



NM EPSCoR 2012 Annual Report

Executive Summary

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

Award Year 4

Report Period: Sept. 1, 2011-Aug. 31, 2012

The full report can be read on the NM EPSCoR website, on the "Reports" page.

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.”

The overarching goal of NM EPSCoR RII3 is 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.”

NM EPSCoR KEY ACCOMPLISHMENTS IN YEAR FOUR

Intellectual Merit

EPSCoR Year 4 accomplishments (described below) address each of the three strategic areas: Research Infrastructure, Cyberinfrastructure and Human Infrastructure. Research investments have continued in the development of watershed-scale observational networks and climate and hydrology models needed in NM for water supply forecasting and water resources decision support. As well, significant progress continues in research on the socioeconomic impacts of basin-scale hydrologic changes to *acequias* - the traditional water supply system for agriculture in small NM communities. Cyberinfrastructure activities led to the launch of the EPSCoR data portal, a key element of the shared data infrastructure for the management, discovery, and delivery of the science data generated by the EPSCoR project. Educational activities for undergraduate students, graduate students, junior faculty and K-12 teachers enhanced NM human infrastructure by improving understanding of climate science, collaborative interdisciplinary research, and diversity issues.

Broader Impacts

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. Over 8,500 K-12 students and 750 teachers participated in EPSCoR-supported outreach events in Year 4, increasing their awareness of climate change impacts on natural resources. The EPSCoR-supported museum climate science exhibit provides information and engagement for approximately 200,000 members of the general public each year. In addition, seed awards were

awarded that integrate research and education for students 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 population of Native Americans and persons of Hispanic descent.

A summary of efforts and key accomplishments in research, diversity, workforce development, cyberinfrastructure, outreach and communication, evaluation and assessment and sustainability for Year 4 are presented below as they align with the objectives of the NM EPSCoR Strategic Implementation Plan that guides our work.

RESEARCH INFRASTRUCTURE IMPROVEMENTS

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

- Eight new SCAN-type stations are prepped for installation in summer 2012; stations installed in Year 3 are generating data available through the NRCS.
- Continued to work on optimizing the parameters for the Snowmelt Runoff Model in 24 sub-basins of the Upper Rio Grande.
- Developed new software tools for analyzing the links between large-scale flow and atmospheric hydrological process.
- Developed models for small-scale (1-100 m) hyporheic exchange and larger scale (1-100 km) basin flows, and models demonstrated for dynamic flows ranging from individual storm events up to seasonal, decadal, and longer time scales.
- Isotopic and aqueous geochemical data from precipitation, stream flow, springs and wells has been assembled and analyzed to help diagnosis flow paths and residence times in selected watersheds.

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

- Conducted a detailed assessment of the effects of the Las Conchas fire on water quality in study area.
- In collaboration with hydrology group, continued studies of meander site at the Valles Caldera National Preserve.
- Continued water quality studies in the Jemez and Hondo watersheds.
- Completed development of an on-site water quality trailer, which is scheduled for installation in June 2012.

Objective 3: Develop interdisciplinary socioeconomics and acequia research capacity.

- Continued involvement with the acequia associations through both informal interactions and participation in community meetings.
- Initiated a study to determine the water balance to the Northern NM acequia farmers.
- Monitored riparian health at both the El Rito and Rio Hondo sites while developing a student and stakeholder driven partnership in a long-term riparian monitoring program.
- Completed an empirical analysis of the impact of conservation incentives utilized by the Albuquerque Bernalillo County Water Utility Authority.
- Conducted studies on the impacts of climate change on water resources and adaptation opportunities in the agricultural sector of New Mexico

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

- Incorporated use of enhanced water quality laboratory facility into undergraduate research activities.

- Collaborated with faculty at UNM on training and use of the analytical instrumentation as well as with researchers at UNM and NMT to carry out collaborative research projects.

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

- *Connecting Communities: Engaging Stakeholders in Research* brought researchers together with acequia association members to discuss research plans and outcomes.
- Collaborators at the Santa Fe Institute led *Developing an Online Network for Teacher Professional Development in Computational Science/Modeling and Simulation*
- Faculty from the Utton Center at the UNM School of Law convened *Water, Agriculture and the Environment in the Southwest under a Changed Climate: Policy Implications*.
- In June 2012, *Water, Energy, and Culture Through Time in the San Juan Basin*, will consider the effects on local indigenous cultures of water use and energy development through the lens of planning and design.

Objective 6: Provide Critical Infrastructure Gap Seed Awards to increase the impact of NM EPSCoR on the critical student population at New Mexico's non-PhD granting institutions.

- Three proposals funded in second round: NM Highlands University, Eastern NM University and UNM-Los Alamos.
- Solicitation for final round of awards released; proposals due in July 2012.

CYBERINFRASTRUCTURE IMPROVEMENTS

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

- Continued development of the NM EPSCoR data portal as an operational element within the broader NM EPSCoR portal, based upon an underlying, custom developed geospatial data and information management and delivery platform.
- Continued to evolve systems for automated processing of the existing FGDC XML metadata records in the portal into corresponding valid ISO metadata, and development of template-based metadata creation tools for bulk metadata creation in support of researcher data integration into the EPSCoR Data portal.
- Developed a system for the automated retrieval of new SNOTEL and SCAN data from the NRCS web site for New Mexico, Arizona, Colorado, Utah, Nevada, and Idaho.
- Significantly improved computer hardware capacity through the addition of the UNM Research Storage Consortium storage system (a 280 TB tiered storage system) to the pool of available storage capacity.

HUMAN INFRASTRUCTURE IMPROVEMENTS

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

- In collaboration with Nevada and Idaho EPSCoR programs, participated in a Diversity Working Group to implement activities in the Tri-State Diversity Strategic Plan.
- Developed Guidelines for Infusing Diversity into RII Proposals for project leadership.
- Revised and updated a database of STEM opportunities in NM for students, teachers, and the general public.
- Increased the number of under-represented minority students supported by NM EPSCoR.

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

- Conducted the annual five-day field-based Teacher Summer Institute at the Valles Caldera National Preserve (VCNP) for middle and high school math and science teachers in collaboration with NM EPSCoR researchers.
- Provided follow-up workshops during the academic year for participants in the Summer Institute on how to use data in their classrooms.
- Participating teachers conducted overnight field trips to the VCNP with students and implemented lessons based on their summer institute experience.
- Supported teacher workshops in environmental education using Project Wet curricula.
- Supported teacher workshops in complex modeling and computation with Project GUTS.

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.

- 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 NM EPSCoR universities.

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

- With NV and ID, offered workshops in Climate Modeling and Hydrologic Information Systems (HIS) at the Tri-State Annual Meeting for graduate students and faculty.
- In collaboration with NV and ID, offering *Interdisciplinary Modeling* course at NMSU for 30 students from the tri-state consortium.
- Supported graduate students attendance at various climate science and CI-related workshops and seminars.

Objective 12: Inform faculty throughout NM about funding opportunities via NSF Days.

- Administered a follow-up survey one year after the successful NSF Day event.

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

- Offered a weeklong training workshop for 21 early-career faculty from 11 higher education institutions in New Mexico, Idaho, and Nevada.
- Added sessions on effective teaching and mentoring to the agenda that included interactive workshops designed to enhance competitiveness and leadership skills; overall evaluation by participants was very positive.

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 an evaluation of the *Degrees of Change* exhibition at the New Mexico Museum of Natural History and Science and implemented improvements.
- Educators at the Sandia Mountain Natural History Center included climate impacts into their field ecology program, which served over 8,500 students in the middle Rio Grande area.
- Planned and delivered a Town Hall meeting on the impacts of drought-enhanced fires on water quality, economy and land use in northern New Mexico.
- Updated and enhanced NM EPSCoR electronic communication tools.

NM EPSCOR MANAGEMENT STRUCTURE

The management of the NM EPSCoR program has multiple levels and is diagrammed on the NM EPSCoR web site (<http://nmepscor.org/content/epscor-structure>). A State Committee acts as the governing body; the Management Team meets regularly to provide input on science and education issues. The Strategic Plan provides guidance for program activities and timelines.

RESPONSE TO NSF RECOMMENDATIONS FROM THE 2011 REVERSE SITE VISIT (RSV)

Details of on-going progress in implementing plans presented in the first RSV response are provided in the body of this report. The full response to the second (2011) RSV is provided in the “Jurisdictional Specific Terms and Conditions” report section. Key steps taken include:

- Held extensive pre-town hall coordination and planning meetings;
- Included in the annual report a chart showing completion of Strategic Plan components;
- Revised the evaluation reporting to include more detailed outcome metrics;
- Continued integration of project data with libraries and national data repositories;
- Updated the Strategic Plan.

RESPONSE TO EXTERNAL ADVISORY BOARD (EAB) REPORT

The EAB strongly commended the leadership of the RII3 for their overall 5-year program plan and their progress to date. Details of the EAB Report and the NM EPSCoR response are provided in the body of the report and Appendix K. Key components are:

- Continuing to articulate the science focus of the project at all major meetings;
- Developing a graphical representation to show alignment of science foci and researchers;
- Working with researchers to populate the project’s data portal;
- Leveraging institutional funds to expand education and outreach activities;
- Encouraging faculty and students to increase their publications output.

RESPONSE TO YEAR THREE EVALUATION REPORT

The Year Three external evaluation report (Appendix L) did not provide any significant overarching recommendations for project leadership. Changes made in response to recommendations to specific components are provided in the discussion of those activities. Other recommendations are provided in the Evaluation and Assessment section of the report.

PROJECT CHANGES DURING YEAR FOUR OF THE AWARD

The project had no significant changes in scope or priorities in Year 4 of the award. The subaward to the Northern NM Network for the design and delivery of the summer teacher institute was terminated when the Network notified NM EPSCoR they would be unable to fulfill the contracted statement of work due to internal administrative changes. The NM EPSCoR office received NSF approval to move those funds to the University of New Mexico so the State Office could manage these activities for the remainder of the award; the change did result in a slight increase in administrative costs of the project.