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Track-2

Collaborative Research: Cyberinfrastructure Development for the Western Consortium of Idaho, Nevada, and New Mexico

Year One External Evaluation Report
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Executive Summary

The goal of the *Collaborative Research: Cyberinfrastructure Development for the Western Consortium of Idaho, Nevada, and New Mexico* project is to promote knowledge transfer to scientists, educators, students, and citizens within and beyond the Consortium by enhancing state CI, and to enable the community science required to address regional to global scientific and societal challenges. To meet this goal, the Consortium adopted three high priority objectives:

- **Increase connectivity and bandwidth.** The Consortium will promote communication and collaboration by improving the connectivity infrastructure within the Consortium.
- **Enhance data and model interoperability.** The Consortium will promote discovery by supporting community-based climate change science through enhanced interoperability between models and other software components, improved access to and usability of Consortium data products through the adoption of standards-based data management and access models, and new data assimilation, analysis, and visualization capabilities.
- **Utilize CI to integrate research with education.** The Consortium will enhance learning by focusing particularly on graduate student and postdoctoral researcher development; extending cyber-enabled science education into middle and high schools and extracurricular programs; and improving outreach to business and industry.

Notable progress was made on each project component during Year 1:

- **Connectivity:** Major accomplishments include upgrading networks to key researchers and their labs (Idaho), upgrading I1 connectivity (Nevada) and installation of more than 20 gateways (New Mexico).
- **Interoperability:** Major accomplishments include defining target interoperability standards that will enable streamlined communication of scientific data and meta data between the three Consortium states; development of draft specification documents related to the model interoperability activities; development of the initial interoperable data portal platform upon which an initial data portal interface will be built and development of enhanced capabilities in the server and client platforms of the CUAHSI HIS system.
- **Cyberlearning:** Three strands of activities were well developed in Year 1 and will continue in subsequent years of the project. The first is supporting attendance by graduate students, post-doctoral researchers and faculty at CI trainings related to computation and climate change. The second activity is developing and disseminating educational materials for middle and high schools students, especially targeting rural schools and schools that reach large numbers of Hispanic and Native American students. The third activity is developing and supporting extracurricular activities to strengthen the STEM pipeline and increase involvement and learning related to CI.

The Consortium successfully engaged various outreach and communication mechanisms in Year 1, including the Annual Tri-State Consortium Meeting, the various Cyberlearning activities described above, and scholarly publications and presentations developed by participating faculty on topics related to the project focus. Collaborations facilitated through the Consortium have also supported successful Innovation Working Group projects and the development and submission of proposals to Federal agencies. Evaluation of these activities documents the participants' commitment to create new partnerships and strengthen existing collaborations.

The Consortium is committed to improving access to CI for underrepresented groups and geographically disadvantaged populations. Year 1 participation data suggest that there is opportunity for improvement in realizing this commitment. Mechanisms were created during Year 1 that will focus additional attention both on serving these populations and accurately tracking their participation.

The External Evaluator offers the following recommendations for consideration by members of the Management Team as they implement continuous improvement activities:

- There is growing national concern that the U.S. is becoming less STEM-competitive on the world stage. One of the objectives of all the RII grants is to increase enrollment in and graduation from high-quality, internationally competitive STEM degree programs. New solutions to this challenge will likely incorporate technology. Perhaps the Consortium's work in education and outreach could be extended to creating a distance-delivered "short course" for high school students (especially for students in isolated areas). This would be a way to actively engage students in exciting, cutting edge STEM science and technology.

- The administrative structure of this project provides an opportunity for experienced grant administrators to mentor faculty with little or no prior administrative experience who have taken on leadership positions within the project's parameters. Developing an intentional focus on the mentoring of individuals with relatively less administrative experience would likely add to the sustainability of this Consortium.

- The CI enhancements that this project supports provide the kind of technology needed to offer university science courses remotely to a worldwide audience in addition to the partner institutions. Perhaps dissemination beyond the region could occur.

- Considerable planning went into organizing the project into components with State and Consortium leads. The outreach group within Cyberlearning appears to be the most cohesive group with a vision for breaking down the walls of STEM enrollment inequities, and strategic plans for related actions. Broad-based participatory implementation is a way to nurture creativity and innovation as well as commitment to the responsibilities associated with membership.

Section 1. Introduction

In 2008, Idaho, Nevada, and New Mexico independently submitted NSF EPSCoR Track 1 Research Infrastructure Improvement (RII) proposals that shared a common theme and addressed a global challenge: climate change and its effects on water resources, ecosystems, and the environment. Following up on their Track 1 RII awards, the three states formed a Consortium to pursue cyberinfrastructure (CI) improvements that would leverage their resources to increase impact and effectiveness. The impetus for collaboration was recognition of the complexity and scale of the scientific challenge, coupled with deteriorating economic conditions in the three states and the ramifications of these conditions for science, education, and economic development. The National Science Foundation funded the resulting proposal (Award #0919123), *Collaborative Research: Cyberinfrastructure Development for the Western Consortium of Idaho, Nevada, and New Mexico*. The NSF RII Track-2 (RII-T2) grant awarded to the Consortium extends from September 15, 2009 to August 31, 2012 (estimated).

Project Goal and Objectives

The goal of the RII-T2 project is to promote knowledge transfer to scientists, educators, students, and citizens within and beyond the Consortium by enhancing state CI, and to enable the community science that is required to address regional to global scientific and societal challenges. To meet this goal, the Consortium adopted three high priority objectives:

- **Increase connectivity and bandwidth.** The Consortium will promote communication and collaboration by improving the connectivity infrastructure within the Consortium. Proposed and future Consortium efforts related to improving research competitiveness, STEM education, and economic development rely on this basic infrastructure.

- **Enhance data and model interoperability.** The Consortium will promote discovery by supporting community-based climate change science through enhanced interoperability between models and other software components, improved access to and usability of Consortium data products through the adoption of standards-based data management and access models, and new data assimilation, analysis, and visualization capabilities.

- **Utilize CI to integrate research with education.** The Consortium will enhance learning by focusing particularly on graduate student and postdoctoral researcher development; extending cyber-enabled science education into middle and high schools and extracurricular programs; and improving outreach to business and industry.

The intellectual merit of the project is summarized in the NSF Award Abstract: Climate change impacts are especially pronounced in the Western United States due to the tight coupling between climate and regional hydrology, and the associated ramifications for the water supply, disturbance regimes (e.g., fire, drought), regional economy, and the quality of life. The proposed CI developments will enable researchers to more effectively share standardized and interoperable data and models, and to more easily develop regionally coupled atmosphere-land surface-hydrology-socioeconomic models. Consortium institutions and states will be linked to more than 200 other Internet2 universities, government research laboratories, companies, and other research facilities throughout the world to

facilitate data-intensive research, collaboration, distributed experiments, grid-based data analysis, experimentation using high performance networking, and social networking. In addition, the proposed investments aim to support effective participation in national and international virtual organizations focused on global climate change, such as the National Ecological Observatory Network and the Consortium of Universities for the Advancement of Hydrologic Science, Inc.

The project's broader impacts, as described in the original proposal result from leveraging existing resources and infrastructure within the participating institutions, jurisdictions, and regions. The institutions that will benefit from increased connectivity include rural institutions and those that serve Hispanic and Native American students and faculty. Open access to the data and models developed within the Consortium and made available through the data archive and the model interoperability framework will ensure that scientific products can be broadly disseminated and readily used by scientists, engineers, and students throughout the world. Moreover, the project will make usable high-quality environmental data, information, and models available for STEM education and outreach. The Consortium's education programs target the development of new CI skills and climate modeling expertise for graduate students, postdoctoral associates, and faculty; the integration of cyberlearning and climate change science into middle and high school science education, especially targeting rural schools and schools that reach Hispanic and Native American students; and the promotion of CI awareness in business and industry.

Project Management Overview

The project management structure is designed to encourage interaction among the three states and among the three activity components that track project objectives. *State EPSCoR Committees* oversee each state's EPSCoR program and include members from community, government, private, and academic sectors from all regions of their respective states. State Committees are a catalyst for integrating academic research capacity with state S&T plans and priorities. *The Management Team* includes the three state Project Directors: Dr. Peter Goodwin (ID), Dr. Gayle Dana (NV), and Dr. William Michener (NM), Project Administrators, and Component Coordinators. *CI Component Teams* carry out the work of the project. An overall faculty lead is assigned to ensure goals and objectives are met for each component: Dr. Fred Harris (NV) for Connectivity/Bandwidth; Dr. Karl Benedict (NM) for Model/Data Interoperability; and Dr. Nancy Glenn (ID) for Cyberlearning. State faculty leads are also identified to oversee state-specific component activities.

Evaluation Purposes and Design

The purpose of the evaluation of this RII-T2 project is to gather and apply qualitative and quantitative data to:

- Provide information to the Management Team for refining and improving project implementation at both the state and Consortium levels;
- Measure progress of the project in meeting its goals, objectives, and annual metrics;
- Assess the impact of the project in developing strong inter-jurisdiction collaborations that address regionally relevant and nationally important climate change science and education; and
- Assess the project's impact on enhancing discovery, learning, and economic development through the use of CI.

The External Evaluator, Dr. Rose Shaw of Metrica, worked with the project management and component leads to design an evaluation plan capable of achieving these purposes. This collaborative development process included the identification of process and outcome metrics by the Management and Component Teams at the November 5, 2009 strategic planning meeting. The resulting plan (refer to Appendix A) draws extensively from the report *A Process-Oriented Approach to Engineering Cyberinfrastructure*,[1] which includes example success metrics for Cyberinfrastructure.

The external evaluation of the project also is grounded in the National Science Foundation's mission for Cyberinfrastructure (NSF 0728) to:

- Develop a human-centered CI that is driven by science and engineering research and education opportunities;
- Provide the science and engineering communities with access to world-class CI tools and services, including those focused on: high performance computing; data, data analysis and visualization; networked resources and virtual organizations; and learning and workforce development;
- Promote a CI that serves as an agent for broadening participation and strengthening the nation's workforce in all areas of science and engineering;
- Provide a sustainable CI that is secure, efficient, reliable, accessible, usable, and interoperable, and that evolves as an essential national infrastructure for conducting science and engineering research and education; and
- Create a stable but extensible CI environment that enables the research and education communities to contribute to the agency's statutory mission.

This report is organized into the following sections:

- *Section 2* reviews cross state communication and dissemination activities, including the Annual Tri-State Consortium Meeting and the research productivity of faculty members associated with this project.
- *Section 3* examines first year progress toward meeting the three project objectives related to connectivity and bandwidth, data and model interoperability, and cyberlearning.
- *Section 4* provides demographic information about the various populations served by the project.
- *Section 5* sets out the External Evaluator's recommendations related to project implementation and the ongoing evaluation process.

[1] *A Process-Oriented Approach to Engineering Cyberinfrastructure*, (February 2006). F. Berman, J. Bernard, C. Pancake, L. Wu, http://director.sdsc.edu/pubs/ENG

Section 2. Communication and Dissemination

This RII Track-2 project places a high priority on communication and dissemination. The project vision is to foster scientific literacy and improve educational and research capacity within the Consortium through three dissemination and communication activities:

(1) Establishing effective internal communications among the Consortium's partners to enable efficient sharing of data and information;
(2) Creating coordinated mechanisms to communicate project results, benefits, and processes to scientists, citizens, and stakeholders within the Consortium and other EPSCoR jurisdictions; and
(3) Developing cyberlearning tools for educational outreach.

2.1 The Annual Tri-State Consortium Meeting

A centerpiece for communication is the Annual Tri-state Consortium meeting. This meeting is an important regional enterprise for fostering collaboration through centralized communication and dissemination. Faculty, graduate students, and postdoctoral associates share ideas and present their work at the meeting.

Prior to the grant award, the three member states of the EPSCoR Tri-State Western Consortium held their first joint meeting, *Building Regional Collaborations*, in Boise, Idaho, on March 30 – April 1, 2009. The purpose of the first meeting was to build the foundation for future collaborations, with emphasis on identifying best practices for broadening participation and reviewing all components of the respective state EPSCoR programs. This meeting provides a baseline for tracking changes in participation and impact in subsequent meetings. http://www.nmepscor.org/node/79

The second annual Western Tri-State Consortium was held April 6-8, 2010 in Incline Village, Nevada. The meeting's theme was *Collaborative and Interdisciplinary Climate Change Science*. The primary goals of the meeting were to: (1) Advance understanding of climate change and its impact on the western U.S. by leveraging resources, data sharing, and data management in ID, NV, and NM and (2) Develop joint research, education, and outreach capacity in the broader region that will lead to development of a virtual center for regional climate change research, education, and outreach.

The first day of the conference focused on Cyberinfrastructure activities across the three states. On the second day, researchers from all three states discussed their work in climate change science, policy and diversity efforts. The meeting included a student poster session in which over 30 student posters were judged by representatives from all three states. **http://www.nmepscor.org/node/227**.

Appendix C contains the External Evaluator's full report on the 2010 Annual Tri-State Consortium Meeting. This report applies several different lenses to examine the impact of the 2010 meeting. First, as detailed in Section 3 of this report, the 2010 meeting drew more participants than the prior year's meeting. From 2009 to 2010 there was a 49% increase in faculty attendance, a 225% increase in postdoc attendance, and a 117% increase in graduate student attendance.

Second, participant satisfaction with the 2010 meeting was high, with 54% of the 64 respondents reporting the meeting met their expectations and 44% reporting the meeting exceeded their expectations. Only one respondent (4%) reported that the meeting failed to meet expectations. More than three quarters (80%) of the respondents rated the meeting better than average or among the best, compared to meetings they had attended this year or in the past. The strongest features of the meeting identified by respondents highlighted the importance of the Tri-State Consortium as a vehicle for providing increased accessibility and reducing the isolation of research, Cyberinfrastructure, education, outreach and workforce development. The agenda was well planned and included something-for-everyone. The web-based survey related to the meeting was completed by 64 (37%) of the 174 registered participants.

Third, the evaluation for both the first and second annual meetings asked participants to identify their reasons for attending from among fixed choices. Although the meeting objectives in 2009 and 2010 were not identical, it is interesting to compare the frequencies of responses. In 2009, the three most frequently selected reasons for attending the meeting were: Interests in fostering collaborations (79%), regional scientific challenges/solutions (50%) and professional enrichment (42%). In 2010, the three most frequently selected reasons for attending were: Interest in fostering collaborations (86%), professional enrichment (63%), and creative approaches to comparing output from regional climate, hydrologic and ecologic models (36%). In addition, there were several notable differences in percentages of responses that likely reflect the increased awareness and commitment to collaboration within the Idaho, Nevada and New Mexico Tri-State Consortium:

- The percentage of respondents attending the Tri-State meeting for opportunities to foster collaboration increased from 79% in 2009 to 86% in 2010.
- Significantly more 2010 than 2009 respondents attended the meeting for professional enrichment ($X^2 = 3.09$, $p < .0789$).
- In 2009 none of the 24 respondents attended the meeting to "share in graduate student advisory roles across jurisdictions" whereas in 2010, six of the 64 respondents indicated this was one of the reasons they attended the meeting.

The 2011 meeting will be April 6-9 in New Mexico. The Project Management team will use formative evaluation feedback related to the 2010 meeting in the planning of the 2011 meeting.

2.2 Research Productivity

One measure of the project's broader impact and its contribution to strengthening the research infrastructure is the research productivity of the faculty associated with the project. As defined in the NSF RII-T1 reporting guidelines 022309, publications are journal articles, text books, monographs, chapters in books, conference proceedings, technical reports, abstracts or other formal written documents, both print and electronic. Publication metrics for assessing research productivity are displayed by state in Tables 1A, 1B, and 1C for baseline.

In determining which publications were pertinent to the scope of this project, the External Evaluator considered the goals of the project to broaden impact and strengthen research infrastructure and included those directly or indirectly (e.g., ecological change, historical distributions of mammals, hydrology, etc.) related to climate change . These publications do not include education-related publications. Publication citation information is provided in Appendix D. This information can be used by interested individuals to disaggregate the publications for specific purposes.

For ease of categorization, calendar years are used as the reporting period for research productivity. Calendar year 2009 is baseline. The publications to date in 2010 are listed in Appendix D. Because the 2010 calendar year has not ended at the writing of this report, 2010 will be included in the Year 2 Evaluation Report.

2.2.1 Idaho

Table 1A: Baseline 1 Idaho Performance Measures for RII-T1 and RII-T2 Climate Change Research Enabled By Track-2 CI Resources

IDAHO Description of Faculty	N	# of peer-reviewed journal publications	# of peer-reviewed conference proceedings	# of other publications	Total # of publications (current normalized # of publications)
			BASELINE (Calendar Year 2009)		
Both T1 and T2	1	2	5		7 (7 per faculty member)
T2 but not T1	1	9			9 (9 per faculty member)
Only T1	15	23			23 (1.5 per faculty member)

Both T1 and T2: For Idaho, one faculty member, Dan Ames, was supported by both Track 1 and Track 2 funding.

T2 but not T1: One faculty member, James McNamara, was a participant of the RII-T2 project, but not the RII-T1 project.

Only T1: The 15 Track 1 (but not Track 2) faculty members at baseline (calendar year 2009) were Colden Baxter, Brian Kennedy, Matt Germino, Scott Lowe, Jen Pierce, Venkat Shridhar, Elowyn Yager, Jeff Hicke, Alistair Smith, Ben Crosby, Kevin Feris, Levan Elbakidze, Robert Heinse, Alexander Fremier and Alejandro Flores.

2.2.2 New Mexico

Table 1B: Baseline New Mexico Performance Measures for RII-T1 and RII-T2 Climate Change Research Enabled by Track-2 CI Resources

NEW MEXICO Description of Faculty	N	# of peer-reviewed journal publications	# of peer-reviewed conference proceedings	# of other publications	Total # of publications (current normalized # of publications)
			BASELINE (Calendar Year 2009)		
Both T1 and T2	3	4			4 (1.3 per faculty member)
T2 but not T1	1	1	2		3 (3 per faculty member)
Only T1	3	8	12		20 (6.7 per faculty member)

Both T1 and T2: William Michener, Karl Benedict and Joe Galewsky were supported by both the Track 1 and Track 2 RII awards.

T2 but not T1: Julie Coonrod was the New Mexico climate change researcher supported by the Track 2 award, but not the Track 1 award.

Only T1: The Track 1 researchers were David Gutzler, Albert Rango and Caiti Steele.

2.2.3 Nevada

Table 1C: Baseline Nevada Performance Measures for RII-T1 and RII-T2
Climate Change Research Enabled by Track-2 CI Resources

NEVADA Description of Faculty	N	# of peer-reviewed journal publications	# of peer-reviewed conference proceedings	# of other publications	Total # of publications (current normalized # of publications)
	BASELINE (Calendar Year 2009)				
Both T1 and T2	3	1	21		22 (7.3 per faculty member)
Only T1	12	35	12	5	52 (4.3 per faculty member)

Both T1 and T2: Three Nevada faculty members were supported by Track 1 and Track 2 funding during the first project year: Sergui Dascalus, Fred Harris and Darko Koracin.

T2 but not T1: No Nevada climate change researchers were supported by Track 2 but not Track 1.

Only T1: The 12 Track 1 climate change researchers at baseline were Jay Arnone, Scott Bassett, Zhongbo Yu, Franco Biondi, Brett Riddle, Dale Devitt, Laurel Saito, Michael Young, Derek Kauneckis, William Smith Jr., Asako Stone and Shahram Latifi. During the first project year (2009-10) Michael Young and Asako Stone changed positions.

Section 3. Meeting Project Objectives

3.1 Connectivity Component

The connectivity objective promotes communication and collaboration by improving the connectivity infrastructure within the Consortium upon which efforts to improve research competitiveness, STEM education, and economic development all rely. Cyberinfrastructure connectivity needs are unique to each of the participating states. The Year 1 plans for connectivity called for

- Idaho to upgrade CI to deliver improved network connections to key university researchers' labs and desktops. Also, to connect difficult-to-access sites within the state by adding to, enhancing and using the Idaho Regional Optical Network (IRON).
- Nevada to increase connectivity into the state network and within the state through networking and video conferencing upgrades as well as networking monitoring tools.
- New Mexico to establish a distributed computing and collaboration infrastructure of computer nodes at portals or gateways at Tribal Colleges and Hispanic-Serving Institutions.

In general, the states have made solid progress is carrying out the work proposed in the R2II application. In the following state-specific sections, anticipated outputs for Year 1 are listed in bold print, followed by a description of accomplishments, obstacles and lessons learned related to that output.

3.1.1 Idaho

Formalized plan for the University of Idaho to utilize IRON to access university facilities in southern Idaho.

- **Accomplishments:** In addition to formalized plans to access Kimberly and Hagerman as described in an RFP to implement the Track 2 improvements, UI has migrated its academic centers in Boise and Idaho Falls to the IRON network over the past year.
- **Obstacles:** Despite some changes in personnel within the networking entities in Idaho, only minor delays were encountered in releasing and completing the RFP process.
- **Lessons Learned:** Access to larger amounts of bandwidth has proven to be very valuable for off-campus sites. The sites are using exponentially more bandwidth than they did before the move to IRON. UI is receiving positive feedback on the reduced amount of time needed to move large data sets, retrieve information, etc.

Upgraded networking equipment installed at the state universities for LAN upgrades and building uplinks that provide 1 to 10 Gb/s service to several key research buildings.

- **Accomplishments:** ISU activated a total of 96 ports at 1Gbps for workstations in Physical Sciences Bldg (Geo-Science) (including a computer lab). It provided 20 new 1Gbps ports in the Physical Sciences server room. ISU has installed the network backbone improvements (Gig Blades) into two WSC6509 core network switches in order to provide 1Gbps uplinks to four buildings. Fiber optic work increased the backbone connectivity from the core at 100Mbps to 1Gbps into those buildings (the blades installed in the core allowed additional buildings to be connected as funding becomes available). 1Gbps links were established between the (2) WS-C6509 core network switches to improve transport speeds between upper and lower campus. The Geosciences offices and labs (Physical Sciences Building) were upgraded with new 1Gbps access switch ports to increase connectivity from 10Mbps to 1Gbps for desktops and servers. All four buildings required fiber optic work to complete the connections. ISU has, under the scope of this project, upgraded select access ports from 10Mbps to 100Mbps as identified by Geosciences. The new network capabilities will be leveraged in the ISU GIS Training and Research Center to improve scientific collaboration and the exchange of large geospatial datasets with rangeland scientists at other Universities and institutions. The increased speed availed by this network improvement will greatly improve data sharing and the real-time exchange of ideas and information especially as increasing amounts of data are transitioning to cloud services.

- **Obstacles:** Limited human resources at ISU to complete the upgrades in a timely manner. Network compatibility issues for College of Engineering connection to IRON through Central IT network at BSU.
- **Lessons Learned:** No matter how much bandwidth is provided the workstation and intra-campus backbone, adequate WAN connectivity between sites and/or to Internet/Internet2 can still be a limiting factor. For the BSU College of Engineering (COE) connections to the I2 and National Lambda Rail are currently limited to 400 Mbps on one connection and to 250 Mbps from IRON to University of Utah, which provides the gateway to I2 and NLR. COE is

currently working with central IT to explore options for upgrading the network at COEN. Also, ISU does not have tools to track and capture (trend) utilization statistics due to financial restraints.

Upgraded aggregation switch (Point of Presence) on IRON and traffic aggregated onto IRON's backbone in Twin Falls to include sites in Hagerman and Kimberly, ID.

- **Accomplishments:** UI facilitated an agreement between IRON and Syringa to provide "virtual POP" locations in Southern Idaho. An RFP was issued to select a vendor or vendors to provide local loop transport connecting Kimberly and Hagerman to IRON/Syringa. The selected solutions will be affordable and sustainable.
- **Obstacles:** During initial discussions it was determined by IRON that a physical POP in Twin Falls was not going to be financially feasible; this led to the "virtual POP" agreement mentioned above.
- **Lessons Learned:** UI is about to reopen discussions with IRON regarding a physical POP in Twin Falls. IRON is open to the idea; there is an opportunity that EPSCoR funding may perhaps be able to provide enough funding to make the physical POP idea become a reality.

Data Sources: Rick Schumacher (ID EPSCoR Project Administrator), Dave Lien (UI Networks and Systems Manager), Maureen Moore (BSU Director of Information Technology Services) and Mark Norviel (ISU Manager, Networking and Telecommunications).

The Idaho EPSCoR additionally reported connectivity measures in a detailed report that is attached to this document as Appendix E. Idaho also provided IRON L3 Service Usage at BSU for May-August 2010.

3.1.2 Nevada

Upgraded network connectivity from NevadaNet in the north to CENIC in Sacramento as well as NevadaNet connectivity to Elko and other parts of the state.

- **Accomplishments:** Upgraded the I1 connectivity in the south from 2 Gbps to 10 Gbps. In the north, the shared I1 and I2 connectivity is out for bid and when awarded will change the connectivity from 1 Gbps to 10 Glsp. The Upgrade to the Reno-Elko link has occurred. The upgrade for the Reno-CENIC link should occur in Year 2.
- **Obstacles:** The CENIC upgrade (north) had to be tied to the annual contract renewal, and was delayed as a result.

Upgraded networking monitoring and security software and hardware; upgraded video conferencing hardware in the north and south.

- **Accomplishments:** Purchases have been completed.
- **Obstacles**: State budget cuts drove reductions in positions at Nevada Net that resulted in delays in projects that were not of the highest priority.

Data Sources: Fred Harris

3.1.3 New Mexico

The New Mexico Computing Applications Center (NMCAC) contributed $1M in connectivity upgrades during the reporting year, fulfilling the state's cost share requirement.

Upgraded gateways at the three large research campuses connected to six Hispanic-serving and Native American-serving campuses in New Mexico.

- **Accomplishments:** Gateways have been installed and are functioning at 20 sites throughout New Mexico. The equipment is the same for all 20 sites. The Gateways are being used for collaboration, research and evaluation activities, including
    - The support of statewide collaboration between colleges and universities through high-definition video conferencing for meetings and distance education.
    - High-definition 3D stereo visualization as a decision theater in which complex problems are modeled in advance of real-time changes to understand possible options in addressing an issue.
    - Scientific rendering/display, analysis of output for numerous scientific services.
    - Computational services for the residents of the Espanola area.
    - The Upper Hondo Water Availability and Decision Support Model for Lincoln County.
    - Broadcast of multiple online courses.
    - Dual credit high school programs to seven Hobbs area high schools.
- **Obstacles:** None

Upgraded software for integrating all components of the gateway systems into a single, user-friendly system along with compression software to minimize the amount of bandwidth needed for connectivity between the sites.

- **Accomplishments:** IG Meeting, the software used for teleconferences, was included in the Gateway package. No additional software has been or will be provided to the Gateway sites.
- **Obstacles:** Meetings can be recorded with the IG Software but, unfortunately, can only be viewed using the IG Meeting software.

Data Sources: Bill Michener and the New Mexico Computing Applications Center (NMCAC)

3.2 Model/Data Interoperability Component

The Interoperability Year 1 Task Plan identified eight primary tasks:

Model and Data Interoperability Framework

1) Evaluate and select surface/hydrologic models to couple with WRF.
2) Evaluate and select CCA and OpenMI for coupling WRF to surface/hydrology models.
3) Analyze and design interface between WRF and surface/ hydrologic models.
4) INITIAL PROTOTYPE: design, develop and test generic interoperability framework prototype.

Interoperable Data Archive

5) Define data/metadata format standards for data products to be archived.
6) INITIAL PROTOTYPE: Implement CRUD services for management of archive objects in mirrored systems.
7) INITIAL PROTOTYPE: Develop required database/file systems; configure for replication across ID, NV, and NM.
8) Develop and implement interoperability tools supporting data analysis/visualization (HIS, WaterML, OpenMI).

According to information provided by Karl Benedict, the Model-Data Interoperability Project Lead and New Mexico Lead, all of these tasks were completed by the end of the first project year.

Based on feedback from the External Advisory Committee, in June 2010, the Interoperability Team updated the metrics to be used to measure the Model/Data Interoperability objective. These revised metrics are shown in Table 2 below. Tables 2A and 2B display data for those metrics applicable to the interoperability activities of individual states during Year 1.

Table 2 – Model/Data Interoperability Metrics

Build an interoperability data archive	**# of data and metadata representations (formats) in the data/metadata format document**
	# of uploaded datasets for which metadata quality meets or exceeds documented expectations.
	# of CRUD API methods/functions in the CRUD API specification
	# of table elements in the data base schema document
	# of data services deployed for geospatial data
	# of data services deployed for observational data
	# of web services posted for data
	# of geospatial data sets made available through web services
	# of time series sites made available through web services
	# of downloads of geospatial data
	Quantity of downloads of geospatial data
	# of downloads of observational data series

	Quantity of downloads of observational data series
	# of registered users of the web services
	# of unique IP addresses that utilize data services
Develop model and data interoperability framework	**HydroDesktop/HIS[2]:** # of software requirements in the tool's Software Requirement Specification (SRS) document
	# of Software requirements met
	# of functions/methods in the tool's API
	HydroDesktop/HIS: # of participants involved in related software development activities (project personnel and members of the open source community)
	# of models or model tools available for execution through the software framework
	# of downloads and/or executions of the software model interconnection framework
	# of registered users of the software model interoperability framework
	# of unique IP address hits on the software model interoperability framework web site
	# of model interconnection scenarios available through the software framework

3.2.1 Idaho

Idaho interoperability activities focused on the following areas: development of Hydrologic Information Systems (HIS), particularly software development; development of HydroDesktop workshops and trainings related to HIS and HydroDesktop, and building human capacity related to this project activity. The specific interoperability metrics applicable to Idaho's work are displayed in Table 2A.

Table 2A: Idaho -Metrics for Interoperability

Activity	Metric	2009-10 Data
Develop model and data interoperability framework	**HydroDesktop/HIS:** # of software requirements in the tool's Software Requirement Specification (SRS) document	113
	HydroDesktop/HIS: # of participants involved in related software development activities (project personnel and members of the open source community)	34

Data Source: Dan Ames

3.2.2 New Mexico

Interoperability activities New Mexico focused on the Interoperable Data Archive. UNM's Earth Data Analysis Center made significant progress in the development of a shared (with New Mexico's Resource Geographic Information System) data infrastructure of the management, discovery and delivery of the science data generated by the EPSCOR projects. New Mexico also made climate model enhancements Table 2B displays data for the Interoperability metrics applicable to New Mexico's work.

[2] Accompanying details can be found at http://hydrodesktop.org.

Table 2B: New Mexico -Metrics for Interoperability

Activity	Metric	2009-10 Data
Build an interoperability data archive	# of data and metadata representations in the data/metadata format document	2 in specification – ISO, FGDC. Defined formats currently in team meeting notes
	# of uploaded datasets for which metadata quality meets or exceeds documented expectations.	0, Metadata/data upload workshop held with researchers on 8/11. Two experimental datasets uploaded and test metadata creation performed
	# of CRUD API methods/functions in the CRUD API specification	6 Read methods currently documented in REST API for NM portal: search, data download, meta-data download, mapper, OGC WMS, OGC WFS
	# of table elements in the data base schema document	25, including 7 core tables, 2 for content management system, and the balance as lookup tables
	# of data services deployed for geospatial data	2 OGC service types are published through the automated services posted for geospatial data – WMS, WFS
	# of data services deployed for observational data	2 OGC service types are published through the automated services posted for geospatial data – WMS, WFS
	# of web services posted for data	6, including those described above for # of CRUD API methods element above.
	# of geospatial data sets made available through web services	0 project generated data sets, 81784 initial data sets available through portal from NM RGIS core content – this number will be reduced in Year 2 to reflect specific EPSCoR – relevant data sets.
	# of time series sites made available through web services	0
	# of downloads of geospatial data	0, as the portal is not yet exposed through the NM EPSCoR web portal
	Quantity of downloads of geospatial data	0
	# of downloads of observational data series	0
	Quantity of downloads of observational data series	0
	# of registered users of the web services	0
	# of unique IP addresses that utilize data services	0

Data Source: Karl Benedict

3.3 Cyberlearning Component

The Consortium's education programs are designed to have far-reaching impact by: (1) developing new CI skills and climate modeling expertise for graduate students, postdoctoral associates, and faculty; (2) integrating cyberlearning and climate change science into middle and high school science education, especially targeting rural schools and schools that reach Hispanic and Native American students; and (3) developing a Industry CI Days Program that promotes CI awareness in business and industry. This

section reviews the cyberlearning activities completed by each state in Year 1. Table 3 at the end of this section provides an overview of activities completed by the Consortium as a whole.

3.3.1 Training Opportunities

The following training opportunities for faculty, graduate students and postdoctoral associates were supported with project funds. Participants are detailed in Section 3 of this report.

Introduction to Hydrologic Information Systems Workshop (4/7/10), 2nd Annual Western Tri-State Consortium Meeting, Incline Village, NV, Dan Ames (Idaho), Workshop Facilitator. This workshop focused on using existing HIS servers and services, requirements for setting up a new HIS server, and how to use the HydroDesktop software to retrieve and interact with HIS server data.Participants who completed the evaluation of the workshop (N=13) rated the program quality as very good. The mean of the overall quality ratings (1 to 5, 5 excellent, 4 very good, 3 good, 2 fair and 1 poor) was 3.92 (Std. Dev. = 0.76). Appendix F contains the full report describing the participant evaluation of this workshop.

Interdisciplinary Modeling: Water-Related Issues and Changing Climate (7/12/10 – 7/30/10). Funding for this four-hour graduate credit course, *Interdisciplinary Modeling: Water Related Issues and Changing Climate*, was provided by EPSCoR in Idaho, Nevada and New Mexico. Dr. Laurel Saito, University of Nevada at Reno (UNR), was the course instructor of record; the coordinating instructors were Dr. Saito (UNR), Dr. Link (UI) and Dr. Fernald (NMSU). This course addressed: (1) the advantages and limitations of using models; (2) different spatial and temporal scales that specific disciplines are concerned with; (3) differences in degrees of uncertainty of data and models, (4) interdisciplinary modeling options; (5) communication between disciplines, where different terminology and perspectives can be a barrier to productive discussion of common issues or concerns; (6) education and training of scientists and modelers about applying interdisciplinary approaches; and (7) interaction with stakeholders and the public. The objective of this course was to engage students in interdisciplinary discourse in modeling by addressing each of these challenges. Appendix G contains the full evaluation report for this course. www.cabnr.unr.edu/saito/classes/nres730/nres730.htm

A total of five participants (two faculty members, one postdoc, one Master's graduate student and one Ph.D. graduate student) attended one or more other Cyberinfrastructure trainings. A faculty member, a graduate student and a postdoctoral associate participated in:

- Process-Based Analysis of Lidar Topographic Data Workshop (6/1/10 and 6/2/10) at the University Corporation for Atmospheric Research (UCAR) in Boulder, CO
- NCAR Weather Research and Forecasting Model Workshop (6/21/10 – 6/25/10). 11th Annual WRF Users' Event, http://www.mmm.ucar.edu/events/2010_wrfusers, Boulder, CO

A faculty member and a graduate student participated in

- CI Summer Institute for Geoscientists (8/9/10 – 8/13/10), SDSC, San Diego, CA. Two tracks were available: (1) Overview of the technologies utilized to develop earth science infrastructure and (2) Utilization of CI-based data systems and tools in geosciences education and outreach

Participants completed an evaluation of their training experience, and 100% reported that the training in which they participated met or exceeded their expectations for increasing their scientific capabilities and their CI literacy. Moreover, 100% of the participants reported that the training in which they

participated will enhance their ability to conduct research in their scientific field. Appendix H contains the full report on the evaluations completed by these training participants.

In addition, the RII-T1 awards received by each of the participating states funded several Consortium activities during Year 1. The New Mexico Faculty Leadership Program was held January 5-7, 2010 at the Santa Fe Institute, Santa Fe, NM. The program included sessions led by internationally recognized experts on project management, leadership, communication and related skills. All three Consortium states were represented by the four postdoctoral associates and seven faculty participants: Idaho (two participants), New Mexico (nine participants) and Nevada (four participants).

IWG (Innovation Working Group) funds support collaborative, trans-disciplinary work within the three Consortium states modeled after NSF's NCEAS (National Center for Ecological Analysis and Synthesis). Direct involvement in RII-funded projects is not a prerequisite for participation in the IWG program. A strategic final objective of the IWG[3] is submission of proposals that target NSF cross-cutting programs and/or the publication of synthesis papers in peer reviewed journals. IWG topics include climatology, hydrology and socioeconomic sciences as well as Cyberinfrastructure and other STEM-related research topics. Each year IWG funds support at least one group focused on education, diversity, communication and outreach. Activities supported by RII-T1 funds are evaluated within those projects.

3.3.2 Cyberlearning in Middle and High Schools

Idaho

Idaho developed cyberlearning materials to support teaching and learning about water resources in a changing climate at the McCall Outdoor Science School (MOSS) and in schools across the state. The main product of this effort is a website (http://mossi.tfhsbruins.com) that contains:

- Links to MOSS, EPSCoR, and the STEM pipeline website.
- Content information (e.g. climate predictions for Idaho; importance of water to Idaho's economic, ecological and social systems; definitions of variables of interest to water researchers).
- A user-friendly interface for uploading water data to HIS that will be shared with the Portneuf Watershed group.
- Data collection protocols.
- Profiles of scientists working on the EPSCoR project in Idaho.
- Lesson plan ideas for the classroom and for the field (with the ability for teachers to upload plans that they develop).

For formative evaluation of the materials developed by MOSS, the working outline of materials development was presented to a group of teachers at the MOSS summer teacher institute. The materials development team sought input from the teachers on web site content and functionality. When the website is rolled out and introduced to teachers (tentatively planned for winter 2011 during the next MOSS teacher institute) MOSS will send a follow up survey to see how teachers are using the website, if they are using it, and what changes they might like to see in the website and the materials.

[3] http://www.nevada.edu/epscor/solicitations/EPSCoR_IWG_TRISTATE%20Solicitation%20FINAL.pdf

Idaho's MOSS cyberlearning team participated in the MOSS Teacher Institute which engaged students in HIS database input, exposure to HydroDesktop and developing Google Earth Layers. The City of Pocatello and Portneuf Watershed Partnership also participated in the cyberlearning elements of the MOSS institute. Information for this section was provided by Nancy Glenn, RII-T2 and ID Cyberlearning Lead, and Dr. Bradley Eitel.

New Mexico

New Mexico Cyberlearning activities in Year 1 included the development and dissemination of educational materials for middle and high schools, *Super Computing Challenge*, *Growing Up Thinking Scientifically* (GUTS) training, and consideration of Industry CI Days,

Materials Development

- **Higher Education:** The graduate seminar at New Mexico Tech, CSE 585-How to be a Researcher, is being delivered for the first time during fall semester 2010. In addition to the integration of distance delivery into CSE 585, a new graduate special topics course, CSE 589-Data Management Advanced Topics, includes distance delivery.
- **Middle School/High School Development:** Three teachers in the *Masters of Science for Teachers* (MST) program at NM Tech participated in the development of materials during the first project year. Materials developed by teachers who have graduated from the MST program and given permission for material use will also be included. Materials developed are assessed and reviewed by Boards and Committees. A final review for alignment with state standards will be conducted by the RII-T2 Cyberlearning team at NM Tech.

Supercomputing Challenge and GUTS

The Supercomputing Challenge is a statewide program for middle and high school students and teachers. The Challenge provides opportunities beyond school for students to apply problem-based learning, laying the groundwork for young people who will be scientists addressing critical issues. Teams use powerful computers to analyze, model and solve real world problems. Project GUTS, founded in 2007, is a summer and after-school science, technology, engineering and math (STEM) program for middle school students in New Mexico. Project GUTS provides opportunities for students to engage in scientific inquiry by investigating topics of interest to their local communities. In Year 1, New Mexico met its goal of serving three new schools not previously involved with GUTS and the Super Computing Challenge in each program. The programs conducted outreach to tribal schools but did not directly serve tribal middle and high schools in Year 1.

Four Super Computing Challenge/GUTS trainings occurred in Year 1. Roundups were held in Albuquerque at UNM, in Española at Northern New Mexico College, in Las Cruces at Dona Ana Community College and in Las Vegas at NM Highlands University. Participants in each location communicated with their colleagues at the other sites through the NM Computer Applications Center Gateways. The two-way voice and video connections enabled students and teachers to see firsthand how these tools can assist with project development and presentations. Participants were especially fascinated by the 3D visualizations.

Las Cruces. This event served 13 middle and high school students and 17 teachers at Doña Ana Community College. The Roundup was hosted by Terri Hansen from NMSU's Scientifically

Connected Communities. On the last morning of the Roundup, State Climatologist David Dubois from NMSU spoke with the students about climate and drought in NM.

Albuquerque. This event served students from Albuquerque, Santa Fe, and UNM outreach. The program included instruction in StarLogo TNG and NetLogo and featured a connection with the NMSU gateway and their roundup. Eileen M. Everett, the Climate Change Educator for the New Mexico Museum of Natural History and Science in Albuquerque, served as guest speaker, appearing at the program via Skype.

Northern/Española. Northern New Mexico College held a four-week morning tutoring program for about 25 Hispanic students. During the last week of the program, students stayed for a Supercomputing Challenge/Project GUTS Roundup in the afternoon. Each session began with a lecture about some aspect of complex systems, which was then related to climate change, for example, fractals and system memory as relating to climate pattern formation and ecosystems and co-dependence. Bogdan State (a PhD student from Stanford) spoke about social networks in order to give students a broad base introduction to the major areas of study in complexity. After the lectures, students received instruction related to the creation of a new model (painted turtles, ice, ecosystem, Classic Logo, NetLogo Ice, and Mystery Model). Students also received instruction in StarLogo TNG and NetLogo. By the end of the week, students were demonstrating familiarity with some of the basic concepts of complex systems and how computer modeling is used to simulate them, with emphasis on computer iteration and stochasticity. IT infrastructure was a major issue at Northern. None of the computers had TNG or NetLogo installed and the bandwidth was too low to download effectively to each computer. Flash drives were circulated to facilitate the installation of StarLogo and NetLogo.

Las Vegas served students from both east and west Las Vegas. Students received instruction in StarLogo TNG and NetLogo. Using the gateway, participants connected to Steven Miller at ENMU gateway. Event organizers learned that the 3D technology is yet to be 100% transparent, for example, the video required full screen mode only to function correctly. EPSCoR Professor Edward Martinez spoke about climate issues in the context of the town's water supply and research he is conducting on the local river. Students had an opportunity to develop their own projects and games, either modifying or creating them from scratch. Graduate students from the Computer and Mathematical Sciences department provided assistance throughout the week.

Industry Cyberinfrastructure Days

The awarded proposal states that an Industry CI Days program will be piloted in NM with business and industry as a target audience to increase CI awareness and promote economic development opportunities. During the summer of 2010, NM EPSCoR facilitated a focus group to determine the needs of the business and industry communities in New Mexico. Findings were presented to the State Committee. Upon consideration of this input, the Committee determined that a better course would be to collaborate with Fast Forward NM, an initiative of the Global Center for Cultural Entrepreneurship. Fast Forward NM provides training in rural communities for the use of computing for personal use and business development. EPSCoR will help Fast Forward NM expand its efforts in the communities of Silver City, Crownpoint and Espanola. This coordinated use of limited funds is likely to produce a more meaningful and sustainable tool for enabling rural areas of New Mexico to take advantage of the emerging cyber infrastructure than the one-time event that was originally planned.

Nevada

Nevada's focus was developing and disseminating education materials for middle and high school students, especially those from underrepresented groups. On July 20, 2010 and during the week of August 9, 2010, a working group of two UNLV faculty members, two graduate students and eight teachers from four different schools in southern Nevada met to develop the cyberlearning curriculum materials related to climate change for secondary science students. In addition to materials development, participating teachers were provided professional development related to the following themes: cyberinfrastructure and climate science, environmental literacy, systems modeling, and a design framework for inquiry-based instruction for cyberlearning http://climatechange.education.unlv.edu/?q=node/9. (Note: The awarded proposal noted that teachers on the materials development teams led by Nevada would be selected from smaller and rural schools or schools with a large minority student population. The eight participants of the Nevada materials development team were teachers from the following schools: Green Valley HS, Las Vegas Islamic Academy, West Preparatory Academy and Del Sol High School.)

The curriculum materials were built to complement and enhance the *Science & Sustainability* curriculum currently used for 9th grade Principles of Science across the Clark County School District (CCSD). Principles of Science and Honors Biology are the only two science courses available to 9th grade students. *Science and Sustainability* is produced and distributed by SEPUP (Science Education for Public Understanding Program) http://www.sepuplhs.org/ and the Lawrence Hall of Science. The centerpiece of this work was a new introductory unit called ***Las Vegas +30*** that localizes the sustainability issue in southern Nevada and establishes climate change as the driving force. The group developed 10 total lessons that complement the topics covered during the first semester of the course. Topics included: composition and history of Earth's atmosphere, optimal temperature range for organisms, relationships among humans and the environment, populations dynamics, changing climate and residential construction materials, energy and climate, and global consequences of increased CO_2.

The participating teachers and their students have access to the materials through a course management system (MOODLE) supported at UNLV http://climatechange.education.unlv.edu/moodle/. The group of teachers working at Green Valley High School in Henderson, NV is participating in an on-going fashion with UNLV faculty as a research and development site for these materials. Materials are being piloted at all of the participating schools.

The materials being developed will compliment the Clark County School District science curriculum. This district serves a population in which 82.8% of the students are from underrepresented groups. http://www.nevadareportcard.com.

Dr. Crippen provided the External Evaluator with the names and email addresses of the eight teachers who participated in this curriculum development project. He sent the teachers an email encouraging them to respond to the External Evaluator's request for information. Six teachers responded to the question sent by the External Evaluator by email. Appendix I contains these responses. In general, participants noted enriched content knowledge of climate change, enhanced capacity to integrate climate change and sustainability concepts into classroom activities, and improved capacity to use technology effectively in presenting these topics. Participants also valued the opportunity for professional networking and collaboration.

According to Nancy Glenn, the RII-T2 Cyberlearning Component Lead, and Kent Crippen, the NV Cyberlearning Component Lead , initial plans to have the middle and high school materials assessed by teachers during the formative evaluation stage (before they are delivered) have been adjusted because the efficacy checklist will not be completed until Year 2. It will then be used to assess the Cyberlearning materials developed during the Year 2 and Year 3 as well as to inform refinement of the materials developed during Year 1 of the project. Mindful of psychometric rigor, the development of the Efficacy Checklist is being informed with/from published instruments that have an existing theoretical and empirical basis.

Section 4. Demographics

This section presents demographic information about the populations served by the Consortium project, including project participants (individuals who spend 160 hours or more over the annual reporting period working on the project). The data in this section identify an opportunity for each of the participating states to engage more participants at every level of the project who are from underrepresented groups.

4.1 Project Participants

Project participants are individuals within the participating states (ID, NM and NV) who spent **160 hours or more** over the annual twelve month period in the RII-T2. Year 1 is the time frame September 15, 2009 to August 31, 2010. Tables 4A, 4B and 4C display for each state a summary of project participants by demographic groups for Year 1. The EPSCoR Office in each state reported data shown in these tables to the External Evaluator.

4.1.1 Idaho

The Idaho faculty member participants were Dan Ames (Model/Data Interoperability), James McNamara (Model/Data Interoperability), Nancy Glenn (Model/Data Interoperability State Co-Lead, and Cyberlearning State Lead), and Karla Bradley Eitel (Cyberlearning). Two non-staff individuals also qualified as project participants: Ted Dunsford, postdoc, who worked with Dan Ames, and Todd Buxton, graduate student, who worked with Karla Bradley Eitel.

Another faculty member, Paul Gessler (Model/Data Interoperability) contributed to the project components, but his involvement did not rise to the threshold level of 160 hours for the project year.

Table 3A: Disaggregated Demographics of Idaho RII-T2 Participants during Year 1

	Men						Women					
	Total	Number of African Americans	Number of Hispanics	Number of Native Americans	Percent URM	Number with disability	Total	Number of African Americans	Number of Hispanics	Number of Native	Percent URM	Number with disability
Faculty	2				0%		2				0%	
Postdocs	1				0%						0%	
Grad students	1				0%						0%	

4.1.2 New Mexico

New Mexico reported six faculty participants: Julie Coonrod (Model/Data Interoperability), William Michener (RII-T2 Co-PI and Connectivity/Bandwidth State Lead), Karl Benedict (Model/Data Interoperability), Joe Galewsky (Model/Data Interoperability), Lori Liebrock (Cyberlearning), and Timothy Thomas (Cyberlearning). Li Dong served as the Postdoctoral Associate. Graduate students Nico Marrero worked with Lori Liebrock and Stephen Brown worked with Julie Coonrod.

Table 3B: Disaggregated Demographics of New Mexico RII-T2 Participants during Year 1

	Men						Women					
	Total	Number of African Americans	Number of Hispanics	Number of Native Americans	Percent URM	Number with disability	Total	Number of African Americans	Number of Hispanics	Number of Native	Percent URM	Number with disability
Faculty	6				0%		1				0%	
Postdocs							1				0%	
Grad students	2		1		50%							

4.1.3 Nevada

The four Nevada faculty participants were Sergui Dascalus (Model/Data Interoperability), Fred Harris (State Lead for Connectivity/Bandwidth and Model/Data Interoperability), Darko Koracin (Cyberlearning) and Kent Crippin (Cyberlearning State Lead).

The postdoctoral associate, Ramesh Vellore (Connectivity/Bandwidth) is working with Darko Koracin. The participating graduate student was Aarti Dhone (Connectivity/Bandwidth). The following faculty members contributed to the work of the project, but not at a level of participation that reached the threshold level of 160 hours during the reporting period were: Eric Fritzinger (Model/Data Interoperability), Michael McMahon (Model/Data Interoperability), David Slater (Technician, Cyberlearning), Graham Kent (Networking), and Edward Anderson (System Computing Office, Networking Upgrades). Graduate student Jigarkumar Patel and postdoc Rakhi Motwani also participated, but at a level of less than 160 hours during the reporting period.

Table 3C: Disaggregated Demographics of Nevada RII-T2 Participants during Year 1

	Men						Women					
	Total	Number of African Americans	Number of Hispanics	Number of Native Americans	Percent URM	Number with disability	Total	Number of African Americans	Number of Hispanics	Number of Native	Percent URM	Number with disability
Faculty	4				0%						0%	
Postdocs	1				0%						0%	
Grad students					0%		1				0%	

4.2 Tri-State Consortium Meeting Participants

Table 5 displays the demographics of the participants who attended the 2009 and 2010 Annual Western Tri-State Consortium meetings. Refer to Section 2 of this report for more information about these meetings.

In 2009 there were 100 participants: 53% faculty, 4% postdocs and 18% graduate students

- Idaho: 49% faculty, 4% postdocs and 20% graduate students
- Nevada: 60% faculty, 3% postdocs and 20% graduate students
- New Mexico: 43% faculty, 5% postdocs and 14% graduates students

In 2010 there were 174 participants: 45% faculty, 7% postdocs and 22% graduate students

- Idaho: 57% faculty, 9% postdocs and 17% graduate students
- Nevada: 39% faculty, 6% postdocs and 30% graduate students
- New Mexico: 38% faculty, 9% postdocs and 17% graduates students

From 2009 to 2010 there was a 49% increase in faculty attendance, a 225% increase in postdoc attendance and a 117% increase in graduate student attendance. In addition, undergraduate students attended in 2010 but not in 2009.

Table 4: Demographics of Tri-State Meeting Participants, 2090 and 2010

Tri-State Meeting Location	Year	Total N	# (%) Male		# (%) Female		With Dis-ability	No. (%) from each State			
			URM	**Not URM**	**URM**	**Not URM**		**ID**	**NM**	**NV**	**Other**
Idaho	2009	100	5 (5%)	68 (68%)	3 (3%)	24 (24%)	1 (1%)	45 (45%)	21 (21%)	30 (30%)	4 (4%)
Nevada	2010	174	15 (9%)	100 (57%)	8 (5%)	51 (29%)	1 < 1%	47 (27%)	42 (24%)	79 (45%)	6 (3%)

Data Notes:

- *Demographics shown are of registrants who were known to have attended the meeting; a small number of registrants may not have attended the meeting.*
- *The number of and demographics of NSF Program Officers who attended a meeting are not included. The External Evaluator is also not included.*

4.3 CI Training and Cyberlearning Participants

The various Cyberlearning and CI training workshops and institutes conducted during Year 1 of the project to serve participants from across the Consortium are described in Section 2 of this report. Table 6 displays broadening participation demographics for the individuals who attended and participated in these events.

Table 5: Broadening Participation Demographics for CI-Trainings and Cyberlearning Component Activities, Year 1

Name of Training or Cyberlearning Program	Year	Total N	No. of Males		No. of Females		No. with disability	Number from each State			
			URM	Not URM	URM	Not URM		ID	NM	NV	Other
Intro to Hydrologic Info Systems (04/07/10)	2010	22	1	13	2	4		8	4	9	1 (MA)
Interdisciplinary Modeling (7/12/10 to 7/20/10)	2010	47	4	29	1	9		7	11	24	1 (CO)
Other CI Trainings	2010	4		4				1	1	2	
Teachers on NV materials development team	2010	8		1	2	4				8	
Teachers on ID materials development team	2010	7		5		2		7			
Teachers on NM materials development team	2010	6		2	1	3			6		
NM: GUTS (Middle School)	2010	42	17	8	12	4			42		
NM Super Computing Challenge (High School)	2010	37	13	6	8	9			13		

Data Notes:

- *The external evaluation demographic data collection protocol included the option "do not want to provide this information", therefore in Table 2 the difference in the number of participants (N) and the sum of the number of males and females represents individuals who elected to not provide demographic information.*
- *In the interest of confidentiality, demographic information is pooled for the four individuals who attended RII-T2 supported CI-trainings.*

A key focus of project activities related to Objective 3 (Cyberlearning) is integrating cyberlearning and climate change science into middle and high school science education, especially targeting rural schools and schools that reach Hispanic and Native American students. Table 7 displays the participants from these targeted populations in various cyberlearning educational activities conducted during Year 1. These activities are described in Section 3.3 of this report.

Table 6: Broadening Participation by Working with Teachers in Schools with Large Minority Student Enrollment and/or in Rural Districts, Year 1

Cyber-learning Component	Name of School	# of Teacher Participants	Is this a Rural School?	School Student Demographics				
				Asian/ Pac Is %	**Am Indian %**	**Hispanic %**	**Black %**	**White %**
NV Materials Development (C4D)	Green Valley High School	4	No	11.1	0.9	20.3	8.4	59.4
	Las Vegas Islamic Academy	1	No	N/I	N/I	N/I	N/I	N/I
	West Preparatory Academy	1	No	3.3	0.4	53.6	39.1	3.7
	Del Sol High School	2	No	0.8	6.6	54.5	12.4	25.8
ID Materials Development	Twin Falls High School	2	No	1.6	0.6	13.7	0.7	83.5
	Jerome Middle School	1	Yes	0.5	0.7	35.6	0.7	62.4
	Middleton High School	1	Yes	0.7	0.3	8.8	0.4	89.8
	American Falls High School	1	No	0.9	3.6	36.9	9.7	58.0
	Assent Junior High School	1	No	N/I	N/I	N/I	N/I	N/I
	Marsing Middle School	1	Yes	0.0	0.4	35.7	9.4	63.5
NM GUTS	Cameo Elementary School	No Info	No			68.6	16.0	14.7
	Las Vegas Middle School	No Info	No		< 1	95.1	< 1	4.2
	Penasco Middle School	No Info	Yes		4.7	91.9		3.4
NM SCC	Deming High School	No Info	No	< 1	< 1	78.2		20.9
	Edgewood Middle School	No Info	Yes		2.1	34.2		63.2
	Quemado High School	No Info	Yes		22.2	11.1		66.7

Data Notes:

- *The three states' Departments of Education provided the student demographics for Table 2B either through email or through information on their respective websites that was accessed by the External Evaluator. Names of schools were provided by activity leaders. Nico Marrero helped verify the names of the NM schools.*
- *Per the Idaho State Department of Education, Assent Junior High School is a program in Boise School District that serves students who are pulled out from other buildings. Student enrollment and ethnicity is tracked at the home school; therefore, no information is available at the state level.*
- *Based on prior experience, the External Evaluator included three categories of rural school districts (as defined by the NCES, http://nces.ed/gov) in the "rural" classification reflected in Table 2:*

- *41 = Rural, Fringe: Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, as well as rural territory that is less than or equal to 2.5 miles from an urban cluster.*
- *42 = Rural, Distant: Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster.*
- *43 = Rural, Remote: Census-defined rural territory that is more than 25 miles from an urbanized area and is also more than 10 miles from an urban cluster.*

It is likely that several of the schools that were "intuitively rural" were classified as fringe, distant or remote town (as defined by the NCES, http://nces.ed.gov/ccd/pdf/al051agen.pdf.:

- *31 = Town, Fringe: Territory inside an urban cluster that is less than or equal to 10 miles from an urbanized area.*
- *32 = Town, Distant: Territory inside an urban cluster that is more than 10 miles and less than or equal to 35 miles from an urbanized area.*
- *33 = Town, Remote: Territory inside an urban cluster that is more than 35 miles of an urbanized area.*

Section 5. External Evaluator Recommendations

The External Evaluator offers the following recommendations to project leadership for consideration in ongoing continuous improvement efforts, based on her observations and assessment of the project to date:

- There is a growing national concern that the U.S. is becoming less STEM-competitive on the world stage. One of the objectives of all the RII grants is to increase enrollment in and graduation from high-quality, internationally competitive STEM degree programs. New solutions to this challenge will likely include the effective use of technology. Perhaps the Consortium's work in education and outreach could be extended to creating a distance-delivered "short course" for high school students (especially for students in isolated areas). This would be a way to actively engage students in exciting, cutting edge STEM science and technology.

- Technology can be used to sustain components of this project beyond the Tri-State region. The funded project proposal notes in the sustainability section:

  > Consortium institutions will develop CI-enabled training activities that can be adopted into curricula at respective institutions and offered remotely to partner institutions via the Access Grid Network and other CI mechanisms. For example, Nevada (UNR) will develop a graduate level class on Climate Modeling in the Atmospheric Sciences Graduate Program that will be offered to students from partner institutions.

  The CI-enhancements that this project supports provide the kind of technology needed for offering university science courses remotely to a worldwide audience in addition to the partner institutions. Perhaps dissemination beyond the region should be considered as well.

- The administrative structure of this project provides an opportunity for experienced grant administrators to mentor faculty with little or no prior administrative experience who have taken

on leadership positions within the project's parameters. Developing an intentional focus on the mentoring of individuals with relatively less administrative experience would likely add to the sustainability of this Consortium and its work.

- Considerable planning went into organizing the project into components with State and Consortium leads. The outreach group within Cyberlearning appears to be the most cohesive group with a vision for breaking down the walls of STEM enrollment inequities, and strategic plans for related actions. Broad-based participatory implementation is a way to nurture creativity and innovation as well as commitment to the responsibilities associated with membership.

- With regard to the NRES 730 course (refer to Section 3.3.1 and Appendix G) supported by project funds, the External Evaluator has discussed the following issues with the course instructor as part of the process of planning the 2011 course. The instructor's understanding of the use of evaluation feedback for constructive purposes is admirable.
    - How can course recruitment be improved? 71% of 21 students in the course learned about the course from one of the faculty members involved with the course. How much would total enrollment decrease if there were fewer than 19 instructors/presenters/ guest lecturers?
    - How many students would enroll in the course if their employer did not pay for it (12 of 23 students reported the employer paid the costs)? This question is related to sustainability.
    - It is likely that the large number of faculty involved in the course would not be able to be sustained in the absence of grant funding. Would it be feasible to supplement the course by including some of the topics in seminars/workshops offered in conjunction with (before/during/after) the Tri-State meeting and other settings?
    - Is there a more efficient way to deliver this course that utilizes Cyberinfrastructure technology, perhaps fewer days on campus supplemented with distance-delivery?
    - Might it be useful to decrease the number of topics covered in this course? Would it be meaningful for the NRES 730 summer 2011 course to include topics for which students in the 2010 course reported low knowledge gains (a kind of follow-up course)? For example, the percentages of students who reported knowledge gains in statistical and mathematical modeling were low (39% and17%, respectively, reported moderate/good gains; none reported great gains). It seems reasonable that these are important topics related to predictive power in modeling ecosystem processes at multiple scales using large data sets. Would revisiting these topics meet the needs of the targeted population?

APPENDIX A. Evaluation Plan for NSF EPSCoR RII Track-2 Project Cyberinfrastructure Development for the Western Consortium (ID, NV, and NM)

PREFACE

This document presents the evaluation plan developed by the projectôs External Evaluator, the projectôs Management Team (MT) and the Component Teams (Connectivity/Bandwidth, Model/Data Operability, and Cyberlearning). The foundation for this evaluation plan is the funded proposal Award #0919123, *Collaborative Research: Cyberinfrastructure Development for the Western Consortium of Idaho, Nevada, and New Mexico*. This is the project description in the abstract available on the National Science Foundation website:

> Idaho, Nevada, and New Mexico have NSF EPSCoR Track-1 Research Infrastructure Improvement (RII) awards that share a common theme of global challenge. Collectively, the project teams are studying climate change and its effects on water resources, ecosystems, and the environment. Subsequently, the three states formed a consortium to pursue cyberinfrastructure (CI) improvements that would leverage their resources so that the cumulative impact of NSF RII investments in the three states could exceed the sum of the parts. The impetus for this Track-2 award was the recognition of the complexity and scale of the scientific challenge and subsequent ramifications for science, education, and economic development.
>
> The NV-ID-NM consortium proposed three high priority objectives: 1) to increase connectivity and bandwidth; 2) to enhance data and model interoperability; and 3) to utilize CI to integrate research with education.

During the strategic planning meeting November 5, 2009 in Reno, Nevada the Component Teams developed metrics after they reviewed the activities, outputs and outcomes provided them by the Nevada PI. Management Team and Component Team members commented on the drafted evaluation plan and editing continued through December 2009.

The first project year is September 15, 2009 through August 31, 2010. Years 2 and 3 will start on September 1st and will end August 31st. Not all metrics include baseline numbers; baseline data are for the time period September 1, 2008 through August 31, 2009.

EVALUATION PLAN STRUCTURE

The evaluation plan is structured around the projectôs three high priority objectives:

1. **Increase connectivity and bandwidth**. Significant effort will focus on promoting communication and collaboration by improving connectivity infrastructure within the Consortium. Proposed and future Consortium efforts related to improving research competitiveness, STEM education, and economic development rely on this basic infrastructure.
2. **Enhance data and model interoperability**. The Consortium will promote discovery by supporting community-based climate change science through enhanced interoperability between models and other software components, improved access to and usability of Consortium data products through the adoption of standards-based data management and aces models and new data assimilation, analysis and visualization capabilities.
3. **Utilize CI to integrate research with education**. The Consortium will enhance learning by focusing particularly on graduate student and postdoctoral researcher development; extending

cyber-enabled science education into middle and high schools and extracurricular programs; and improving outreach to business and industry.

This evaluation plan draws extensively from information in the report[4] from the Engineering Advisory Committeeôs Subcommittee on Cyberinfrastructure which includes example success metrics for Cyberinfrastructure. Table 2 on page 15 of *A Process-Oriented Approach to Engineering Cyberinfrastructure* is copied below.

Metric Type	What it Assesses	Example Metrics
Usage	Amount of use of resource by user community	Number of users of resource: Utilization, throughput (computation); Number of collections (data); Number of hits (web); Number of downloads (software), etc.
Usability	ñEase of useò of resource by user community	Turnaround time (computation); User satisfaction as assessed by surveys; Informal feedback from users; Software productivity measures
Deep impact	Importance of science and engineering enabled by resource	Publication in peer-reviewed journals and conferences; Community recognitions and awards; ñLandmarkò publications
Broad impact	Extensiveness of user community, accessibility of resources	Number of disciplines, communities served; Number of publications enabled, Number of courses, dissertations, and other educational vehicles enabled
Expanding Use of Cyberinfrastructure	ñGrowthò of Cyberinfrastructure as an enabling technology	Number of new users (great than some threshold of times) of Cyberinfrastructure components and resources
Coordination of Cyberinfrastructure	Integration and interoperability of Cyberinfrastructure components	Number or percentage of times that resources or software is used together
Technology Transfer promoted by Cyberinfrastructure	Movement of academic Cyberinfrastructure efforts to the private sector of ñproductizationò	Number of deployed Cyberinfrastructure tools and technologies initiated with the academic community and productized within the private sector
Workforce impact	Individuals involved in the provision of Cyberinfrastructure	Number (gender, race, creed, level) of individuals involved in Cyberinfrastructure-related professions; Number (gender, race, creed, level) of individuals with Cyberinfrastructure-oriented education or training and their increase/decrease over time.

EVALUATION SCOPE

The evaluation plan does not include assessment of project compliance or cost benefit analysis. Compliance factors include financial records (including purchasing and installation of CI hardware and software) and leadershipôs required reporting to the National Science Foundation.

The evaluation will utilize qualitative and quantitative data to: (1) provide information to the Management Team for refining and improving project implementation at both the state and Consortium levels; (2) measure progress of the project in meeting its goals, objectives, and annual metrics; (3) assess the impact of the project in developing strong inter-jurisdiction collaborations that address regionally relevant and

[4] *A Process-Oriented Approach to Engineering Cyberinfrastructure*, (February 2006). F. Berman, J. Bernard, C. Pancake, L. Wu, http://director.sdsc.edu/pubs/ENG

nationally important climate change science and education; and (4) assess the projectôs impact on enhancing discovery, learning, and economic development through the use of CI.

This evaluation plan includes metrics developed by the Component Teams as well as success (outcome) metrics in the publication, *A Process-Oriented Approach to Engineering Cyberinfrastructure.*

PROJECT PARTICIPATION

Table 1 is designed to display a summary of project participation by demographic groups for each of the three years of the project. Reported annually, project participants are individuals within ID, NM and NV who spend 160 hours or more over the annual twelve month period.

Table 1: Disaggregated demographics of Track-2 project participants

	Number of Men						Number of Women					
	Total	# Af.-Am.	# Hisp.	# Nat. Am	Percent URM	# with disability	Total	# Af.-Am.	# Hisp.	# Nat. Am	Percent URM	# with disability
Year 1												
Faculty												
Postdocs												
Grad students												
Year 2												
Faculty												
Postdocs												
Grad students												
Year 3												
Faculty												
Postdocs												
Grad students												

THE PROJECT'S OVERARCHING GOAL

The three Track 2 Components are Connectivity (Objective 1), Interoperability (Objective 2) and Cyberlearning (Objective 3). The projectôs overarching goal is to:

> Promote knowledge transfer to scientists, educators, students and citizens within and beyond the Consortium by enhancing state cyberinfrastructure, and to enable the community science that is required to address regional to global scientific and societal challenges.

The overarching outcome of this Track-2 NSF RII project is stated in the proposal:

> Track 2 investments will enhance the ability of the ID-NV-NM Consortium to better address 21st century grand scientific and societal challenges related to climate change through increased competitiveness for research funding and sustained partnerships among our jurisdictions.

Definitions from the NSF RII Reporting Guidelines

- **RII Faculty or equivalent.** RII faculty are defined as faculty at the lead or participating universities, colleges, or community colleges, who devote 160 hours or more over a twelve month

period of their professional activities to one or more of the research areas of the RII or to tasks related to the RIIôs education, outreach or knowledge transfer missions.

- **RII Graduate Student.** RII graduate students are defined as students enrolled in a graduate degree program at one of the RIIôs participating universities, and colleges, who devote a 160 hours or more over a period of 12 months of their research and educational activities to one or more of the research areas at the RII program under the supervision of an RII faculty or staff member. This category includes both students who are and those are not financially supported by the RII funds so long as they meet the other criteria.
- **Publications.** Publications are journal articles, text books, monographs, chapters in books, conference proceedings, technical reports, abstracts or other formal written documents, both print and electronic.
- **Collaborator.** An RII collaborator is an individual affiliated with the RII program that does not meet the 160 hour requirement for RII participants.
- **External Collaborator.** An external institutional collaborator refers to an institution or organization outside of your jurisdiction that is involved with RII activities and events but has no contractual relationship.)
- **RII Undergraduate Student.** RII undergraduate students are defined as students enrolled in an undergraduate degree program at one of the RIIôs participating universities, colleges, or community colleges, who are either doing research in one or more of the research areas at the RII project under the supervision of a RII faculty. This category includes both students who are and those are not financially supported by the RII funds so long as they meet the other criteria.

Performance measures for the overarching goal are displayed in Table 2. These metrics will be disaggregated by state.

Table 2: Performance measures for the overarching goal and its outcomes

DEEP IMPACT (The importance of STEM and Climate Change research enabled by the CI resources)						
	N	**-1- Total # of Climate Change (CC) peer-reviewed publications**	**-2- # of CC peer-reviewed publications with authors from 2 or more Consortium states**	**-3- # of CC peer-reviewed publications with authors from 2 or more Track 2 Component Groups**	**-4- # of all CC publications (using the annual report definition of publication)**	**-5- # of all CC publications with consortium collaboration (using the annual report definition)**
Track 2 (but not Track 1) participants						
Both Track 1 and Track 2 participants						
Only Track 1 participants				N/A		

We will also highlight publications and grant applications/funding that were not possible without Track 2 enhancements and/or resulted directly out of Track 2 participation. Other research productivity metrics unique to Track 2 participants (i.e., do not include individuals who are Track 1 but not Track 2

participants). These measures do not include baseline data so they begin with Year 1. The templates will be extended to include years 2 and 3; data will be disaggregated by state.

Table 3: Performance measures for the impact of CI resources on participating researchers

DEEP IMPACT (The importance of STEM and Climate Change research enabled by the CI resources)				
	N	**-1-** **# of all (CC and non-CC) presentations resulting from Track 2 participation**	**-2-** **# of publications in CI journals (CC and non-CC)**	**-3-** **# of Track 2 authors of publications in CI journals (CC and non-CC)**
Track 2 Faculty				
Track 2 Postdocs				
Track 2 Graduate Students				

Objective 1: Connectivity

Connectivity activities are reported by state since Cyberinfrastructure connectivity needs are unique to each of the states.

- Idaho: Upgrade CI to deliver improved network connections to key university researchersô labs and desktops. Connect difficult-to-access sites within Idaho by adding to, enhancing and using the Idaho Regional Optical Network (IRON).
- Nevada: Increase connectivity into the state network and within the state through networking and video conferencing upgrades as well as networking monitoring tools.
- New Mexico: Establish a distributed computing and collaboration infrastructure of compute nodes at portals or gateways at Tribal Colleges and Hispanic-Serving Institutions.

The anticipated outputs reported at the November 5, 2009 planning meeting were:

- Idaho
  - Formalized plan for the University of Idaho to utilize IRON to access university facilities in southern Idaho.
  - Upgraded networking equipment installed at the state universities for LAN upgrades and building uplinks that provide 1 to 10 Gb/s service to several key research buildings.
  - Upgraded aggregation switch (Point of Presence) on IRON and traffic aggregated onto IRONôs backbone in Twin Falls to include sites in Hagerman and Kimberly, ID.
- Nevada
  - Upgraded network connectivity from NevadaNet in the north to CENIC in Sacramento, as well as NevadaNet connectivity to Elko and other parts of the state.
  - Upgraded networking monitoring and security software and hardware.
  - Upgraded video conferencing hardware in the north and south.
- New Mexico
  - Upgraded gateways at the three large research campuses connected to six Hispanic-serving and Native American-serving campuses in New Mexico.
  - Upgraded software for integrating all components of the gateway systems into a single, user-friendly system along with compression software to minimize the amount of bandwidth needed for connectivity between the sites.

Table 4: Metrics for Connectivity developed by the Connectivity Team

State and Metric **Note:** These metrics do not include baseline data because they all result from Track-2 project activities.	Annual Data		
	2009-10	**2010-11**	**2011-12**
Idaho: Number of connections at improved speeds			
Idaho: Number of connections per site			
Idaho: Number of connections per machine			
Nevada: Utilization into the state in GB			
Nevada: Utilization within the state in GB			
New Mexico: Number of portals installed			
New Mexico: Utilization by institution in GB			

Outcomes

Improved connectivity between and within the three states will result in increased data-intensive research, scientific collaborations, distributed experiments, grid-based data analysis, IP videoconferencing, social networking and cyber-enabled learning. Network improvements on Consortium campuses will remove bandwidth bottlenecks and allow faculty involved in climate-related research at each university to fully utilize available bandwidth for research and education.

The following table displays Connectivity outcome measures pertaining to the amount of use and ease of use of Cyberinfrastructure (CI).

Table 5: Outcome measures for amount and ease of use

Description of Indicator by State	Outcome Measure
Idaho: Utilization	Percentage increase in utilization (GB) in years 1, 2 and 3 compared to 2008-09 utilization
Idaho: Bandwidth usage	Percentage increase in bandwidth usage of IRON in years 1, 2 and 3 compared to 2008-09 bandwidth use
Nevada: Into-state utilization	Percentage increase in utilization (GB) in years 1, 2 and 3 compared to 2008-09 utilization
Nevada: Within-state utilization	Percentage increase in utilization (GB) in years 1, 2 and 3 compared to 2008-09 utilization
New Mexico: Utilization	Percentages increase in utilization (GB) in years 1, 2 and 3 compared to 2008-09 utilization.
ID, NV and NM user satisfaction	Survey of Track-1 researchers satisfaction with network improvements
ID, NV and NM increased data-intensive research	External Evaluator interview of Track-2 PIs at each of the universities regarding connectivity upgrade benefits to researchers

Objective 2: Interoperability

Inoperability activities were confirmed by the Interoperability Team:

- Develop a model and data interoperability framework: Establish a model and software interoperability framework based on emerging national and international standards along with scenarios and applications that make use of that framework. The framework will allow users to specify, maintain and update ï through a central user interface and a common methodology ï a collection of software tools, and the interconnections between tools needed to accomplish climate research tasks.
- Build an interoperability data archive: The Consortium will implement a data archive model that is based upon open data and metadata standards and supports standard data interoperability models. The interoperable data archive will enable streamlined discovery of and access to data products generated by all three state EPSCoR programs. These activities will use web interfaces to communicate the availability of data, models, training, and activities of researchers; will leverage existing national/international resources; and will make any code that is developed available through open source outlets.

The Interoperability objective is: Enable community-based climate science through model and data interoperability solutions.

The outputs resulting from the activities were developed and confirmed by the Interoperability Team.
Activity 1 outputs:

1. User configurable interface for accessing, linking and managing process chains in support of climate science
2. Coupled Atmospheric, surface process and hydrologic models

Activity 2 outputs:

1. Climate data products are discoverable via searches against standard data and service metadata
2. Climate analysis and data products are deliverable both as individual data products and as services that may be integrated into other analysis systems

Important Interoperability milestones are:
Activity 1 milestones:

1. Completion of data/metadata format document for science teams
2. Completion of CRUD API specification
3. Completion of database schema document

Activity 2 milestones:

1. Completion of document on evaluation/assessment criteria of models to include in the prototype system
2. Completion of document on candidate models considered for adoption, modification, adaptation, or reproduction for use in the software model interoperability framework (model integration tool)
3. Completion of software frameworkôs requirements specific document
4. Completion of software frameworkôs design document, including API guidelines
5. Completion of Alpha version of the software model interoperability framework
6. Completion of Beta version of the software model interoperability framework
7. Deployment of web site for collaborative open source community development of the software interconnection framework (SourceForge or CodePlex)

Metrics for Interoperability do not include baseline data because all measures are generated as a result of this Track-2 projectôs activities.

Drawing on feedback from the External Advisory Committee, the Interoperability Team updated the metrics in June 2010. Tables by state display summaries of the updated metrics.

Table 6: New Mexico -Metrics for Interoperability

Activity	Metric	Annual Data for NM		
		2009-10	2010-11	2011-12
Build an interoperability data archive	# of data and metadata representations (formats) in the data/metadata format document			
	# of uploaded datasets for which metadata quality meets or exceeds documented expectations.			
	# of CRUD API methods/functions in the CRUD API specification			
	# of table elements in the data base schema document			
	# of data services deployed for geospatial data			
	# of data services deployed for observational data			
	# of web services posted for data			
	# of web services posted for data			
	# of geospatial data sets made available through web services			
	# of time series sites made available through web services			
	# of downloads of geospatial data			
	Quantity of downloads of geospatial data			
	# of downloads of observational data series			
	Quantity of downloads of observational data series			
	# of registered users of the web services			
	# of unique IP addresses that utilize data services			

Table 7: Idaho -Metrics for Interoperability

Activity	Metric	Annual Data for ID		
		2009-10	2010-11	2011-12
Build an interoperability data archive	# of data and metadata representations (formats) in the data/metadata format document	Not Applic		
	# of uploaded datasets for which metadata quality meets or exceeds documented expectations.	Not Applic		
	# of CRUD API methods/functions in the CRUD API specification	Not Applic		
	# of table elements in the data base schema document	Not Applic		
	# of data services deployed for geospatial data	Not Applic		
	# of data services deployed for observational data	Not Applic		
	# of web services posted for data	Not Applic		
	# of web services posted for data	Not Applic		
	# of geospatial data sets made available through web services	Not Applic		
	# of time series sites made available through web services	Not Applic		
	# of downloads of geospatial data	Not Applic		
	Quantity of downloads of geospatial data	Not Applic		
	# of downloads of observational data series	Not Applic		
	Quantity of downloads of observational data series	Not Applic		
	# of registered users of the web services	Not Applic		
	# of unique IP addresses that utilize data services	Not Applic		
Develop model and data interoperability framework	# of software requirements in the toolôs Software Requirement Specification (SRS) document			
	# of Software requirements met	Not Applic		
	# of functions/methods in the toolôs API	Not Applic		
	# of participants involved in related software development activities (project personnel and members of the open source community)			
	# of models or model tools available for execution through the software framework	Not Applic		
	# of downloads and/or executions of the software model interconnection framework	Not Applic		
	# of registered users of the software model interoperability framework	Not Applic		
	# of unique IP address hits on the software model interoperability framework web site	Not Applic		
	# of model interconnection scenarios available through the software framework	Not Applic		

Table 8: Nevada -Metrics for Interoperability

Activity	Metric	Annual Data for NV		
		2009-10	2010-11	2011-12
Build an interoperability data archive	# of data and metadata representations (formats) in the data/metadata format document	Not Applic		
	# of uploaded datasets for which metadata quality meets or exceeds documented expectations.	Not Applic		
	# of CRUD API methods/functions in the CRUD API specification	Not Applic		
	# of table elements in the data base schema document	Not Applic		
	# of data services deployed for geospatial data	Not Applic		
	# of data services deployed for observational data	Not Applic		
	# of web services posted for data	Not Applic		
	# of web services posted for data	Not Applic		
	# of geospatial data sets made available through web services	Not Applic		
	# of time series sites made available through web services	Not Applic		
	# of downloads of geospatial data	Not Applic		
	Quantity of downloads of geospatial data	Not Applic		
	# of downloads of observational data series	Not Applic		
	Quantity of downloads of observational data series	Not Applic		
	# of registered users of the web services	Not Applic		
	# of unique IP addresses that utilize data services	Not Applic		
Develop model and data interoperability framework	# of software requirements in the toolôs Software Requirement Specification (SRS) document			
	# of Software requirements met	Not Applic		
	# of functions/methods in the toolôs API	Not Applic		
	# of participants involved in related software development activities (project personnel and members of the open source community)			
	# of models or model tools available for execution through the software framework	Not Applic		
	# of downloads and/or executions of the software model interconnection framework	Not Applic		
	# of registered users of the software model interoperability framework	Not Applic		
	# of unique IP address hits on the software model interoperability framework web site	Not Applic		
	# of model interconnection scenarios available through the software framework	Not Applic		

Outcomes

EPSCoR Track 2 investments will provide new model and data interoperability solutions and an integrative software framework that will transform exploration, experimentation, and innovation in climate research. Project activities build upon existing resources within Idaho, Nevada, and New Mexico, and are designed to leverage other major NSF-supported initiatives (including CUASHI HIS, GEON, and CSDMS). The project will significantly reduce the difficulty in finding, accessing, and using the diverse data products available in the Consortium. Consortium results (data and models) and resources (archives) will become readily accessible to the broader community of environmental scientists, decision makers, students, and the public.

The following table displays Interoperability metrics pertaining to broad impact, usage, usability and expanding use of Cyberinfrastructure (CI).

Table 9: Outcome measures for Interoperability broad impact, usage, usability and expanding use of CI

Description of Indicator	Outcome Measure
Users of each set of web materials when they become available on the web site	Number of consortium users as defined by computer domains
	Number of non-consortium users described by approximate geographic location using Google Analytics code and/or domain
The use of the web materials and software by Track-1 researchers in ID, NM and NV	External evaluation survey of Track-1 researchers in years 2 and 3
Use of data interoperability framework	External evaluation survey of Track-1 researchers in years 2 and 3 on how the framework is employed as a framework in their research or to adapt the framework for their own specific uses.
Use of software when it is distributed (current expectation is in the third project year)	Tracking of downloads of software from a depository ï the current expected depository is the Community Surface Dynamics Modeling System (CSDMS)

Objective 3: Cyberlearning

Cyberlearning activities are described in the proposal:

- A series of training opportunities to develop cyberinfrastructure capacity and hands-on experience with climate modeling and scientific information systems will be provided for middle/high school students, undergraduates, graduate students, postdoctoral associates, and faculty. Training opportunities will include:
  - ñIntroduction to Climate Modelingò
  - ñIntroduction to the Hydrologic Information Systemò
  - TeraGrid workshops
- Participant support in other training opportunities will include:
  - Linux Clusters Institute (LCI) Workshop
  - The National Center for Atmospheric Research (NCAR) advanced climate modeling workshops and short courses
- New cyber-enabled curriculum and education materials will be created, implemented for middle school and high school science education and disseminated through a portal site. These will include:

    - Cyberlearning materials related to computational climate science
    - Informal education materials (e.g., GUTS, NM Supercomputing Challenge, WET)
- An Industry Cyberinfrastructure Days program will be piloted in NM with business and industry as a target audience to increase cyberinfrastructure awareness and promote economic development opportunities.

Metrics developed by the Cyberlearning Team during the November 5, 2009 strategic planning session are displayed in the table below. Metrics are grouped by the activity categories:

1) Offer and support CI training in computation and climate change
2) Develop and disseminate materials for MS/HS
3) Develop and support extracurricular CI activities
4) Develop and deliver industry CI days

New Mexico is in the state in this Consortium with extracurricular Cyberinfrastructure activities

All cyberlearning participant data will be disaggregated by state, STEM underrepresented minority status (URM), gender and disability status.

The following table is a template for recording annual Cyberlearning metric data. Baseline data will not be collected for these metrics because even within existing programs, the measures are related to new aspects of the program.

Table 10: Metrics for Cyberlearning developed during the strategic planning session

Activity	**Metric**	**Annual Data**		
		09-10	**10-11**	**11-12**
CI training in computation and climate change	# of trainings			
	# of participants trained			
	# of participants aggregated by degree program			
Develop and disseminate MS and HS materials	# of materials developed by category			
	# of entities to which materials are disseminated			
	# of downloads of materials (e.g., from portal)			
Develop and support extracurricular CI activities	# of new schools participating in *GUTS*			
	# of new schools participating in *Super Computing*			
	# of students participating in *GUTS*			
	# of students participating in *Super Computing*			
	# of new content modules			
	# of programs to which CI information is disseminated			
Develop and deliver Industry CI Days	# of participants			
	# of participants disaggregated by industry group			

Outcome

The outcome for Cyberlearning is: Participants of all targeted groups in cyberlearning activities will increase awareness, skills and knowledge in climate change and cyberinfrastructure.

The following table displays Cyberlearning metrics pertaining to broad impact: the extensiveness of the user community and accessibility of Cyberlearning resources.

Table 11: Outcome measures for broad impact of Cyberlearning

Description of Indicator	Outcome Measure
Integration of CI in New Mexico	Name of the NM course that distance delivery was integrated into, who takes the course, when was it first delivered, and what are the course ratings by students?
Geographic diversity of users	MS and HS communities geography (rural, suburban, urban)
Cultural diversity of users	Description of tribal Middle and High Schools served
Usage of materials for MS & HS use	Teachersô feedback regarding how and when materials are used
Industry partners served	Number and description of private sector participants
Quality of Cyberlearning trainings	Participantsô evaluation of facilitation, content and implementation
Usefulness of training to participants	Participantsô rating of job usefulness of acquired skills and knowledge
Courses enabled	Description of university courses utilizing cyberlearning resources
Integration of research with CI	Which NSF Track-1 RII faculty were involved with cyberlearning activities?
GUTS	Number of schools served that were not previously involved with this program (the goal is three schools)
GUTS	Impact on the schools assessed through surveys and/or interviews
GUTS	Documentation (e.g., course syllabi) of sustainability of the integration of materials and simulations in the three new schools
Supercomputing Challenge	Number of schools served that were not previously involved with this program (the goal is three schools)
Supercomputing Challenge	Evidence of how this program has impacted participating teachers
Gateway Consultant	Evidence of increased usage of gateway equipment at the schools served by the consultant obtained through External Evaluator interview of the Gateway Consultant

The following is a summary of the anticipated broader impact of the four types of Cyberlearning activities. The framework was developed by the External Evaluator and was completed along with the Component Lead. The information was reviewed by the Leadership Team and was then finalized.

The Idaho Cyberlearning Team members are Sarah Penney, Nancy Glenn, and Dan Ames.

High Priority Objective: Communication and Dissemination

Foster scientific literacy and improve educational and research capacity within the Consortium through three dissemination and communication activities:

(1) establishing effective internal communications among the Consortiumôs partners to enable efficient sharing of data and information;

(2) creating coordinated mechanisms to communicate project results, benefits, and processes to scientists, citizens, and stakeholders within the Consortium and other EPSCoR jurisdictions; and

(3) developing cyberlearning tools for educational outreach.

A centerpiece for communication is an annual tri-state CI meeting that will include Track 1 and 2 members. Faculty, graduate students, and postdoctoral associates will share ideas and present their work at the meeting. *These tri-state meetings represent an unprecedented leap in collaborations and information sharing between our states.*

Consortium Outreach and Education Activities

IDAHO										
Name of State's RII Track 2 Component, Activity, or Program	**Broadening Participation**			**Work force Develop-ment**	**CI**	**Education**	**Human Resource Develop-ment**	**Year(s) RII Institution Participates in this Activity**		
								BSU	**UI**	**ISU**
	Diver-sity	Outreach	Commu nication							
Develop and disseminate educational materials for MS/HS	X	X			X	X			Yrs 1, 2, and 3	
Offer and support CI training in computation and climate change	X	X		X	X	X	X		Yrs 1, 2 and 3	Yrs 1, 2 and 3

NEVADA										
Name of State's RII Track 2 Component, Activity, or Program	**Broadening Participation**			**Work force Develop-ment**	**CI**	**Education**	**Human Resource Develop-ment**	**Year(s) RII Institution Participates in this Activity**		
								DRI	**UNLV**	**UNR**
	Diver-sity	Outreach	Commu nication							
Offer and support CI training in computation and climate change [LEAD]	X	X		X	X	X	X	Yrs 1, 2 and 3	Yrs 1, 2 and 3	Yrs 1, 2 and 3
Develop and disseminate educational materials for MS/HS [LEAD]	X	X			X	X			Yrs 1, 2 and 3	

NEW MEXICO										
Name of State's RII Track 2 Component, Activity, or Program	**Broadening Participation**			**Work force Develop-ment**	**CI**	**Education**	**Human Resource Develop-ment**	**Year(s) RII Institution Participates in this Activity**		
	Diversity	Outreach	Communication					**NM Tech**	**UNM**	**NM EPSCoR**
Develop and disseminate educational materials for MS/HS	X	X			X	X		Yrs 1, 2, and 3		
Develop and deliver Industry CI Days	X	X	X	X	X					Yrs 1, 2 and 3
GUTS and Super computing Challenge	X				X	X	X	Yrs 1, 2, and 3		
Gateway Training	X				X	X	X	Yrs 2 and 3		
Offer and support CI training in computation and climate change	X	X		X	X	X	X	Yrs 1, 2 and 3	Yrs 1, 2 and 3	Yrs 1, 2 and 3

APPENDIX B. Spring 2010 Impact Report
(Tracking of 2009 & 2010 Tri-State Meeting Participants)

Introduction

Forty-nine faculty members (35), graduate students (9), a postdoc (1), teaching assistants (2) and director/specialist (2) listed as registered for both the 2009 and 2010 Tri-State Meetings were asked to complete a web-based evaluation form. All 48 were identified as being from ID, NV or NM. Nine EPSCoR-associated (Track 1 PIs, administrative staff) also attended both years but were not included in this tracking. The following chart displays the affiliations and states of the 49 individuals.

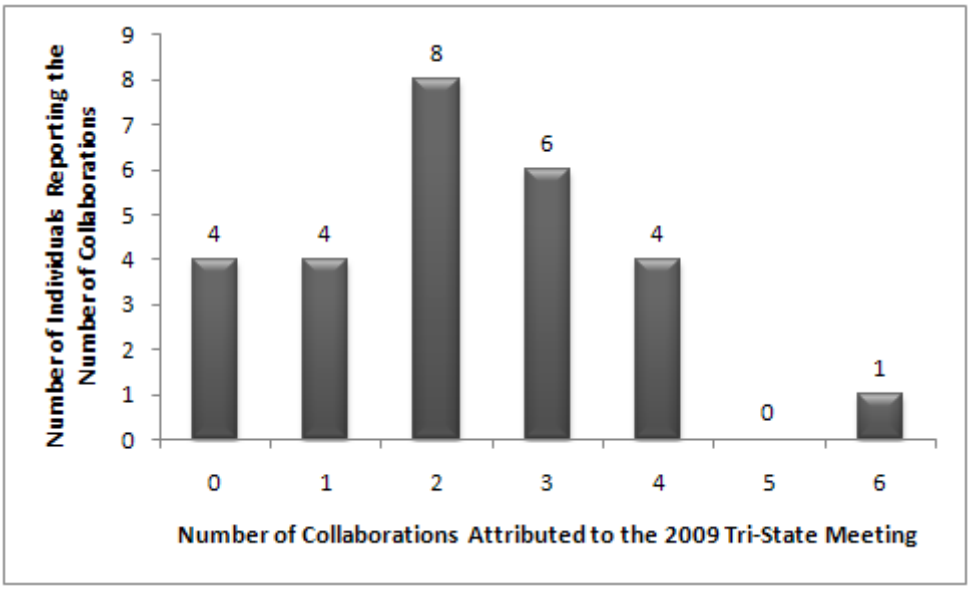
Affiliation	Number	Percentage of all 49	State	Percentage by State
BSU	8	16.3	ID (N = 19)	40.7
ISU	4	8.2	13 faculty members	
UI	7	14.3		
Diné College	1	2.0	NM (N = 13)	24.4
NM Museum Natural History	1	2.0	10 faculty members	
NM Tech	4	8.2		
NMHU	1	2.0		
NMSU	2	4.1		
UNM	4	8.1		
DRI	6	12.2	NV (N = 17)	34.6
UNLV	4	8.1	12 faculty members	
UNR	7	14.3		

Collaborations Resulting from Attending the 2009 Meeting

The survey was completed by 27 (55%) of the 49 targeted individuals. The first question on the tracking form was: ***The most frequently cited reason for attending the 2009 and 2009 annual tristate meetings was the opportunity to meet with colleagues, share ideas, learn from one another and foster collaboration. How many collaboration relationships resulted from you attending the 2009 meeting?***

One comment was noted: I believe one of the most effective means for collaborative efforts between scientists within the Tri-State Consortium has been the *Innovative Working Groups*, which the PIs from all three states have been involved in. These groups have spurred active research collaborations involving people from all three states with the intention of having a submitted proposal at the conclusion of the funding period.

Clearly, the definition of a collaborative relationship varied. One individual wrote, "It depends how you count them (by # of people or by # of activities)." This will need to be clearly stated in the 2011 tracking survey as two different questions: How many people? How many activities?[5] Two collaborations were attributed to the 2009 Tri-State Meeting on average (mean 2.2, standard deviation 1.5).



The next question on the survey was: **Did attending the 2010 meeting strengthen a collaborative relationship within the tri-state region (but not with a colleague at your current university) that started as a result of attending the 2009 meeting?** Six individuals responded either "not sure" or "doesn't apply". Among the other 21 respondents, 19 recorded "yes" and two recorded "no".

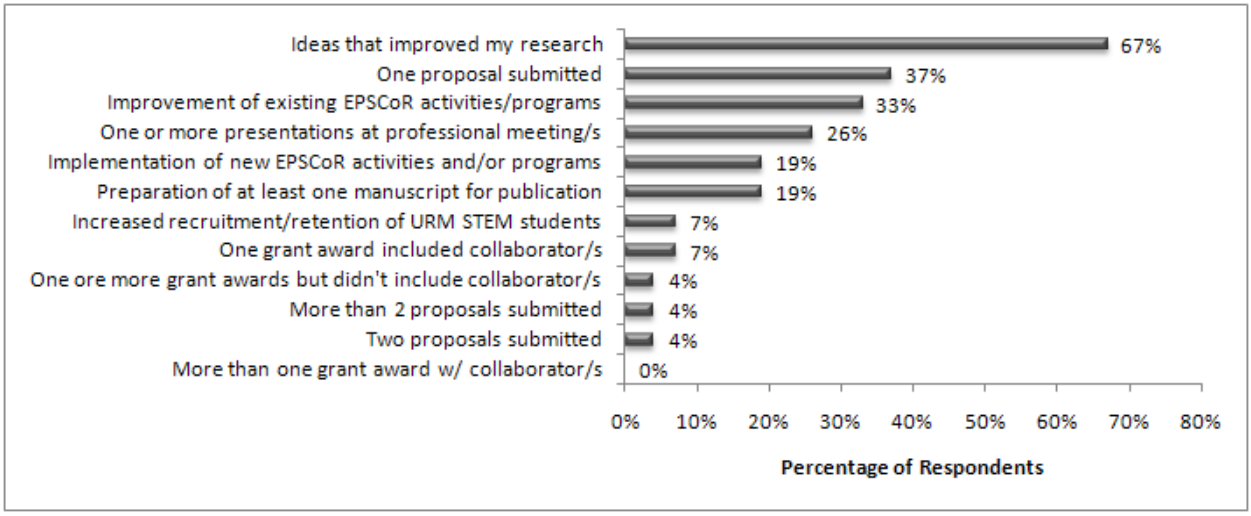
Respondents reported the impact of the 2009 meeting on fostering collaboration by checking off possible listed outputs/activities with the option for "other". "Other" clarifications were:

- Participation in the Tristate Interdisciplinary course as a guest instructor.
- Development of an interdisciplinary and interstate graduate class.
- Proposals in preparation
- Interdisciplinary multi-institution modeling class

[5] In a previous study I did (not in ID, NV or NM) of collaboration within researchers conducted as part of an external evaluation it was apparent that major differences exist in what constitutes collaboration, and that collaboration data reliability could be improved if criteria for what constitutes collaboration, collaboration stages and/or types of collaboration were standardized across the project. Important metrics for assessing collaboration results are the ñstandardò ones (proposals, publications and presentations). A resource for process evaluation of collaboration is *Assessing your collaboration: a self evaluation tool (Borden & Perkins, 1999)* (http://wwww.joe.org/joe/1999april/tt1.html

- Participation in an out-of-state workshop
- This meeting was invaluable in terms of yielding contacts for future proposals.
- An IWG award
- Connections between our "ecological change" team of researchers and those conducting parallel work in another state. Plans for a professional society meeting special session.
- Brought up the idea of having exhibits exchanged between states.

The percentages of respondents agreeing with each of the listed outputs/activities are displayed below.



Note: Percentages as number of responses are 4% (1), 7% (2), 19% (5), 26% (7), 37% (10), and 67% (18)

The following are the responses to the question: ***What reasons would you give a colleague for attending the annual tri-state meeting in 2011?***

- Meet colleagues - new collaborations
- Attendance is a requirement for receiving NSF EPSCoR funding.
- See what others are doing.
- The attendees are like minded with respect to the need for research into climate change impacts. Very relaxed atmosphere.
- Opportunity to gain a broad understanding of the work (CI development, research, and education) being done in support of mountain hydroclimatology in and between all three states.
- It's a good opportunity to see what work is going on in each state and among states related to climate change, including exposure to what other disciplines are doing that relate to your work.
- Be informed of current activities and future developments, and possibly establish multi-state contacts for collaborative research projects.
- Collaboration and even time to work with colleagues that you already have collaboration with.
- Good opportunity for people in NV to expand out their work to other regions. Also, to develop new collaborations.

- Raising awareness of your work in the region, connecting with other investigators, potential for collaboration--both in research and education realms.

- Proposal collaboration, networking for jobs and opportunities for students
- Opportunity to meet with colleagues and other potential colleagues with closely aligned research interests.
- It is a mechanism to achieve the broader goals of the programs, i.e., interdisciplinary interaction
- Networking with both in-state and out-of-state colleagues and getting updated on research progress.
- Meaningful and substantial participation and collaboration, valuable progress reports, good sharing of information, new opportunities for collaboration.
- Mainly to see what other states are doing and how we can complement each other.
- Networking, collaborations, ideas.
- Opportunities to expand collaboration, increase visibility of your own contributions, and enhance understanding of individual findings in the larger context of the tri-state climate investigations.
- Attend to meet others that are working on similar issues.
- Continued collaboration, and hopefully more
- Share the expertise and research findings among researchers not only in the same but also from other fields. Share opinions and feedback from other research groups. Establish collaborative research activities.
- Collaboration!
- This is a great opportunity to interact with a large group of researchers and educators who are broadly interested in climate change and its effects on the western United States.
- Getting to know the research being done by peers in the Tristate regions.
- I have received real value from each tri-state meeting (two) that I have attended. It is a high value opportunity.

APPENDIX C. 2010 Tri-State Annual Meeting Evaluation Report

Background

Idaho, Nevada, and New Mexico NSF EPSCoR joined programs 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. Program Directors, scientists and educators from the three states met in New Mexico, November, 2008 and Idaho, December, 2009, to create a coordinated Cyberinfrastructure (CI) research and development plan to serve both as a platform for future climate change research collaborations and the foundation for the EPSCoR NSF Track-2 RII. http://www.nmepscor.org/node/229

The Western Tri-State Consortium (ID, NV and NM) supports opportunities for scientific collaboration, and enhances each state's ability to secure competitive funding and tackle complex climate change research agendas (http://www.nmepscor.org/node/119). The Tri-state Innovation Working Group (IWG), funded by the Western Tri-State Consortium, supports collaborative, trans-disciplinary NV, NM and ID work. An objective of the IWGs is the submission of proposals that target NSF cross-cutting programs and/or the publication of synthesis papers in peer reviewed journals. The first RFP was released in May 2009 and the first IWG proposal was funded in fall 2009.

The three member states of the EPSCoR Tri-State Western Consortium held their first joint annual meeting, *Building Regional Collaborations*, in Boise, Idaho, on March 30 – April 1, 2009. Morning plenary sessions on the second day were devoted to best practices for broadening participation. Both days had afternoon concurrent sessions with presentations covering all components of the state EPSCoR programs. The overarching goal for the meeting was to make concrete progress toward future collaborations. http://www.nmepscor.org/node/79

Introduction: The Second Annual Meeting

The second annual Western Tri-State Consortium meeting's theme was *Collaborative and Interdisciplinary Climate Change Science* and the primary goals of the meeting were to:

- Advance understanding of climate change and its impact on the western U.S. by leveraging resources, data sharing, and data management in ID, NV, and NM.
- Develop joint research, education, and outreach capacity in the broader region that will lead to development of a virtual center for regional climate change research, education, and outreach.

The meeting was held April 6-8, 2010 in Incline Village, Nevada. The first day of the conference focused on Cyberinfrastructure activities across the three states. On the second day, researchers from all three states discussed their work in climate change science, policy and diversity efforts. The meeting included a student poster session in which over 30 student posters were judged by representatives from all three states. http://www.nmepscor.org/node/227

1st Annual (2009) and 2nd Annual (2010) Participation

Although the number of registrants is not an accurate count of the number of attendees because individuals who register might not attend a meeting, the registration list is a consistent way to report

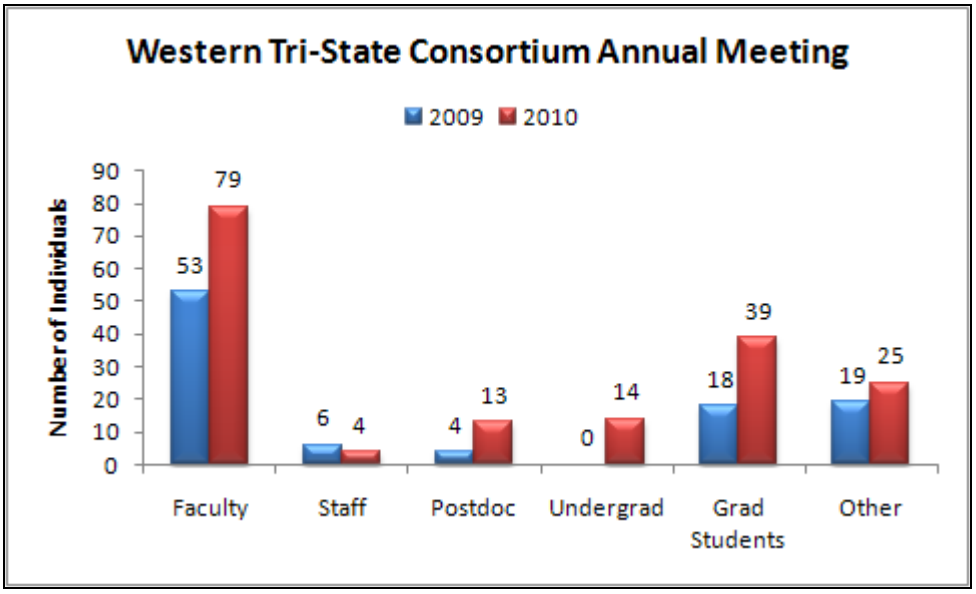
planning and interest in the meetings over time. These data do not include NSF Program Officers or the External Evaluator. Some individuals categorized as "staff" are research assistants/associates. Some faculty/researchers (faculty) are also university administrators. State NSF EPSCoR staff were recorded as "other" except for using "faculty" to represent the PI/co-PI's position, and they were not associated with any university even though they might be contracted with a university.

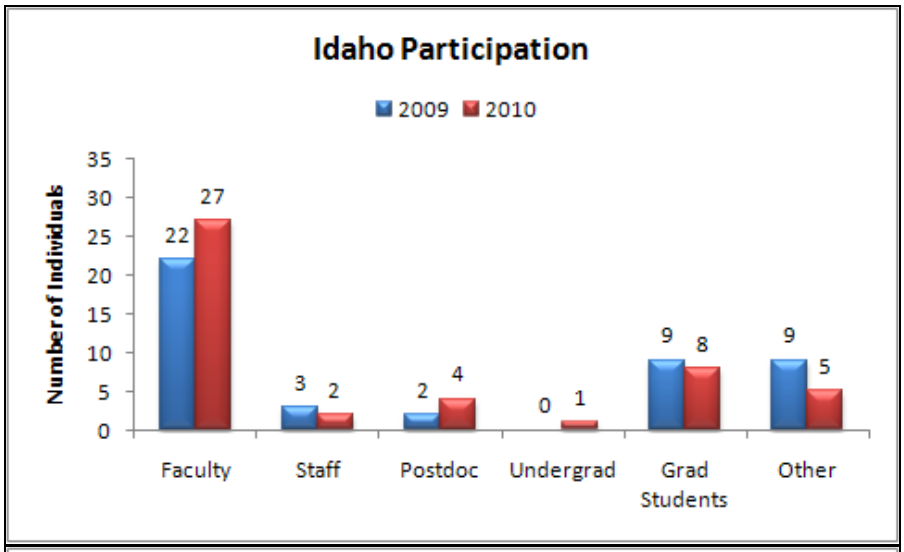
For the two Annual Tri-State Western Consortium Meetings:

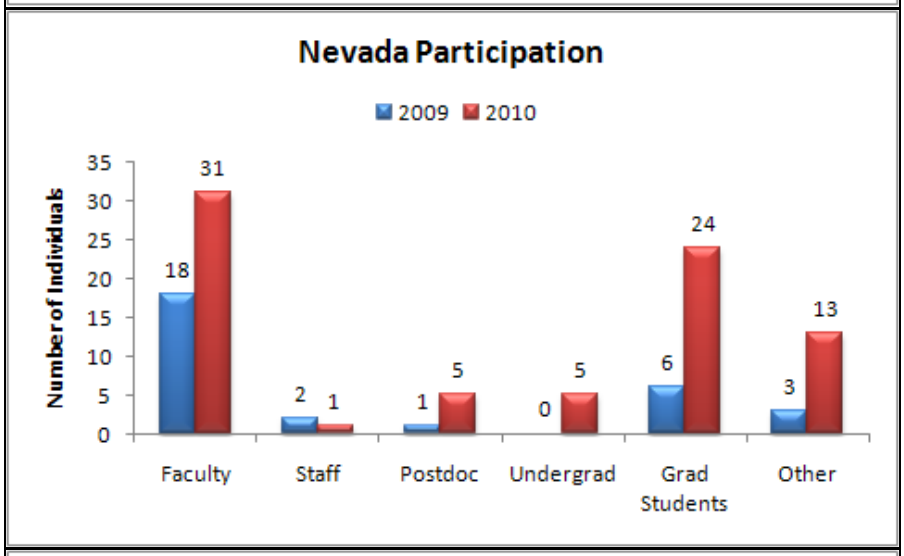
- In 2009 there were 100 individuals: 53% faculty, 4% postdocs and 18% graduate students
    - IDAHO: 49% faculty, 4% postdocs and 20% graduate students
    - NEVADA: 60% faculty, 3% postdocs and 20% graduate students
    - NEW MEXICO: 43% faculty, 5% postdocs and 14% graduates students
- In 2010 there were 174 individuals: 45% faculty, 7% postdocs and 22% graduate students
    - IDAHO: 57% faculty, 9% postdocs and 17% graduate students
    - NEVADA: 39% faculty, 6% postdocs and 30% graduate students
    - NEW MEXICO: 38% faculty, 9% postdocs and 17% graduates students

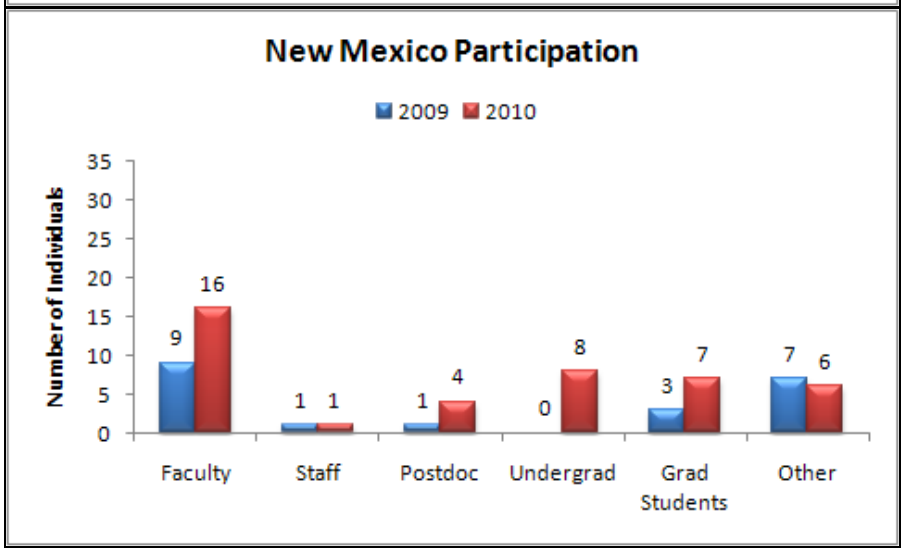
Several charts summarizing these data are displayed for the Consortium as a whole and for each of the states for the 1st and 2nd annual meetings. Undergraduate students attended in 2010 but not in 2009. From 2009 to 2010 there was a:

- 49% increase in faculty attendance
- 225% increase in postdoc attendance
- 117% increase in graduate student attendance




Idaho Participation
2009
2010
Number of Individuals
35
30
25
20
15
10
5
0
22
27
3
2
2
4
0
1
9
8
9
5
Faculty
Staff
Postdoc
Undergrad
Grad Students
Other


Nevada Participation
2009
2010
Number of Individuals
35
30
25
20
15
10
5
0
18
31
2
1
1
5
0
5
6
24
3
13
Faculty
Staff
Postdoc
Undergrad
Grad Students
Other


New Mexico Participation
2009
2010
Number of Individuals
35
30
25
20
15
10
5
0
9
16
1
1
1
4
0
8
3
7
7
6
Faculty
Staff
Postdoc
Undergrad
Grad Students
Other

The following two tables display the data summarized in the previous bar charts.

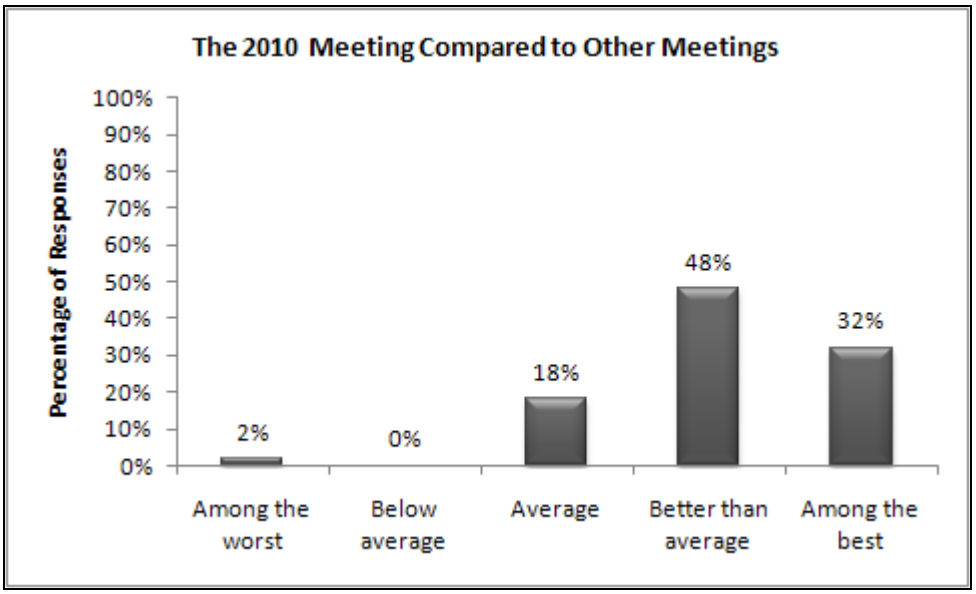
1st Annual Western Tri-State Consortium Meeting Registrants						
State	**Affiliation**	**Faculty/ Researcher**	**Staff**	**Postdoc**	**Graduate Student**	**Other**
Idaho N = 45	BSU	7	2	1	4	
	ID Nt'l Lab					1
	ID NSF EPSCoR	1				5
	ISU	4		1	2	1
	UI	10			3	1
	UI-McCall		1			
	iDiversityWorks!					1
Nevada N = 30	DRI	4		1	4	
	NSF EPSCoR	1				
	NSHE					3
	UNLV	6	1		1	
	UNR	7	1		1	
New Mexico N = 21	Diné College	1				
	Los Alamos Lab					1
	Minnick & Assoc					1
	NMHU	1				
	NM NSF EPSCoR	1				2
	NM Public ED					1
	NMSU	1		1		1
	NM Tech	2			2	
	NMU	3	1		1	
	NM Museum Nt'l History					1
Other N = 4	CU-Boulder	1				
	USDA-ARS-NW Watershed Ctr	3				
	TOTAL	**53 Faculty/ Researchers**	**6 Staff**	**4 Postdocs**	**18 Graduate Students**	**19 Other**

2nd Annual Western Tri-State Consortium Meeting Registrants							
State	**Affiliation**	**Faculty/ Researcher**	**Staff**	**Postdoc**	**Students**		**Other**
					UG	**Grad**	
Idaho N = 47	BSU	8		1		5	
	ID NSF EPSCoR	1					4
	ISU	5		3	1	1	
	UI	13				2	1
	UI-McCall		2				
Nevada N = 79	DRI	6		4		4	
	NSF EPSCoR	1					
	NSHE						7
	UNLV	10		1		9	5
	UNR	12	1		5	11	
	NSC	1					
	NV Dept of Ed						1
	Truckee M. CC	1					
New Mexico N = 42	Diné College	1					
	Los Alamos Lab	1					
	Minnick & Assoc						1
	NMHU	1			1	1	
	NSF EPSCoR	1					1
	NM CAC						1
	NMSU	1		1	4		
	NM Tech	3		1		6	
	NMU	8	1	2	3		
	Northern NM Net						1
	Comp Challenge						1
	NM Museum Nt'l History						1
Other N = 6	USDA	2					
	UC-SB	1					
	CUASHI						1
	USGS	1					
	Utah State Univ	1					
	TOTAL	**79 Faculty/ Researchers**	**4 Staff**	**13 Postdocs**	**14 UG Students**	**39 Grad Students**	**25 Other**

Evaluation of the Meetings by Participants

The web-based survey was completed by 64 (37%) of the 174 registered participants. Participant satisfaction with the meeting was high with 54% of the 64 respondents reporting the meeting met their expectations and 44% reporting the meeting exceeded their expectations. Only one respondent (4%) reported that the meeting failed to meet expectations.

The 64 respondents rated (1 among the worst, 2 below average, 3 average, 4 better than average and 5 among the best) the meeting compared to meetings they had attended this year or in the past. The distribution of ratings is displayed below.



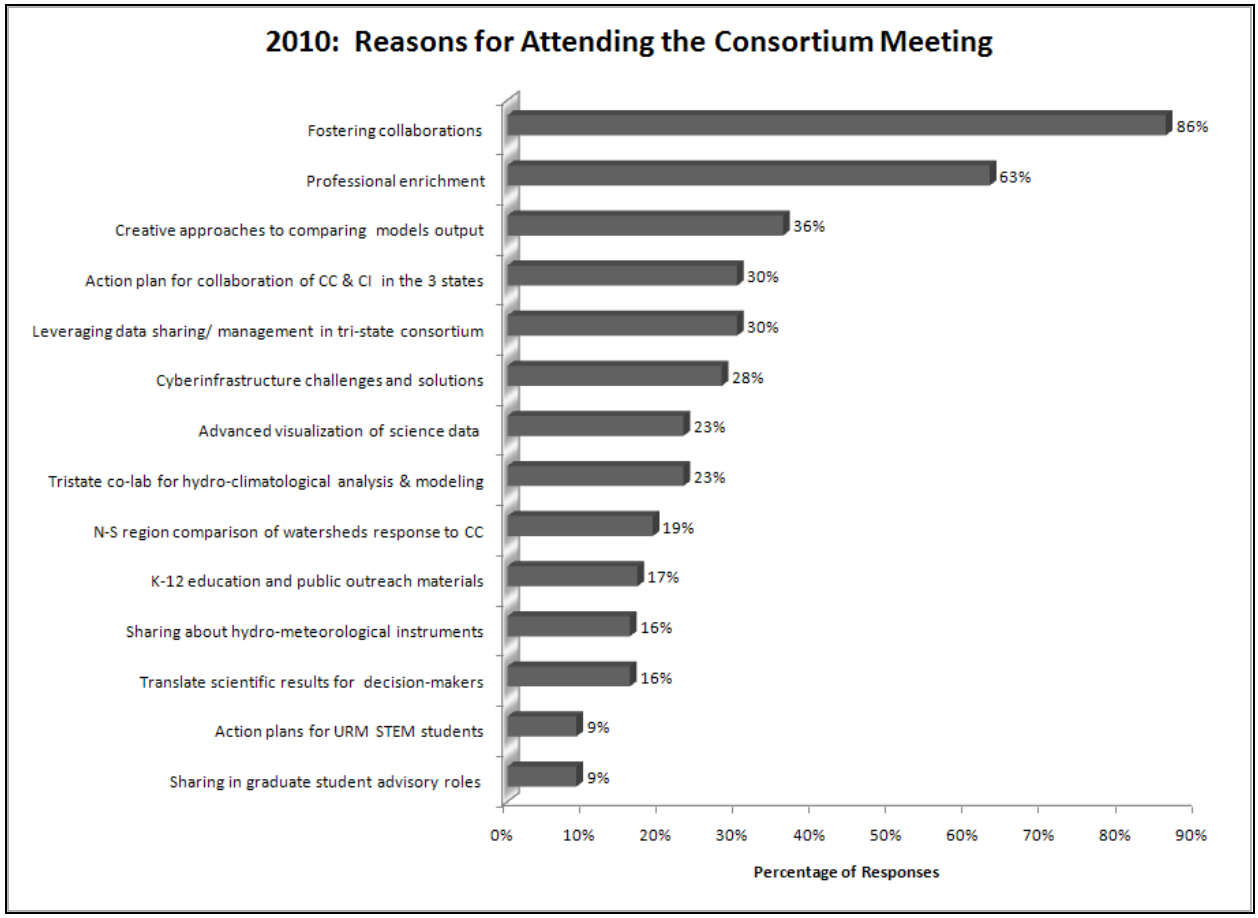
Reasons for Attending (2009 and 2010)

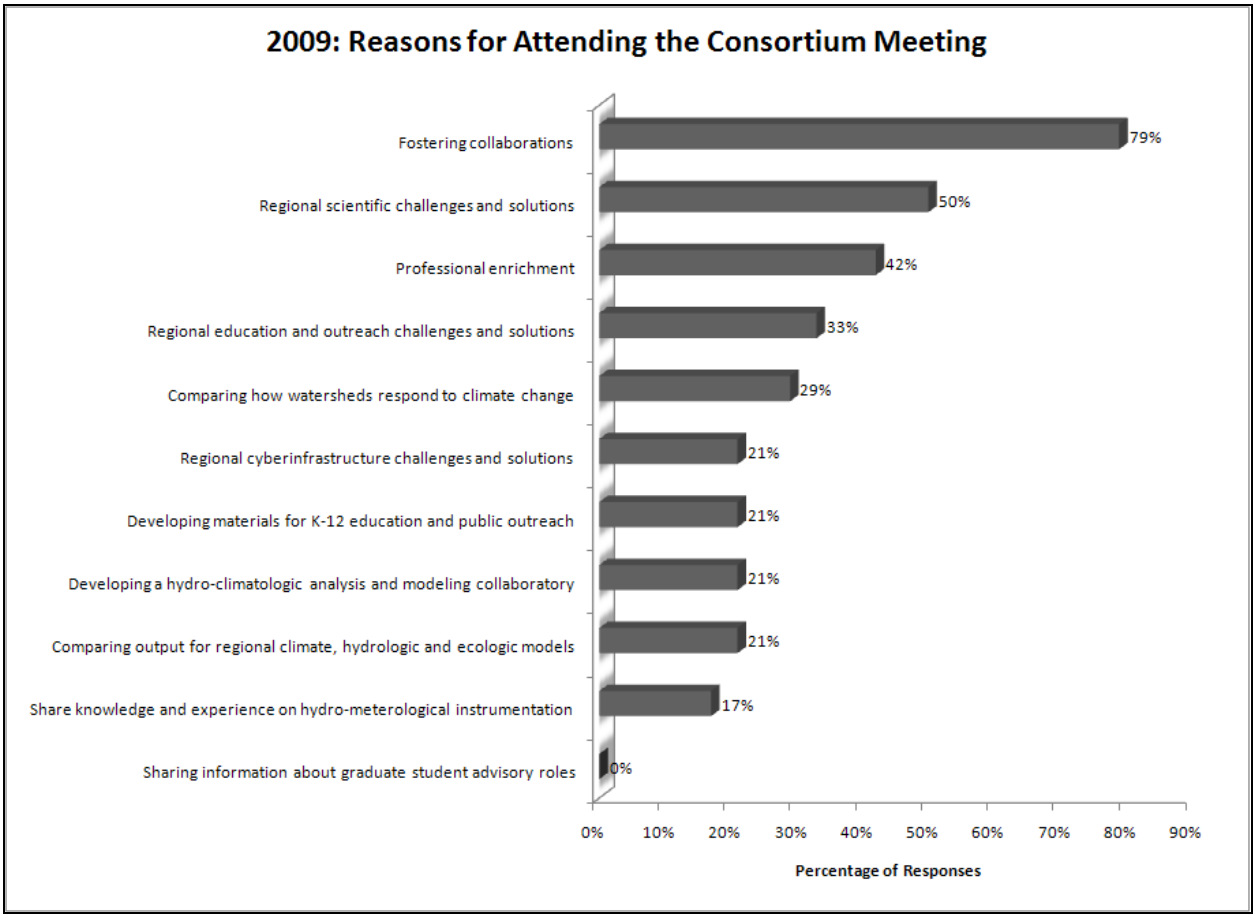
In 2009 and 2010 the fixed choices provided on the evaluation form were determined by the meeting objectives. Although the meeting objectives were not identical it is interesting to compare the frequencies of responses. The three most frequently selected reasons for attending the meeting were:

- In 2009: Interests in fostering collaborations (79%), regional scientific challenges/solutions (50%) and professional enrichment (42%).
- In 2010: Interest in fostering collaborations (86%), professional enrichment (63%), and creative approaches to comparing output from regional climate, hydrologic and ecologic models (36%).

There were several notable differences in percentages of responses that likely reflect the increased awareness and commitment to collaboration within the Idaho, Nevada and New Mexico tri-state Consortium.

- The percentage of respondents attending the tri-state meeting for opportunities to foster collaboration increased from 79% in 2009 to 86% in 2010.
- Significantly more 2010 than 2009 respondents attended the meeting for professional enrichment ($X^2 = 3.09$, $p < .0789$).
- In 2009 none of the 24 respondents attended the meeting to "share in graduate student advisory roles across jurisdictions" whereas in 2010, six of the 64 respondents indicated this was one of the reasons they attended the meeting.





Additional Analysis of Reasons for Attending the Meeting

For the 40 respondents who attended the meeting for professional enrichment, the five most frequent reasons for attending the meeting are listed here along with the percentage of the 40 respondents displayed in parentheses.

- Opportunity to meet with colleagues, share ideas, learn from one another and foster collaboration (90%)
- Action plan for collaboration of interdisciplinary CC science and CI among researchers in the consortium (35%)
- Leveraging data sharing and data management in the tri-state consortium (33%)
- Cyberinfrastructure challenges and solutions (27%)
- Advanced visualization of scientific data for research, education and outreach (27%)

For the 24 respondents who did not include professional enrichment as a reason for attending the meeting, the five most frequent reasons for attending the meeting are listed here along with percentages of responses.

- Opportunity to meet with colleagues, share ideas, learn from one another and foster collaboration (79%)
- Creative approaches to comparing output from regional climate, hydrologic and ecologic models (37%)
- Cyberinfrastructure challenges and solutions (29%)
- Leveraging data sharing and data management in the tri-state consortium (25%)
- Action plan for collaboration of interdisciplinary CC science and CI among researchers in the consortium (21%)

For the 40 respondents including and the 24 respondents not including professional enrichment as a reason for attending the meeting, the percentages agreeing with "Development of approaches to translate results of scientific investigations for use by decision makers" as a reason for attending differed noticeably.

	Recorded Professional Enrichment as a Reason for Attending the 2nd Annual Tri- State Meeting	
	YES (N = 40)	NO (N = 24)
Development of approaches to translate results of scientific investigations for use by decision makers	25%	0%

For the 11 respondents who reported "development of materials for K-12 education and public outreach", the five most frequent reasons for attending the meeting were:

- Opportunity to meet with colleagues, share ideas, learn from one another and foster collaboration (91%)
- Professional enrichment (73%)
- Advanced visualization of scientific data for research, education and outreach (45%)
- Leveraging data sharing and data management in the tri-state consortium (36%)
- Action plan for collaboration of interdisciplinary CC science and CI among researchers in the consortium (36%)

Overall Quality Ratings of the Sessions

Tuesday Sessions	N	Percentage of Recorded Ratings					Mean
		Poor -1-	Fair -2-	Good -3-	Very good -4-	Excellent -5-	
Networking Breaks	32		6	31	41	22	3.78
A1: CI data policy	29		14	35	35	17	3.55
A2: CI architecture	30		17	40	23	20	3.47
A3: CI data formats/connectivity	31		16	42	19	23	3.48

Wednesday Sessions	N	Percentage of Recorded Ratings					Mean
		Poor -1-	Fair -2-	Good -3-	Very good -4-	Excellent -5-	
B1: Policy resilience	20		10	40	25	25	3.65
B2: Climate variability and predictions	43		7	33	44	16	3.70
C1: Communicating with stakeholders	21	5	9	33	29	24	3.57
C2: Using climate predictions	37		11	32	41	16	3.62
C3: Tech advances in Hydroclimatology	22		5	45	27	23	3.68
D1: Policy/Social survey construction	16		19	25	25	31	3.69
D2: Climate trends – western watersheds	40		3	45	35	17	3.67

Wednesday Sessions	N	Percentage of Recorded Ratings					Mean
		Poor -1-	Fair -2-	Good -3-	Very good -4-	Excellent -5-	
D3: Cyberlearning	20		25	40	15	20	3.30
E1: Hydrologic information systems workshop	24		4	46	17	33	3.79
E2: Vegetation and Hydroclimatology	26		4	27	42	27	3.92

Thursday Sessions	N	Percentage of Recorded Ratings					Mean
		Poor -1-	Fair -2-	Good -3-	Very good -4-	Excellent -5-	
EPSCoR and NSF priorities	49		20	35	29	16	3.41
Tri-state collaborations and synergies	50	2	20	20	44	14	3.48
Tri-state innovation working groups	46		15	39	37	9	3.39
Roundtable discussion	35	6	14	34	34	11	3.31
Networking breaks	45		4	27	49	20	3.84

The Keynote Addresses

Wednesday's Keynote Speaker, Frank Tuitt, University of Denver, spoke about *Signals and Strategies for Increasing Campus Diversity***.** He was not included in the list of registered participants. In his dissertation, Black Souls in an Ivory Tower Dr. Tuitt examined the pedagogical practices and learning conditions that African American graduate students identify as most beneficial to their learning. He served as the Cabot Postdoctoral Research Fellow with the Bok Center for Teaching and Learning at Harvard University and a research assistant for the Harvard National Campus Diversity Project. Dr. Tuitt is a co-editor and contributing author of the book **Race and Higher Education: Rethinking Pedagogy in Diverse College Classrooms**.
http://www.gse.harvard.edu/impact/stories/alums_students/he_edd/tuitt.php One respondent wrote, "The diversity key note speaker on Wednesday was amazing and I felt like I personally got a lot out of that speech." Another wrote, "The keynote speaker was very, very, very good!"

Thursday's Keynote Speaker, Jeff Dozier, University of California, Santa Barbara spoke about *Snowmelt Runoff, The Fourth Paradigm, and the End of Stationarity*. He was included in the list of registered participants. In October 2009 Dr. Dozierwas awarded Microsoft Research's second annual Jim Gray eScience Award. The award recognizes innovators whose work has made an especially significant contribution to the field of data-intensive computing. Dozier was specifically cited for his pioneering research on remote sensing, water resources, and climate change, and his contributions to the integration of environmental science and computer science. Dozier currently investigates how climate change affects the mountain snowpack and the management of water from snowmelt. Dozier is one of the contributors to *The Fourth Paradigm: Data-Intensive Scientific Discovery* (Hey, Tansly & Tolle, 2009, Microsoft Research).

Benefits of Attending the Meeting

Respondents recorded the benefits of attending this meeting. The benefits were all about **OPPORTUNITY**. The meeting offered opportunities to:

- Brainstorm about STEM retention
- Broaden climate change, its impacts and mitigation strategies
- Build interdisciplinary synergies
- Build on education ideas
- Discuss future proposal writing
- Display a poster and get ideas and feedback as well as network
- Establish linkages between efforts
- Find potential collaborators across disciplines and states
- Gain knowledge and experience from poster competitors
- Get feedback on research projects
- Hear presentations and participate in other professional development opportunities
- Hear the review of climatic models
- Identify shared needs for data and/or models
- Increase understanding of the overall problem and complexity in each research topic
- Learn about CI activities in the three states and seeing how system integration was progressing
- Learn about the challenges that civil engineering researchers face
- Learn how to improve data quality by updating sensors and location sites of weather stations
- Learn more about National Science Foundation funding
- Learn of ways to organize data to a main location to increase data retrieval efficiency
- Learn the latest ideas
- Learn what environment science researchers need from Cyberinfrastructure
- Learn what is and isn't working for others
- Listen to Denise Barnes from NSF
- Make direct contact with other EPSCoR faculty and students
- Network with others with common interests
- Participate in the HIS workshop
- Plan for an interdisciplinary modeling course
- Promote one's work and to learn what others are doing

These were verbs respondents used to describe the meeting's benefits:

Brainstorm
Broaden
Build
Discuss
Display
Establish
Find
Gain
Get
Hear
Identify
Increase
Learn
Listen
Make
Network
Participate
Plan
Promote
See
Share
Understand
Update

- See old friends and colleagues, and make new contacts
- See the new technology
- Share ideas and solutions
- Share software tools that will save a Cyber group months of hard work
- Understand better the EPSCoR and goals within each of the three states.
- Up-date myself on partner states' advances and technologies.

Strongest Features of the Meeting

Respondents commented on the strongest features of the meeting. Many of the strongest features were also the benefits of attending the meeting. The beautiful location, food, and atmosphere of the meeting were all strong features. The meeting was praised for being well-organized. (External Evaluator's note: It was apparent that a great deal of work went into planning the meeting.) One respondent wrote, "Very well organized-I liked that each day had a purpose, and that the goals were often recalled." Other strongest features recalled by participants included:

- Brief talks that forced speakers to get to the point
- Collaboration
- Data One presentation by Bill Michener and the Policy Resilience Session
- Diversity of people at the meeting
- Everything
- High science content interactions
- Inclusion of graduate students in all aspects of meeting
- Knowledge sharing among states and across disciplines
- Limited presentations followed by discussion in small and large groups
- Long networking breaks
- Networking
- Obtaining weather data in different regions, interpreting the data and explaining the big picture about the data
- Organization and timekeepers
- The 3-state consortium
- The diversity workshop
- The HIS workshop
- The key note speaker
- The poster session
- The Wednesday's session because participants from a range of backgrounds could choose sessions
- Things were well-organized, informative, and even entertaining
- Variety of session topics
- Very energetic presentations with knowledgeable presenters

The strongest features highlighted the importance of the Tri-State Consortium as a vehicle for providing increased accessibility and reducing the isolation of research, Cyberinfrastructure, education, outreach and workforce development. The Consortium made the "whole greater than the sum of the parts." The agenda was well planned out and included something-for-everyone.

Suggestions for Meeting Improvement

Suggestions for improvement were made by about half the participants. These suggestions are grouped into several topic areas.

Presentations and discussion

- Question/Answer session should follow every presentation (even for some overviews), since it would be more helpful for audiences to understand and focus.
- Exclude talks that are too specific or too obvious/trivial.
- More discussion groups rather than just sitting and watching presentations. One of the most important goals of these meetings should be to brainstorm and make use of the gathering of experts to get solutions and ideas for the EPSCoR program.
- Overall willingness to make changes to program to support research discussions.
- Improve the efficiency of round table discussion
- Allow more time for Q/A after each presentation (usually 3 or 5 min)
- More presentations of individual research efforts. It is difficult to collaborate when it is not certain what the other state's research goals are. It seems that this is difficult at the beginning of the projects.
- I think that a lot of the presentations the first day could have been made into sessions so for those of us to whom it wasn't as relevant could have focused on more relevant topics

Structure

- Arrange only up to two concurrent sessions.
- Cyber should be listed into the main agenda

- **More depth; maybe less breadth**
- **More interdisciplinary sessions**
- **More sessions that include <u>everyone</u> – research, CI, diversity outreach and education**
- **Research-based, scholarly content**
- **Build in some flexibility**

Scholarly/ professional resources and activities

- Profiles of investigators along with bibliographies of their work completed and in progress related to EPSCoR topics
- More emphasis on scientific results and activities, less emphasis on artificially induced pseudo-collaborations.
- It is very frustrating to go to these meetings and feel like I don't have any time for meaningful discussions about research, and all time is scheduled for traditional talks (which are not conducive to collaborative research progress).
- I think that in order to foster collaborations, we must first know what all the participants from other states are doing. We learned some of this in the talks but more sessions in which we break out into research topics and are introduced to the individual investigators from each state. Otherwise, unless our research focus was covered in one of the few talks, we will not know with whom we should try to network and collaborate. Then, our networking breaks could be more productive because we have actually met our potential collaborators.

Time-keeping and providing time between sessions knowing some sessions will go over time

- Keeping to time better so things weren't so rushed.
- Presentations should have been kept to time (at least in the sessions I attended). This would have left more time for questions, discussion and networking.

- The timing of the presentation was sometimes a little rushed but that can be expected especially when there are questions being asked of the speaker.
- Time control should be better managed for each presentation (5 min, 3 min, 1 min, warnings)

Intra- and inter-interdisciplinary and inter-component interactions and sessions

- Allowing for data and knowledge communication across the different components. I suggest having some sessions in which every body learns about the data gained from the different components before splitting into more specialized sessions.
- Provide more space for interaction at breaks. It appeared that there was an almost complete separation between the social and education and "hard science" components.
- More smaller group discussions (both within and between fields) - these would help foster connections between individuals and groups and provide a good avenue for brainstorming
- Enhance the communication and knowledge sharing between researchers from different fields. I will be useful to have more sessions that target to researchers in different fields, as opposed to discussion of technical detail among researchers in the same field.
- Include a workshop for researchers about increasing diversity

Human behavior

- Ban wireless internet connection in meeting room(s).

Poster session

- More flexibility in the poster session
- The graduate poster session could have been organized in the standard fashion where judges are anonymous and filter through the crowd. Limiting discussion to two minutes encourages over - generalization of complex topics which should not be encouraged in up and coming professionals.

Roundtable and breakout sessions

- I think a session that allowed breakout groups to meet in smaller numbers about specific aspects/components of the respective states' projects would have been beneficial.
- Any round table or break out group sessions should be more highly structured and have tangible outcomes. Why are we expending so much energy discussing, say, the future needs of climate change observations, when nothing (that I know of) will come of it?
- During the Roundtable discussion (very good idea) we ran out of time. If we had just 10 more minutes we could have reached some ground breaking ideas. Again its amazing the results you can get when you bring together scientists from so many fields from so many intra-state institutions.

Wednesday and Thursday sessions

- Honestly, I had a hard time in the Thursday sessions. The Wednesday sessions were much more applicable and interactive.
- Wednesday's schedule when all sessions fell behind.
- The Wednesday morning STEM action plan session, which was really well run and engaged everyone in great discussion.

Include outcome planning as well as meeting process

- Could do with improvement on fostering potential collaboration (at least from my perspective). Seemed to be a lot of talk and no action.

Additional activities

- A tour of the local watershed
- More keynote speakers from other states to provide a different perspective and new approaches
- More informal networking time - no speakers during lunches.
- Since there were a lot of undergraduates there-have a breakout session for undergraduates. Since we may be interested in attending graduate school in one of the tri-state, maybe have someone from each school present their program.

Suggestions for the 2011 Tri-State Annual Western Consortium Meeting

Suggestions for next year's 2011 tri-state meeting were made; each bullet is an individual's comment. Some respondents repeated their suggestions for improving the 2010 meeting.

- Data should be an important section of climate change topics, and everybody should join. So no need to separate.
- Whiteboard meetings
- It would be nice to have a discussion/meeting with just graduate students and people who agree to act as graduate mentors.
- Perhaps some greater variation in break-out sessions? More help from the moderators in the sessions to not just make use listen to talks but to give opportunity for the group to discuss potential collaboration ideas, or to break into smaller groups for discussion around specific talking points like was done in one session yesterday.
- Report back from parallel sessions; interaction between physical and social sciences
- In a year's time we'll have considerably more students, more projects and more data. The challenges will be to have all of this presented concisely and in sessions that foster questions, discussion and networking. Keep the long breaks and short presentations!
- More about education/outreach, ecology, and social science. We identified K-12 as a crucial time to reach students both for climate literacy and as potential scientists. Ecology and social science are important to determine the effects of climate change and also have feedbacks (e.g., through changes in land use and land cover) that are relatively unknown and extremely important.
- I felt like there was almost not enough overlap of people between sessions. CI people were there Tues, but there was need for discussion of the science and the scientists showed up Wednesday. Thursday there was discussion which needed CI people and several had left.
- More poster sessions? Coordination of travel to save money. More scientists from outside the consortium to interface with. More workshops.
- Increase sessions to have more understanding and feedback from researchers outside the specific field. More interaction and involvement with the researchers from all fields will be valuable.
- Profiles of investigators along with bibliographies of their work completed and in progress related to EPSCoR topics. A focus on education will be excellent and timely.
- The roundtable of the state of research in each state should have come at the beginning to give participants a framework for who is working on what.
- Interdisciplinary modeling; please do keep time open for networking.

- More research presentations
- I would love to see research sessions that people submit abstracts to, just like AGU or ESA. Some sessions were slightly disjointed, some people were not prepared, and some people were excluded from sessions they should have presented in because the organizer did not know all the EPSCoR researchers in her/his field.
- Pastries
- Maybe in the poster sessions, break them into groups according to what the research is on.
- Sessions on demonstrating where collaborations have worked and why collaborating would be beneficial.
- A tour
- PI presentations of research agendas as a way of fostering collaborations
- Include a workshop for researchers about increasing diversity
- Possibly focus more on open discussions
- More on cyberlearning. One session didn't seem like it was enough. Of course, the cyberlearning aspect of the project is my focus, so take that how you will.
- Hands-on training. Highlight science enabled by collaboration (e.g., cross-state comparison)
- More scientific sessions, allow participants to submit abstracts to science sessions.
- Allow more time for people to get together in smaller groups. How about having time NOT listening to talks, but for people to discuss funding opportunities, share data, etc in smaller groups.
- Weekend should be part of the meeting. We have to be on campus for teaching requirements. So, if it starts on Friday covering the week end, it would be wonderful. I had to attend only one day of the conference this year just for this reason.
- Larger group for the HydroDesktop demo. Maybe show a demo to the general group.
- More introductions of individual researchers, topics and teams. More focused discussion time for specific research topics.
- Roundtable discussion, keynote speaker and 1-2 20-30 min networking breaks along with many power-point discussions of climate change research and cyber group progress. The poster session was very good also.

Additional Comments

Thirteen individuals recorded additional comments about the meeting:

- Silly comment but it would be great to have the coffee/tea out for the entire meeting. It was sometimes cleared away during breaks when it would have been nice to get some caffeine.
- Hard to beat the location
- I heard many rumblings about the lack of attendance by/invites for public school educators. I think they should be invited, given their own session where they can tell us about how the workshops they attended have worked/not worked and what they have been able to bring to the classroom successfully. Also they need some sort of forum for discussing the value of further collaboration between tertiary and secondary level educators. Perhaps they could even help us address the "problem of diversity" in STEM fields. Let's bring them in on that discussion and hear what they have to say.

- It was a wonderful conference to learn and expand my knowledge on the climate change problems. I appreciate greatly for having this invaluable learning experience, which will contribute to enhancement and progress in my research. Thank you very much.
- Tahoe was beautiful!
- Well organized
- The roundtable discussion on the last day could have been planned better. I realize the last day's last session is always difficult, but the discussion was very lively, yet meandered quite a bit!
- It was a wonderful experience, thank you so very much of the opportunity.
- I think these are good meetings
- Good meeting; nicely organized; good facilities
- Location was very nice.
- Keep up the good work of networking. Venue was great but next year it is preferred in a place of flight arrival locations than to drive for few hours after landing. Example. Albuquerque. It saves lot of time and reduces the carbon foot print!
- This was a good meeting and I've come away with ideas about next steps that are forming percolating. I have to remind myself that there are other topics and tasks on my plate!

Tri-State Session Lead Moderators

Both quantitative and qualitative data were gathered in the exploratory process evaluation of the 2nd Annual Western Tri-State Consortium Meeting. Qualitative data were appropriate for understanding the quality and impact of the meeting on the meeting attendees. To triangulate information, qualitative information was gathered from several subsets of meeting attendees.

Purposive sampling, one of the most common qualitative sampling strategies, identified the subset of the larger group of meeting attendees, and was constructed to serve the purpose of understanding the meeting from the "inside" perspective, that of a Lead Moderator. As in all purposive sampling, this group is a non-representative sample. Sixteen different sessions were led by 15 Lead Moderators. The Lead Moderators were contacted by the External Evaluator and were asked to complete a web-based survey. Ten (67%) of the Lead Moderators completed the survey.

As a group these ten Lead Moderators felt this was a well organized, valuable meeting. The attractiveness of the meeting location, friendly atmosphere, comfortable hotel and safe environment were all excellent. Very good features of the meeting were that it included good food and beverages and built working relationships, had a clear purpose, created involvement, had a fast internet connection, supported generation of ideas, included meaningful content, had a balanced agenda, included well prepared presenters, encouraged pooling of knowledge, had reasonable costs, stuck to the agenda, was time efficient and provided time for asking questions. Based on Moderators' experiences and observations, some participants formulated plans resulting from the meeting; there was some tentativeness about the depth, breadth and sustainable impact of the meeting. One moderator offered a suggestion: This type of meeting should identify concrete collaboration efforts and firmer templates for their execution. This was more like hand waving about collaboration in principle. Another moderator wrote: It would be beneficial to have the opportunity to have follow-up discussion about the actual topics presented, whether they adequately covered and included needed topics and people and if the communication evoked new ideas and teaming.

These are highlights of responses from the Lead Moderators:

- The room arrangements worked well including the large "U" arrangement on the first day and the round tables in the other sessions. Everyone was able to see the screen well. One respondent wrote, "The round table format was good for encouraging more engagement from the audience than a traditional classroom setup." Another wrote, "The round tables worked well and were convenient for people to both listen and work."
- Having two or three microphones and people designated to move the microphones around in larger rooms helps facilitate discussion.
- Having time keeping equipment available would be helpful for keeping sessions moving smoothly. One moderator suggested that it would be helpful if the time keeping equipment was a time machine with colored lights.
- In general, technology worked well. One moderator reported having some "glitches" getting the projector to work.
- The ratios of percentages of presentation time to discussion time were most frequently 50/50 and 80/20. The planned allotments were most frequently 50/50. One outlier was the CI Architecture session which planned for 75/25 and used ~90/10.
- If speakers went over their allotted time then discussion was limited unless the session did not keep on schedule. This worked fairly well for one of the sessions because running about 40-minutes over time was possible because the extra time cut into the lunch hour.
- A scheduled 90-minute session was cut to a bit over one hour because the previous session went over more than 30-minutes. The shortened session probably resulted in less discussion than would have occurred if the session had been 90-minutes.

Nine moderators noted the strongest features of their sessions:

- A diverse set of talks that were linked together by an innovative "thread".
- The discussion included all states representatives and initiated discussion on possible collaboration afterwards.
- The discussion period worked well. People were interested in discussing the topic and many different points of view were put forth.
- Diversity of the presentations and, probably, the discussion afterwards.
- The amount of information (both technical and general) was very strong. This generated a great deal of interest.
- The opportunity for discussions between modelers and empiricists, climatologists and hydrologists.
- The discussion was the strongest feature.
- Participation of audience
- Good overview of the diversity of activities going on in each of the three states.

The features needing improvement in the sessions were recorded:

- Need more structure/guidance from the organizers in the set up of the sessions. Probably need more "direction" from State offices in "assigning" presenters for state overviews for specific topics.
- A few presenters went far over the time they were allotted and strayed from the focus of the session. The transition between speakers was a bit slow, too.
- Schedule the Tri-State Innovation Working Groups for at least 90 minutes since it focused on collaboration between the three states.

- There were some problems with obtaining presenters from all three states because of busy schedules.
- It would be helpful to prescreen the number of slides and remind the speaker about the time limit before the talk.
- Have someone other than the moderator designated to be the time keeper.
- Make information on good Power Point slides available to moderators and presenters prior to the meeting (when presentations are being prepared).

The moderators were asked for suggestions if a session speaker doesn't adhere to the time-keeper's signal:

- Don't worry about it. Content is more important than schedule.
- If a time machine is not available, then the moderator stands up giving signals to conclude the talk.
- You sometimes have to be pushy. I tend to stand up and then move closer and closer to the speaker if they ignore my signals to wrap up. Sometimes it is necessary to cut in and stop them if they have really abused the time limit.
- A visible cue to them that they are over their time is a good first step. I do think, however, that a strong stance on timing could be helpful, to the extent that the projector is disabled when the time limit is exceeded. Many presenters simply lose track of time and forget to watch for cues, so that kind of final indicator may be useful.
- Stand up at one-minute to go. Get eye contact when time is up and request that he/she wind it up. After three minutes suggest that one terminate the talk.
- Allow the speaker to go slightly over time and interrupt if needed to move on. Best to be very proactive and emphasize the importance of sticking to the schedule with speakers ahead of time.
- Use a card with the time or approach the speaker on the side of the room "to hint".
- I have found that if I stand (at one-minute left), move to the presenter (at time out) works fairly well in encouraging them to wind up.

Characteristics of effective Lead Moderators (and co-Moderators) were highlighted by the respondents:

- Creativity in drafting an interesting session idea; able to thread together a variety of approaches and perspectives
- Adaptability in implementing
- Skilled at keeping talks on time and session on schedule especially if there are parallel sessions so that participants can move effectively between sessions
- Ability to initiate discussion even if there is no question from the audience; it is the moderator's job to determine how to get things flowing; needs to be able to effectively facilitate discussions and questions.
- Able to set up a speaker list
- Able to give a brief overview of the session, speaker introduction and a good summary during the session conclusion
- Good organizational skills
- Attention to detail in designing and outlining the gals of the session and the logistics (time, structure) for the presenters
- Establishes communication before the session with the speakers

- Prompt attention to presenter needs
- Good contacts with potential presenters
- Quick communication habits
- Good general knowledge of the topic is required to ensure appropriate speakers
- Pointed, efficient, not too "strict" on the format in order to adjust for creative and unexpected outcomes; flexible

The Lead Moderators rated (almost all did this, most did this, some did this and none or hardly anyone did this) characteristics of good Power Point slides that were listed. As a group, the moderators felt that 70-100% of the slides adhered to these characteristics most or almost all of the time.

Moderators were asked if they had enough time to invite and confirm speakers for your session, and if not, how time they felt they needed to do this. Their responses are copied here:

- The response from other states was not prompt. I believe that there was enough time.
- Yes, I had enough time. (3 responses)
- It could have been a longer lead time, also, it would have been useful to have had a few paragraphs describing (a) why the particular session topic was suggested and (b) any specific outcomes that were desired from the session.
- No, I was asked late to fill in for someone who could not attend.
- Yes, although we ran into issue with finding "any" speakers for some components. This is where having some support from the State office could help "prod" speakers to come forward to present on specific topics.
- No, months are needed.
- Yes, quite enough. Lining up speakers was fairly easy with the time I had available.

These were comments recorded by seven respondents:

- Great meeting overall. Very valuable, but overall would have had greater value if fewer participants were focused on proposal deadlines the week after the meeting, which was unforeseeable when the meeting was scheduled.
- The previous session ran over into our session time, which was unfortunate. We had too many outreach/educators and not enough science PIs come to the session.
- I appreciate ID and NV EPSCoR's efforts to make this meeting right for NSF – the EPSCoR offices deserve a compliment.
- The conference was a great success – a great deal of information was shared and all three states were brought up-to-date on the accomplishments and progress of the others. Grouping related presentations by day was a good decision as it allowed attendees to pick the most relevant presentations. The view was superb and the social activities were second-to-none. Very nicely done.
- I'm not sure how one facilitates knowledge exchange, but it would have been useful to have had a session at the end where each of the moderators reported back to the group as a whole. That would have allowed information on what other sessions were discussing and the potential for interdisciplinary cross-fertilizations.
- I think the meeting organizers did a great job.
- By the end of the day it seemed that the audience (and certainly the moderator) was somewhat tired and so the session ended after the completion of the presentations so there wasn't discussion.

Should the Posters be Judged?

Twenty-four individuals who participated in the Tristate meeting in both 2009 and 2010 were asked: ***Student posters were not judged at the 2009 tristate meeting and they were judged at the 2010 tristate meeting. Which do you prefer? (What about this idea – undergraduate posters are not judged and graduate student posters are judged?)*** These were their responses grouped into general categories:

Judge both Undergraduate and Graduate Posters

- Poster judging is fine.
- Judging is probably good . . . anything to improve the scientific content of these meetings, which is meager at best.
- All posters should be judged.
- Judging is a good thing, even for UG's if possible
- Yes...judge
- Judging of student posters is fine (undergrad and/or grad).
- I like the judging. It helps get the posters viewed and communicated.
- I think both undergraduate and graduate posters should be judged. Competition is always a stimulating factor at all levels of education.
- Both should be judged by a judge committee, but also the overall audience.
- I like the judging. It makes it a bit more "real" for the students.
- The student posters should be judged. This increases the involvement of the students, which is always a good idea.
- Both graduate and undergraduate judging is preferred.
- Judge them all
- Please do judge all posters

Judge both Undergraduate and Graduate Posters as Separate Groups

- I think that a competition with recognition of high-quality posters is a great idea (with separate divisions for undergraduates and graduates). Having separate divisions for undergraduate students, graduate students, and even faculty would be even better.
- Judging is good for getting interaction with students, but there were so many posters, it seemed somewhat time-consuming and overwhelming. You could separate judging for undergraduate and graduate to reduce the load on individual judges.
- You could separate judging for undergraduate and graduate to reduce the load on individual judges.
- A poster contest for graduate students and a separate poster contest for undergraduate students.
- Judged! Two categories of judged.
- Posters being judged. I think it is good to have poster competition both in undergraduate and graduate students' posters, but separately.
- All posters should be judged; an undergraduate award should also be given out.

No Judging

- I prefer posters not to be judged, although I know that students were excited about the possibility of winning a cash prize.

- Neither should be judged. It's a nice idea but detracts from the objectives of building partnerships with other researchers.

Would it be possible for there to be an application process for presenting at the Tri-State meeting? In this way the scientific content would be peer-reviewed before the meeting.

Not Sure

- Not sure. Either way.

Ideas for Improving the Poster Session

- There were too many posters for the judges to judge all posters at the 2010 meeting. Get more judges.
- Have time for students to give five-minute, not two-minute presentations.
- Having undergraduate, graduate and faculty posters would be even better
- Judging is good for getting interaction with students, but there were so many posters, it seemed somewhat time-consuming and overwhelming.
- I was very disappointed that investigators were not "allowed" to bring along posters and share them informally (i.e., outside the scope of the student poster competition). My feeling is that we should encourage folks to bring posters along, whether they were formally entered as part of a student competition or not, and even "last minute" (assuming there is space). This will facilitate the kind of free-form dialogue needed in this venue and that relates best to the spirit of this meeting.
- Have social and biophysical judges, not just biophysical bias.
- It seemed the posters were better received in 2010, much better for the students. I don't know that this is attributed to the judging or other factors.
- Judging all the posters was a great burden on the judges, so the actual judging needs to be planned better.) All posters should be judged; an undergraduate award should also be given out.

How Many Posters per Judge?

Another purposive sample consisted of 25 faculty, one postdoc, one research associate (nine individuals from each of the three states; 8 women, 19 men). All of the 27 individuals were sent identical emails***:*** ***I've gotten some feedback that there were too many posters per judge at the Tristate meeting. In your experience, approximately how many posters per judge is optimal?*** There were 23 respondents (one individual did not have enough experience to comment).

- Hmmm - tough one! I wonder if this would work: if you had a team of judges and gave them each 5 to rank in order of merit. Then have each judge re-visit the top choices of the others? And then have those top choices ranked by all judges... does that make sense?
- My quick thoughts: 5-10 minutes per poster with presenter in attendance is good. If the presenters can be told they have a certain amount of time, say 7 minutes, to present the poster then the judges can spend that amount of time per poster.
- I suppose it depends on the number and type of qualifications being asked to judge on. I would think more than 15 would get cumbersome.
- I think the judges were asked to do maybe 25 or 30 in just a couple hours. I would give 10-15 minutes per poster, so the judges have time to digest the content and speak with the student. So if the session is two hours long, then 8-12 posters per judge. Then have the judges get

together toward the end of the session and decide on the top 3 - 5 posters. Have all judges that visited these posters then arrive at a final ranking.

- No more than a dozen.
- I would think 6 posters per judge would be ideal.
- I like 5 minutes per poster + 1 minute transit time, so 10 per hour more or less. That is difficult to pull off at some sessions with a lot of participants though.
- After about 60-90 minutes it gets pretty tiring! In 60-90 minutes I think you can cover about 6-8 posters (if you talk to the presenters it's hard to get away in under 10 minutes! Many are interesting and you end up asking lots of questions which take up time). Another strategy I've seen some places take is to let the judging take place without the presenters (so there is no talking) – if there is a judging sheet and some well defined criteria I think you could zip through the posters in about 5 minutes each (and judge more posters). I think that 6-8 posters per judge (if you were having conversations with each person) is about right. Just a guess!
- From my experience, I would guess about 10-15.
- I'd suggest 8, maybe 10 max.
- I'd say about 5-7 depending on how long they'll be up (the more time, the more you can judge, but definitely about 15 minutes per poster).
- I'm not sure I've never been a poster judge, but if I was maybe 10 or so would seem reasonable.
- Five posters per judge? Ten max.
- 3-5 per person is best.
- In the only poster judging event I organized, we had 4 judges for about 8-10 posters. Each one was supposed to evaluate all of the posters (but some of them didn't get to all of the posters). In my opinion, time should be a consideration. Our evaluation forms were pretty simple. If you figure each judge should spend 10-15 minutes per poster, then if there are 8 posters, that's over one hour to as much as two hours per judge, which seems like a lot. It seems like keeping the judges' commitment to an hour would be reasonable.
- I don't really have experience evaluating posters (other than in my classes), but I assume judging about 10 posters in a couple of hours should not be a problem.
- I've run some of these before and we try to keep the number of posters/judge to no more than 5-6. One important aspect is to try and overlap the judges enough so that each poster gets 3 judges, if possible.
- Given the relatively short time frame for the session, I'd say no more than 4 per judge.
- If the judges spend 90 minutes judging the posters (my assumption), I would think that they would want at least 8 minutes per poster with a 20 minute follow up period to take a second look. That means no more than 10 posters. Of course you could have a larger team that makes first cut recommendations, after which the entire team reviews the final top 5-8 posters. I don't remember how many posters where at the last conference but my guess is that there was about 25-30. I think this is doable as long as you have at least 3 to 4 judges. The posters are extremely important and I think we need to ask for more faculty participation.
- 3-4 posters per judge
- 5-8 posters is optimal
- 5 posters is a good number. Three would be a minimum (for perspective) and seven the max (although more superficial).

Networking Sessions

Twenty-four individuals who participated in the Tristate meeting in both 2009 and 2010 were asked: ***Based on your experiences why are some breaks between sessions that are for networking better than others? What makes some poor, some so-so and some excellent?***

- Less scheduled evening time might help
- Depends on who I talk to, depends on the scientific content of the session.
- Length of break is important; food is easy to consume, no lines for food and drink, space to move around to different groups or individuals
- Groups tended to cluster quite a bit, based on affiliation. Breakout groups with breaks within the breakouts seem to be better. Happy hours help too.
- The best networking breaks have a draw besides food. They also need to be long enough to be able to accommodate a meaningful discussion. We also need to recognize that attendees will often be trying to catch up with their offices during parts of those breaks, so there is necessarily some dilution of the networking while that is happening. The best networking occurs during the post sessions (receptions, poster sessions, etc.) when folks aren't as distracted with the other activities of the day.
- If people have a clear mandate to establish collaborations, and they dedicate a session on which questions to explore together, that would then make the breaks excellent opportunities to continue the discussion on a more personal and informal basis.
- Time of day -- morning breaks are better; afternoon breaks - people tend to drift away; same as the last day of the meeting (people leave early).
- The venue setup is important to promote this networking. Not sure if the Tahoe setting was good for large breaks where networking occurred.
- Networking breaks are good whenever they occur--and it is always important to have a few snacks and drinks. They may be best if they follow on the heels of a provocative presentation that stimulates dialogue.
- Primarily the setting. There needs to be relatively quiet, comfortable spaces for discussions, as well as easy access to refreshments.
- The best breakout sessions come after provocative science talks.
- Links to the themes in the preceding sessions help.
- I do not think that some breaks are better than others -- in principle all can provide equal opportunities. I did not notice differences between them, but I attended only the Cyber workshop on Tuesday April 6. I think we need even more time for networking and sharing of information, which can be done best during these breaks.
- Seating might be arranged so that each table has colleagues from different states. Most of the time, each state people tend to stay together.
- I think to some degree it is a random variable: determined by various things like what you are currently working on, who happened to be at the meetings, who you happened to run into during the break, etc. Of course some structure might help, in terms of mixing and mingling but if there are no common interests then the forced groups will probably not work.

- I think the outcomes of the networking sessions are primarily dependent on the attendees' motivation level. Therefore I think networking sessions earlier in the meeting, but after some science discussion, can be more functional.
- I believe it is all related to the session prior to the break. If the session is on a specific topic in stead of a more general topic it is more likely that attendees have research interests in common.
- Energy - after presenting I was tired for a few hours. I liked the mid morning breaks for networking - the afternoon ones we all seemed tired (particularly on the third day).
- A topic of discussion is more or less based on the topic of session before the break. Sessions that include audiences to discuss how they can collaborate might enhance the networking discussions.
- I think there is very little that can be done structurally to foster networking after a session, but I have noticed that vigorous discussions in session often lead to more effective networking during breaks.
- It is my feeling that having someone provide a focus for a networking break is a good idea. Then folks know what to chat about.
- Finding collaborators is not easy. Even if you find one, we need to go an extra mile to keep the contacts alive. With teaching and other academic loads, it becomes pretty challenging. Nevertheless, there is no excuse to not build this collaboration.

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APPENDIX D. Citations of Publications

Idaho

ID Baseline (2009): Both T1 and T2 Peer Reviewed Journal Publications

1. **Ames, D.P.**, Rafn, E., Van Kirk, R., and **Crosby, B.** (2009). Estimation of stream channel geometry in Idaho using GIS-derived watershed characteristics. *Environmental modeling and software*, 24:3, pp 444-448.
2. Michaelis, C. and **Ames, D.P.** (2009). Evaluation and implementation of OGC web processing service for use in client-side GIS. *Geoinformatica*, 13:1, pp.109-120.

ID Baseline (2009): Both T1 and T2 Peer Reviewed Conference Proceedings

1. **Ames, D.P.**, Kadlec, J., Horsburgh, J. and Maidment, D. (2009). Introducing the CUAHSI Hydrologic Information System Desktop Application (HydroDesktop) and open development community, *American Geophysical Union Annual Fall Meetin*g, San Francisco, CA
2. Horsbugh, J.S., Tarboton, D.G., Schreuders, K., **Ames, D.P.,** McNanara, J.P., Marchall, L.a., McGlynn, B.L., Kane, D.L., Tidwell, A., Boll, J., Hinman, N. and Barber, M.E. (2009). INRA constellation of experimental watersheds: Cyberinfrastructure to support publication of water resources data, *American Geophysical Union Annual Fall Meeting*, San Francisco, CA
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2. Panda, S. S., **Ames, D.P.** and Panigrahi, S. (2010). Application of vegetation indices for agricultural crop yield prediction using neural network techniques, *Remote Sensing*, 2(3): 673-696

ID Baseline (2009): T2 (not T1) Peer Reviewed Journal Publications

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13. Holecek, D.E., Cromwell, K.J. and **Kennedy, B.P.** (2009). Juvenile Chinook salmon summer habitat availability, use and selection in a Central Idaho Wilderness Stream, *Transactions of the American Fisheries Society*, 138: 633-644
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17. Lorion, C.M. and **Kennedy, B.P**. (2009). Relationships between deforestration, riparian forest buffers and benthic macroinvertebrates in lowland neotropical streams, *Freshwater Biology*, 54: 165-180
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7. Kremens, R., **Smith, A.M.**, Dickinson, M. (2010) Fire Metrology: current and future directions in physics-based measurements, Fire Ecology, 6:13-35
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16. **León, A.S.,** Ghidaoui, M.S., Schmidt, A.R. and Garcia, M.H. (2010). A robust two-equation model for transient mixed flows, Journal of Hydraulic Research, 48:44-56
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9. **Koracin, D.;** Vellore, R.; Hatchett, B.J.; McCord, T.; Koracin, J.; Horvath, K.; Belu, R., "Variability of Climate Predictions Relevant to Hydrological Resources", Eos Trans. AGU, 90(52), Fall Meet. Suppl., Abstract U13B-0062, p. , vol. , (2009). Conference abstract
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21. Seelbinder, B. and **S. Dascalu** (2009). Student's Aid: A Touchscreen Device, *Procs. of the 18st Intl. Conf. on Software Engineering and Data Engineering (SEDE-2009)*, Las Vegas, NV, June 2009, pp. 73-78

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1. Brown, D., Hoang, R., Sgambati, M, Brown, T., **Dascalu, S**., and **Harris, F.C., Jr** (accepted 2010). An application for tree detection using satellite imagery and vegetation data, *Journal of Computational Methods in Sciences and Engineering*
2. Hegie, J.M., Kimmel, A.S., Parian, K.H., **Dascalu, S.,** and **Harris F.C. Jr.** (accepted 2010). WiELD-CAVE: Wireless ergonomic lightweight device for use in the CAVE, *Journal of Computational Methods in Sciences and Engineering*.
3. Motwanti, R., **Harris, F.C., Jr**., and **Dascalu, S.** (accepted 2010) An Eigen-normal approach for 3D mesh watermarking using support vector machines. *IACSIT International Journal of Computer Theory and Engineering*

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11. **Motwani, R**., Motwani, M., **Harris Jr. F.,** Bryant, B., Agarwal, A., (2010) Watermark Embedder Optimization for 3D Mesh Objects using Classication Based Approach", in *Proceedings of IEEE International Conference on Signal Acquisition and Processing* (ICSAP 2010), February 9-10, 2010, Bangalore, India
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13. Vellore, R.; Hatchett, B.; **Koracin, D.,** "Climate prediction downscaling of temperature and precipitation in the Great Basin region", The 18th Conference on Applied Climatology, 90th Annual American Meteorological Society Meeting, Atlanta, GA, p. , vol. , (2010). Conference abstract
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33. Young, M., E. A. Ernesto, **Z. Yu**, J. Zhu, and D. M. Smith (2009). Reducing saturated hydraulic conductivity of soil with polyacrylamide. *The Soil Science Society of America Journal*. 73, 12-20. doi:10.2136/sssaj2007.0378. (SCI, IF: 2.104)
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NV Baseline (2009): T1 (not T2) Peer Reviewed Conference Proceedings

1. **Arnone** JA III, Jasoni RL, Larsen JD, Coulombe WG, Darrouzet-Nardi A, Luo Y, Verburg PSJ (2009) Ecosystem respiratory responses to interannual and seasonal temperature variability in intact tallgrass prairie ecosystems in the EcoCELLs. *EOS Trans.* AGU Fall Meeting Suppl., San Francisco, CA
2. **Biondi, F.** (2009). Recent increase in maximum temperature at the tropical treeline of North America. *EOS Transactions of the American Geophysical Union*, 90(52) Fall Meeting Supplement, San Francisco, California. Abstract B33A-0361.
3. **Biondi, F**. and S. Strachan (2009). A 2300-year tree-ring chronology and its climatic implications for the eastern Sierra Nevada/western Great Basin. *Proceedings of the International Symposium on Terminus Lakes: Preserving Endangered Lakes Through Research*. University of Nevada, Reno, p. 38.
4. **Biondi, F**. and S. Strachan (2009). An expanded tree-ring network for eco-hydro-climatic research in the Great Basin of North America. *Abstracts of the Annual Meeting of the Association of American Geographers*, Paper Session on "Climate, Wildfire, and Woodland Dynamics in the Great Basin of North America - II", Las Vegas, NV.
5. Bradley, M., R. Tausch, and **F. Biondi** (2009). Pre- and Post-Settlement Stand Development of Woodland Ecosystems in Lincoln County , Nevada . *Abstracts of the Annual Meeting of the*

Association of American Geographers, Paper Session on "Climate, Wildfire, and Woodland Dynamics in the Great Basin of North America - I", Las Vegas, NV.

6. Cheek, J., **F. Biondi** , R. Tausch, and J. Sibold (2009). Fuel Analysis in Upper Elevation Pinyon-Juniper Woodlands of Lincoln County, NV. *Abstracts of the Annual Meeting of the Association of American Geographers*, Paper Session on "Climate, Wildfire, and Woodland Dynamics in the Great Basin of North America - I", Las Vegas, NV.
7. Kilpatrick, M., J.S. Sibold, S. Strachan, and **F. Biondi** (2009). Tree-ring Based Fire History of the Clover Mountains , Lincoln County , Nevada. *Abstracts of the Annual Meeting of the Association of American Geographers*, Paper Session on "Climate, Wildfire, and Woodland Dynamics in the Great Basin of North America - I", Las Vegas, NV.
8. **Latifi, S** (2009) Sixth International Conference on Information Technology: new Generations, ITNG 2009, Las Vegas, NV, 27-19, *IEEE Computer Society*
9. Morris, R., M. Norton, **D. Devitt**, E. Zamora, R. Heflebower and R. Call. 2009. An International and Multi Institutional Cooperative Desert Horticulture Program for Southern Nevada. Acta Horticulturae. Proc. of the Vth International Symposium on Horticultural Education, Research, Training and Consultancy. pp. 147-152.
10. **Saito, L.S., F. Biondi,** J. Salas, and S. Strachan (2009). Combining a water balance model for streamflow simulations with long tree-ring records to improve estimation of water resources variability. *EOS Transactions of the American Geophysical Union*, 90(52) Fall Meeting Supplement, San Francisco, California. Abstract H23I-05.
11. Solander, K., **L. Saito**, J. Salas, and **F. Biondi** (2009). The Application of a Dendro-Hydrologic Model to the Upper Meadow Valley Wash Watershed, Lincoln County , Nevada. *Abstracts of the Annual Meeting of the Association of American Geographers*, Paper Session on "Climate, Wildfire, and Woodland Dynamics in the Great Basin of North America - II", Las Vegas, NV
12. Strachan, S. and **F. Biondi** (2009). Precise Dating of Comstock-Era Charcoal Ovens in the Great Basin: A Dendrochronological Perspective. *Abstracts of the Annual Meeting of the Association of American Geographers*, Paper Session on "Climate, Wildfire, and Woodland Dynamics in the Great Basin of North America - II", Las Vegas, NV.

NV Baseline (2009): T1 (not T2) All Other Publications

1. **Kauneckis, D.** and Halsing, D. (2009), Incorporating the social sciences in environmental management decisions, chapter in *Science plan for the Lake Tahoe Basin: Conceptual framework and research strategies*, eds. Z. Hymanson and M. Collopy, USGS: Washington, D.C.
2. Kozubowski, T. J., A.K. Panorska, and **F. Biondi** (2009) Mixed multivariate models for random sums and maxima.Pp. 145-171 in A. SenGupta (Ed.) *Advances in Multivariate Statistical Methods*, Vol. 4, Statistical Science and Interdisciplinary Research, World Scientific, Singapore.
3. Shearer, A.W., Mouat, D.A., **Bassett, S.D**., Binford, M.W., Johnson, C.W. and Saarinen, J.A. (2009), *Land use scenarios: Environmental consequences of development*, Taylor & Francis, Ltd., Boca Raton, FA, pp. 422.
4. **Smith, Jr., W.** (2009), Disaster on Pacific Islands: Contextualizing external emergency response and technology, Earthzine serving the global earth observation system of systems (GEOSS), volume on Hazards and Disaster Mitigation
5. **Smith, W.** (2009) Differences in vulnerability to hazards; Environmental rights, Indigenous water methods; Small Islands, *Encyclopedia of Geography*, Sage

NV Year 1 (2010 to date): T 1 (not T2) Peer Reviewed Journal Publications

1. **Arnone JA III**, Jasoni RL, Larsen JD, Irschick C, Miller WW, Davison J, Thomas JM, Leger EA, Verburg PSJ (2010) Water use efficiency and productivity of alternative crops for agriculture in Nevada U.S.A. under conditions of low water availability. *Plant and Soil* (in review)
2. Baghzouz M., **D.A. Devitt,** L.F. Fenstermaker and M.H. Young. (2010). Monitoring vegetation phenological cycles in two different semi-arid environmental settings using a ground based NDVI system: A potential approach to improve satellite data interpretation, *Remote Sens*. 2010, **2**(4), 990-1013
3. Bao, W., X. Zhang, S. Qu, and **Z. Yu** (2010). One-dimensional hydrodynamic model accounting for tidal effect. *Hydrology Research* (China special issue). Accepted (SCI, IF: 0.74)
4. Bao, W., X. Zhang, **Z. Yu**, and S. Qu (2010). Real-time equivalent conversion correction on river stage forecasting with manning's formula. *Journal of Hydrologic Engineering*. In press (SCI, IF: 1.336)
5. **Biondi, F**. and I. Galindo Estrada (2010) Tree-ring evidence for the 1913 eruption of Volcán de Fuego de Colima, Mexico. In: M. Stoffel, M. Bollschweiler, D. R. Butler, and B. H. Luckman (editors), Tree Rings and Natural Hazards: A State-of-the-Art, Series, *Advances in Global Change Research*, Vol. 41, Springer, New York, pp. 453-464.
6. **Biondi, F.,** and P. Hartsough (2010). Using automated point dendrometers to analyze tropical treeline stem growth at Nevado de Colima, Mexico. *Sensors* 10: 5827-5844
7. Carroll, R.W.H., Pohll, G., McGraw, D., Garner, C., Knust, A., Boyle, D., Minor, T., **Bassett, S.** and Pohlmann, P. Mason (2010), Valley groundwater model: Linking surface and ground water processes in the Walker River Basin, NV, *Journal of the American Water Resources Association*, 46(3): 554-573, DOI: 10.1111/j.1752-1688.2010.00434.x
8. **Devitt D.A**., L.K. Fenstermaker, M.H. Young, B. Conrad, M. Baghzouz and B. Bird (In press). Evapotranspiration of mixed shrub communities in phreatophytic zones of the Great Basin region of Nevada (USA). *J. Ecohydrology*
9. Di Filippo, A., A. Alessandrini, **F. Biondi**, S. Blasi, L. Portoghesi, and G. Piovesan (2010). Climate change and oak growth decline: Dendroecology and stand productivity of a Turkey oak (*Quercus cerris* L.) old stored coppice in Central Italy. *Annals of Forest Science* 67 (7): 14 pages, DOI: 10.1051/forest/2010031
10. Houston, D., D. K. Shiozawa, and **B. R. Riddle** (2010). Phylogenetic relationships of the western North American cyprinid genus Richardsonius, with an overview of phylogeographic structure. *Molecular Phylogenetics and Evolution* 55:259-273
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12. Lucchesi AJ, **Arnone JA III**, Sherry RA, Wallace LL, Luo Y, Verburg PSJ (2010) Immediate and lagged responses to an anomalously warm year of intact tallgrass prairie ecosystems in the EcoCELLs: impacts on plant community composition and species diversity and their ecological and environmental controls? *Global Change Biology* (in preparation)
13. Mantooth, S. J., and **B.R. Riddle** (in press 2010) . Molecular biogeography: the intersection between geographic and molecular variation, *Geography Compass*.
14. Neiswenter, S.A. and **B.R. Riddle** (2010). Evolution of silky pocket mice in the Perognathus flavus species-group: diversification in emerging grasslands in western North America. *Journal of Mammalogy* 91:348-362.

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16. Oláh-Hemmings, V., J.R. Jaeger, M.J. Sredl, M.A. Schlaepfer, R.D. Jennings, C.A. Drost, D.F. Bradford, and **B.R. Riddle** (2010). Phylgeography of declining relict and lowland leopard frogs in the desert Southwest of North America. *Journal of Zoology* 280:343-354
17. Oláh-Hemmings, V., J.R. Jaeger, M.J. Sredl, M.A. Schlaepfer, R.D. Jennings, C.A. Drost, D.F. Bradford, and **B.R. Riddle** (2010). Phylgeography of declining relict and lowland leopard frogs in the desert Southwest of North America. *Journal of Zoology* 280:343-354
18. **Riddle, B.R**., and D.J. Hafner. 2010. Integrating pattern with process at biogeographic boundaries: the legacy of Wallace. Introductory essay to symposium papers. *Ecography* 33:321-325
19. **Saito L**, Rosen MR, Roesner LA, Howard N. 2010. Improving estimates of oil pollution to the sea from land-based sources. *Marine Pollution Bulletin* 60: 990-997
20. **Saito, L**., Fiedler, F., Cosens, B., & **Kauneckis, D**. (2010 forthcoming), Visions of interdisciplinary graduate education in water resources, *Water Resources and Environmental Visions for 2050*, eds. Grayman, W., Loucks, D., and **Saito, L**.
21. Shanafield M, Rosen M, **Saito L**, Chandra S, Lamers J, Nishonov B. (Accepted). Nitrogen sources to four lakes in Uzbekistan. *Biogeochemistry*
22. Sherry RA, Wallace LL, **Arnone JA III**, Schimel DS, Verburg PSJ, Luo Y (2010) Rapid shifts in plant community structure and species abundances in response to extreme temperature and precipitation anomalies in an Oklahoma tallgrass prairie. *Global Change Biology* (in review)
23. Snyder, K.A., R. Monnar, S.R. Poulson, P. Hartsough, and **F. Biondi** (2010) Diurnal variations of needle water isotopic ratios in two pine species. *Trees* 24: 585–595
24. Solander, K., **L. Saito**, and **F. Biondi.** (2010) Streamflow simulation using a water-balance model with annually-resolved inputs. *Journal of Hydrology* 387: 46–53
25. Verburg PSJ, Young A, **Arnone JA III** (2010) Do increased summer precipitation and N deposition alter fine root dynamics in a Mojave Desert ecosystem? *Global Change Biology* (in review)
26. Walker, D. and **Shahram Latifi** (2010) Improving bounds on link failure tolerance of the star graph. Inf. Sci. 180(13): 2571-2575
27. Yang C., Z. Lin, Z. **Yu, Z**. Hao and S. Liu (2010). Analysis and Simulation of Human Activity Impact on Streamflow in the Huaihe River Basin with a Large-scale Hydrologic Model. *Journal of Hydrometeorology*, 11: 810-821, doi: 10.1175/2009JHM1145.1. (SCI, IF: 2.739)
28. Yasim, S.S. and **Shahram Latifi** (2010). Optimal Subcube Embeddability in Hypercubes with Additional Dimensions, *Parallel Processing Letters* 20(1): 91-99
29. Yu, Z., H. Lü, **Y. Zhu**, S. Drake, and C. Liang (2010). Long-term effects of revegetation on soil hydrological processes in vegetation-stabilized desert ecosystems. *Hydrological Processes*, 24(1), p. 87-95, DOI: 10.1002/hyp.7472. (SCI, IF: 1.336)

NV Year 1 (2010 to date): T1 (not T2) Peer Reviewed Conference Proceedings

1. **Biondi, F**. (2010) Testing the Pyroclimatic Hypothesis for Mt.Irish, Nevada, USA. In: K. Mielikäinen, H. Mäkinen, and M. Timonen (editors), ***Abstracts of WorldDendro2010*,** The 8th International Conference on Dendrochronology. METLA, Rovaniemi, Finland, p. 145
2. **Biondi, F.** and S. Strachan (2010). Hypothesis-driven research on climate change impacts: the Nevada NSF-EPSCoR example. Abstracts of the *"High-Five" Symposium: The Future of High-Elevation Five-Needle White Pines in Western North America*, University of Montana, Missoula.

3. **Biondi, F.**, J.D. Salas, S. Strachan, and **L. Saito** (2010). A dendrohydrological reconstruction for the Walker River Watershed (eastern Sierra Nevada/western Great Basin, USA) using new modeling techniques. Special section on "High Resolution Models: Developments, Integration, and Applications", Abstracts of *The 3rd USGS Modeling Conference*, Denver, Colorado.
4. Bunn, A., and **F. Biondi** (2010) Dendrochronology in R with the dplR library. In: K. Mielikäinen, H. Mäkinen, and M. Timonen (editors), Abstracts of WorldDendro2010, The 8th International Conference on Dendrochronology. METLA, Rovaniemi, Finland, p. 274
5. Hoover, K., S. R. Poulson, **F. Biondi**, and S.J. Underwood (2010). Eco-hydrological pathways inferred from stable isotopes in a Pinus ponderosa and Pinus monophylla woodland of the Sheep Range, southern Great Basin, USA. *Abstracts of the Annual Meeting of the Association of American Geographers*, Washington, D.C.
6. Vittori, J., L. **Saito**, **F. Biondi**, and J.D. Salas. (2010) A Novel Approach for Reconstructing Past Streamflows Using Watershed Modeling in the Upper Walker River Basin, California. *Abstracts of the Annual Conference of the Nevada Water Resources Association*, Las Vegas, Nevada
7. Bacon, S. N., G. K. Dalldorf, E. V. McDonald, S. E. Baker, D. E. Sabol Jr., T. B. Minor, **S. D. Bassett**, S. R. MacCabe and T. F. Bullard (2010). Predictive soil maps based on geomorphic mapping, remote sensing and soil databases in the desert southwest. Pages 409-419 in Boeettinger, J., D. Howell, A. Moore, A. Hartemink and S. Kienast-Brown, eds., *Digital soil mapping: bridging research, production and environmental application*, Springer, Netherlands.
8. **Shahram Latifi**: *Seventh International Conference on Information Technology: New Generations*, ITNG 2010, Las Vegas, Nevada, USA, 12-14 April 2010
9. Yasim, S.S. and **Latifi, S.** (2010). Optimal subcube embeddability in hypercubes with additional dimensions

NV Year 1 (2010): T1 (not T2) All Other Publications

1. **Devitt D.A**. and R.L. Morris. 2010. Water conservation in the urban landscape. In: Turfgrass Water Conservation. University of California Press
2. Hafner, D.J. and **B.R. Riddle** (in press). Boundaries and barriers of North American warm deserts: an evolutionary perspective. Pp. xxx-xxx, Palaeogeography and Palaeobiogeography: Biodiversity in Space and Time. (P. Upchurch, A McGowan, and C. Slater, eds.). CRC Press, Boca Raton.
3. **Kauneckis, D**. and Cuffe, O. (2010), Nevada climate change survey of public agencies: executive summary, pp. 1-17.
4. **Kauneckis, D**. and Flagg, M. (2010), Results from a survey of local green business certification programs in the United States, pp. 1-17.
5. Lomolino, M. V., **B. R. Riddle**, R. J. Whittaker, and J. H. Brown (2010). *Biogeography, fourth edition*. Sinauer Associates, Inc.
6. **Riddle, B.R.** (in press). The expanding role of phylogeography in historical biogeography, ecology, evolution, and conservation / global change biology. Pp. xxx-xxx, in *The Handbook of Biogeography* (A. Millington, M. Blumler, G. MacDonald, and U. Shickhoff eds.). Sage Publications Limited.
7. **Riddle, B.R.**, R.J. Ladle, S. Lourie, and R.J. Whittaker. (accepted*) Chapter 4: Basic biogeography: estimating biodiversity and mapping nature,* Conservation Biogeography (R.J. Whittaker and R.J. Ladle, eds.). Oxford University Press.

8. **Saito L**, Fiedler F, Cosens B, **Kauneckis D.** (Accepted). A vision of interdisciplinary graduate education in water and environmental resources in 2050. In *Water Resources and Environmental Visions for 2050*. Edited by Grayman W, Loucks DP, **Saito L**. ASCE.
9. **Smith Jr., W.** (Forthcoming 2010) *Social, Political and Economic Dimensions of Water Resources Development*. Springer. New York and the Netherlands.
10. **Smith Jr., W.** and A. Safi. 2010. *Encyclopedia of Geography*. "Environmental Rights." Ed. Barney Warf, Volume 2: 994-998.
11. **Smith Jr., W.** and N. Grenier. 2010. *Encyclopedia of Geography*. "Indigenous Water Methods." Ed. Barney Warf, Volume 3: 1573-1576. Mentored graduate student publication (1 of 3 from 2005-2010).
12. **Smith Jr., W.** and P. Shed. 2010. *Conservation Society of Pohnpei Newsletter*. "Enhanced Mapping Capacity Supports Biodiversity Conservation."
13. **Smith Jr., W.** and R. Perkins. 2010. *Encyclopedia of Geography*. "Small Islands." Ed. Barney Warf, Volume 3: 1634-1637.
14. **Smith Jr., W.** and Y.D. Wang. 2010. *Encyclopedia of Geography*. "Differences in Vulnerability to Hazards." Ed. Barney Warf, Volume 2: 742-744.

New Mexico

NM Baseline (2009): Both T1 and T2 Peer Reviewed Journal Publications

1. **Michener, W.K.**, Keith L. Bildstein, Arthur McKee, Robert R. Parmenter, William W. Hargrove, Deedra McClearn, and Mark Stromberg (2009). Biological Field Stations: Research Legacies and Sites for Serendipity, *BioScience*, 59(4):300-310
2. Brunt, J.W. and **Michener,W.K.**, The Resource Discovery Initiative for Field Stations: Enhancing Data Management at North American Biological Field Stations (2009). *BioScience*, Vol. 59, No. 6, Pages 482–48
3. **Galewsky, J.** (2009). Shadow development during the growth of mountain ranges: An atmospheric dynamics perspective. *Journal of Geophysical Research* **114**:F1
4. **Galewsky, J.** (2009) Orographic precipitation isotopic ratios in stratified atmospheric flows: Implications for paleoelevation studies. *Geology* **37**:9, 791-794

NM Year 1 (2010 to date): Both T1 and T2 Peer Reviewed Journal Publications

1. Brookshire, David G., David Goodrich, Mark D. Dixon, L. Arriana Brand, **Karl Benedict**, Kevin Lansey, Jennifer Thacher, Craig Broadbent, Steve Stewart, Molly McIntosh, and Doosun Kang (2010). Ecosystem services and reallocation choices: A framework for preserving semi-arid regions of the Southwest, *Journal of Contemporary Water Research & Education*. Issue 144 (1): 60-74

NM Baseline (2009): T2 (not T1) Peer Reviewed Journal Publications

1. Stormont, J.C, E. Farfan, and **Coonrod, J.** (2009) Total Soil Water Evaporation in a Riparian Environment: Model Development and Application, *Journal of Hydrologic Engineering*, Vol. 14, No. 9, pp 904-912

NM Baseline (2009): T2 (not T1) Peer Reviewed Conference Proceedings

1. Isaacson, K, and **J. Coonrod**, Climate Change and Potential Impacts on Groundwater Levels Along the Rio Grande, *AWRA 2009 Spring Specialty Conference* – Managing Water Resources and Development in a Changing Climate, Anchorage, AK, May 4-6, 2009
2. **J. Coonrod**, Rio Grande Basin Flow in Response to Climate Change, *IV Annual Rio Grande Compact Forum*, Water Assembly, April 16, 2009. (Invited)

NM Baseline (2009): T2 (not T1) All Other Publications
NM Baseline (2009): T1 (not T2) Peer Reviewed Journal Publications

1. Kennedy, T. , **D.S. Gutzler** and R.L. Leung (2009). Predicting future threats to the long-term survival of Gila Trout using a high-resolution simulation of climate change, *Climatic Change*, v 94, p 503-515
2. Laliberte, A., **Rango, A.** 2009. Texture and scale in object-based analysis of subdecimeter resolution unmanned aerial vehicle (UAV) imagery. *IEEE Transactions on Geoscience and Remote Sensing.* 47:761-770

3. Laliberte, A., **Rango, A.,** Jenkins, V., Roanhorse, A., First results for an image processing workflow for hyperspatial imagery acquired with a low-cost unmanned aerial vehicle (UAV), *Journal of Applied Remote Sensing* (JARS)
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5. **Rango, A**., Laliberte, A., Herrick, J.E., Winters, C., Havstad, K.M., **Steele, C**., Browning, D.M. (2009). Unmanned aerial vehicle-based remote sensing for rangeland assessment, monitoring, and management. *Journal of Applied Remote Sensing* (JARS). Vol. 3, 033542.
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NM Baseline (2009): T1 (not T2) Peer Reviewed Conference Proceedings

1. Laliberte, A., **Rango, A.,** Winters, C., Maxwell, C., Slaughter, A. (2009). Rangeland remote sensing applications with unmanned aerial systems (UAS) in the national airspace: challenges and experiences, American Society for Photogrammetry and Remote Sensing Proceedings, January 15, 2009
2. Laliberte, A.S., **Rango, A**., Winters, C., Slaughter, A.L., Maxwell, C.J. (2009). Unmanned aerial vehicles for hyperspatial remote sensing of rangelands: object-based classification and field validation [abstract]. American Society for Photogrammetry and Remote Sensing (ASPRS) Annual Meeting, April 26-30, 2010, San Diego, CA
3. **Rango, A.** and Havstad, K. (2009). Water harvesting applications for rangelands, Meeting Proceedings, March 13, 2009
4. **Rango, A., and Steele, C.M.** (2009). Using New Methods to Improve Snowmelt Runoff Forecasting and Assess Climate Change Impacts on Water Supplies. 5th Symposium on Southwest Hydrometerology, Albuquerque, NM, September 30 – October 1
5. **Rango, A., Steele, C.M.** and DeMouche, L. (2009). Infrastructure Improvements for Snowmelt Runoff Forecasting and Assessments of Climate Change Impacts on Water Supplies in the Rio Grande Basin. Eos Trans. AGU, 90 (52), Fall Mtg. Suppl., Abstract U13B-72.
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7. Ritchie, J.C., **Rango, A.,** Schmugge, T.J. (2009). Reflectance Measurements of Vegetation Communities in Arid Rangelands of New Mexico [abstract]. *Society for Range Management*

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9. Steele, C.M., Lucero, M. and Silva, A. 2009. Using GIS to Guide Spatial Sampling of Atriplex Canescens in the Northern Chihuahuan Desert. Annual Meeting of the Rio Grande Branch of the American Society for Microbiology, New Mexico State University, February 27 -28, 2009
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11. **Steele, C.M., Rango., A.** and Bleiweiss M. (2009). Comparison of snow mapping methods in the upper Rio Grande Basin, new dimensions in earth observation. University of Leicester. September 8-11, 2009.
12. **Steele, C.M., Rango**., A., Laliberte., A, Winters, C., Maxwell, C. and Slaughter, A. (2009). Unmanned aerial vehicle platforms for acquisition of very fine spatial resolution imagery over arid rangelands. University of Leicester, September 8-11, 2009.

NM Year 1 (2010 to date): T1 (not T2) Peer Reviewed Journal Publications

1. **Gutzler, D.S.,** and L. van Alst, (2010). Interannual variability of wildfires and summer precipitation in the Southwest," *New Mexico Geology*, v 32, p 22-24
2. **Gutzler, D.S**., and T.O. Robbins (2010). Climate variability and projected change in the western United States: Regional downscaling and drought statistics," *Climate Dynamics*, DOI 10.1007/s00382-010-0838-7
3. Laliberte, A.S., Herrick, J.E., **Rango, A.,** Winters, C. (2010). Acquisition, orthorectification, and object-based classification of unmanned aerial vehicle (UAV) imagery for rangeland monitoring. *Photogrammetric Engineering and Remote Sensing.* 76:661-672
4. **Rango, A.**, Laliberte, A. (2010). Impact of Flight Regulations on Effective Use of Unmanned Aircraft Systems for Natural Resources Applications. *Journal of Applied Remote Sensing* (JARS). Vol. 4, 043539.
5. Smith, A.M.S., Falkowski, M.J., Hudak, A.T., Evans, J.S., Robinson, A.P. And **Steele, C.M.** (2010). Comparing field and remote estimates of forest canopy cover, *Canadian Journal of Remote Sensing*., 36(5):447-459

NM Year 1 (2010 to date): T1 (not T2) Peer Reviewed Conference Proceedings

1. Havstad, K., Bestelmeyer, B., **Steele, C.,** Burkett, L., Williamson, J. and Yao, J. (2010). Lessons from an extreme event - selected Chihuahuan Desert dynamics in the 5 decades after the 1951-1956 drought. Working Landscapes – Providing for the Future. 63rd Annual Meeting of the Society for Range Management and the 50th Annual Meeting of the Weed Science Society of America, February 7 - 11, 2010, Denver, Colorado

APPENDIX E. Supplemental Report on Idaho Connectivity

Regarding Connectivity Activities Completed in Year 1

Idaho State University - Pocatello

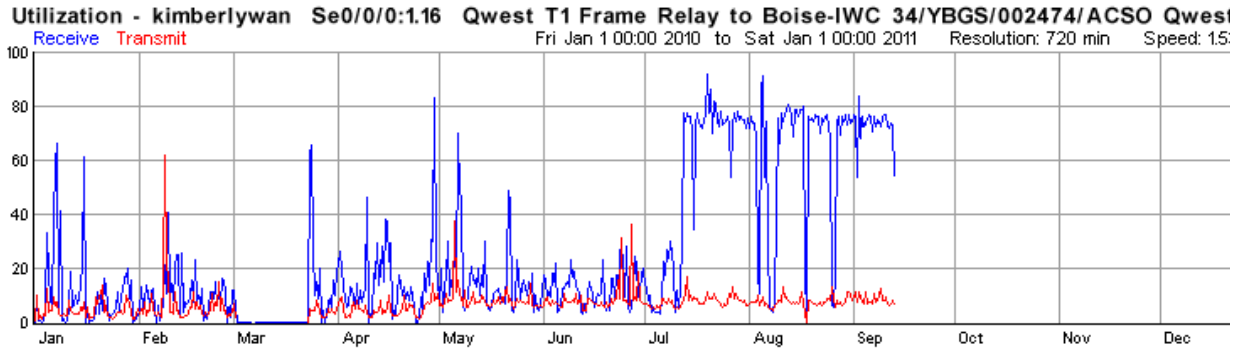
We activated a total of 96 ports at 1Gbps for workstations in Physical Sciences Bldg (Geo-Science) (including a computer lab)
We provided 20 new 1Gbps ports in the Physical Sciences server room.
We upgraded (4) buildings (as previously specified) from 100Mbps to 1Gbps to the core.

From Aug 2009 to Aug 2010 there was an increase of 48Mbps (five minute average) in Internet/Internet2 traffic.
From Aug 2009 to Aug 2010 there was an increase of 38Mbps (five minute average) in IP traffic across the core intra-campus switches.
We estimate a total of 7426 workstations connected to the network today with less than 10% growth since Aug 2009. (this is due to financial conditions)
ISU des not store utilization data but have real-time monitors that are tracked on a daily basis. ISU reports a marked increase of approximately 40% this year. This is total campus utilization of Internet/Internet2 resources and is not tracked by IP, research project or any particular discipline.

University of Idaho

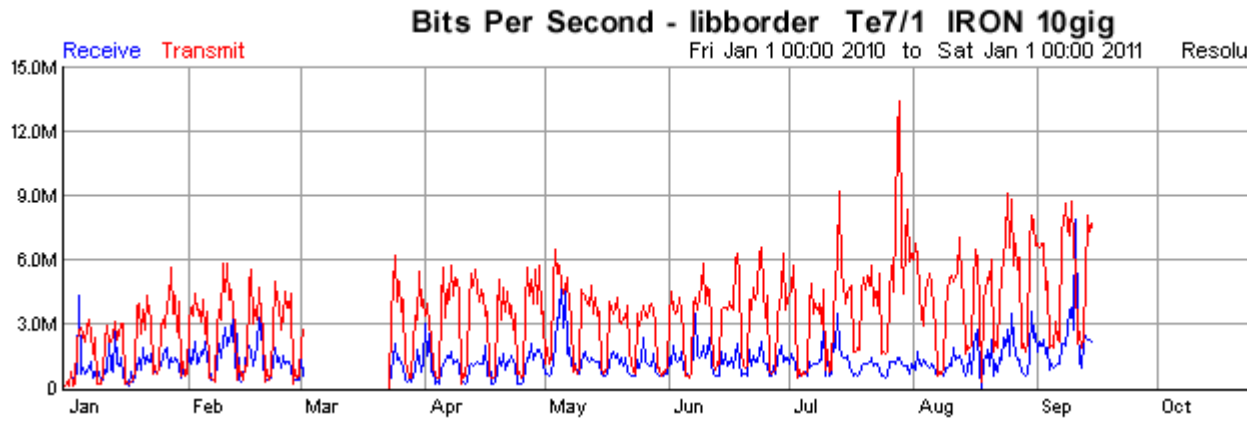
Central UI IT does not manage the Hagerman site so I have no data for it. Current utilization of IRON is zero (I think this is correct, RJS).

Kimberly data is available and is summarized below by the graph and table. Bottom line, network utilization has increased significantly in Kimberly. Track 2 Network improvements are pending – anticipated later this fall.



			1 min	1 min	1 hour	1 hour
	Rx gigabytes	Tx gigabytes	Max Rx Mbps	Max Tx Mbps	Max Rx Mbps	Max Tx Mbps
Sep-09	27.4	15.5	1.5	1.5	1.5	0.7
Oct-09	39.3	25.0	1.5	1.5	1.2	1.4
Nov-09	27.0	20.1	1.5	1.5	1.0	1.3
Dec-09	32.2	26.5	1.5	1.5	1.4	1.2
Jan-10	49.3	21.0	1.5	1.9	1.5	1.2
Feb-10	50.8	32.5	1.5	1.9	1.4	1.4
Mar-10	23.0	6.4	1.5	1.6	1.5	534.4
Apr-10	77.8	27.2	1.5	1.6	1.5	741.0
May-10	79.1	44.1	1.5	1.9	1.5	1.4
Jun-10	65.4	44.7	1.5	1.5	1.4	1.4
Jul-10	255.4	40.9	1.5	1.6	1.5	594.2
Aug-10	309.5	39.0	1.5	1.7	1.5	975.3

UI – Moscow: We currently use the IRON network only for layer 2 transport to and from Moscow and other UI facilities across the state. Due to this limited usage the amount of traffic we send across the IRON network is pretty low. The following graph shows our utilization in 2010.



This table, similar to the one produced for Kimberly, shows the amount of data transferred and the average 1 min data rate.

			1 min	1 min
	Rx gigabytes	Tx gigabytes	Max Rx Mbps	Max Tx Mbps
Sep-09	137.3	112.5	0.4	0.3
Oct-09	68.5	388.7	0.2	1.2
Nov-09	233.0	467.9	0.7	1.4
Dec-09	220.8	721.3	0.7	2.2
Jan-10	340.8	702.2	1.0	2.1
Feb-10	432.2	858.2	1.4	2.8
Mar-10	109.8	334.1	1.1	3.4
Apr-10	363.4	1,100.0	1.1	3.3
May-10	455.1	999.3	1.4	3.0
Jun-10	432.7	1,100.0	1.3	3.4
Jul-10	396.4	1,400.0	1.2	4.2
Aug-10	468.7	1,500.0	1.4	4.7

Once we switch to IRON as our primary ISP, no later than January of 2011, the amount of traffic crossing the IRON network will increase **substantially**.

Boise State University

Idaho Intermediate Outcome Measures

	Utilization in GB	Bandwidth Usage[1]
Baseline 2008-09	0	0
Year 1 2009-10	4.32	36Mb /month

[1] 2009-10 is bandwidth usage of IRON

Not sure what the difference is between "Utilization in GB" and "Bandwidth Usage". They seem the same to me.[Utilization Note]

Boise State made its initial connection to the Idaho Regional Optical Network (IRON) in December 2008. Over a period of months, we modified our routing parameters, with other start-up connections on the regional network. During the Baseline Year 2008-09, Boise State had minimal if any traffic on IRON. By Year 1, 2009-10, we had reconfigured our connection to the INL site as the primary connection for specific research identified departments.

As of Aug 2010, our monthly 95th percentile traffic on IRON is 36.1 Mb, our peak is 261.4 Mb. This month's traffic is consistent with the previous 3 months of traffic. BSU has attached IRON traffic reports for the months of May - Aug 2010

APPENDIX F: April 7, 2010 HIS Workshop – Participant Evaluation

The evaluation form was completed by 13 participants. The mean of the overall quality ratings (1 to 5, 5 excellent, 4 very good, 3 good, 2 fair and 1 poor) was 3.92 (Std. Dev. = 0.76). Frequency distributions of the responses to the four fixed choice items are displayed followed by responses to the three open response items.

Ratings of the workshop content		
Too challenging	**Appropriately challenging**	**Not challenging enough**
1 (8%) of the responses	10 (77%) of the responses	2 (15%) of the responses

Ratings of the workshop pace		
Comfortable	**Too slow**	**Too fast**
11 (85%) of the responses	2 (15%) of the responses	-

Ratings of the overall quality of the workshop				
Excellent -5-	**Very good -4-**	**Good -3-**	**Fair -2-**	**Poor -1-**
3 (23%)	6 (46%)	4 (31%)	-	-

Likelihood participants would recommend this HIS workshop to a colleague				
Highly likely -5-	**Very likely -4-**	**Somewhat likely -3-**	**Hardly likely -2-**	**Not likely -1-**
5 (39%)	6 (46%)	2 (15%)	-	-

Suggestions for topics to add or expand upon if the workshop is repeated were recorded by five respondents:

- Installing HIS server Developing Extension
- Make sure you follow a script we can follow and pre-test things before you do them
- How to change/summarize the data How to export only certain series
- More real data would be great
- Additional time to install and configure an HIS server, then use HydroDesktop to connect to it.

Suggestions for topics to remove or reduce if the workshop is repeated were recorded by six respondents:

- Data Structure Introduction on general principles
- Intro could be shorter to allow more focus on hands on
- Metadata needs to be worked upon.
- Seems about right.
- Focus more on hands on exercises and less on the web pages.

Comments and recommendations:

- Work on the metadata and updation of data on regular basis. Also, there is a problem with projection if you are adding data in another projection. No way to put the two together. Too many things to be worked on, but this is a great effort at integrating whatever datasets we have currently.
- Instructors were good.
- Allocate more time for detailed HIS architecture, implementation, and modification. Seeing how to create plug-ins or correct problems encountered in the HIS and HydroDesktop systems would be quite useful.
- It would be better to test the functions to be demoed in the workshop.
- Really helpful. But need to add some functions like the identify button in ArcGIS. But not sure the long-term existence of the tool and maintenance.
- Good job!
- Good for the time available.

APPENDIX G: Evaluation Report on UNR Course NRES 730
July 12-30, 2010

Introduction

Funding for this four-hour graduate credit course, *Interdisciplinary Modeling: Water Related Issues and Changing Climate*, was provided by EPSCoR in Idaho, Nevada and New Mexico. Dr. Laurel Saito was the Instructor of Record.

This course addressed: (1) the advantages and limitations of using models; (2) different spatial and temporal scales that specific disciplines are concerned with; (3) differences in degrees of uncertainty of data and models, (4) interdisciplinary modeling options; (5) communication between disciplines, where different terminology and perspectives can be a barrier to productive discussion of common issues or concerns; (6) education and training of scientists and modelers about applying interdisciplinary approaches; and (7) interaction with stakeholders and the public. The objective of this course was to engage students in interdisciplinary discourse in modeling by addressing each of these challenges. www.cabnr.unr.edu/saito/classes/nres730/nres730.htm

Instructors and guest lecturers included faculty members from Nevada, Idaho and New Mexico.
Coordinating Instructors:

- **Laurel Saito** (Dept. of Natural Resources and Environmental Science, University of Nevada Reno (UNR); aquatic ecosystem modeling)
- **Alexander Fernald** (Dept. of Animal and Range Sciences, New Mexico State University (NMSU); surface-groundwater interaction modeling)
- **Timothy Link** (Dept. of Forest Resources, University of Idaho (UI); snowpack energetics modeling)

Co-Instructors:

- **Darko Koracin** (Div. of Atmospheric Sciences, Desert Research Institute (DRI); ocean-atmospheric modeler)
- **Sajjad Ahmad** (Dept. of Civil and Environmental Engineering, University of Nevada Las Vegas (UNLV))
- **Caiti Steele** (Jornada Agricultural Research Service, NMSU; remote sensing and GIS)
- **Mark Stone** (Dept. of Civil and Environmental Engineering, University of New Mexico (UNM); water resources modeling)

Guest lecturers:

- **Kumud Acharya** (Div. of Hydrologic Sciences, DRI; ecosystem modeling)
- **Franco Biondi** (Dept. of Geography, UNR; data and models)
- **Cliff Dahm** (Dept. of Biology, UNM; nutrient spiraling modeling)
- **Levan Elbakidze** (Dept. of Agricultural Economics and Rural Sociology, UI; economics modeling)
- **Steve Jenkins** (Dept. of Biology, UNR; modeling philosophy and history)
- **Derek Kauneckis** (Department of Political Science, UNR; environmental policy analysis)
- **David Kreamer** (Dept. of Geology, UNLV; thermal stratification modeling)
- **Anna Panorska** (Dept. of Mathematics and Statistics, UNR; statistical modeling)
- **Rina Schumer** (Div. of Hydrologic Sciences, DRI; groundwater modeling)
- **Aleksey Telyakovskiy** (Dept. of Mathematics and Statistics, UNR; mathematical modeling)
- **Vince Tidwell** (Geohydrology Dept., Sandia National Labs; systems dynamics modeling)
- **Scott Tyler** (Dept. of Geological Sciences and Engineering (GSE), UNR; vadose zone hydrology)

How Students Learned about the Course

For 21 graduate students enrolled in NRES 730 (Summer 2010) who reported how they learned about the course, 71% of them (15 out of 21) learned about the course from a university faculty member who was a participant in the course as an instructor/presenter/lecturer (instructor). This external evaluation information was gathered using email.

Number of students	How they learned about the course
15	From an NRES 730 instructor/presenter/lecturer
1	UI faculty member
1	Email from distance learning program
1	EPSCoR email followed by an email from a faculty member
1	From a friend in the same graduate program (friend learned about it from a listserv)
1	DRI faculty member
1	UNR/DRI Colloquium and email

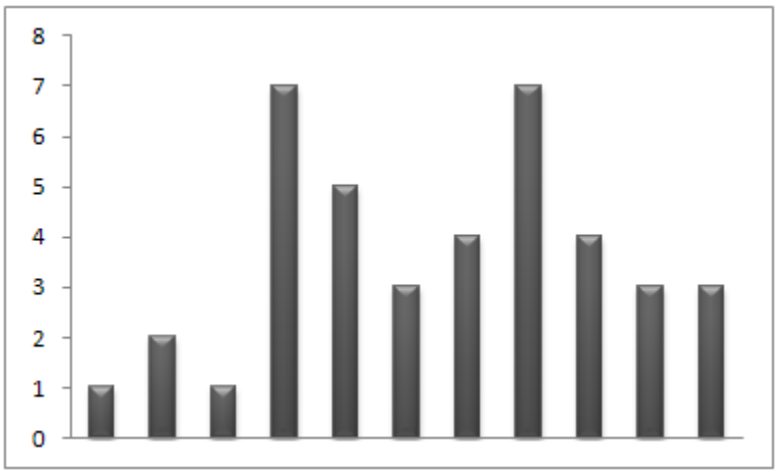
Daily Process Evaluation Results

During the course, students evaluated each lecture and instructor on a daily basis. Dr. Saito sent the forms at the end of the course to the External Evaluator for processing. Following a format Dr. Saito used previously, the external evaluation compiled the data, summarized and reported the results in 41 separate reports that are not included in this report; they were distributed to each of the three EPSCoR Offices. Students were required to sign their names on the forms but individual results were not reported. In September 2010 Dr. Saito sent each of the session evaluation summary reports to the session instructor/s.

The following is a short summary of the ratings recorded for effectiveness (0 to 4, 0 no help, 1 a little help, 2 moderate help, 3 much help and 4 very much help) of lectures/exercises in covering the material and whether or not the lecturer was effective in covering the material (yes/no).

The (pooled) mean of the ratings recorded for all the effectiveness of lectures/exercises was 2.9 which translates to “much help”. Data displays are included here to provide information for debriefing course strengths, areas needing improvement, lessons learned and impact on future NV EPSCoR NSF RII-T1 courses, workshops, institutes and other professional development. The frequency distribution of the mean ratings is displayed on the following page.

Mean Rating	Frequency	Percentage
1.8	1	2.5
2.0	2	5.0
2.2	1	2.5
2.7	7	17.5
2.8	5	12.5
2.9	3	7.5
3.0	4	10.0
3.1	7	17.5
3.2	4	10.0
3.3	3	7.5
3.4	3	7.5



In the following table the means and numbers of yes/no responses are displayed in descending order of mean effectiveness.

Date	Instructor Code	Effectiveness 0 to 4		Covering Material Yes or No		
		N	Mean	N	Effective	Not effective
July 13, 2010	A/B	23	3.43	23	23	0
July 22, 2010	C	23	3.43	23	23	0
July 12, 2010	D	22	3.41	23	22	1
July 23, 2010	E	23	3.39	23	23	0
July 16, 2010	I	22	3.27	23	23	0
July 27, 2010	A	23	3.26	23	23	0
July 23, 2010	E, F and G	23	3.26	23	21	2
July 22, 2010	B and H	22	3.18	22	22	0
July 16, 2010	I and J	22	3.18	21	21	0
July 12, 2010	K	23	3.17	23	23	0
July 22, 2010	H	23	3.17	23	23	0
July 13, 2010	B	23	3.13	23	23	0
July 15, 2010	K, L, and M	23	3.13	23	23	0
July 16, 2010	J	23	3.13	23	23	0
July 13, 2010	A	23	3.09	23	23	0
July 19, 2010	N	23	3.09	23	23	0
July 26, 2010	K and O	23	3.09	23	23	0
July 15, 2010	Q, L and M	22	3.09	22	20	2
July 19, 2010	K and P	22	3.00	22	21	1
July 26, 2010	O	23	2.96	23	22	1
July 12, 2010	K et al.	23	2.96	23	21	0
July 20, 2010	R and S	23	2.91	23	23	0
July 14, 2010	T	23	2.87	23	23	0

Date	Instructor Code	Effectiveness 0 to 4		Covering Material Yes or No		
		N	Mean	N	Effective	Not effective
July 29, 2010	U	23	2.87	22	22	0
July 20, 2010	P and V	23	2.83	23	23	0
July 27, 2010	K	23	2.83	23	23	0
July 29, 2010	D	23	2.78	23	23	0
July 21, 2010	W	23	2.78	23	22	1
July 14, 2010	Q	23	2.78	22	20	2
July 14, 2010	X/Q	22	2.73	23	22	1
July 28, 2010	Y	23	2.70	23	23	0
July 23, 2010	F	23	2.70	23	22	1
July 19, 2010	U	23	2.70	23	21	2
July 20, 2010	R, S, P & DD	23	2.70	21	20	1
July 21, 2010	W	22	2.70	21	20	1
July 15, 2010	AA	23	2.65	22	22	0
July 12, 2010	Q	21	2.19	23	20	2
July 28, 2010	BB	23	2.04	23	20	3
July 21, 2010	Z	23	2.00	21	17	4
July 15, 2010	AA	18	1.83	15	11	4

Feedback from Course Instructors

The External Evaluator used email to solicit information about the course impact from the course instructors and presenters. This did not include the instructor of record, Dr. Saito. The responses are displayed in this report. This was the email request:

Dear instructors, co-instructors and guest lecturers:

Thank you for your participation in the ***Interdisciplinary Modeling: Water Related Issues and Changing Climate*** course.

For the EPSCoR evaluation process we need input from you about the course. Please send me an email in which you 'debrief' about the class. Specifically,

1) strengths and/or weaknesses of the class; and 2) the professional impact on you of being involved in the class.

Results: Strengths

- Students/faculty from different institutions working together
- Great breadth of topics
- Integrating class projects
- Tight, intense and focused time of education
- Working with a strong team of interdisciplinary team of instructors and a wide variety of students
- The comments from students are always overwhelmingly positive. Allows cross-disciplinary communications and collaboration in a manner unusual in traditional class settings. Creates a forum for hearing about faculty member's research from other disciplines.
- This is a great opportunity to expose students to complex environmental aspects and guide them how to approach interdisciplinary studies.

- This course was comprehensive in detailing interdisciplinary models, scales, and interdisciplinary applications and challenges.
- The course used STELLA as a very useful platform to encourage interdisciplinary modeling and critical thinking.
- The course was *very* organized and prepared.
- The course involved outstanding lecturers and brought three states together to create an outstanding course.
- The lead instructor and coordinator, Dr. Saito, was exceptional in bringing together many lecturers, creating an online portal, and placing course content on wiki.
- The class projects were unique to the states, incorporated students from different majors and different states, and challenged the students to apply what they learned.
- I think the main strength of the class is the variety of topics presented, and the fact that students from multiple backgrounds interact with one another in class projects.
- The course helps students explore more ways of solving research problems. It helped students with a variety of backgrounds better able to understand others point of views, which helps for successful collaboration.
- Amazing opportunity for students to learn from a diverse group of experts that none would be able to get at any of their home institutions.
- Course fills a key niche in interdisciplinary systems modeling that is not offered at my home institution.
- Opportunity for students to interact with a diverse array of top-notch students from other states who are working in similar areas. A number of students developed plans to collaborate after the course ended.

Results: Weaknesses and Suggestions for Improvement

- Great breadth limited the depth any particular topic could be explored
- Intensity of the class seemed to be a little hard on some students
- Time is too short, but it may be difficult for both faculty and students if it is longer. But it is possible to find an ideal time frame/mode of teaching that makes this issue go away.
- Resources available to prepare the labs so they include actual data and real work modeling problems are limited.
- The scope might be somehow reduced (e.g., have students present a certain topic to the class in addition to the final projects). I am not sure if the students should be more formally tested on the course materials and content - that might be something to think about doing in the future.
- The majority of the course was devoted to lectures and may have contributed to poor retention of information given.
- Discussion between lecturers regarding content of individual lectures and development of projects could have been improved. Linking the lectures to the project would have improved the course.
- A potential weakness is the fact that the class covers so many topics, but Laurel has done a very good job at keeping plenty of background information available for the students.
- It would have been more effective if there had been more opportunity to interact with students outside of the classroom and break times i.e. more opportunity to learn about the individual projects and challenges that students were facing in order to brainstorm more effectively.
- In some cases, student abilities to tackle the individual projects was hampered by technical challenges of learning Stella or Powersim, hence more time spent up front learning some of the systems modeling tools would have been useful.

Results: Professional Impact

- Expanded my professional network
- Enjoyed working with the students
- It is excellent. Effective in training the students with a relatively short but lot of topics. It is a quality course merely because of so many faculty involved.
- Allowed interaction with faculty from other disciplines working on water-related issues. Seeding a number of ideas for research projects and collaborative funding opportunities where the social sciences can add value to the modelers. Created potential for working directly with students on projects cross-disciplinary projects and serving as advisor for students involved with local and regionally based research.
- The professional impact on me for being involved in the class is overall a positive one. First, it shows collaboration between the educational and cyberinfrastructure components of the project. I feel that with each time that I have to present these materials, I learn something new or learn a new way to explain certain things more clearly.
- The main impact for me was that it provided me the opportunity to compress a complex subject like general modeling and climate modeling into a context that students from various departments and background can absorb. This was useful for other future outreach activities.
- Teleconference meetings and lecturing with other faculty provided an opportunity to meet faculty in other states and revealed future opportunities to collaborate.
- Creating a lecture on interdisciplinary modeling and issues in my field was a self-learning experience and re-emphasized the importance of interdisciplinary work.
- Being involved with the preparation of a short-course on a cutting edge topic motivated me to be involved in similar future teaching efforts and opportunities.
- I was interested in trying to reach this group of students, and I had a good experience teaching to them.
- A surprising aspect of being involved in the course was in the networking opportunities with other instructors. I made a number of professional contacts that will likely advance my personal research. The course was also a learning opportunity in interdisciplinary systems modeling, and some of the approaches discussed in the course are being incorporated into a large interdisciplinary proposal that is currently in preparation. Likewise, a greater opportunity for the various instructors to meet and discuss research informally would have been beneficial.

Selected Student Assessment of their Learning Gains (SALG) Results

At the end students rated (1 to 5, 5 high) their gains in understanding of a list of topics. The mean ratings are displayed in the following table.

Topic	Mean Rating
Model concepts and issues	4.4
Ethics of modeling and why model	4.1
Food web/ecosystem modeling	4.1
Vegetation-atmosphere, canopy interception	4.1
Thermal stratification modeling	4.0
GIS, remote sensing, and snow hydrology modeling	4.0
Hydrologic/watershed modeling	3.9
Interdisciplinary modeling for ecosystem restoration	3.9
Weather and climate modeling	3.8

Topic	Mean Rating
Nutrient spiraling modeling	3.8
Why the past matters	3.8
Adding people to the equation	3.8
Groundwater/surface water interactions	3.8
Evapotranspiration modeling	3.8
Linked modeling approaches, including CSDMS	3.8
Issues of scale	3.7
Groundwater modeling	3.7
Integrating policy decision-making into policy design	3.7
Integrating policy in decision-making	3.7
Vadose zone modeling	3.6
Uncertainty and calibration in modeling	3.6
Economics modeling	3.3
Statistical modeling	3.1
Mathematical modeling	2.7

Extended Studies has its own class evaluation form that was administered at the end of the course. These forms were submitted directly to the office of Extended Studies. Students also completed a pre-course SALG survey. All SALG results were distributed to the course instructors.

Use of Formative Evaluation

Dr. Saito summarized the evaluation-information-refinement loop:

> Since the course is fairly novel (in my opinion), the evaluations are very useful in determining what appears to work and what doesn't. It also helps me to gage whether the course met the goals that were guiding me as I organized the course. To some extent, I expect that the goals of instructors and students in this course may not fully be the same as mine, and so the feedback helps to see where those disconnects might be. This has helped in shaping the application process for the course, designing the course projects, and providing guidance to instructors.

External Evaluator Comment

If this course is offered again next summer then I recommend considering reducing the number of evaluation forms students were required to complete. I would also encourage having students complete the evaluation forms anonymously.

APPENDIX H. Summary of CI Training Participant Feedback

The evaluation form was developed in collaboration with PI, the ID and NM Program Administrators and each stateôs Outreach Coordinator. The final version of the form was posted on the external evaluation website. Each state was responsible for making sure the individuals they supported for these trainings completed the form.

Two training participants expressed their appreciation for the opportunity to participate in Cyberinfrastructure training:

- A wonderful experience both for technical and networking reasons; many thanks
- First of all, I want to tell you how much I appreciated being able to attend this conference. I cherished this opportunity and will put my full energy into our climate change research.

Five men (two faculty members, one postdoc, one Masterôs graduate student and one Ph.D. graduate student) participated in four Cyberinfrastructure trainings. A faculty member, a graduate student and a postdoctoral associate participated in these three trainings:

- The Weather Research and Forecasting Model (June 21-25, Boulder, CO)
- TeraGrid (August 2-5), Pittsburgh, PA
- A Workshop on Processed-Based Analysis of Lidar Topographic Date (June 1-2, Boulder, CO)

A faculty member and a graduate student participated in the Cyberinfrastructure Summer Institute for Geoscientists (August 9-13, San Diego, CA)

These five men reported the degree to which the training met their expectations (did not, met or exceeded) for increasing their scientific capabilities and their Cyberinfrastructure (CI) literacy. Three training participants reported the training in which they participated met their expectations for increasing their scientific capabilities and their CI literacy. One individual reported the training met his expectations for increasing scientific capabilities and exceeded his expectations for increasing his CI literacy. The fifth individual reported that the trainings exceeded his expectations for increasing his scientific capabilities and his CI literacy.

All five men reported that the training in which they participated will enhance their ability to conduct research in their scientific field:

- Absolutely. The training added new techniques and methods for planning, implementing and analyzing high resolution topographic data. These data are essential to my study of how landscapes respond following anthropogenic, biologic, tectonic and meteorological disturbances.
- Definitely, yes. In this training I learned about data integration and visualization, handling LiDar data, KML programming for Google Earth, and cloud computing for large data. All these topics will help me as a researcher working in the area of climate change.
- The workshop was oriented towards the identification of WRF capabilities and limitations, which will help me in my research.
- This training will definitely enhance my ability to conduct research in my scientific field. I gained more knowledge on the mechanism of high performance computing, petascale computing, grid computing, and cloud computing. The training was a good opportunity for me to share my ideas with other researchers and to learn the novel techniques on these topics.
- Yes, my background in CI is not strong so this training helped me understand ways to use CI in hydrology research.

These were the descriptions recorded for how the training increased awareness, skills and knowledge in the area of climate change or other scientific disciplines.

- I gained valuable knowledge related to Cyberinfrastructure, such as the innovation on grid computing, cloud computing, and etc. These technologies improved my engineering skills, and thus, will benefit our Climate Change program.
- I use LiDar data for watershed and hydrodynamic modeling. Google Earth will be a good tool to display some of the results such as flood extents.
- The seminar allowed me to see how advances in computer technology (software and hardware) are shaping the future of scientific research. I am now looking at utilizing supercomputers to expand the scope of my climate model.
- The training increased my abilities in making statistically robust comparisons between different topographic surfaces. In my research these differences are typically driven by changes in climate influencing hydrology and river form. Both these topics were covered extensively by experts in these fields.
- The workshop enhanced our ability to perform analyses and interpretations of modeling results. Additionally, a special course was given about Coupling WRF with other models. This course increased the skills I need to couple WRF with a Hydrological model system, which is one of the future objectives of my climate modeling research.

Ways in which the training increased CI-literacy (awareness, skills and/or knowledge) were reported:

- I learned about handling large data sets and data visualization techniques.
- My understanding of open source applications for geologic modeling has increased.
- This training elucidated numerous resources for both downloading and uploading existing LiDar datasets from data distribution centers. I also learned more efficient ways of manipulating and analyzing the unusually large datasets.
- This training provided me with the opportunity to see many famous researchers on high performance computing and to listen to their keynote addresses as well as visiting with them in person. In addition, I had the chance to discuss some problems on CI with them. I also received many valuable suggestions on how to increase my CI-literacy.
- Tips were given to better use WRF with High-Performance Computing tools.

All five men found the application review and award process timely. They also expressed appreciation for the assistance they received from personnel in the EPSCoR offices. One training participant reported that getting the award early allowed for paying early registration fees and hotel rates that cut the cost of lodging by half.

Shaw (9/16/10)

APPENDIX I. Nevada Curriculum Development Project
Summary of Participant Feedback

What did you gain from participating in the development of these materials? Their responses (copies and pasted) to this question are displayed.

> The week long curriculum development workshop afforded me the opportunity to collaborate with my peers on multiple climate change lessons and walk away with web-based inquiry lessons. I have just finished implementing the first one and I am excited to use the next couple! My students loved using technology while looking at the global and local impact of climate change. Furthermore, I was introduced to new ideas on theoretical and practical implementation of inquiry, argumentation, and use of technology with students. For example, the lesson we fondly name Zero incorporated the use of Google Earth as a way in evaluate and record multiple data sets in one very visual and student friendly inscription. We also had the students addressing a scientific question, gathering evidence and creating arguments based on evidence. It was a worthwhile and productive week that resulted in lessons ready to use with students and from my experience thus far with my students the curriculum has impacted student learning! Thanks for allowing me the opportunity to participate in this program!
>
> This project helped me to understand how I might address the issue of climate change and sustainability in class. Finally, it helped me to see just how I can make these issues relevant to my students and their lives in Las Vegas.
>
> Here is a very brief summary (in no particular order, and not all inclusive) of what I gained during the CD4 project week:
>
> 1) Ability to better integrate the concepts of climate change in various activities in the Principles of Science Activities (Chapters) - I left the project with so many ideas for connections that I had never even thought of before
> 2) Ability to develop an online learning environment using the Moodle
> 3) Ability to develop 5-DIE lesson plans + upload them and be able to use them with my students
> 4) Activity Zero for Principles of Science - ready for classroom use
> 5) The use and practice of the argumentation format "claim-warrant-data" throughout the project made me feel more comfortable with it - I finally started using it with my students
> 6) Various ideas about different Principles of Science activities - an inevitable outcome of working with other Principles of Science teachers, plus a new spin on the use of models and modeling in science.
>
> This opportunity to work with Dr. Crippen was truly rewarding and inspiring and I am very grateful I had the privilege. I hope I am not forgetting something very important - it was definitely a packed week - information, skills, new points of view, new ways of teaching science and helping students learn.
>
> The Cyberlearning Curriculum Development for Climate Change project was challenging (in a good way) and required a change in my thought processes. We utilized an inquiry process that

really challenged our thinking. The process forced me as a teacher to really think about what I wanted students to know. In a very careful thoughtful manner I had to lead them down a path that would lead to a discovery of the concepts the students needed to know. It was easy to delve into this project because its relationship and goals directly correlated with our community and what our students really needed to understand about where they live. I think as a team we could see right off the bat how our students would benefit from infusing technology into the Science and Sustainability Curriculum. The Cyberlearning curriculum is thoughtful, deep and well-organized and really draws on the outcomes Nevada students should walk away with. I think I gained an opportunity to be a part of a project that will have a lasting effect on Nevada students.

I gained (1) Networking - insight into the thoughts of several other people who teach Principles of Science, which is a difficult course to present. New ideas are always welcome. (2) Experience with Moodle - which I've wanted to be able to use but didn't know how to set up at all. I'd now rate myself as at least basic. I need more practice, but Dr. Crippen has made a site available to us so we can try things out. I think this will be an invaluable tool. Again, the networking through C4D is wonderful. (3) Building the 5DIE model was very interesting. I was unfamiliar with it until C4D but I can see where this model of lesson could be an amazing tool in my classroom. I have been trying to incorporate more cyberlearning into my classes for years and it was awesome to be able to work with this group of teachers and learn how to better utilize it instead of just doing a webquest.

I really learned a lot from working with Dr. Crippen, I was completely lacking any climate change content in my freshman curriculum for principles of science. Climate change was not really listed as a standard so we just overlooked it. I am happy to say that the lesson plans we developed changed that and my curriculum is now rich with climate change content! I have also learned allot about data, and what context it needs to be in, in order for it to be information. Metadata is a word I am now much more familiar with and I make sure that my students understand why it is important for data to be in the proper contextual format in order for it to become useful information. I also learned allot about the 5 die format for creating lesson plans! I am so glad that I was presented with the opportunity to work with Dr. Crippen and I learned so much it is hard to put all in words!

Shaw (9/16/10)