New Mexico EPSCoR Response to Reverse Site Visit

Specific Recommendations:

1. Enhance the diversity of faculty at the PhD degree granting institutions. Recognizing that hiring decisions are the prerogative of the various universities, the panel encourages the NM EPSCoR team to do some creative thinking about mechanisms to inform the universities of the diversity goals of the RII program. [Response should consist of a revised diversity plan to increase the participation of women and underrepresented minorities on the faculty.]

The three major research institutions in New Mexico have made significant strides with respect to enhancing the diversity of faculty and students at their campuses. The University of New Mexico and New Mexico State University both have comprehensive equity and inclusion plans, and New Mexico Tech is in the process of revising its plan. Within the past two years, the University of New Mexico hired a new Vice President for Equity and Inclusion. An initial review of data compiled in the October issue of the Chronicle of Higher Education indicate that Hispanic and Native American faculty diversity at both the University of New Mexico and New Mexico State University exceed that of their peer institutions in the western U.S. and nationally. Nevertheless, New Mexico EPSCoR recognizes that there remains room for significant improvement. Consequently, our immediate plan for action is to: (1) complete an environmental scan of institutional diversity at colleges and universities in New Mexico and at peer institutions within our region; (2) compile pointers to existing diversity plans at New Mexico institutions and highlight exemplary plans within and outside our state; and (3) convene a diversity workshop as part of our New Mexico EPSCoR State Committee meeting that will be held Monday October 26th in Albuquerque (the first meeting to be attended by our recently-appointed Co-Chair—Dr. Viola Flores who is the Secretary of Higher Education in New Mexico). The information that is prepared for this meeting as well as the outcomes of this workshop will be used to further fashion a best practices diversity plan for New Mexico's research universities that highlights EPSCoR diversity goals, builds on key EPSCoR programs such as the Faculty Leadership Program, and provides recommendations and approaches for increasing the participation of women and underrepresented minorities on the faculty. The Plan will be researched and presented for review at the spring meeting of the New Mexico EPSCoR State Committee. Pending approval of the State Committee, the final Plan will be presented to the Council of University Presidents at their fall 2010 meeting.

2. Develop mechanisms to follow-up with the summer workshop participants, especially students, so that long-term outcomes can be tracked, quantified and reported.

EPSCoR evaluator Kirk Minnick will conduct and maintain longitudinal data on participants in the two EPSCoR summer programs; undergraduate students in the Undergraduate Research Opportunities Program (UROP) and secondary school teachers in the Teacher Summer Institute. E-mail and postal addresses were collected from student and teacher participants in summer 2009. The UROP student's emails were verified through the collection of baseline data using an online survey tools. The

evaluator will follow up with both sets of workshop participants in the spring using the email addresses and the postal addresses as a backup. We intend to contact student participants yearly to track long-term outcomes from their participation in EPSCoR activities. Data tracked will include not only academic progress and career decisions, but also assessment of attitudes, involvement, and knowledge of climate change science issues. The teacher data tracking focuses on the success of curriculum implementation in the classroom.

3. Develop a succession plan to grow junior staff, with the added benefit of increasing institutional diversity in leadership roles over the course of the project. Leadership should understand all aspects of the project to ease transitions while vacancies are being filled.

The succession plan for New Mexico EPSCoR encompasses several elements. First, the EPSCoR Management Team comprises a mixture of senior and more junior faculty from the institutions involved In the RII project. The intent is to involve more junior faculty in a collaborative leadership group along with more "seasoned leaders" so that they may understand and contribute to leading a large multi-institutional research, education, and outreach enterprise. It is anticipated that Management Team members, because of their understanding of all aspects of the project, can ease transitions while vacancies are being filled and be well-poised to apply for leadership positions within their institutions or in the State EPSCoR office should openings occur. Second, the Faculty Leadership Program provides leadership training to young faculty and post-doctoral fellows at institutions throughout New Mexico, many who exhibit significant leadership potential and who are envisioned to assume leadership positions within their respective institutions. Third, our plan for growing junior staff in the State Office focuses on developing career ladders, which will provide a planned progression to a new job and advancement within the Department and the University system. There are three steps in the career ladder program:

a. The Manager completes a Pre-Approved Career Ladder form containing the education, experience, distinguishing characteristics and job responsibilities required for the progression to a higher classification.
b. An agreed time-line for completing the acquisition of the necessary skills and/or knowledge and the proposed salary increase will be agreed upon by individual staff and Manager. HR approval is required.
c. Develop requirements such as completion of education, professional certification/licenses and/or specific experience to be completed by staff and assist the employee in meeting these requirements.

We have just advanced two individuals in the State Office to higher-level positions (Morrato and Danzillio) and are working to provide career advancement opportunities for two other individuals (Gomez and Arguelles).

4. Develop a plan for scientific synthesis across the interdisciplinary research projects.

The New Mexico EPSCoR RII project was conceived of initially as a highly

interdisciplinary research program that would entail integration and synthesis across scales of time, space, and discipline. With additional funding provided by Los Alamos National Laboratory's Institute for Advanced Studies, EPSCoR annually supports one intensive scientific synthesis workshop entitled: "Bridging Disciplines and Scales." The first year's workshop was held in July 2009 and focused on scientific synthesis of climate data and models across an array of scales from global to regional to state and local scales. Scientists and students involved in the New Mexico EPSCoR program worked with each other as well as nationally recognized experts (including Dr. Ruby Leung who is on the NM EPSCoR External Advisory Committee) to resolve many of the complex scale challenges faced by climate scientists. Subsequent planned "Bridging Disciplines and Scales" workshops are designed to: (1) synthesize data and models across the climate and hydrologic sciences; and (2) bridge data and models between the geosciences and the socio-economic sciences.

In addition to the "Bridging Disciplines and Scales" workshop, researchers may propose and be supported to participate in Innovation Working Group (IWG) activities whereby participants focus intently for a week on integration and synthesis of science concepts, data, and models. Our first IWG effort was recently successfully concluded (led by Sam Fernald of New Mexico State University), focusing on hydrology and New Mexico's acequias (i.e., the historic water management systems). It was envisioned that current and future IWG science activities will include groups that focus almost exclusively on integrating and synthesizing data generated within New Mexico (and by EPSCoR scientists and others as appropriate) as well as groups that would focus on regional data such as those data that are common among scientists that are associated with our tri-state western consortium (i.e., Idaho, New Mexico, Nevada).

Finally, scientific synthesis across the interdisciplinary research projects is enabled through work sessions at the annual EPSCoR All Hands' Meeting as well as virtual meetings supported through our collaboration technology (VTC and wiki).

5. Consider working with pre-service teachers at the undergraduate institutions as a means of further impacting K-12 students in New Mexico.

The University of New Mexico and New Mexico State University have the largest undergraduate secondary teacher preparation programs in New Mexico and members of NM EPSCoR's management team have long-standing professional associations with both institutions' Colleges of Education. NM EPSCoR will collaborate with UNM and NMSU education faculty to incorporate materials using EPSCoR-generated data and resources into secondary science methods courses for pre-service teachers. In addition, NM Highlands University is located in the region of EPSCoR study; opportunities to include pre-service education teachers from NMHU into the Teacher Summer Institute will be pursued. EPSCoR partner The Northern New Mexico Network coordinates and delivers the EPSCoR K-12 education program including the Summer Institute. The Northern Network has a long-standing relationship with NMHU, and has worked with NMHU to improve secondary teacher preparation in math and science in northern New Mexico. We will seek to strengthen and develop existing Northern

Network – NMHU connections, and to integrate EPSCoR climate change research into these efforts. Finally, Eastern NM University is currently seeking funding for a secondary math and science post-Bachelor's teacher preparation program that will draw upon New Mexico professional development providers for a portion of the program's instruction. If the ENMU program receives funding, EPSCoR will work to establish a partnership through which EPSCoR resources can be disseminated.

6. Consider additional dissemination of the Spanish translated educational resources and other educator-produced resources through DLESE, NSDL and Windows to the Universe, which has a multilingual web site.

The NMMNHS held a facilitated stakeholder input workshop in October, at which it was decided that all the exhibit materials for the Climate Change in New Mexico exhibit would be bi-lingual in English and in Spanish. We anticipate approximately 250,000 people will see the exhibit during its first year. Most of the exhibit materials are integrated into the exhibit display. However, the museum is currently seeking funds for additional handout materials; these would also be available in Spanish. We have discussed the possibility of further dissemination with the Museum Climate Change Educator, a position partially funded by EPSCoR, and the working group on the Climate Change Exhibit will ascertain the feasibility of this idea. Classroom curricula materials are being developed by and for secondary teachers from northern New Mexico rural schools through our partner organization, the Northern Network, and the Summer Teacher Institute. Bi-lingual production of these materials was not included in the original proposal. EPSCoR coordinated a meeting of the Northern Network, the NMMNHS, Earth's Birthday, and the NM State Math and Science Bureau last August aimed at initiating an informal partnership among the 3 education non-profits. These organizations will be better equipped to solicit external grant funding for climate change education in a collaborative partnership than as individual entities. EPSCoR will continue to promote and assist the development of this non-profit partnership, and will propose that the creation and dissemination of Spanish language education materials be included as one of their funding goals.

7. Increase the leadership diversity and include senior faculty from the lead institutions in the working group on diversity.

Marnie Carroll, a senior faculty member from Dine College, and Mike Pullin, an Associate Professor from New Mexico Tech, currently provide the leadership for the Diversity Committee. They have also recently been awarded an Innovation Working Group project that focuses on enhancing the STEM pipeline from New Mexico's Tribal and regional colleges and universities to the major research universities. This workshop is scheduled to occur in January 2010 and provides an opportunity to identify and engage additional senior faculty from the lead institutions in the working group on diversity. The expansion of the diversity committee, discussion on how to advance diversity goals in Year 2, and integration of diversity activities across research scientists and research activities, will be a priority activity at our annual All Hands Meeting that is being held in November 2009.

8. Schedule a meeting of the advisory committee. [Provide date and agenda for advisory committee meeting as well as the date for EPSCoR statewide meeting to be held in 2009.]

The External Advisory Committee is scheduled for Monday evening thru Wednesday morning, January 11-13, 2010.

The agenda includes:

January 11, 2010 – arrivals, tour of State Office, dinner and introductions to key EPSCoR staff and project participants, State Committee members, and university officials.

January 12, 2010 – full day of reports and review activities by component and topic:

- Research infrastructure improvements – equipment, laboratories, modeling, Innovation Working Groups, Seed Grant program, etc.
- Cyberinfrastructure improvements – web portal, interoperability, supercomputer based modeling, integration and synthesis, metadata, etc.
- Human infrastructure – UROP, Faculty Leadership Program, Graduate training, diversity, outreach (museum exhibit, statewide seminar series, science cafes, etc.)
- Progress in meeting project milestones, challenges and opportunities
- Next steps

January 13, 2010 – writing and final discussion and report-back, departures

The EPSCoR statewide All Hands Meeting is scheduled for Monday November 23, 2010.

9. Prepare and implement a coherent, evaluation and assessment plan that utilizes qualitative and quantitative approaches to provide both formative feedback and summative assessment. Evaluation results should be used systematically to guide program improvement. [Response to consist of revised evaluation plan.]

The evaluation and assessment plan has been updated to reflect comments from the RSV and changes that have occurred during Year 1 (see Appendix A). The evaluation is multi-tiered and includes linking appropriate assessment methods and personnel to specific objectives. Project staff are responsible for the day to day assessment of implementation of the strategic plan and using the project database to track deliverables. The external evaluator is responsible for providing formative assessment of project activities through observations, meeting attendance and participant feedback surveys. The external evaluator is also responsible for ensuring the project database is collecting the kinds of data needed for assessing intermediate and long term outcomes of project activities. The external advisory committee provides oversight and evaluation of progress on project objectives, through the lens of external experts who have struggled with the same or similar goals, but who are not constrained by the day to day

hindrance of project researchers and managers. The AAAS provides the project with an evaluation perspective based on nationally known experts in the project content areas. Finally, NSF provides review through its reverse site visits and feedback from the program officer.

The following summarizes the metrics to be tracked and reported annually.

- People: Participant demographics of faculty, postdocs, undergrads, K-12, collaborators, institutions; diversity of all the above
- Material Infrastructure: Equipment purchased & installed, models developed and cyberinfrastructure acquired (number, type, use, results);
- Knowledge generation: presentations, publications, proposals and awards, products and patents
- Discovery Learning: data collected, observations and research (number, type, kind, availability)
- Knowledge generation: presentations, publications, proposals and awards, products and patents
- Outreach/Public Dissemination: Scientific literacy and outreach efforts, curriculum development, public outreach, public presentations, policy and policy makers impacted

The evaluation uses both qualitative and quantitative approaches to provide feedback for program improvement. Project participant feedback on events is provided back to the project within 2 weeks of the event. Computer software for collecting, organizing, managing and reporting are used to provide the project with assessment and evaluation data, these include an assessment and evaluation reporting database, online survey software and activities logic model database.

10. Develop a plan to sustain the meteorological stations at the end of EPSCoR funding. Sustainability of SNOTEL and SCAN network stations seems to be well addressed in the proposal by planning for their incorporation into other programs.

In Year 1 of the award, 3 weather stations have been purchased and 2 have been installed in the Rio Grande South Valley area of Albuquerque. We are presently conducting farm visits to locate and install the third station, which we hope to have in place by mid-November. Second year funding will allow us to purchase 17 more weather stations. Five (of the 17 will be located on the Navajo Nation in Northwestern New Mexico. We will work with the Navajo Nation Department of Water Resources and the Navajo Agricultural Products Industry (NAPI) to establish the location of these stations. The remaining 12 stations will be strategically placed in gaps that exist in our present weather station network. All weather stations will remain property of the NMSU Climate Center. Telemetry for the stations in the Rio Grande South Valley will run through the Middle Rio Grande Conservancy District (MRGCD) hydrology weather station network. MRGCD has several weather stations and we were allowed to tap into their radio system. Data will be collected from an FTP site and uploaded on the NMSU Climate Center website. Telemetry for the 17 new stations will be through the NRCS NWCC meteor burst system. We will establish an MOU with NRCS to transmit the meteorological data from our stations through their system. Using the NRCS NWCC

system is more efficient and cost-effective. The NMSU Climate Center receives sustained support from annual state appropriations.

During Year 2 we will winterize and upgrade 10 US Forest Service Remote Automated Weather Station (RAWS) sites located at high elevations in the EPSCoR northern NM study area. These sites are on US Forest Service land. Like the USDA/NRCS SNOTEL and SCAN sites, the USDA/Forest Service will take ownership and responsibility for the RAWS sites. The sites will become part of their meteorological data collection network.

[11. Also provide a plan for collaboration between the water quality researchers at New Mexico Highlands University and New Mexico Tech, specifically addressing data compatibility and calibration issues.]

The Year 2 plan for water quality research has improved collaboration among New Mexico Tech and New Mexico Highlands researchers by addressing the following: 1) adding a breakout session to the All Hands Meeting in November dedicated to this group of researchers, 2) increasing the frequency of phone and VTC communication with routinely scheduled (4 to 6 week) tele- or video-conferences, and 3) implementing a water quality wiki site housed and managed by NMT with subscription by every water quality research team member. In addition, a new cohort of water quality research graduate students, all at the Masters level, is being coordinated and formed. They will meet at the November All Hands Meeting, will participate in quarterly VTC meetings, and will meet face-to-face semiannually (e.g., before and after summer field season).

Data collected by instrumentation installed in the field are calibrated on a routine maintenance schedule with the laboratory instruments housed at NMHU (Martinez aquatic chemistry lab) and New Mexico Tech (Pullin environmental chemistry lab). Data from both field and lab instrumentation are statistically compared to determine whether field instruments are functioning properly and within an acceptable error range. Cross-validation of field and lab instrument calibration is done before and during field season by delivering samples collected and analyzed at NMHU to the NMT laboratory, and vice versa.

APPENDIX A. NM EPSCoR Evaluation and Assessment Plan

Evaluation Plan for New Mexico EPSCoR RIII: 2008-2013
(Revised October, 2009)

The overarching goal for NM EPSCoR RII3 is:

> "Provide the critical infrastructure, computational support, and educational and outreach opportunities to foster excellence in climate change research and collaboration".

The strategic plan identified 14 overarching objectives organized under three broad areas. These are:

I. Research Infrastructure

- Enhance climate and hydrology research infrastructure
- Improve water quality monitoring in high altitude streams
- Develop interdisciplinary acequia research capacity
- Critical gap infrastructure for New Mexico Highlands University
- Innovation working groups
- Critical infrastructure gap seed awards

II. Cyberinfrastructure

- Data acquisition, processing, and storage models
- High performance computing
- Interoperability
- Collaboration technologies
- NM climate change web portal

III. Human Infrastructure:

A. Education Plan

- Teacher professional development institute
- Undergraduate Research Opportunities program
- Graduate research training opportunities
- Faculty leadership fellowship program
- NSF Days

B. Outreach and Communication Plan

- Climate change exhibit
- Climate change seminar Series
- Climate change science cafes
- Town Hall meeting

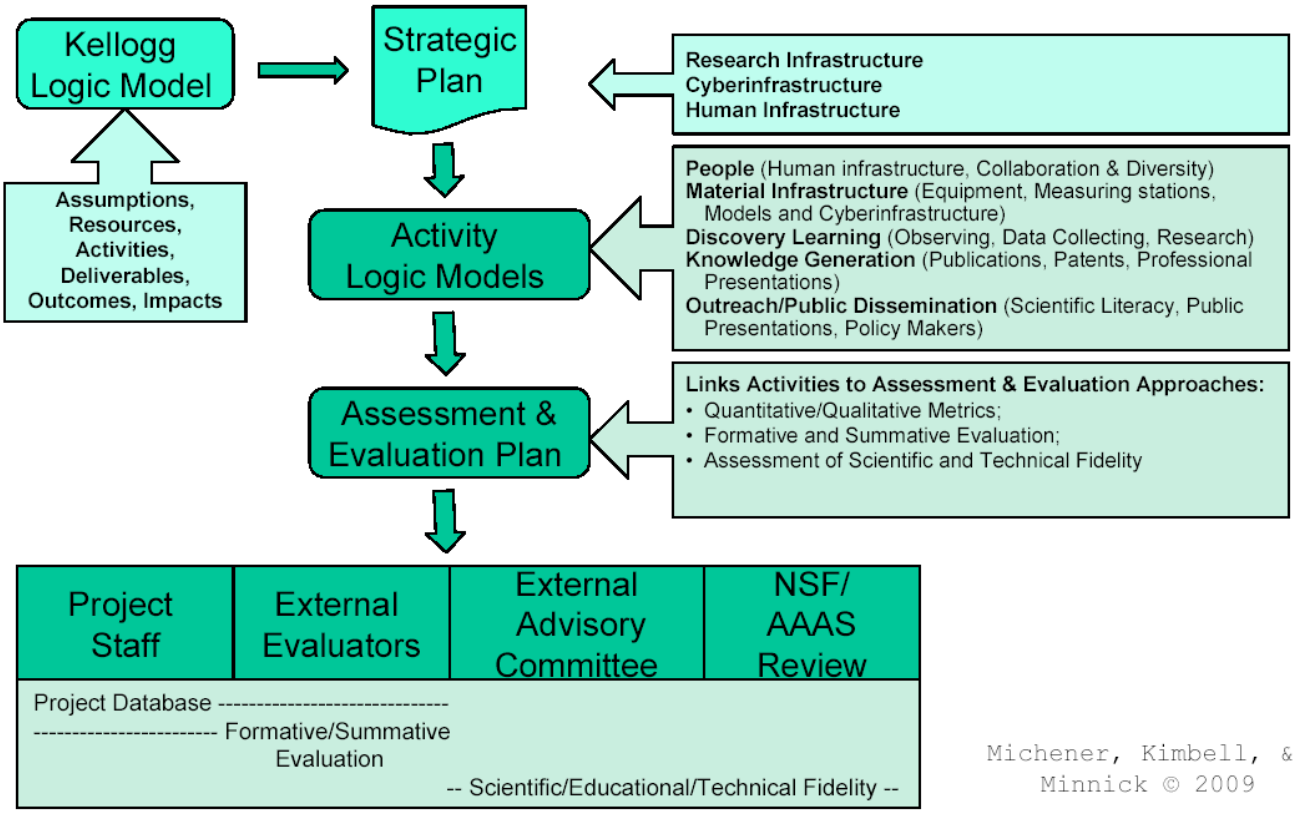
C. Diversify the Human Infrastructure

- Place-based, locally relevant science education
- Strategic student recruitment (BS, MS, PhD)
- Diversity approach embedded throughout
- Programmatic collaboration and networking

Figure 1 presents the overview of the evaluation which is multi-tiered and includes linking appropriate assessment methods and personnel to specific objectives. Project staff are responsible for the day to day assessment of implementation of the strategic plan and using the project database to track deliverables. The external evaluator is responsible for providing formative assessment of project activities through observations, meeting attendance and participant feedback surveys. The external evaluator is also responsible for ensuring the project database is collecting the kinds of data needed for assessing intermediate and long term outcomes of project activities. The external advisory committee provides oversight and evaluation of progress on project objectives, through the lens of external experts who have struggled with the same or similar goals, but who are not constrained by the day to day hindrance of project researchers and managers. The AAAS provides the project with an evaluation perspective based on nationally known experts in the project content areas. Finally, NSF provides review through its reverse site visits and feedback from the program officer.

Figure 1

Assessment and Evaluation Process



All members of the evaluation team need both quantitative and qualitative data to assess the progress of the EPSCoR climate change project objectives and to provide feedback for improving the project activities. The assessment and evaluation plan is designed to match the

type of data collected with the objective being evaluated to inform the RII3 whether the outcome is being reached. The formative evaluation will focus on project development and implementation, including the policies and procedures that enable or hinder the research faculty to conduct their research; the public outreach group being able to produce a kiosk for the public that is understandable and scientifically correct, and the cyber-infrastructure group working team being inclusive of all the affected parties in the state. The time spent on assessing the formative evaluation will result in fewer missteps, better adherence to timeline and a more successful implementation.

The external evaluator will collect and evaluate formative data to assist NM EPSCoR leadership in assuring quality of program management and effective project development and implementation. An effective formative evaluation is essential to identifying organizational and structural areas that may enable or inhibit progress towards project goals. Data such as meeting minutes, communications/ correspondence, project documentation, interviews/observations and participant feedback will help inform the formative evaluation.

The following questions are modeled after those presented in the NSF User-Friendly Handbook for Project Evaluation (1998:7) and will help form the inform the formative evaluation:

- Is the project component being implemented as planned?
- Are the appropriate staff/faculty/partners involved and working together towards the component goals(s)?
- Are there adequate resources/materials/equipment available?
- Are the appropriate participants selected and involved in the planned activities?
- Do the activities/strategies match those described in the plan/proposal? If not, are the changes in activities justified and described?
- Are activities being conducted according to the proposed timeline? By the appropriate personnel?

The external evaluator will attend a sampling of NM EPSCoR activities under all project initiatives, including research initiatives, cyperinfrastructure, diversity, education and outreach and communication. The focus of the observations will be on collecting evaluation data that will assist the management team in improving the implementation of the activities, documenting the outputs, and gaining a better understanding of the process involved in implementation of the proposed components.

The progress evaluation questions begin to assess whether the strategy is resulting in progress towards the stated goals and whether there are activities that are working better than others. It is critical during these formative assessments that the strategy leaders are kept informed of the evaluation results so that the RII3 strategies can be modified as needed. As timely communication of findings is critical a formal report is not the best method for sharing findings. Instead information will be conveyed to strategy leaders and project leaders through email and during project team meetings. A more formal rendition of the formative results and actions taken by strategy leaders will be provided to the EAC and other external review teams.

The progress evaluation will be based on agreed upon metrics with each of the strategy leaders, in consultation with the principal investigator. These will include collecting quantitative and qualitative data that measure the research production; research portfolio quality; human

resources development; research investments and materials; research collaboration and networking; research climate, culture and communications; and diversity. An example of some of the metrics are: number of publication; patents; number and nature of successful awards from NSF and other funding sources; number of large research centers awards, number of faculty/staff/students supported, success rate for research proposals, number and nature of collaborative research, amount of state funding for research, number of women and under-represented faculty and students involved in research. The outcome metrics will include the assessment of teacher inclusion of scientific research in their classroom, URO and RTG students becoming science majors and hopefully, graduates. Public outreach metrics will be more difficult to assess, although we can measure behavioral attitudes and changes in perception of museum goers, we will also include the tracking of requests to the EPSCoR office for research presentations from community groups and newspaper coverage of activities.

The following summarizes the metrics to be tracked and reported annually:

- People: Participant demographics of faculty, postdocs, undergrads, K-12, collaborators, institutions; diversity of all the above
- Material Infrastructure: Equipment purchased & installed, models developed and cyberinfrastructure acquired (number, type, use, results);
- Knowledge generation: presentations, publications, proposals and awards, products and patents
- Discovery Learning: data collected, observations and research (number, type, kind, availability)
- Knowledge generation: presentations, publications, proposals and awards, products and patents
- Outreach/Public Dissemination: Scientific literacy and outreach efforts, curriculum development, public outreach, public presentations, policy and policy makers impacted

The last level of evaluation will be summative or outcomes based. This takes place after a project component has been implemented and had the time to have its intended impact. The summative evaluation explores a component's strengths and weaknesses, effective parts, impacts on participants and institutions, and whether the component is cost effective and worth keeping. Individual components will transition to this evaluation step at different times during the five years of the initiative. Some components may not reach the point of being able to be assessed with a summative evaluation during the five years. However, because the summative evaluation builds upon the progress evaluation data being collected through out the project, we will be able to make some tentative judgments regarding the worth or value of all the components by the end of the five years.

Assessment and Evaluation Databases

The size of the project and the number of people, activities and objectives involved require the use of technology for tracking and assessing the results. There are three levels of software that will be used to conduct the evaluation: assessment and evaluation reporting database, online survey software and activities logic model database.

The assessment and evaluation reporting database is designed to collect the data from project participants on the people, material infrastructure, discovery learning, knowledge generation and outreach/public dissemination activities that have been accomplished. These data are to be entered by either the participant themselves or a designee who will enter the information every six months. This information is used for completing the NSF Annual Report and providing information on the project to the external advisory committee and AAAS. It is also used by project staff for tracking adherence to the strategic plan and early identification of problem areas. The external evaluator also used this database to conduct followup with project participants and report project outputs and outcomes as they relate to the various components. The data are collected by objective and is linked to project year, participant, component, and institution.

Online survey software is used to collect and store participant feedback on project activities. We are currently using SurveyMonkey, which allows export to statistical software, so that results can be summarized and imported into the assessment and evaluation reporting database to be linked with the reporting of project activities. Event satisfaction surveys will be collected from participants in the following programs: undergraduate research opportunities, teacher professional development, faculty leadership, innovation working groups, graduate research training opportunities and others as appropriate. Although some project participants will compete surveys off-line, these will be input into the online database for ease of tracking and analysis. The surveys will contain a common set of core item, plus question specific to the goals/objectives of the specific program. This will allow for cross-program comparisons.

The online survey software will also be used to conduct follow-up with workshop participants so that long term outcomes can be tracked. Email addresses will be exported from the assessment and evaluation reporting database and a survey invitation sent electronically to the workshop or project participant. The results of followup surveys for tracking student outcomes will be able to be imported into the assessment and evaluation reporting database by individual so that these outcomes can be linked to component.

The third software tool is an activities logic model database which stores the strategic plan activities by component . This data is currently stored in FileMaker Pro and allows for the electronic generation of activities. Outputs and outcomes by component, as outlined in the strategic plan. This database will evolve as plans change, however, the outcomes should remain the same. This database can be linked to the assessment and evaluation reporting database to identify gaps between the strategic plan activities and those reported in the assessment and evaluation reporting database.

The external evaluator will be assisted by a graduate student who will provide data collection support as well as by the NM EPSCoR IT support person who will assist in the reporting database used for tracking proposals, publications, awards, patents, people, participants, education and outreach activities, and other types of outputs generated by the EPSCoR participants. The database will provide the contact information for tracking undergraduate and graduate students involved in the RII research efforts for conducting longitudinal evaluation of impact.

Table 1 provides a summary of the implementation evaluation questions, sources of information, data collection methods and reporting process and timeframe. This process will apply to each component detailed on page 1 and include each of the specific research infrastructure

improvement programs; cyperinfrastructure program components and human infrastructure. As previously stated, the focus of the formative evaluation process is to assess the effectiveness of the implementation of the various components and to inform the management team in a timely fashion of any problems in resources, inhibiting policies or other challenges to an effective implementation of the RII3 strategies. Evaluation methods will include conducting interviews, surveys, document reviews, observations, document reviews, and maintaining project data on activities and outputs.

Table 2 provides a summary of the output evaluation questions, data collection strategies, and evaluation metrics. The output evaluation questions are focused on capturing the numbers of people, things, activities, etc. that have been proposed by the various RII3 components. The next table on progress evaluation details the expected outcomes.

Table 3 provides a summary of the progress evaluation questions, data collection strategies, and evaluation metrics. The evaluation questions cover the major areas of Research Production, Research Portfolio Quality, Human Resource Development, Research Investments and Materials, Research Collaboration and Networking and Research Climate, Culture and Communication. The progress evaluation assess the outcomes that have resulted from the activities and outputs generated by RII3.

Table 4 provides a summary of the summative or outcomes evaluation questions, data collection strategies, and evaluation metrics. The questions and data collected in the progress evaluation are not repeated here, although these data will be included as part of the summative evaluation. What has been added are the additional evaluation questions related to judging the worth of a component. These questions are applicable across components and therefore are not repeated by area.

Table 1: Implementation Evaluation Questions and Data Collection Process

Evaluation Question	Data Sources	Data Collection Process	Frequency
1. Is the project component being implemented as planned?	Component leaders Selected researchers Project staff Progress reports Attendance at project activities	Interviews, document review	Continuous collection but rotating among components. Reviewed and reported every 6 months
2. Are the appropriate staff/faculty/partners involved and working together towards the component goals(s)?	Component leaders Selected researchers Project staff Progress reports	Interviews, document review	Continuous collection but rotating among components. Reviewed and reported every 6 months
3. Are there adequate resources/materials/equipment available?	Component leaders Selected researchers Project staff Progress reports	Interviews, document review	Continuous collection but rotating among components. Reviewed and reported every 6 months
4. Are the appropriate participants selected and involved in the planned activities?	Component leaders Selected researchers Project staff Progress reports	Interviews, document review	Continuous collection but rotating among components. Reviewed and reported every 6 months
5. Do the activities/strategies match those described in the plan/proposal? If not, are the changes in activities justified and described?	Component leaders Selected researchers Project staff Progress reports Attendance at project activities	Interviews, document review, observations	Continuous collection but rotating among components. Reviewed and reported every 6 months
6. Are activities being conducted according to the proposed timeline? By the appropriate personnel?	Component leaders Selected researchers Project staff Progress reports Attendance at project activities	Interviews, document review, observations	Continuous collection but rotating among components. Reviewed and reported every 6 months

Table 2: Outputs Evaluation Questions and Metrics

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	1. To what degree have the climate stations been upgraded/expanded in northern NM?	Bathke, Rango, Martinez, Pullin	Progress reports & document review	Bi-Annual	Type of expansion/upgrades to climate monitoring system
Research Infrastructure Programs	2. To what degree have technology developed for other environments been developed/deployed in the 3 study basins?	Dahm,Crossey ,Bowman,Pullin	Progress reports & document review	Bi-Annual	# of sensors deployed and type of innovation
	3. How many seed grants and dollars have been awarded to regional university/tribal college faculty?	Project staff	Progress reports& document review	Annual	# of grants, dollars awarded, # undergrads students involved
	4. How many PhD students are involved in University-National Lab Fellowship Program on multi-scale and multi-disciplinary model development?	Project staff	Progress reports & document review	Annual	# of students involved
	5. How many innovation working groups have been held involving how many scientists/educators on which topics?	Project staff	Project reports & document review	Annual	# of working groups, topics, # and type of people involved
Cyberinfrastructure	1. To what degree is the data generated from remote sites and other project sources being processed into a uniform data model within the project?	EDAC (Benedict),Researchers, project staff	Progress reports & document review	Continuous, annual	# of data sites being captured, # of different formats being integrated, # of scientists able to access central data system
	2. Degree of use of HPC computing by tRIBS modeling researchers?	Gatewsky, Ringler, Vivoni, tidwell, NMCAC	HPC logs, progress reports, document review	Annual	# of models generated, # of HPC cycles used
	3. Degree of development of interoperability open standards and client interfaces for accessing and interfacing with project data?	EDAC Researchers, project staff	Progress reports document review	Annual	# and type of standards developed and interfaces provided
	4. Degree of development of collaboration technologies; including web-based online meetings with screen sharing, video & audio, record & replay capability and project portal for knowledge sharing of documents, data	EDAC, project staff	Progress reports, document review, website	Annual	# and type of web-based meetings, # and type of threaded discussions, # and type of documents and data on portal, # of researchers &

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	and threaded discussions?				decision makers involved in different collaboration CI strategies
	5. To what degree has the climate change portal development been used to access project info, etc. and is it able to emulate the quick information access of other science portals?	EDAC	Progress reports, portal access statistics	Annual	# of individual ip addresses accessing site by month, type of material being accessed (news, project info, documents/publications, data and services.
Education	1. To what extent is the Summer Institute for Teachers involving teachers from target school districts and involving project scientists?	Project staff, RII3 component leaders	Progress reports, project database	Annual	# and makeup of school teams, # of school teams applying, geographical distribution and extent of team member participation, # and role of research scientists
	2. To what degree is the Undergraduate Research Opportunities Program (UROP) involving students from non-PhD institutions?	RII3 component leaders, project database	Progress reports, project database	Annual	# of undergrad students involved and their institutions, # of applicants
	3. To what extent is the Climate Change Research training Group (RTG) promoting linkages, creating cadre of scientists and engaging MS and PhD students and faculty from all NM degree granting institutions and NM national labs?	RII3 component leader, project staff	Project database, Document review	Annual	# of courses developed, # and institution of scientists and students enrolled in seminars, # and type of
	4. To what degree is the Junior Faculty Leadership Training workshop involving faculty from across the state in communicating science to different audiences, diversity, assessment & evaluation, cyberinfrastructure and improving productivity?	RII3 component leaders, project staff	Project database, agendas, document review	Annual	# and institution of faculty attending, # and time spent on stated subjects
	5. Is NSF Days involving faculty from all NM universities/ colleges?	Project staff	Project database	Year 2	# and institution of attendees

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
Outreach and Communication	1. To what degree is the NMMNHS Science on a Sphere being visited and receiving publicity?	NMMNHS, news media	Project database	Annual	# of museum visitors, news articles/stories
	2. To what degree is the urban public attending climate change seminar series and receiving publicity?	Project staff, news media	Project database	Annual	# of attendees, new articles/stories
	3. To what degree are the Science Cafe reaching rural New Mexican and receiving publicity?	Project staff, news media	Project database	Annual	# of attendees, news articles/stories
	4. To what degree does the Town Hall meeting engage New Mexicans in public policy discussions about climate change and decreased water supply?	Project staff	Project database	Year 4 & 5	# of attendees, publicity before & after, # and type of pubic policy efforts resulting
	5. To what extent is the public using the Climate Change Web Portal?	EDAC	Web site statistics, online survey	Annual	# of web site hits, web survey on location of visitor
Diversity	1. To what extent are under-represented faculty and graduate students involved in RII3 research efforts 1-5?	RII3 component leaders, project staff	Project database, document review	Annual	# and racial/ethnic background of participants and their roles in research efforts
	2. To what extent are under-represented faculty/staff involved in cyberinfrastructure development objectives 1-5 and content on web portal?	RII3 component leaders, progress reports	Project database, document review	Annual	# and racial/ethnic background of CI participants and inclusion of content relevant to under-represented
	3. To what degree are under-represented students, faculty, teachers and schools serving underrepresented involved in RII3 education objectives 1-5?	RII3 education component leaders, progress reports	Project database, document review	Annual	# and racial/ethnic background of participants and their roles in education efforts
	4. To what extent are the public outreach activities involving children, youth and adults from under-represented groups in the communication and outreach objectives 1-5?	RII3 outreach component leaders, progress reports	Project database, document review	Annual	# and racial/ethnic background of outreach participants and inclusion of content relevant to under-represented

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	5. To what degree is the RII3 management team, AAAS, EAC, CUP, SEC members of under-represented groups and addressing issues of diversity?	Project management, agendas, progress reports	Project database, document review	Annual	# and racial/ethnic background of management committees and inclusion of issues of diversity

Table 3: Progress Evaluation Questions and Metrics

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
Research Infrastructure Programs	1. Are researchers increasing their R&D capacity and competitiveness as compared to the US?	NSF BIIS, university grants and contracts	NSF/university contracts & grants	Annual	Increase in number, size and success rate of research proposals
	2. Are faculty maximizing the state R&D capacity through collaboration?	University Faculty	Web Survey and interviews	Years 1, 3 and 5	Increased collaboration between/among faculty at different universities/labs
	3. To what degree is the research investment from federal, state and private sources increasing?	NSF, state budgets, university contracts & grants	Internet data	Years 1, 3 and 5	Total research $ for STEM research
	4. Are researchers increasing their professional standing and recognition by peers?	Peer review journal citations	Review of citation index	Years 1, 3 & 5	Increased # of publications and citations in major journals
	5. To what extent are local and regional policymakers incorporating RII3 research findings and models in water management deliberations?	Water policy makers in state	Surveys & interviews	Years 1, 3 and 5	Increased knowledge and use of RII3 research findings
Cyberinfrastructure	1. To what extent is the cyberinfrastructure able to provide for the computing & storage needs of researchers?	Research faculty	Surveys & interview	Annual	Increased use of EDAC by researchers
	2. Degree to which collaboration technologies have led to increased research collaboration and enhanced research competitiveness?	Research faculty	Surveys & interviews	Annual	Increased collaboration and research funding via EDAC tools

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	3. To what extent is the climate change portal being accessed and referenced by local and regional water planers and other researchers?	Local & regional planners, links from other portals	Survey, interviews, web searches	Years 1, 3 & 5	Increased use and links to portal
Education	1. Is there evidence that the Summer Institute for Teachers has increased interest, knowledge and achievement in science in participating schools?	K-12 teachers and schools	Survey, interviews, achievement data	Years 2,3,4 & 5	Increase in teacher/student interest, content and achievement in science
	2. Are NM K-12 students closing the gap with students nationwide on a nationally administered test in science?	NCES	Internet	Annual	Overall increase in state NAEP science scores and
	3. To what degree are UROP students increasing their interest and knowledge of STEM research careers?	UROP students	Web survey, interviews	Years 2, 3, 4 & 5	Interest & knowledge of STEM careers
	4. To what extent has the Climate Change Graduate Seminar and Regional Climate Modeling courses impacted students?	CCGS & RCM students	Web survey	Years 2,3,4 &5	Increased interest in climate research field
	5. How has the Junior Faculty Leadership Training increased communication skills, knowledge & promotion of diversity and how to run a research lab?	JFLT faculty	Web survey & interviews	Annual	Increased knowledge, confidence and skills in training areas
Outreach and Communication	1. Are NM citizens increasing their literacy regard science and water issues?	Natural History Museum	Survey	Annual	Increase in science literacy of New Mexicans
	2. Are NM citizens increasing their monetary support of science research?	State legislature web site	S&T Budget allocations	Annual	Increase monetary support for science research
	3. Are NM citizens supportive of policy changes that enhance science research and private/public partnerships?	State legislature web site	Policy changes and memorials	Annual	Increased support for science research private/public
	4. To what extent are Science Cafe attendees increasing their understanding of climate change impacts?	Science Cafe attendees	Survey	Annual	Increased knowledge of climate change in NM

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	5. To what extent is the Science on a Sphere exhibit changing museum goers attitudes and knowledge of climate change?	Museum goers	Survey	Annual	Changing attitudes & knowledge of climate change and local impacts
Diversity	1. Are under-represented K-12 students closing the gap with white students on state administered test in science?	NMPED	NMPED	Annual	Decrease in science score gap between white, Hispanic and Native students
	2. Are under-represented K-12 students closing the gap with white students on nationally administered test in science?	NCES	Internet	Annual	Decrease in NAEP science score gap between white, Hispanic and Native students
	3. Are under-represented undergraduate and graduate students closing the gap in declaring their intention to major in science?	University institutional research offices		Annual	Increase in percentage of women and other underrepresented groups in undergraduate/graduate science majors
	4. Are under-represented faculty closing the gap in their percentage representation in science departments?	ADVANCE	ADVANCE	Annual	Increase in percentage of women and other underrepresented groups in science faculty

Table 4: Summative/Outcomes Evaluation Questions and Data Collection Process

Evaluation Question	Data Sources	Data Collection Process
1. Was the project component successful? What were its strengths and weaknesses?	Component leaders Selected researchers, Project staff Progress reports, Attendance at project activities	Interviews, document review
2. To what extent did the component meet its overall goals?	Component leaders, Selected researchers, Project staff Progress reports	Interviews, document review
3. What aspects of the component were most effective?	Component leaders, Selected researchers, Project staff Progress reports	Interviews, document review

4. Were the results worth the cost of the component?	Component leaders, Selected researchers, Project staff Progress reports	Interviews, document review
5. Did the component meet all its stated goals and objectives?	Progress evaluation (see Table 3)	Document review
6. What unanticipated outcomes resulted from the component activities?	Component leaders, Selected researchers, Project staff Progress reports	Interviews, document review