university requirements associated with hiring and recruitment necessitated delays in hiring staff and students. Consequently, the majority of the instrumentation is being installed over the summer and during early fall of 2009. The planned annual NM EPSCoR meeting, to be held in conjunction with the External Advisory Board in late summer, will be delayed until mid- or late fall. It is anticipated that activities that experienced initial delays will be back on track by the end of year 1.

Some changes in cooperating personnel occurred between when the proposal was submitted and when the award was received. Specifically, Dave Gutzler's administrative efforts at UNM were taken over by Joseph Galewsky; NMSU is replacing the State Climatologist position previously occupied by Deborah Bathke; Enrique Vivoni (NMT) was hired by Arizona State and his research and component lead duties were assumed by John Wilson; The Northern Network replaced educational activities undertaken by the Chihuahuan Desert Nature Park; and Jessica Sapunar-Jursich replaced Celena Connelly at the NM Museum of Natural History and Science. Notably, Katherine Mitchell joined the EPSCoR management team as Associate Director in December, 2009.

<b>NM EPSCOR RII3: CLIMATE CHANGE IMPACTS ON NEW MEXICO’S MOUNTAIN SOURCES OF WATER</b>	<b>I</b>
<b>NM EPSCoR Key Accomplishments in Year One</b>	<b>i</b>
<b>Project Changes During Year One of the Award</b>	<b>iv</b>
<b>INTRODUCTION</b>	<b>1</b>
<b>PARTICIPANTS AND PARTICIPATING INSTITUTIONS</b>	<b>2</b>
<b>PROJECT DESCRIPTION</b>	<b>5</b>
<b>1. Research Accomplishments and Plans</b>	<b>5</b>
Climate and Hydrology	5
Water Quality	6
Acequia Interdisciplinary Research	7
Aquatic Chemistry Laboratory at New Mexico Highlands University (NMHU).	7
<b>2. Diversity of People and Institutions</b>	<b>9</b>
2a. Broadening Participation	9
The NM EPSCoR Undergraduate Research Opportunities Program (UROP)	9
The NSF Geosciences - AIHEC program in climate change science education	12
2b. Institutional Collaborations	13
Western Tri-State Consortium	13
Institutional Collaborations within New Mexico	14
<b>3. Workforce Development</b>	<b>15</b>
NM EPSCoR Teacher Summer Institute	15
STEM Workforce Development at NMHU	16
<b>4. Cyberinfrastructure</b>	<b>18</b>
Project Tracking and Evaluation Database	18
NM EPSCoR Web Portal	18
Tri-State Coordination of Cyberinfrastructure Activities	19
NM Cyberinfrastructure Activities	20
UROP and Cyberinfrastructure Activities	20
<b>5. Outreach and Communication</b>	<b>21</b>
Climate Change Exhibit at the New Mexico Museum	21
<b>6. Evaluation and Assessment</b>	<b>22</b>
<b>7. Sustainability and Outcomes</b>	<b>23</b>
7a. Seed Funding / Emerging Areas	23
Innovation Working Groups	23
Tri-State Innovation Working Groups	24
7b. Education / Human Resources Development	24
Junior Faculty Leadership Workshop	24
Graduate Research Training	26
<b>7c. Leveraging NSF funded programs</b>	<b>26</b>
<b>8. Management Structure</b>	<b>28</b>
NM EPSCoR Management Team	28
NM EPSCoR State Committee	29
NM EPSCoR RII 3 Strategic Plan	29
<b>9. Unobligated Funds</b>	<b>30</b>
<b>JURISDICTION SPECIFIC TERMS AND CONDITIONS</b>	<b>31</b>



## **INTRODUCTION**

The NM EPSCoR RII 3 Program  
Annual Report  
Award Year One: September 1, 2008 – May 31, 2009.

The structure of this annual report is based on the guidelines provided by NSF EPSCoR and on the Strategic Implementation Plan developed at the New Mexico EPSCoR RII 3 strategic planning session in October, 2008. The Implementation Plan utilizes the NM EPSCoR program's logic model of research infrastructure, cyberinfrastructure and human infrastructure capacity building. Within each of these three areas, the plan specifies objectives to be met throughout the course of program delivery. There are a total of 14 objectives in the plan. The complete Strategic Implementation Plan is included as an Appendix.

The NM EPSCoR RII 3 annual report for Year 1 follows the outline determined by NSF EPSCoR; the report sections and headings follow NSF guidelines. To facilitate reader comprehension, each section begins by listing the Implementation Plan objective(s) that fall under that heading. The objectives are numbered following the scheme established for the Implementation Plan. Twelve of the 14 plan objectives are discussed; two objectives are not undertaken until later years of the award.

**PARTICIPANTS and PARTICIPATING INSTITUTIONS**

NM EPSCoR RII 3, “Climate Change Impacts on Mountain Sources of Water”, is a multi-institutional, multi-disciplinary collaboration across the state of New Mexico. The primary research, education and outreach entities active in Year 1 of the award include:

- 3 research universities: New Mexico State University (NMSU)(Las Cruces), New Mexico Tech (NMT)(Socorro), and University of New Mexico (UNM)(Albq).
- 1 regional university: New Mexico Highlands University (NMHU) (Las Vegas)
- 1 tribal college: Dine’ College (Dine’) (Tsaile)
- 1 state museum: New Mexico Museum of Natural History and Science (NMMNHS) (Albq)
- 2 national laboratories: Sandia National Labs (SNL)(Albq), Los Alamos National Labs (LANL) (Los Alamos)
- 1 non-profit educational organization: The Northern New Mexico Network (The Network, or NNet) (Albuquerque)
- 1 national preserve: the Valles Caldera National Preserve (VCNP) (Jemez Springs)

Although there are additional partner institutions, and many additional collaborators and participants, the following table (Table 1) lists the core NM EPSCoR scientists, educators and collaborators whose work is detailed in this report. (This list is equivalent to the NSF Fastlane request for RII participants at “the faculty and equivalent” level of collaboration.)

Table 1. Primary NM EPSCoR scientists, educators and collaborators active in Year 1 of the award

NM EPSCoR Role	Name	Institution	Department
Cyberinfrastructure	Karl Benedict	UNM	Earth Data Analysis Center
Remote Sensing	Max Bleiweiss	NMSU	Environmental and Plans Science
Education	Marnie Carroll	Dine	Executive Director Center Environment
Economics	Janie Chermak	UNM	Economics
Aquatic Chemistry	Laura Crossey	UNM	Earth & Planetary Sciences
Aquatic Ecology	Clifford Dahm	UNM	Biology
Education	Mary Jo Daniel	St of NM	New Mexico Public Education Dept.
Water Resources	Leeann De Mouche	NMSU	Extension Plant Sciences
Education	Anna Espinosa	NNet	K-12 Math Education Coordinator
Outreach	Eileen Everett	NMMNHS	Climate Change Educator
Hydrology	Alexander (Sam) Fernald	NMSU	Range Science
Water Resources	William Fleming	UNM	Community and Regional Planning
Climatology	Joe Galewsky	UNM	Earth and Planetary Sciences
Economics	Brian Hurd	NMSU	Agricultural Economics
Education	Lisa Majkowski	NMT	Earth & Environmental Science
Aquatic Chemistry	Edward Martinez	NMHU	Natural Resources
Ecology	Robert Parmenter	VCNP	Preserve Director
Education	Dick Powell	NNet	K-12 Science Education



Participants and Participating Institutions			
			Coordinator
Aquatic Chemistry	Michael Pullin	NMT	Chemistry
Remote Sensing	Albert Rango	NMSU	USDA ARS Jornada Experimental Stations
Climatology	Todd Ringler	LANL	Climate, Ocean, and Sea Ice Modeling Group
Sociology	Jose Rivera	UNM	Community and Regional Planning
Education	Clyde Romero	SFIA	Santa Fe Indian School
Cyberinfrastructure	Renzo Sanchez-Silva	UNM	Earth Data Analysis Center
Outreach	Jessica Sapunar-Jursich	NMMNHS	Director of Education
Remote Sensing	Caiti Steele	NMSU	USDA ARS Jornada Experimental Stations
Hydrology	Vince Tidwell	SNL	Geo-Hydrology
Hydrology	John Wilson	NMT	Earth & Environmental Science

Demographics for the primary NM EPSCoR scientists, educators and collaborators active in Year 1 of the award are shown in Table 2.

Table 2. 2009 NM EPSCoR primary scientists, educators and collaborators

Demographic	Number	Percent
Female	10	37%
Male	17	63%
Underrepresented Minority Ethnic/Race	23	23%

*Appendix B: RII Participants* details complete participant demographics in aggregate for the entire project and for each institution. These data include all participants, for example faculty, staff, students, K-12 teachers, external advisory board members, etc. and are not restricted to the core project personnel shown above in Table 1. Demographics for all project participants in Year 1 of the award, as detailed in *Appendix B*, are shown in Table 3.

Table 3. 2009 NM EPSCoR participants

Demographic	Number	Percent
Female	36	36%
Male	61	61%
Underrepresented Minority Ethnic/Race	5	18%

*Appendix A: Faculty Support* is also attached as an Appendix showing NM EPSCoR support in terms of months and amount of salary on the RII project. It *does not indicate* the time expended since most core project participants do not receive salary from the RII 3. The appendix shows faculty financial support from other grant sources.



## **PROJECT DESCRIPTION**

### **1. Research Accomplishments and Plans**

Research progress was made in each of the objectives for research infrastructure improvement.

Strategic Plan Objective 1: Enhance climate and hydrology research infrastructure.

#### *Climate and Hydrology*

The central research challenge of NM EPSCoR RII 3 is to understand how future changes in seasonal temperature and precipitation regimes will impact snowpack, snowmelt and spring runoff in the mountainous region of north central New Mexico. This region, the southernmost extent of the Rocky Mountain range, serves as the headwaters for river systems of crucial importance to NM, including the Rio Grande. Year 1 of the award focused on scouting field sites, designing the field campaign, and purchasing the equipment needed to begin investigating these questions.

Equipment was procured by New Mexico State University (NMSU) to significantly upgrade climate and hydrology observing networks in north-central New Mexico. Necessary materials, instruments and computers for the fabrication and on-site installation of observing stations measuring precipitation including snowfall, temperature and soil hydrology were purchased. Completed purchasing as of spring 2009 included: 3 meteorological stations that will be located in the Middle Rio Grande Basin, 9 snow measurement stations including 3 SNOTEL site installations and 6 Enhanced SNOTEL site installations, and 4 soil moisture stations configured as SCAN sites. Station equipment began to be transported to the field in June, and installation is ongoing throughout summer, 2009.

In support of the new and more extensive climate-hydro-meteorology observing network, NMSU leveraged NM EPSCoR funds and established a new research technician position entitled Hydro-meteorological Instrument Coordinator. The Coordinator will assist in the planning and maintenance of all weather, SNOTEL and SCAN stations. He/she will also dedicate half time to the *acequia* project (described below) and acequia hydrology equipment installation, maintenance, and data acquisition. The position was advertised late May, 2009 and will be filled in June.



Figure 1. Satellite imagery is used to map snow areal extent in north-central New Mexico.

NMSU researchers and postdocs have parameterized and are running the Snow Runoff Model (SRM) on each of the 25 most important snowmelt sub basins in the Rio Grande drainage. Simulated runs will begin summer, 2009 to forecast high-altitude first order stream flows as well as hydrologic scenarios for larger downstream river systems. At this time the climate variables input to the model come from standard statistical probability techniques and do not

yet include NM EPSCoR research products that seek to improve the climate scenario inputs. In addition, revision and printing of the SRM user manual was completed and made available fall, 2008.

A full set of Landsat TM imagery for the entire study area has been collected and processed at NMSU. This dataset will serve as baseline data for mapping snowfall. Models and techniques for mapping snow areal extent and estimating snow depth from satellite imagery are currently being tested and compared. It is anticipated that the methodology for snow mapping will be chosen this summer from the initial trials, at which time a time-series of historic Landsat TM data will be acquired, mosaicked, and processed.

A longer-term research objective is to support development of coupled atmosphere-land surface process models. Climatological research at UNM during Year 1 of the award has focused on characterizing convective extremes; for example, simulating extreme precipitation events in mountainous topography. New cloud resolving models will improve the parameterization for convective rainfall in climate models as they are applied at the mesoscale to terrain such as that found in northern New Mexico. An EPSCoR-funded graduate student at UNM working on land surface processes in the region is using the North America Regional Reanalysis (NARR) dataset to evaluate soil moisture variability across the Southwestern US. An EPSCoR-funded undergraduate in this same group is looking at ensemble climate model output to assess variability in climate change projections. Using the National Center for Atmospheric Research (NCAR) Community Climate System Model (CCSM) multiple model runs under differing initial conditions provide a distribution of results that can be used to obtain statistical confidences regarding climate change projections. EPSCoR will support the above students and two additional graduate students to attend a training workshop this summer at NCAR in parameterizing and running WRF (Weather Research and Forecasting), a mesoscale climate forecasting model.

Research at NMSU began the establishment of the Semi-distributed Land Use and Runoff Process (SLURP) model on the upper Rio Grande basin. The SLURP model will be used to assess the consequences of climate change on the competing uses of water including agriculture, urban supplies, recreation, endangered species, and power. Over the past year, SLURP code has been rewritten to accept input of snowmelt runoff from the SRM model.

Strategic Plan Objective 2: Improve water quality monitoring in high altitude stream
--

### *Water Quality*

Climate change impacts on mountain sources of water are not restricted to hydrologic elements such as timing and flow amounts, but also effect water chemistry. There is a particular need to understand the chemical constituents of streams in snowmelt-dominated watersheds that are important for both ecosystem and human health. NM EPSCoR RII 3 will deploy a set of state-of-the-art, near-real-time, autonomous water quality in-stream sensors for monitoring the quality of surface water in at least two watersheds in New Mexico that are fed by snowmelt. Year 1 meetings among investigators determined that the watersheds selected should coincide with the *acequia* research project described below and with the snow hydrology research and SNOTEL stations. The selected watersheds are the Rio Hondo, Rio Bravo and Las Truchas. Scouting locations for the in-stream sensors began with a site criteria meeting at the Valles Caldera in May, 2009 and continues early summer with 3 field campaigns.

NM EPSCoR funds analytical laboratory equipment purchases for the environmental chemistry lab at NMT. This includes purchases of carbon analysis instrumentation - dissolved organic carbon, and absorbance and fluorescence. Several instrument demonstrations have been held at NMT, more are scheduled for this summer; final selection of a vendor will occur by early August. An in-stream iron sensor is being designed and built in-house at NMT for the NM EPSCoR RII 3 project. Materials and supplies were purchased in Year 1 with initial bench testing this summer. The iron sensor will be unique in that it will be deployable under extreme conditions of cold water.

Strategic Plan Objective 3: Develop interdisciplinary socioeconomic and hydrologic research capacity in *acequia* systems research.

#### *Acequia Interdisciplinary Research*

*Acequias* are the traditional water management system of rural northern New Mexico. Their communal governance and 'ditch irrigation' management systems provide unique physiographic and cultural elements to help understand the effects of changing mountain hydrology on land and water use, ecosystem change, and stream flow. NM EPSCoR RII 3 will install new *in situ* infrastructure, use high-resolution satellite data, and work with simulation models to characterize *acequia* system flow distribution and surface-groundwater hydrological interactions. A collaborative interdisciplinary team integrates social, economic, ecological and hydrological research to understand climate change impacts on *acequias*, and *acequia* management responses to climate variability.

In Year 1, five visits to study sites were conducted by interdisciplinary teams of 3 to 5 researchers. The Rio Hondo and Rio Truchas rivers were selected as important and understudied watersheds in which *acequia* systems play a major role in basin hydrology. Two intensive study sites, one on the Rio Hondo and one on the Rio Truchas, were chosen in June. Hydrology and water quality instrumentation will be installed at these locations. Hydro-meteorology equipment was purchased and installation begins late summer and early fall, 2009. The sites will begin collecting hydrology data for studies of surface water-groundwater interaction in fall of 2009. The in-situ real time water quality sensors will not be deployed at the intensive study sites until Year 2 of the award.

The first *Acequia* Focus Group meeting will be conducted August, 2009 near the Rio Truchas site with community members, *acequia* water managers, and the *acequia's* central manager, the Mayordomo. This meeting will introduce the research agenda to the community. Initial meetings were conducted over the past winter with the Taos Valley *Acequia* Association and their Mayordomo and the Rio Truchas *Acequia* Association. Socio-economic research in the community does not begin until Year 2, after the sociology team has laid the groundwork for community based participatory research in Year 1.

Strategic Plan Objective 4: Provide critical gap infrastructure for New Mexico Highlands University.

#### *Aquatic Chemistry Laboratory at New Mexico Highlands University (NMHU).*

NM EPSCoR funded the establishment of an aquatic chemistry laboratory at NMHU for state-of-the-art water quality analysis that enhanced the institutions ability to perform research on climate

change and water resources. Ordering was completed in April for three analytical systems that are being installed in the new Hilton Science Building at NMHU this summer (Table 4).

Table 4. Aquatic chemistry equipment at NMHU

Instrumentation	Analyses	Installation date	Cost
Ion Chromatograph System	Ions and Cations	May-09	\$27,735.72
Total Organic Carbon Analyzer	Organic carbon	Jun-09	\$31,205.00
Graphite Furnace Atomic Absorption Spectrophotometer	Heavy metals	Jul-09	\$65,921.00

Prior to purchasing the equipment, NMHU did not have any instrumentation available for water quality research. Researchers paid for the analyses of their water, sediment, soil and plant samples at state lab facilities. The new aquatic chemistry lab prevents declines in data quality due to degradation of samples during storage, and is far less costly, leading to greater numbers of samples analyzed.

A primary incentive for the laboratory upgrade was to improve the quality of graduate student research at NMHU, and specifically to provide training in the use of analytical instruments for graduate and undergraduate students. All equipment was purchased with on-site training by the vendor. Training in use of the Total Organic carbon analyzer occurred in June for Dr. Edward Martinez, the water chemistry lab technician, and several graduate students.

Three students have been recruited to work on NM EPSCoR Climate Change -Water Quality Research in the new aquatic chemistry lab. Two new graduate students have been recruited by Dr. Martinez and will begin field work this summer at a Valles Caldera stream study site. These students will be trained to use the new instrumentation through the summer (June-July). They will conduct fieldwork and begin water sample analyses from mid June onward. They will formally enter the NMHU graduate program next fall. One undergraduate student will work on an NM EPSCoR Climate Change-Water Quality Research project during the summer. This student has a long-term working relationship with Dr. Martinez, and will be recruited to begin the graduate program at NMHU in fall 2010. In addition, two summer UROP students will work with Dr. Martinez during summer 2009 on research projects that utilize the new laboratory equipment.

## 2. Diversity of People and Institutions

### 2a. Broadening Participation

Strategic Plan Objective 10: Develop an Undergraduate Research Opportunity Program that increases the exposure of students at non-PhD granting institutions to high quality, relevant, hypothesis-driven research.

#### *The NM EPSCoR Undergraduate Research Opportunities Program (UROP)*

The NM EPSCoR UROP is a summer undergraduate research program specifically designed to broaden participation from under-represented groups in science and technology. Application is available to students attending two-year, tribal, or four-year non-Ph.D.-granting colleges in New Mexico. Student recruitment emphasized day-long campus visits to these institutions. The program PI, Michael Pullin, NMT and the program manager Lisa Majkowski, NMT conducted visits to six campuses during spring of 2009. They visited science faculty in a variety of departments (biology, chemistry, earth sciences, natural sciences, computer science, and engineering) and the campus career services department. Visits generally consisted of a research seminar and PowerPoint presentation on the UROP program plus distribution of application materials. Schools visited are listed in Table 5. Applications were received from all of these schools as a direct result of the visits. The UROP program website at New Mexico Tech (<http://infohost.nmt.edu/~climate/>) contains general information about the program, the research projects available to students, and all application materials.

Table 5. 2009 UROP Recruitment Visits

Recruiter	School	Minority Serving	# Students Contacted
Michael Pullin	Diné College (Shiprock)	Yes	40
Michael Pullin	San Juan College	Yes	10
Lisa Majkowski	Eastern New Mexico University	No	50
Michael Pullin	New Mexico Highlands University	Yes	20
Lisa Majkowski	Northern New Mexico College	Yes	2
Majkowski/Pullin	Southwestern Indian Polytechnic Institute	Yes	40

*UROP Applicants.* Application materials were submitted by a total of 15 students. Demographics for applicants with all required materials submitted are shown in Table 6. Application materials included a form that assessed the student's motivation for applying, expectations of the program, future education and career goals, ranking of preferred research projects, and how the student learned about the program. Two letters of reference were required. The application deadline was March 31, 2009.

Table 6. 2009 UROP Application Demographics

Demographic	Number	Percent
<i>Gender</i>		

Project Description: Diversity of People and Institutions

Female	6	40%
Male	9	60%
<i>Race/Ethnicity</i>		
African American	0	0%
Asian	0	0%
Caucasian	8	53%
Hispanic	4	27%
Native American	3	20%
Pacific Islander	0	0%
Total Underrepresented Minorities	7	47%
<i>Educational Level</i>		
Freshmen	2	13%
Sophomore	9	14%
Junior	2	60%
Senior (non-graduating)	2	13%
<i>Educational Major</i>		
Biology	4	26%
Chemistry	2	12%
Computer Science	2	12%
Earth Science	1	6%
Engineering	4	26%
Natural Sciences	1	6%
Other	1	12%
<i>Colleges</i>		
Dine College	2	13%
Eastern NM University	3	20%
NM Highlands University	3	20%
Northern NM College	1	7%
San Juan College	5	33%
Southwestern Indian Polytechnic Institute	1	7%
<i>Information on UROP Program</i>		
Recruiting Visit	8	53%
Faculty/School	6	40%
Poster	1	7%

*Selection and Program Participants.* Ten students were selected to participate in the UROP by a team consisting of the UROP PI, Program Manager and the scientist research advisors in each research area. All but one selected student accepted the offer of a slot in the program. The participants and their demographics are listed in Tables 7 and 8. The program has achieved greater than 50% female participation. Underrepresented minority participation is also high at 40% (all Hispanic or Latino). One physically disabled student, Tracy Jones, a deaf woman, was recruited and selected for the program.

Table 7. 2009 UROP Program Participants

First	Last	Gender	Race /	Academic	Home Institution	Project Advisor
-------	------	--------	--------	----------	------------------	-----------------



Project Description: Diversity of People and Institutions

	r		Ethnicity	Major(s)		
Rober t	Brana m	Male	Caucasian	Engineering	San Juan College	DeMouche / Rango
Noel	Cardon	Femal e	Caucasian	Biology	Eastern New Mexico University	Parmenter / Martinez / Pullin
James	Carnes	Male	Caucasian	Geology	Eastern New Mexico University	Fernald
Jessic a	DeSant o	Femal e	Hispanic or Latino	Chemistry	New Mexico Highlands University	DeMouche/Ran go
Trace y	Jones	Femal e	Caucasian	Education and Computer Science	San Juan College	Benedict / Sanchez-Silva
Delyn	Martin ez	Femal e	Hispanic or Latino	Biology	New Mexico Highlands University	Parmenter / Martinez / Pullin
Eric	Morris	Male	Caucasian	Engineering	San Juan College	Wilson
Nikki	Rendo n	Femal e	Hispanic or Latino	Biology	Northern New Mexico College	Wilson
Rache l	Roach	Femal e	Caucasian	Computer Science	San Juan College	Benedict / Sanchez-Silva
Josep h	Torres	Male	Hispanic or Latino	Chemistry and Math	New Mexico Highlands University	Fernald

Table 8. 2009 UROP Participant Demographics

Demographic	Number	Percent
Female	6	60%
Male	4	40%
Underrepresented Minority	4	40%

*Program Activities.* Year 1 of the NM EPSCoR UROP program runs from May 31 through August 1, 2009. A brief overview of the planned summer activities is included in this annual report. The ten UROP students participate in five intensive research projects hosted at three NM EPSCoR research universities. The students are enrolled in a graded, three-credit, upper division interdisciplinary science course in the academic department of their choice (biology, chemistry, chemical engineering, or earth science) at New Mexico Tech. Students receive tuition, housing, travel expenses, food allowance and a stipend.

UROP students spend the first week of the program at New Mexico Tech attending mini-courses focused on climate change and the environment. The UROP program runs concurrently with a NSF-funded Research Experiences for Undergraduates (REU) program at New Mexico Tech. Students from both programs attend the mini-courses together. UROP students are invited to participate in science-oriented Saturday field trips that are part of REU program, whenever it is practical. UROP students depart NMT for their research project institutions at the end of the first week. For the following two months they will formulate a research question, conduct field and laboratory research, collect data and prepare a final formal research report/presentation. The program culminates in a research conference held at New Mexico Tech on Friday, July 31, 2009. Student participants from the NM-EPSCoR UROP program and the New Mexico Tech REU program will present their research results to an audience of faculty and graduate students.

Strategic Plan Objective 8: Enhance diversity in all elements of the NM EPSCoR Program. A) Increase the number of incoming students into STEM disciplines from underrepresented groups.

*The NSF Geosciences - AIHEC program in climate change science education*

NM EPSCoR has integrated into its program activities a new project entitled, "An Introduction to Climate Change from an Indigenous Perspective: a collaborative curriculum development project of the Tribal Colleges". The project is coordinated by NM EPSCoR Associate Director, Katherine Mitchell. With funding by NSF's Geosciences Education program, the American Indian Higher Education Consortium (AIHEC) and 14 Tribal College faculty are developing a Geosciences course series focusing on climate science, climate change and climate change impacts. The semester-long course targets sophomore-level Native American students enrolled in Tribal Colleges and Universities. The project seeks to increase recruitment of Native American students into science careers, and to improve climate change literacy among all students at Tribal Colleges. The curriculum introduces students to multiple disciplines in the earth and atmospheric sciences within the overarching theme of global climate change. Importantly, the curriculum structure that has been developed this past year does not parallel existing college climate change survey courses, but rather is taught from the perspective of the traditional ecological knowledge held by native peoples of North America. A research practicum, using Cyberinfrastructure-enabled access to Geosciences data, instrumentation and computing resources, is being developed by AIHEC and NM EPSCoR, and provides the opportunity for students to practice e-Science in collaboration with research mentors at the National Center for Atmospheric Research and NASA.

Two workshops were held in 2009, the first in January at the Institute of American Indian Arts (IAIA) Lifelong Learning Center in Santa Fe, NM and the second in June at the National Center for Atmospheric Research (NCAR) in Boulder, CO. Seventeen science faculty from 14 tribal colleges participated in the workshops and the curriculum development. The climate change course will be offered across 10 tribal colleges for the first time in January, 2010. In New Mexico, Dine' College faculty serve on the curriculum development team and Dine' will offer the course in January. Southwestern Indian Polytechnic Institute (SIPI), in Albuquerque, has the course slated for approval by Academic Affairs this fall.

NM EPSCoR contributes time and expertise towards this multi-cultural, multi-institutional effort. Katherine Mitchell, Project Co-I, channels New Mexico's climate change science resources towards multiple aspects of the project, including assistance from NM scientists in creating datasets for

course laboratories and in assisting tribal college faculty with advanced science content. NM EPSCoR supports Dr. Mitchell's time on the project.

## *2b. Institutional Collaborations*

### *Western Tri-State Consortium*

New Mexico has joined the Nevada and Idaho NSF EPSCoR programs in forming a consortium of EPSCoR states with similar research agendas related to climate change and water resources. The consortium model significantly increases opportunities for scientific collaboration and enhances each state's ability to secure competitive funding and tackle complex climate change research agendas.

Each year the Western Tri-State Consortium of Idaho, Nevada and New Mexico (#0814387, #0814372, and #0814449) will conduct an annual meeting of current NSF EPSCoR participants. The primary purpose for this meeting is to foster collaborations among the NSF EPSCoR RII projects and participants in our respective states and to identify common challenges and solutions related to the themes of our states' RII programs. The meeting agendas and presentation formats, facilitated sessions, working group breakouts, etc., are specifically and carefully developed to spur collaboration among program directors, cyberinfrastructure scientists, research scientists, education professionals, and outreach and diversity program coordinators. The meeting will rotate among the three EPSCoR jurisdictions.

The first annual meeting of the Western Consortium was hosted by Idaho EPSCoR in Boise, Idaho on March 31-April 1, 2009. Approximately 100 people attended this event. The final attendance roster is attached as an appendix. Presentations from the meeting were made available to the participants and the public at the following website:  
[http://www.webs.uidaho.edu/epscor/Web%20Pictures/Western\\_Consortium.htm](http://www.webs.uidaho.edu/epscor/Web%20Pictures/Western_Consortium.htm)

A formal evaluation survey was prepared by Dr. Rose Shaw and distributed at the meeting. Findings are summarized below:

“Participant satisfaction with the meeting was high with 54% of respondents reporting the meeting met their expectations and 42% reporting the meeting exceeded their expectations. Only one respondent reported that the meeting failed to meet expectations. The strongest features of this well-organized meeting, which was an opportunity to learn about innovative activities in the three EPSCoR states, were ample networking opportunities and the break-out sessions. The keynote speaker was noted as a strongest feature by five of the respondents.”

“The three most frequently selected reasons for attending the meeting were interests in fostering collaborations, regional scientific challenges/solutions and professional enrichment.”

“Benefits from attending the meeting were the opportunity to meet with colleagues from the other two EPSCoR states, to interact with others having similar interests, to share ideas, to learn from one another about a variety of topics including research and recruiting for diversity, and the opportunity to form new collaborative relationships.”

One significant outcome of the Western Consortium meeting was commitment by the Program Directors to adopt and jointly sponsor a funding opportunity employed by New Mexico, the

Innovation Working Groups (IWGs). IWG funding is discussed in the Sustainability and Outcomes section under Seed Funding/Emerging Areas.

*Institutional Collaborations within New Mexico*

Collaborations on research and education projects have been plentiful in the first year of the project among New Mexico institutions of higher education, education and outreach organizations, and state and federal agencies. Many of these collaborations are described within the report sections on research, broadening participation, cyberinfrastructure, and workforce development. The following activities briefly highlight some of the collaborative undertakings not discussed in other sections of the report:

The New Mexico Public Education Department, the Northern NM Network, The Earth's Birthday Project, and the Museum of Natural History have established a collaborative partnership towards creating educational materials on climate change for 8<sup>th</sup> and 9<sup>th</sup> grade students.

The water quality research, which is a collaboration between UNM and NMT, has now grown to include NMHU due to its new water chemistry lab facility. These three institutions will have 6 EPSCoR-funded graduate students working on water quality and climate change issues; joint graduate student activities are planned.

NMHU is offering a training workshop on water chemistry analyses for students from Dine College, the Institute for Environmental Studies.

NMSU has established a working relationship with USDA/NRCS/NWCC in Oregon and Colorado for the procurement of SCAN and SNOTEL site equipment and for technical assistance. Additionally, the New Mexico NRCS office has offered to help identify and evaluate the SCAN & SNOTEL site selections.

NMSU also contacted and established a cooperative relationship with the Navajo Nation for siting and installing 5 weather stations on tribal lands in Year 2 of the award. A cooperative agreement with the U.S. Forest Service for the enhancement of NM RAWs stations in project year 2 was also completed.

### 3. Workforce Development

Strategic Plan Objective 9: Enhance teacher professional development for STEM areas in northern New Mexico.

#### *NM EPSCoR Teacher Summer Institute*

NM EPSCoR has selected The Northern New Mexico Network for Rural Education, an educational cooperative of 28 school districts in northern New Mexico, to serve as our partner for the RII 3 teacher professional development component. The Northern Network (The Network, NNet) is a 36-year collaborative of small, rural, predominately minority districts in North Central and Northeastern New Mexico, an area serving approximately 30,000 students. The NNet mission is to work with school districts to improve the quality of life in rural northern New Mexico by being an advocate and catalyst for the improvement of education for all children. The Network forges partnerships, develops funding avenues, and delivers programs that promote K-12 professional development in science and mathematics.

Partnership with NNet is a key step in achieving NM EPSCoR objectives. The school districts it serves are located in northern New Mexico in the mountainous central part of the State in which our climate change research is focused. These school districts are small, rural, and poorly funded. They are predominantly Hispanic and almost 75% of the population speaks Spanish as the primary language in their homes. Three of the school districts have a majority of Native American students, (Apache, Navajo, and Taos pueblo). The longtime working relationship established by NNet with these school districts provides the access and cultural understanding that are necessary to solicit successful participation by their teachers and administrators. In addition, NNet has extensive experience in improving STEM education. They currently have in place a program of 'circuit riders' - math and science pedagogy professionals who travel from school to school and assist teachers on-site in the implementation of NNet programs. Consistent and ongoing on-site attention is crucial to the adoption of climate change curriculum that the NM EPSCoR educational plan seeks to develop.



**Figure 2. Teacher Summer Institute participants working on field projects at the Valles Caldera.**

The Northern Network will provide a one-week inquiry-based curriculum development summer institute for secondary science teachers and teams of science/math teachers at the Valles Caldera National Preserve (VCNP), another NM EPSCoR partner and field research site. The Valles Caldera Summer Teacher Institute program engages teachers in the development of curricula on climate change in New Mexico, using field studies in water, soils, botany, and sampling methods. NNet has actively recruited 8<sup>th</sup> and 9<sup>th</sup> grade teachers and coordinated course content for the summer 2009 field program entitled "Rim to River". Participants are listed in Table 9 and

participant demographics are included in Table 10. Teachers receive a stipend for their week of attendance, and all housing and food costs are paid.

Table 9. 2009 Teacher Summer Institute Participants

First Name	Last Name	Gender	Race / Ethnicity	Home Institution
Martha	Pena	Female	Hispanic or Latino	Roberston High School
Diane	Medford	Female	Hispanic or Latino	Los Alamos High School
Carlos	Mazanares	Male	Hispanic or Latino	Dulce High School
Leighanna	Hedderman	Female	Not Hispanic or Latino	Cimmarron High School
Valerie	Villa-Lopez	Female	Not Hispanic or Latino	West Las Vegas High School
Jana	Serna	Female	Not Hispanic or Latino	Mora High School
Christina	Lovato	Female	Hispanic or Latino	West Las Vegas High School
Jeremy	Marley	Male	Not Hispanic or Latino	Jemez Valley
Marvin	MacAuley	Male	Hispanic or Latino	Penasco High School
Lillian	Sides	Female	Hispanic or Latino	Pecos High School
Joe	Matteson	Male	Not Hispanic or Latino	Pojaque Valley High School
Donna	Ortiz	Female	Hispanic or Latino	Robertson High School
Jessica	Esquibel	Female	Hispanic or Latino	Penasco High School
Vanessa	Vicenti	Female	Not Hispanic or Latino	Dulce High School

Table 10. Teacher Summer Institute Demographics

Demographic	Number	Percent
Female	10	72%
Male	4	28%
Underrepresented Minority	8	57%

In keeping with the NM EPSCoR research emphasis on climate change impacts on mountain sources of water, this summer's teacher institute offers field techniques, data collection, and data analysis centered on hydrology and water quality in high-altitude stream basins. An Appendix shows the daily program activities. Instruction is provided by NM EPSCoR scientists and collaborators offering half-day hands-on training with the teachers.

*STEM Workforce Development at NMHU*

NMHU EPSCoR partners are particularly active in STEM workforce development programs for Hispanic Students. During the first two weeks of June, 26 high school students from around the state of NM participate in the NMHU/LCC Science and Agriculture Summer Experience (SASE) Project. These 26 students will have the opportunity to use the instrumentation purchased through the NM EPSCoR funding.

Luna Community College, LCC, is located in Las Vegas, NM near NMHU. The EPSCoR team lead at NMHU is also the Project Director of a College Cost Reduction Administration Act (CRAA) grant that focuses on improving the seamless transition of STEM students from LCC to NMHU through improved articulation efforts and the development of student/faculty support centers at both institutions. Both the SASE Project and the CRAA grant have the goal of increasing the number of Hispanic students graduating with a degree in a STEM discipline.

#### 4. Cyberinfrastructure

Strategic Plan Objective 7: Enhance scientific data and model output generation, management, discovery, and use through cyberinfrastructure.

##### *Project Tracking and Evaluation Database*

NM EPSCoR is designing and implementing a new database for RII 3 project information tracking and program evaluation. The database content with detailed table and field information was designed by the RII program evaluator, Kirk Minnick. During Year 1 the database design was coded in PostgreSQL and installed on the servers used to host the project's IT resources. The database consists of 64 tables, representing a combination of lookup tables used to populate interface controls and perform data validation, and tables used for storage of project and activity data. Over the course of this effort, development went through several iterations, and has now resulted in a stable data model that will be used for capturing long-term program evaluation data.

The database will be available online for all project participants to input and access their project-related activities. An initial web interface for data input, editing and display has been completed. The interface uses the Python programming language and makes use of the TurboGears python framework to streamline the deployment of database driven web applications. This interface is currently oriented toward NM EPSCoR administrative users, and is not yet suitable for use by project scientists. Planned work for the remainder of Year 1 includes development of an easy-to-use online web interface and training for project scientists and participants in its use.

##### *NM EPSCoR Web Portal*

The previous NM EPSCoR RII project produced a web site based upon static HTML that was proving to be too labor intensive to maintain and update. NM EPSCoR RII 3 management made the decision to transfer to a web content management framework that would allow program staff to edit, update and maintain the web content. After evaluating several alternative systems, including Plone, Drupal, Wordpress, and Typo3, Drupal was adopted as the platform for the new NM EPSCoR program portal. Drupal was deployed on an NM EPSCoR project server, the web site layout was designed, content was written, and a graduate student webmaster assembled and maintains the site. The new web portal is available at <http://www.nmepscor.org>, and is illustrated in the figure.

The screenshot shows the New Mexico EPSCoR website. At the top, there is a search bar and a navigation menu with tabs for Home, About Us, Research, Education, Outreach, Opportunities, Database, Forms, and Publications. Below the navigation, there are two columns of news and events. The left column is titled 'NM EPSCoR News' and lists several articles with their titles and dates. The right column is titled 'Events' and lists upcoming meetings and workshops. At the bottom of the page, there is a section titled 'EPSCoR' with a brief description of the program and a calendar for the month of July.

The new web portal offers important future capabilities beyond its current role of communicating NM EPSCoR

program information to the public and educational and governmental entities in the State. Project scientists currently have access to NM EPSCoR news, calls for proposals, award announcements,



and publications; however, these functions will be improved and extended. New functionality that will be developed this year includes a web page interface for conference and workshop registration that will include online completion of registration forms and travel and logistics arrangements. The online conference system will both facilitate NM EPSCoR administrative tasks and provide participant information data directly to the NM EPSCoR project database.

### *Tri-State Coordination of Cyberinfrastructure Activities*

Significant progress was made in furthering the support for interoperable data discovery and delivery among the ID, NV, and NM EPSCoR projects. The first annual NM EPSCoR Tri-State Consortium Meeting in Boise, Idaho held a Cyberinfrastructure Working Group half-day session. NM EPSCoR coordinated and led the working group session. Twelve attendees from the three states presented, discussed and drafted consensus documents in the following areas:

- Interoperability standards proposed for adoption by the tri-state consortium
- Interoperability models with other national networks
- The establishment of topic-specific working groups to further the efforts of the tri-state CI team
- Newly established shared resources available to project participants from all three states

Three groups of interoperability standards were recommended for adoption by the respective state projects before data and processing services are developed. The first group of standards are those developed and maintained by the Open Geospatial Consortium (<http://www.opengeospatial.org>) and relate to the delivery of geospatial data via web services. These standards include the Web Map, Web Feature, and Web Coverage Service (WMS, WFS, and WCS, respectively) standards. It is anticipated that WMS services will facilitate geospatial data visualization, and that WFS and WCS standards will facilitate the exchange of vector and raster based geospatial data.

Two groups of standards were identified as target metadata standards. The first is the FGDC Content Standard for Digital Geospatial Metadata (CSDGM), Vers. 2 (FGDC-STD-001-1998) which is already in use by the geospatial clearinghouses in ID and NM. The second is the ISO 19115:2003 geospatial metadata standard. Given the current use of FGDC metadata in a variety of activities within ID and NM, it was decided that metadata conformant with the FGDC standard would still be produced, although with an understanding that all three states will migrate new metadata production to the ISO19115 standard. This strategy will ultimately entail the conversion of FGDC metadata to the ISO standard, but a variety of tools exist for performing this conversion. As opportunities arise for the development of new metadata management and generation systems over the 5-year course of the tri-state collaboration, the focus will be on those that are compatible with the ISO standard.

The working group identified two general web service model standards for use by the states in the development of custom services. These are, in order of preference based upon simplicity of implementation, the Representation State Transformation (REST) web service interface model, the Simple Objects Access Protocol (SOAP) standard, and related web-service standards that have come out of the World Wide Web Consortium (W3C). The CI-Team decided that when selecting standards to implement for particular products and services, the preference will be for existing open standards that are optimized for the specific types of data (e.g. OGC standards for geospatial data, FGDC/ISO standards for geospatial metadata). The REST and SOAP service models will be adopted when other, more specific, standards are not usable.

In reference to national networks and related network capabilities that will be targeted by the tri-state consortium, three networks were specifically identified: CUAHSI, USGS CLICK, and

GEON/OpenTopography. The CUAHSI Open Data Model (ODM) and service interfaces will be used when water-related data are managed and exchanged. The USGS CLICK system will be used for storing LiDAR data. The GEON/OpenTopography system will be used for the integration of LiDAR processing algorithms.

Three topical working groups were identified and formed during the Boise CI Team meeting. The first is an *Architecture* working group that will provide guidance and reference documentation on CI architecture issues related to the tri-state collaboration projects. The second is a *Data Policy* working group that will review the data policies developed by the individual NM EPSCoR states, and will propose policies for sharing data and products between the scientists and research projects. The third working group will address issues related to *Data Formats and Instrumentation Systems Connectivity*. This working group will focus on coordinating common data ingest formats and recommendations to researchers on how instrumentation data should be compiled and organized in order to enable shared observation system data processing models across states.

#### *NM Cyberinfrastructure Activities*

The New Mexico CI representatives to the tri-state working group presented two shared resources implemented by NM in support of this project collaboration. The first is a shared versioning system hosted on NM EPSCoR servers. It is based on the Subversion control system, has an integrated wiki called Trak, and includes an issue tracking system. NM EPSCoR hosts the version control system and provides a shared code repository for consortium collaboration on software development projects.

The second shared resource is an online collaboration site accessed through UNM's Earth Data Analysis Center (EDAC subscribes as a hosted service through Basecamp (<http://www.basecampHQ.com/>)). This site allows collaborators from all three states to share information through messages, upload and share documents, establish and maintain to-do lists, establish milestones, and work on collaborative writing projects through a versioned *whiteboard* interface. To date, the collaboration site includes 30 members representing 7 organizations across all three states and was utilized by the CI team members writing the collaborative EPSCoR Track 2 proposal.

#### *UROP and Cyberinfrastructure Activities*

As part of the Summer 2009 UROP program, the Earth Data Analysis Center at the University of New Mexico is hosting two undergraduate students from San Juan College in Farmington, NM. These students are working with EDAC staff in evaluating NM EPSCoR data products and developing FGDC metadata for products that meet criteria for long-term retention and delivery through the planned NM EPSCoR data portal. Students are working on the development of a web-based database application for tracking the status of individual data products. This includes evaluating the data generated by previous NM EPSCoR project science teams for long-term storage and delivery (in consultation with the researchers that produced them), using ArcCatalog and other tools to create and manage FGDC metadata records, and working with EDAC staff in the integration of these data products into the data management system that will provide the foundation for the NM EPSCoR data portal.

## 5. Outreach and Communication

Strategic Plan Objective 14: Create a citizenry that is informed about climate change and its impact on NM's natural resources via public outreach and communication.

### *Climate Change Exhibit at the New Mexico Museum*

The New Mexico Museum of Natural History & Science (NMMHS, or Museum) receives NM EPSCoR funding to design, fabricate and install a new Climate Change in New Mexico exhibit at the Museum. Jessica Sapunar-Jursich, Director of Education at the Museum, spearheads the project. Initial planning meetings have been held with Museum curators, exhibit design and development staff, NM EPSCoR, and the guest curator selected for the project, Dave Gutzler. Dr. Gutzler is a climatologist on faculty at UNM in Earth and Planetary Sciences. He is active not only in climate change research but multiple statewide task force and outreach initiatives. Dr. Gutzler's guest curator position is funded through NM EPSCoR and commits approximately one and a half months of his time to the museum exhibit. Planning meetings have honed the exhibit 'grand message' and worked on logistics regarding room selection, technological needs and budgets.

NMMNHS is a department within the State of New Mexico. Like many state government budgets of the past year, New Mexico has seen decreases in spending. The NM EPSCoR support for the Climate Change exhibit is key to the 2009 – 2010 exhibit schedule at the Museum, as it is currently the *only* new exhibit being mounted. Additional funds are being sought through the Museum Foundation to improve and expand the Climate Change exhibit in keeping with the central role it will play in Museum activities over the course of the next years.

NMMNHS has also made progress establishing a Climate Change Education program. The Museum hired a Climate Change Educator, Eileen M. Everett, to coordinate and implement the scope of work related to public outreach events. NMMNHS partners with the National Association of Science and Technology Centers (ASTC) as a sub-award recipient on their NSF grant "Communicating Climate Change". This small grant provides "seed money" for public education and outreach related to climate change. The ASTC award and the NM EPSCoR award together are able to fund the full salary for the Museum's Climate Change Educator in addition to funding public outreach events. The NM EPSCoR Outreach and Education scope of work reaches the general public and adult audiences. The ASTC Outreach and Education scope of work reaches the general public and family audience. The joint funding leverages the two NSF programs and broadens the outreach audience.

Planning began for outreach activities that formally begin in Year 2 of the award. NMMNHS will coordinate and offer a Climate Change Seminar series at the Museum, and Science Café's in small-town locations across northern New Mexico.

## 6. Evaluation and Assessment

NM EPSCoR has three external evaluation mechanisms: 1) a 7-person External Advisory Committee of science, education and outreach scientists and professionals providing expert guidance in their field, 2) a contracted sub-award with the American Association for the Advancement of Science for site visit and overall program review, and 3) an external consultant evaluator, Kirk Minnick and Associates, for data collection and assessment assistance to the NM EPSCoR Management Team.

Neither the External Advisory Committee meeting nor the AAAS site review was scheduled before this current reporting period ended (May 31, 2009). Due to the delayed start date of the project, EPSCoR scientists and the Management Team felt that this input would be of most value after the close of the Year 1 summer field season. They requested that the Advisory Committee and AAAS meetings not be scheduled before late fall of 2009.

The external evaluator, Kirk Minnick of Minnick and Associates, worked closely with the EPSCoR state office to develop processes and procedures for documenting project activities and outcomes. This included producing a technical document to guide the development of the online assessment and evaluation database to track people, infrastructure, proposals/awards, publications, conferences/seminars, collaborations/ partnerships, products/technologies/databases created and educational/public outreach activities. All tables are linked to project components and are closely aligned with the strategic plan. Development of the database is discussed under the section on Cyberinfrastructure.

Surveys were developed and administered to participants in the Junior Faculty Leadership Training (JFLP) program, K-12 Teacher Summer Institute, and the Undergraduate Research Opportunity Program (UROP). The UROP and teacher professional development programs involved pre-post surveys to assess the change in knowledge, attitudes, and beliefs of the participants. Surveys were customized to the program specified outcomes. For instance, the goals of the UROP program are to increase the knowledge and understanding of undergraduates concerning the research process (including skills and tools), climate change, science and potential careers. Interviews of participants will also be conducted to provide the component leaders with information on how to improve the program for next year. The summer programs are not completed, therefore data are not yet available. The results of the JFLP surveys are reported in the section on Human Resource Development and included as an Appendix.

During Year 1 the EPSCoR management and the evaluator held meetings to map the strategic plan to logic models for each project component. Using the strategic plan, the strategies, activities, output objectives, output indicators, short term (3-5 years) and long term (6-10) outcomes are being mapped to each of the following areas: People (Human Infrastructure, Collaboration and Diversity); Material Infrastructure (Equipment, Measuring Stations, Models and Cyberinfrastructure), Discovery Learning (Observing, Data Collecting, Research), Knowledge Generation (Publication, Patents, Professional presentation) and Outreach/Public Dissemination (Scientific literacy, Public presentations, Policy makers). By bringing together the strategic plan and the metrics from the assessment and evaluation plan we will be able to provide the component leaders and external advisory boards with a tool to assess the progress of each of the components. The assessment and evaluation database is an integral part of the strategy for storing the metrics and indicators.

## 7. Sustainability and Outcomes

### 7a. Seed Funding / Emerging Areas

Strategic Plan Objective 5: Use Innovation Working Groups (IWGs) to address key scientific, education, diversity, and workforce development challenges.

#### *Innovation Working Groups*

Innovation Working Groups support week-long working group activities that are modeled after those held at the highly successful NSF-funded National Center for Ecological Analysis and Synthesis (NCEAS). An IWG supports 8-12 scientists or educators to work together on challenges in the climatological, hydrological and socioeconomic sciences, as well as education, outreach and diversity. Anticipated outcomes of the IWGs include synthesis papers and proposals that target NSF cross-cutting programs.

The IWG Request for Proposals (RFP) was developed and written by NM EPSCoR management and submitted to the Management Team for comments and changes. The RFP was purposely designed to solicit succinct proposals, with a single-page abstract and three pages maximum of narrative. IWG participant and budget information is kept to one page in length. The review criteria that were developed emphasize:

- Topic aligned with EPSCoR Track 1 research and education agenda
- Diversity of Institutions (minimum of two NM institutions represented)
- Significant participation by women and members of underrepresented groups
- Multi-and trans-disciplinary participation
- Intellectual merit and transformative nature of the project

The RFP was released to NM EPSCoR participants in April, 2009 with a due date of June 1<sup>st</sup>. The RFP is available on the NM EPSCoR web site: <http://www.nmepscor.org/node/29>.

Submitted proposals were reviewed in a conference call by the full NM EPSCoR Management Team in addition to 2 external anonymous reviewers who completed written reviews. Two proposals were submitted, and both were awarded funding after complying with review team revisions. An NM EPSCoR goal is that at least one IWG each year will focus on education, outreach or diversity, and this goal was achieved in Year 1. Mike Pullin (NMT) will collaborate with Marnie Carroll (Dine) on an initiative to increase diversity in STEM fields in NM's institutions of higher education.

- Natural and Human Dynamics of Acequia Systems. Lead Investigator: Dr. Alexander (Sam) Fernald, New Mexico State University.

This project will bring together a group of local, national, and international experts to explore the interactions between ecosystem functions and human cultures of traditional acequia irrigation systems. The primary objective will be initial preparation of a grant proposal to the National Science Foundation (NSF) Dynamics of Coupled Natural and Human Systems (CNH) program. Additional objectives will be writing an integrative paper and preparing complementary grant proposals. The project will build on the activities of the socioeconomics and acequia hydrology team of the current New Mexico EPSCoR project, "Climate Change Impacts on New Mexico's Mountain Sources of Water". This interdisciplinary team is effectively working together to understand climate change impacts on hydrology of acequia irrigated valleys and community resilience to change based on acequia culture and tradition. The IWG will allow this team to

synthesize complex intersecting topics and produce a clearly formulated and competitive CNH proposal along with other related outcomes.

- The New Mexico STEM Higher Education Diversity Pipeline. Lead Investigators: Dr. Micheal Pullin, New Mexico Tech, and Marnie Carroll, Dine College.

Minority racial and cultural groups are underrepresented at the undergraduate, graduate, and professoriate levels in New Mexico colleges and universities, especially in science, technology, engineering, and mathematics (STEM) fields. This proposal describes an innovation working group (IWG) that will establish a STEM higher education diversity pipeline for the state of New Mexico. The proposed IWG will bring together a group of diverse faculty and university professionals from a wide range of higher education institutions in NM for five days in the fall of 2009. This IWG will examine the current state of diversity efforts at their own institutions, develop a mission for the group, examine mechanisms for assessment, identify gaps in diversity efforts, develop a statewide pipeline that promotes the advancement of underrepresented minority students, and plan grant writing to fill identified gaps and facilitate the pipeline.

#### *Tri-State Innovation Working Groups*

One significant outcome of the Western Consortium meeting was commitment by the Program Directors to adopt and jointly sponsor a funding opportunity employed by New Mexico, the Innovation Working Groups (IWGs). Funds were committed to support a Tri-State IWG that will promote inter-jurisdictional collaboration in keeping with the concepts and criteria developed for the NM IWG. A Tri-State IWG RFP was developed and released in May, 2009 with a due date of July 1<sup>st</sup>. Proposal submissions are being reviewed by the Project Directors and Assistant Directors of the three states; results will be reported in the next annual report.

#### *7b. Education / Human Resources Development*

Strategic Plan Objective 13: Enhance leadership skills for faculty via a Faculty Leadership Fellowship Program.
---

#### *Junior Faculty Leadership Workshop*

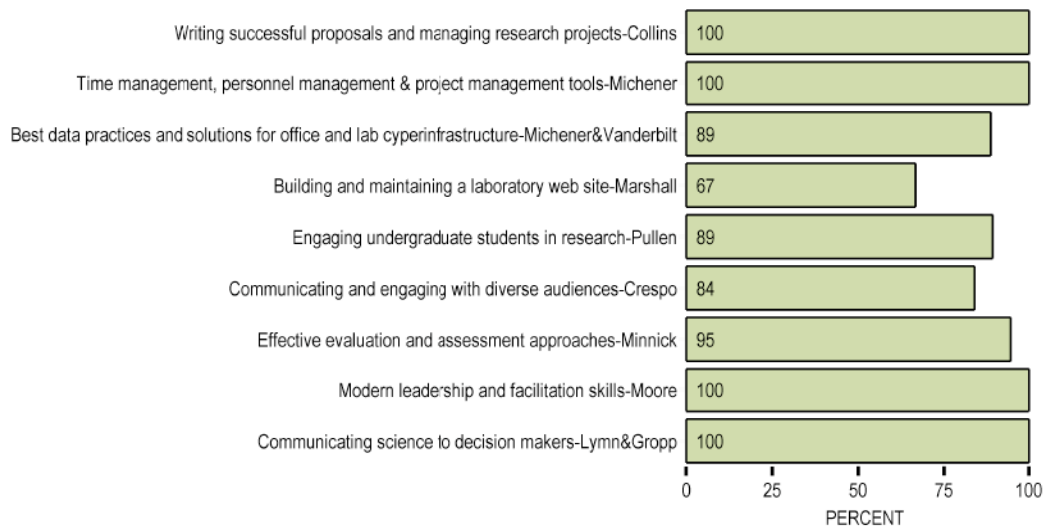
The Faculty Leadership program is designed to provide training for early-career faculty that enhances their leadership skills and increases their competitiveness for national-level funding opportunities. Nineteen early-career faculty from higher education institutions across New Mexico convened for three days in January, 2009 for an on-site workshop held at the Sevilleta LTER research complex south of Albuquerque. Topics were wide-ranging, including communication with decision-makers, proposal development, management of large research projects and laboratories, meeting facilitation and “broadening impacts” through education and outreach. A sample of presentations and activities are below.

- Scott Collins (Director, Sevilleta LTER Program, UNM) conducted a session on writing competitive research proposals and management skills needed to conduct a successful research projects.
- William Michener (NM EPSCoR Executive Director) and Kristin Vanderbilt (Sevilleta LTER Program, UNM) worked with faculty on time management, personnel management, and project management tools.

- Mike Pullin (Assistant Professor, NMT) discussed his success with undergraduate research programs and the importance of engaging students in research early on in their academic careers.
- Kirk Minnick (CEO, Minnick and Associates) provided approaches and examples of effective research program evaluation and assessment and how to meet the evaluation expectations of science funding agencies.
- Carl Moore (The Community Store) led a series of exercises and activities designed to help young faculty understand their own leadership style and how to develop a skill set that supports their growth as a leader. Carl also helped faculty acquire strategies and techniques for effective meeting facilitation.
- Nadine Lymn (Ecological Society of America) and Robert Gropp (American Institute of Biological Sciences) led a hands-on workshop designed to help faculty communicate science more effectively to decision-makers. Participants engaged in mock meetings and dialogues in which they interacted with political figures, the press, and funding agency program managers or representatives. The exercise was especially tailored to help young faculty gain experience in communicating and obtaining funding from federal science funding entities.

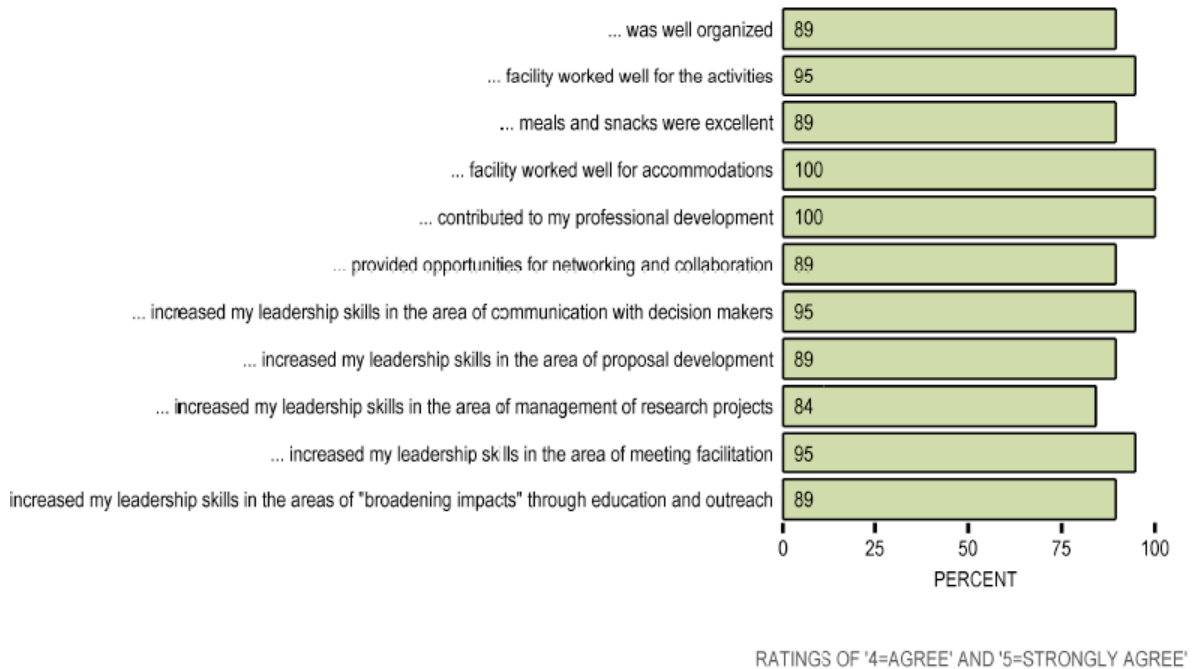
Evaluation of the Junior Faculty Leadership program initiative, the workshop concept, and the specific workshop topics, were all extremely positive. Participant responses to the question of whether the January workshop had “increased my leadership skills in the area of communication with decision makers” were 95% ‘strongly agree’. To the broader question of whether the workshop had “improved my professional development” responses were 100% ‘agree’ or ‘strongly agree’. Graphs below provide results for some of the survey data; all survey results are attached as an Appendix.

Graph 1. Faculty Leadership Workshop, January 2009. Faculty participant ratings of Quality of Content



RATINGS OF '4=VERY GOOD' AND '5=EXCELLENT'

Graph 2. Faculty Leadership Workshop, January 2009. Faculty participant ratings of Workshop Overall



Strategic Plan Objective 11: Design and develop graduate research training group opportunities.

*Graduate Research Training*

NM EPSCoR has a longer term project objective of supporting a Graduate Summer School in Regional Modeling that will include extensive hands-on training in running relevant climate, hydrologic, and socioeconomic models. This activity is slated for development in Year 2 of the award cycle. However, through the NM EPSCoR partnership with Los Alamos National Laboratory, and NM EPSCoR collaborator Todd Ringler, a 3-day summer workshop in mesoscale climate modeling will be held summer of 2009. The workshop is titled: *“Simulating the Spatial-Temporal Patterns of Anthropogenic Climate Change: A Workshop in the Bridging Disciplines, Bridging Scale Series”*, and is supported by the Los Alamos Institute for Advanced Studies, Los Alamos National Laboratory Center for Nonlinear Studies and New Mexico EPSCoR Program. Presenters and attendees are nationally-known experts, in addition to scientists from the Western Tri-State Consortium – New Mexico, Idaho and Nevada. The agenda is attached as an Appendix and participant data will be included in next year’s annual report.

**7c. Leveraging NSF funded programs**



Several NM EPSCoR faculty have NSF support that is detailed in *Appendix A: Faculty Support*. Because few NM EPSCoR research scientists receive salary from the EPSCoR grant, other grant sources are intrinsically key to achieving the EPSCoR RII 3 goals.

A brief listing follows for the more significant NSF funding and programs that have been leveraged in the past year.

- Funding was acquired by Edward Martinez at NMHU to purchase an FS3100 auto chemistry analyzer and block digester through the NSF MRI Program. NM EPSCoR funds directed toward critical infrastructure upgrades to the aquatic chemistry lab at NMHI were used to purchase an Ion Chromatograph and a Total Organic Carbon Analyzer.
- The climatology group at UNM, working under Joseph Galewsky, has very close ties with the NSF-funded National Center for Atmospheric Research. In particular there is a close working relationship with the Mesoscale and Microscale Climate Modeling group. These ties extend not only to meetings and intellectual support but include crucial access to supercomputing time for model runs of the CCSM model. In addition, NCAR is assisting UNM with graduate student training on-site at NCAR in the WRF model.
- NSF has recommended the Jemez River Basin Critical Zone Observatory (JRB CZO) for funding beginning in October, 2009. The Jemez River Basin lies within the NM EPSCoR study area. The CZO is led by a group of Earth Scientists at the University of Arizona. This group has worked closely in the past with several NM EPSCoR researchers on the SAHRA project in the Valles Caldera National Preserve. Discussions are already underway to facilitate interactions among the Arizona and NM EPSCoR research projects, to include: a joint field technician for hydro-meteorology stations, shared baseline data, an annual science meeting for all participants on the CZO, and joint purchasing of equipment and instrumentation.
- The Western Tri-State Consortium represents a significant leveraging of NSF funds. Two specific projects are underway. The first is the Tri-State IWG, described above under the Emerging Areas section. The second is a joint NSF AGEP proposal being submitted by Idaho and New Mexico.
- The NMMNHS is recipient of an NSF award to ASTC that was combined with the NM EPSCoR funds to hire a full time Climate Change Educator for the Museum.

There are two NSF proposal submissions of note that would leverage EPSCoR funding for STEM education.

- Edward Martinez at NMHU is partnering with Wind River Ranch, a non-profit nature center and working ranch dedicated to Conservation and Science Education. They will submit an NSF GK-12 grant to support faculty and graduate student research while supporting K-12 science education in our local school districts. Involved in this project is a former NSF Einstein Distinguished Educator Fellow who will provide training for faculty, graduate students and K-12 educators in best practices. The NMHU portion of the proposal centers on climate change and its impacts on water sources and leverages EPSCoR investments, especially in field research sites.
- NM EPSCoR is working with The Northern Network to assist them in submission of an NSF MSP grant for rural schools in northern New Mexico. If this proposal is funded, it would greatly enhance the desired interactions among scientists, teachers, and the public, that NM EPSCoR supports.

## 8. Management Structure

The management of the NM EPSCoR program has multiple levels and is diagrammed on the NM EPSCoR web site (<http://www.nmepscor.org/node/4>). The NM EPSCoR office leadership staff is Dr. William Michener, Executive Director, Dr. Katherine Mitchell, Associate Director, and Anna Morrato, Program Administrator. Katherine Mitchell assists the Director in program management and oversees project database development and data collection per NSF requested standards. Fiscal and contract management is performed by Anna Morrato. Part-time support staff have been added and include new positions in Accounting - Megan Gallegos, Administrative Assistance - Celina Gomez, and Information Technology - David Danzilio.

### *NM EPSCoR Management Team*

The RII 3 project has a 14 member Management Team which has convened by conference call at least quarterly over the past year, responded to relevant problems, and made determinations on science and education issues of importance to the project. The Management Team is listed in Table 11. The current configuration reflects changes in personnel within the project that occurred since fall of 2008.

Table 11. NM EPSCoR Management Team (Originally proposed and Current)

	Original Proposal Team Member		New Team Members: Changes approved by NSF	
1	[Deb Bathke]	NMSU	Sam Fernald	NMSU
2	Karl Benedict	UNM		
3	[Stephanie Bestelmeyer]	CDNP	Marnie Carroll	Dine College
4	Janie Chermak	UNM		
5	Mary Jo Daniels	NM PED		
6	[Dave Gutzler]	UNM	Joe Galewsky	UNM
7	Rhea Graham	AECOM		
8	Edward Martinez	NMHU		
9	Al Rango	NMSU		
10	Todd Ringle	LANL		
11	Bob Parmenter	VCNP		
12	Mike Pullin	NMT		
13	Clyde Romero	Taos Pueblo		
14	[Selena Conneally]	NMMNHS	Jessica Sapunar-Jursich	NMMNHS
15	Anne Watkins	Biophilia		

*NM EPSCoR State Committee*

The NM EPSCoR governing body is the State Committee, composed of Vice Presidents and Deans from every institution of higher education in the State, along with key individuals from the National Laboratories, State Government, and private industry. The State Committee has met twice during Year 1 of the award. A November, 2008 meeting centered on the following: a review of EPSCoR's role in funding science in the State; discussions of the new RII 3 award with an update by the EPSCoR Director on the proposed scope of work; review of RII 3 budgets and the distribution of funds among the institutions; and means of broadening participation and increasing collaboration across all sectors of the state economy. The November meeting took place in Albuquerque at the New Mexico Museum of Science and History, and the Committee was familiarized with the EPSCoR-funded Climate Change Exhibit and Education program.

In May, 2009 the State Committee met in Santa Fe at the hotel owned by Picuris Pueblo, the Inn at Santa Fe. The Committee put forward a motion to have the New Mexico Secretary of Higher Education serve as a permanent Co-Chairperson. Upon approval from the Council of Presidents, the By-Laws will be rewritten to state that the Secretary is a permanent Co-Chair with the Deputy Secretary serving as an alternate.

Tom Bowles, Science Advisor to Governor Richardson, and a State Committee member, presented on the newly completed New Mexico State Science and Technology Plan. The plan is available at the NM EPSCoR website (<http://www.nmepscor.org/node/87>). Most of the materials and presentations from the meeting, including Tom Bowles' presentation, are available at the website (<http://www.nmepscor.org/node/93/>).

*NM EPSCoR RII 3 Strategic Plan*

A facilitated two-day strategic planning session for all components of the RII 3 was held in October, 2008 in Albuquerque. All of the principal EPSCoR participants listed in **Table 1** were in attendance. Each project component had prepared a planning document using the following outline: strategic objective, activities supported, participants, resources, specific actions by year, deliverables and milestones by year, efforts to promote sustainability and additional information (changes in activities, deliverables, use of resources, scope of work). The annual report Executive Summary contains the strategic plan executive summary with main project components and their objectives and activities. The full strategic plan is available on the NM EPSCoR website homepage ([www.nmepscor.org](http://www.nmepscor.org)).

The strategic plan was submitted to NSF in January, 2009, as per NSF requirements, and within the specified timeline agreed upon by the NM EPSCoR Program Manager, Denise Barnes.

## 9. Unobligated Funds

This summary provides the salient features of year 1 financial status for NM EPSCoR.

### NM EPSCoR RII 3 Year One Funds

Awarded	Expended	Balance	Encumbered	Non-Expended	% Non-Expended
\$ 3,000,000	\$ 703,811	\$ 2,296,189	\$ 1,947,952	\$ 348,237	11.6 %

- Year 1 funding for the NM EPSCoR award totaled \$3 million. A balance of \$348,237, or 11.6% of the original budget, remains as non-expended funds derived from actual expenditures, encumbrances and projected expenditures through August 31, 2009.
- The non-expended funds reflect the following changes in the Year 1 spending plan: 1) NM EPSCoR RII 2 Supplemental funds covered some administrative and operational costs for the first part of the grant year; 2) travel and participant support funds for an External Advisory Committee meeting in Year 1 were not utilized; 3) attendance at the Western Tri-State Consortium Annual Meeting in Idaho in lieu of hosting an in-state annual conference reduced travel and participant support expenditures; and 4) Innovation Working Group funds were not fully awarded due to the delayed project start and a reduced number of submissions in the first year.
- Requested carry-over funds applied to Year 2 will automatically be applied to the corresponding line-items as budgeted in Year 1 and will continue to follow the original Scope of Work.

## **JURISDICTION SPECIFIC TERMS and CONDITIONS**

The General Programmatic Terms and Conditions (PTCs) for the New Mexico EPSCoR Research Infrastructure Grant Program (RII) Cooperative Agreement are met and discussed in the annual report. Conditions are contained in the report as follows: 1) Key Personnel, discussed under Management Structure; 2) Program/Project Description discussed under Project Description sections; 3) Project Governance discussed under Management Structure; 4) Governing Responsibilities, discussed under Management Structure and appendix included with Strategic and Implementation Plan; Reporting Requirements, met by this report; Awardee Support of Ongoing Management, met by NSF RSV on September 15, 2009.

The following references the Jurisdiction Specific Programmatic Terms and Conditions (PTCs) for the New Mexico EPSCoR Research Infrastructure Grant Program (RII) Cooperative Agreement.

### 7. State-Specific Terms and Conditions

*7.1.a. The strategic plan must include a revised cyberinfrastructure plan that includes 5-year goals tying the cyberinfrastructure capabilities to scientific projects and requirements by year. The plan must identify an initial and specific set of software systems and technologies chosen to implement the major components of the working CI environment. The plan must show how existing software and tools will be leveraged. The plan must show new and diverse opportunities for the team to engage with CI at the national level, particularly on the human resource side in building relationships with technologists and researchers on related activities outside of the State. Any new software developed as part of the project must be released under an OSI (<http://www.opensource.org/>) approved Open Source License. Modifications or extensions of existing software should also be released under an Open Source license, if allowed under the existing software license.*

The NM EPSCoR RII3 Strategic Plan and Implementation Plan include a revised CI plan that ties CI capabilities to science projects and requirements by year (see pages 33-34 of the Implementation Plan). Initial and specific sets of software systems and technologies were chosen to implement the major components of the working CI environment. In particular, Drupal was selected as the web content management system and the initial data products are implemented in RGIS, a comprehensive and user-friendly system that serves to substantially leverage NM EPSCoR resources. Furthermore, NM CI experts are actively working with their counterparts in Idaho and Nevada to leverage existing investments in software and tools such as the CUAHSI-HIS. The CI experts from the Tri-State Consortium recently collaborated on a Track II CI project that significantly leverages and expands upon existing resources. NM CI experts are leading an effort to incorporate Tri-State developed software into CSDMS—a national repository for climate change-related modeling software. NM EPSCoR CI experts will be actively engaged in national DataNet efforts once the announced awardees are funded. The Tri-State CI meetings have already been successful in selecting open source licenses and in identifying an array of interoperability standards that will be adopted in the western EPSCoR region.

*7.1.b. Within three months of the effective date of the award, the detailed plan to address the socio-economic impacts of basin-scale hydrologic changes to acequias must be submitted to NSF via email to the cognizant program officer. The plan must include descriptions of models to be developed and employed, and provide anticipated outcomes.*

The detailed plan to address the socio-economic impacts of basin-scale hydrologic changes to acequias was submitted to the cognizant program officer as part of the Implementation Plan (pages 21-25). The plan include models to be developed and employed, and provided relevant timelines, milestones, and outcomes.

*7.1.c. The strategic plan must include a revised diversity plan that includes strategies and initiatives to hire a more diverse faculty, including women and underrepresented groups in STEM. Future funding will be based, in part, on progress in increasing the number of women and underrepresented groups in STEM in leadership positions on projects funded by this award.*

A revised diversity plan was included in the Implementation Plan (see pages 35-37). Significant attention is paid to increasing the number of women and underrepresented groups in STEM in leadership positions on all aspects of the EPSCoR project. Notably, the three recent proposed additions to the EPSCoR State Committee are comprised entirely of women and members of underrepresented groups. Although there is presently a hiring freeze at all NM universities, we plan to engage the State Committee in dialogue with the Secretary of Higher Education (recently added as a permanent position on the State Committee) to develop and enhance mechanisms for increasing faculty diversity. An important component of our efforts to increase faculty diversity focuses on providing young faculty with leadership and related training that can enhance their retention and advancement within the academic enterprise (see Faculty Leadership Fellowship Program on page 44 of the Implementation Plan).

*7.1.d. The strategic plan must include a revised diversity plan that includes strategies and initiatives to increase research collaboration with regional and tribal colleges and increase numbers of undergraduates involved in research.*

In addition to the revised diversity plan, NM EPSCoR established a specific program that is entirely focused on strategies and initiatives to increase research collaboration with regional and tribal colleges and increase numbers of undergraduates involved in research (see Undergraduate Research Opportunity Program on page 40 of the Implementation Plan). This Program will complete its first successful “graduation” just after the annual report is submitted.

It is also especially noteworthy that Marnie Carroll (Dine College and Chair of our Diversity Committee) and Mike Pullin (NMT) were successful in organizing an Innovation Working Group that will convene in fall 2009 and include STEM professionals and administrators from throughout New Mexico. This IWG also specifically focuses strategies and initiatives to increase academic and research collaboration with regional and tribal colleges, and increase the retention of STEM students and their engagement in meaningful research experiences.

*7.1.e. The awardee is only authorized to expend funds up to \$3,000,000 for the first year of this project. Following the submission and approval of the annual progress report for year one, the awardee may expend up to \$3,000,000 in the second year. This report shall be submitted to the cognizant NSF Program Officer, via FastLane, 90 days prior to the anniversary of the effective date of this award.*