



5550 W. Flamingo Road, Suite A2, Las Vegas, Nevada 89103  
Phone (702) 522-7070

**To:** Jim Coleman, Chair; Michael Campana; Fred Choobineh; Jeff Gray; Malcolm Hughes; Ruby Leung; Young-Doo Wang; Mike McCaffrey

**From:** Gayle Dana, Project Director, Nevada NSF EPSCoR Program  
Nick Lancaster, Tom Piechota, Mike Collopy, Nevada NSF EPSCoR Climate Change Project Co-PI's

**Re:** Responses to Comments from the site visit of the Nevada NSF EPSCoR External Research and Technical Advisory Board (ERTAB), February 3, 2010

**Date:** April 14, 2010

The External Research and Technical Advisory Board (ERTAB) conducted a site visit and meeting at the Desert Research Institute in Las Vegas, Nevada on February 3, 2010 in order to review the progress to date on Nevada's NSF EPSCoR project, "Nevada Infrastructure for Climate Change Science, Education and Outreach." The ERTAB submitted a report of their visit and recommendations for the project.

The Principal Investigators of the Nevada NSF EPSCoR Climate Change Program very much appreciate the valuable feedback and recommendations of the ERTAB. We have responded to each recommendation with specific strategies on how we plan to incorporate these recommendations. The responses are embedded after each recommendation in the ERTAB's February 14, 2010 Memo/Report. If after reviewing our responses, the ERTAB has any concerns about our approaches, please do not hesitate to contact Gayle Dana (775-674-7538; [Gayle.Dana@dri.edu](mailto:Gayle.Dana@dri.edu)).



Office of Research

February 14, 2010

**To:** Gayle Dana, Director, Nevada NSF EPSCoR Program

**From:** Jim Coleman, Chair; Michael Campana; Fred Choobineh; Jeff Gray; Malcolm Hughes; Ruby Leung; Mark McCaffrey; Young-Doo Wang

**Re:** Comments from the site visit of the Nevada NSF EPSCoR External Research and Technical Advisory Board (ERTAB), February 3, 2010

The External Research and Technical Advisory Board (ERTAB) conducted a site visit and meeting at the Desert Research Institute in Las Vegas, Nevada on February 3, 2010 in order to review the progress to date on Nevada's NSF EPSCoR grant "Nevada Infrastructure for Climate Change Science, Education and Outreach." ERTAB members present at the review meeting included Dr. Michael Campana, Dr. Fred Choobineh, Dr. James Coleman (Chair), Dr. Jeff Gray, Dr. Malcolm Hughes, Dr. Ruby Leung, Mr. Mark McCaffery and Dr. Young-Doo Wang. Dr. Rose Shaw, the external evaluator, was also present and participated in the discussion and preparation of recommendations with the ERTAB. The agenda of the meeting consisted of presentations by the Nevada team on their EPSCoR program, including detailed reports of the progress made to date in the major focus areas of climate, water, ecology, cyberinfrastructure, policy and outreach, and education. ERTAB members were also given a tour of an urban water conservation research center in North Las Vegas that has been instrumented with the sensor infrastructure that is a key piece of Nevada's EPSCoR program.

Below is a summary of the main points of the ERTAB's discussions:

The Advisory Committee was very impressed with several aspects of the project. The Nevada team has made truly excellent progress over the last year, and, overall, ERTAB was very enthusiastic regarding the potential of the project. The specific aspects of the project in which ERTAB reacted positively are described below:

1. The Nevada team is to be commended for their thoughtful and detailed responses to last year's ERTAB review, as well as being responsive to the comments made during the NSF reverse site visit. We were very impressed with the team's willingness to accept recommendations, think about them carefully, and adjust the project in ways that we felt were very appropriate. Examples include:
  - Last year, ERTAB members were "concerned that there was a risk of the Nevada team focusing too strongly on the notion of infrastructure building and diminishing the need for advancing the scientific body of knowledge." In an excellent response to our concern, the Nevada team developed a set of scientific hypotheses to drive advancing the scientific body of knowledge and guide the development of the infrastructure. We were very impressed with their focus on the science. The list of hypotheses is extensive and is clearly stated in a way that drives the infrastructure.

However, we recommend that the team work on focusing, integrating and prioritizing the hypotheses as they move forward. Scientific hypotheses that are developed particularly to explore the interactions among climate, hydrology, and ecosystems should have higher priority to take advantage of the interdisciplinary team and to yield larger overall scientific impacts. All areas of the interdisciplinary team need to actively reach out across disciplines to develop an integrated plan to synthesize the hydrologic/ecologic measurements, which cover a shorter time scale and smaller space scale, with climate modeling that covers a longer time scale and larger space scale. A designated interdisciplinary project lead may be necessary to develop and implement an integration strategy.

**Response to Point 1 - Bullet 1:** Project Co-PI, Nick Lancaster, will be designated the interdisciplinary project lead and work with the Component Leads to develop an integration strategy.

- Last year, ERTAB recommended that the Nevada “team consider an early adoption of a statistical downscaling component, based on an existing, accepted methods, which will enable climate change impacts to be assessed and provide early insights on climate surprises, interactions between different impacts, areas that require more detailed modeling and analyses, and methods to refine the approach.” ERTAB was extremely impressed that the Nevada team effectively adopted the statistical downscaling approach and integrated that approach with dynamical downscaling. We were particularly impressed with the progress made in this area given the small number of people involved. However, it is important for Nevada to gain some depth in this part of the project and to have succession planning for faculty leadership.

**Response Point 1 – Bullet 2:** In year 2, the Climate Modeling component hired one new postdoctoral researcher (Dr. John Mejia) and one new faculty member (Dr. Eric Wilcox), both residing at DRI. UNR is completing a search for a new faculty member in paleoclimate modeling, with the new hire scheduled to start at the beginning of year 3. As these three new faculty become established, we will ensure that they will play an increasing role in the activities of the climate modeling component and on the component steering committee.

- ERTAB was glad to see that a postdoctoral researcher and a junior faculty member have been hired to expand the capability in climate modeling. To gain more in-depth insights on regional climate change and its impacts, the team now needs to prioritize the scientific hypotheses and research focus. Potential scientific themes that are relevant to Nevada include processes associated with the complex orography, aerosol effects from upwind pollutants, and land-atmosphere interactions.

**Response to Point 1 – Bullet 3:** We recognize that the Climate Modeling group needs to fully integrate the work of new faculty into their research, as well as take advantage of new areas of expertise. The group is being encouraged to adopt a more coordinated approach and to develop formal interactions between different campuses, as well as to reach out to

modelers in other disciplines. These activities will help to develop a clear research focus and clear hypotheses, in coordination with the needs of members of the water and ecology components. Already, members of the climate modeling component are engaged in interdisciplinary proposals – including NSF Water and Climate Sustainability, as well as joint projects in the areas of water resource management and climate change effects on Micronesia and Guam. To leverage the NSF EPSCoR climate modeling activities, the team has received an award from the DOE - Office of Science: Simulating Climate at Regional Scale Program. The study is titled “North Pacific Mesoscale Coupled Air-Ocean Climate Simulations Compared with Observations.”

- Last year, the ERTAB reminded the team that “the climate of Nevada is characterized by very strong variability in time scales from the interannual to multidecadal. Not only does the variance of precipitation totals, for example, tend to be large compared to the mean, but shifts in climate regimes have led to extreme conditions persisting, in some cases for decades. This is bad news and good news for this program. The bad news is that it will present a challenge to determine whether the regional effects of global climate change have emerged from such strong background variations. On the other hand, the good news is that this richly varied climate history provides a wide range of circumstances, even in the last few decades, in which to test models linking climate, ecology, hydrology and society in Nevada. By emphasizing the explanation of what has already happened in Nevada, the project will acquire increased scientific credibility and public interest.” ERTAB was pleased that the Nevada team has done a good job of considering variability on the different time scales, and of joining with their colleagues in Idaho and New Mexico in this endeavor. ERTAB also recognizes that this is a very difficult problem, and encourages the team to continue to evolve and improve their approach to dealing with this variability.

**Response to Point 1, Bullet 4:** Climate variability on different temporal and spatial scales is recognized as very important by the climate modeling group. It forms a basis for recent proposals including one to NSF’s Water and Climate Sustainability program, as well as NV NSF EPSCoR internal seed grant proposals that emphasize impacts of climate variability on groundwater resources. The climate modeling team recognizes the importance of decadal variability and, depending on the computer capabilities, will extend some of the simulations to capture future decadal variations.

- Last year, ERTAB noted that “the two interdisciplinary science questions (ISQs) to which the potential interdisciplinary science teams are to respond in the seed grant RFP are quite broad, which should ensure that teams will be able to respond with maximum creativity.” ERTAB was a bit concerned that the specific questions listed below each ISQ were very good examples, but ERTAB recommended that it should be clear that the teams are free to answer whatever question(s) they deem appropriate, as long as the question fits within the general area of the two ISQs.

ERTAB was impressed with the seed grants and the interdisciplinary science teams that were funded, so this issue is no longer a concern.

- Last year, the ERTAB stated that “although the project outlines a pipeline of education and outreach from middle school through doctoral research, a missing component is the continued intervention of middle school students in the formative years of high school.” ERTAB was very impressed with the new programs put in place to engage middle school teachers in Science (e.g., the 12 middle school teachers who participated in the 2-week summer workshops).
  - Last year, ERTAB gave some recommendations regarding how the policy and outreach components could be improved. We are pleased that Nevada is developing demand-side frameworks in the policy component. Additionally, the policy component has progressed nicely in a short period of time. Two hires have been made and six graduate students are being supported, with another faculty hire anticipated. The Nevada team established the Social Science Climate Change Network (SSCCN) and developed a very good understanding of the nature of stakeholders in Nevada through a survey. They have achieved good success with the various Native American groups in Nevada by exhibiting sensitivity to the tribal needs and culture. There has been less success with the ranching community. This might be because of suspicion of academics. ERTAB suggests that increased collaboration with the cooperative extension network might facilitate greater interactions with ranchers.
2. ERTAB wants to commend the Nevada team for truly attempting to create an interdisciplinary team. Most of what passes for interdisciplinary work is really multidisciplinary work. True interdisciplinary work requires that those who are participating work side-by-side instead of retreating into their disciplinary lairs, only to emerge when the final report is required. ERTAB members noted that they have seen few such interdisciplinary endeavors as successful as this one. The Ecological Change and Water Resources Project, the Education Component, and the Policy and Outreach Component best exemplify the strong interdisciplinary aspect of the Nevada Infrastructure for Climate Change Science, Education, and Outreach project. We encourage all involved to continue to nurture and maintain this approach and to extend this to the climate-hydrology integration.

**Response to Point 2:** We appreciate the comments regarding the interdisciplinary activities of the component groups during the performance period, especially those of the Water and Ecology groups, which resulted from numerous conference calls and discussions, many organized by Co-PI Tom Piechota. The meetings and interactions have clearly strengthened the design of the transect, and most importantly the science questions that will drive the research. We see the Water and Ecology components as being nearly hand-in-glove and inseparable, so the connection between these groups is naturally close, and will remain close as the transect monitoring sites are installed, tested and monitored.

We also agree that interactions between climate and hydrology should be strengthened, which should be easier now that the regional climate modeling component has completed the hiring of a new faculty member (Eric Wilcox) and post-doc (John Mejia). Some of these interactions are already ongoing (e.g., John Mejia's involvement in the Water Sustainability and Climate proposal to NSF that DRI is preparing). With the progress the climate modeling component has reported during recent meetings and presentations, we suggest organizing periodic (e.g., monthly) technical meetings, as is done with the Water/Ecology components. We can present and discuss research findings, and identify the connections between the downscaled climate modeling output and the upscaled ecologic and hydrologic data. Another connection that can and should be made will be to better incorporate the atmospheric monitoring activities (e.g., atmospheric particulate matter and snow albedo seed grant work by Hans Moosmuller, DRI) as a connection between the climate and resulting hydrologic response.

3. With the need to provide regionally focused science and related education, outreach, communication and decision-support, ERTAB believes that the Nevada Infrastructure for Climate Change, Education and Outreach project has the potential to serve as a test-bed and national model for integrating research, education (broadly defined) and cyberinfrastructure. The challenges of becoming an effective national model are daunting and include substantial resource constraints at the state level, leadership who are overcommitted, and the inherent tension in fostering inter and transdisciplinary collaborations. That said, the project, by continually refocusing and recalibrating its goal of developing a "new interdisciplinary capability to detect, analyze, and model the effects of regional climate change on landscapes, ecosystems, and water resources and communicate research results to decision makers and the public," has an important story to tell other regions as they seek to monitor and prepare for changes in climate.
4. ERTAB wants to commend the Nevada team for their response to the NSF site visit to create a cyberinfrastructure plan. The plan that was presented to us is very strong.
5. ERTAB was encouraged that the Tri-state collaboration has begun and seems to be moving forward. We were particularly encouraged that the RII Track 2 proposal for shared cyberinfrastructure was funded and is aligned with the RII Track 1 award. Furthermore, we were impressed that Nevada's pending Track C.2 proposal aligns well with the funded RII Tracks 1 and 2. This alignment will make additional resources available to achieve the goals and objectives of Track 1 award and will magnify impacts of all three awards (we hope the C.2 proposal gets funded).
6. ERTAB was very impressed with all aspects of the Nevada administrative structure. In the past year, the Nevada team has put in place a very complex, highly interdisciplinary project, while at the same time: (1) responding thoughtfully and in a detailed manner to last year's ERTAB report; (2) completing their strategic plan; (3) preparing for and

responding very well to the NSF reverse site visit; (4) completing and being awarded the Track 2 funding and starting the tri-state collaboration; and (5) preparing the proposal for track C.2. The only way that all this could have been accomplished is through a sound, integrated administrative structure. Furthermore, we were really impressed with our interactions among the Nevada group regarding how they acted as a truly integrated team. We highly commend the current administrative leadership. We were also pleased to see the Nevada team thinking about a succession plan.

7. Faculty hires are a critical piece of this infrastructure plan and necessary to build both a critical mass and the depth necessary to assure sustainability. We were pleased to hear that the EPSCoR positions were still going forward despite Nevada's budget difficulties, showing a real commitment by UNR, UNLV and DRI to the EPSCoR program. On the other hand, during the time we were there the Las Vegas newspaper announced the potential of deep budget cuts to all the Nevada campuses and even announced the potential closing of DRI as one solution to the budget problems. ERTAB is certainly concerned about this with respect to the continuation of this project, the morale and security of the key faculty participants in this project, and about the continued hiring of new faculty to build the necessary critical mass. The Education and Outreach components of the project in particular appear to be especially vulnerable to the prospect of state cuts.

**The ERTAB members also made the following recommendations to help improve the project:**

1. In the spirit of integrating science, education and cyberinfrastructure, and being mindful of "unfunded mandates," ERTAB proposes some questions for the Nevada team to consider as it becomes more mature:
  - How can formal education from graduate level on down to middle schools be more fully integrated, perhaps with additional funding from IGERT, Discovery K12, G-K12 and similar programs? What strategies will be employed to engage and recruit underrepresented audiences?

**Response to Recommendation 1 – Bullet 1:** The Leadership team has agreed in principle that submitting an IGERT proposal is a good idea. The team will discuss in the near future how a fully integrated IGERT proposal should be approached. A G-K12 proposal spearheaded by UNR project Co-PIs (Collopy and Mensing) was in the works last year, but was not selected to move forward (only one per institution was selected). We will resume our efforts on submitting a G-K12 proposal this year.

To address middle school education, Paul Buck (DRI/NSC) submitted a proposal to NSF's Geoscience Education Program in March 2010 and he is currently preparing another proposal that will be submitted to NASA's Global Climate Change Education Program in late April 2010.

Dr. Buck is has also initiated a collaboration with Mark McCaffrey at CIRES (University of Colorado, Boulder) on a proposal submission to

NSF's Climate Change Education Partnership program (Phase I). Dr. Buck has approached a faculty member in UNLV College of Education and at NSC, and will be looking to involve some of our Nevada NSF EPSCoR climate change project faculty in this NSF proposal as well. Dr. Buck expects to partner with a variety of Clark County, NV K-12 and informal science organizations. The LOI for this proposal is due in late April 2010, with full proposal due in late May 2010.

Dr. Buck also intends to revise and resubmit a NSF Math Science Partnership proposal, which was declined in last year's competition. Reviews of the first proposal were sufficiently positive to merit resubmission with revisions that address the reviewers comments. In the submission, they expect to include activities that might be able to fill the long-recognized high school gap in our Track 1 award. The RFP will be out in June/July 2010 for this new competition.

- What are the short term and long term opportunities to more fully connect formal education programs with outreach, policy and communication efforts?

**Response to Recommendation 1 – Bullet 2:** An important effort that started in Year 2 and will go nearly the length of the project (through Year 4 and possibly in Year 5) will be the development of an outreach video. This will be targeted for general audiences, but will also be a valuable resource for education programs. As this material is developed, we could possibly ask for the Middle school teachers to review and provide feedback. As this material is developed and feedback provided, this is something that will likely lead to publication on outreach and education on climate change.

As some of the infrastructure is developed (i.e., environmental transects, GIS lab), we will encourage NSHE institutions to take field trips to see the facilities. This will represent multidisciplinary enrichment at undergraduate and graduate levels. Existing support staff for the project can host field trips. For example, Brian Bird has already hosted such a trip for Dr. Smith's GIS class to explore how to use ecological sensors.

We will also encourage Postdoctoral scholar Zhongwei Liu, who is co-funded by the NSF EPSCoR Education and Policy Components, to play a significant role in connecting these programs. We will also rely on the efforts of the Education Curriculum graduate student (currently Amy Northrup) to accomplish these connections.

- How can current and future surveys be more effectively coordinated and used as needs assessments in order to better address decision-making and information gaps among stakeholders?

**Response to Recommendation 1 – Bullet 3:** It is important to underscore that baseline surveys conducted in Year 1 and 2 are needed to begin to understand stakeholder perceptions and knowledge of climate

change. With the understanding gained, we can start to identify gaps among stakeholders as indicated by the comment above. The existing surveys were part of an effectively coordinated effort that was meant to reach various demographic audiences. There was a need to vary the surveys depending on the audience; for example we can't ask Native Americans the same questions as business groups. This coming summer (2010), the Policy Component has a big task to pull the diverse responses together. A next step (in Year 3) will be investigating what the literature shows to be the best methods for taking knowledge such as this, including needs and gaps, and figuring out how best to communicate about it, and to start to survey how policy leaders process decisions related to climate change to understand those mechanisms. This will add utility to the base data we collected. At this time the component will also focus on integrating workshops (e.g., geovisualization of scenarios), resurvey some populations, and host stakeholder meetings to discuss information they need for decision making.

- The cyberinfrastructure education plan described in the *Response to the Reverse Site Visit Recommendations* outlines how the data portal will serve education audiences, with “comprehensive user education and support via on-line tutorials, a user manual, examples, indexes, FAQs, e-mail support, and accessibility features.” When and how will this be developed and how will it dovetail with Track 2 goals and objectives?

**Response to Recommendation 1 – Bullet 4:** Regarding the “when” part of the question, the plan is to develop the educational portion of the web portal largely as part of Track 1, with an initial version in the summer of 2010. As the data portal will have in each subsequent year a new version, the educational part of the portal will also have new, enhanced versions in each of the following years of the project (Track 1).

Regarding “how it will be developed”, we foresee that most of the education material will be under its own section of the portal, e.g., “For Students,” and most likely in an additional section “For Educators.” We expect that material for these sections will come primarily from the project’s education group as well as from our own group (CI). It will be organized and posted by the CI group’s developers in consultancy with the other project components, particularly the education component. Some of the more system-oriented features, such as examples, support, and FAQs will be created in concert with the education group and will be updated automatically. Accessibility for persons that are disabled or have limited capacities will be addressed by implementing appropriate XHTML-related features in the web portal, e.g., image captions, scaling text, alternate text.

In the Track 2 project we envision that the educational parts of the portal will be updated with material created by the project’s education component (Track 2) as well as the incorporation of several additional features and capabilities, primarily emphasizing interactivity and

collaboration. For example, the educational part of the portal can be extended in Track 2 using dynamic documentation methodologies such as wikis.

- As video and other digital resources documenting research, education and outreach efforts are developed and collected, how will they be archived and used synergistically to provide context for the science and communicate the project elements to non-technical audiences

**Response to Recommendation 1 – Bullet 5:** The video being produced by the Policy, Decision Making and Outreach Component will be accessible to a wide range of audiences from non-technical to college students. The Component has designated Zhongwei Lui (Postdoc) as a point of contact to ensure that scholarly work from the project is made available through the project website, but more importantly, available through the UNLV Library Institutional Repository (<http://digitalcommons.library.unlv.edu/epscor/>). Many major universities are now developing these repositories for scholarly work that make it freely accessible to the wide range of audiences and searchable through most scholarly databases. As the Cyberinfrastructure Component develops the Data Portal, the Policy Component will encourage them to consider how “information” is also part of this valuable resource.

2. The educational outreach activities focus across middle school, undergraduate, and graduate education. There seems to be a gap of interaction between the middle school focus (with middle school teachers) and undergraduate education. That is, it is not clear how a pipeline of future scientists is developed due to the apparent lack of any evidence of high school interaction. A suggestion is to consider a multi-tiered mentoring model, whereby undergraduates assist in teaching concepts to high school students, and the high school students then help as facilitators in mentoring efforts to middle school students. This is a proven mentoring model introduced in Boston to mobilize teens in their out-of-school time to gain knowledge in technology-rich domains and to create their own ways to share knowledge with their younger peers. For more details, please see:

Millner, A., & Daily, S. (2008). Creating an Educational Ecosystem for Design, Personal Fabrication and Invention. In C. Kimble & P. Hildreth (Eds.), *Communities of Practice: Creating Learning Environments for Educators* (Vol. 1, pp. 403-428). Information Age Publishing.

The program may also be a good fit for funding through the NSF Graduate STEM Fellows in K-12 Education program, whose goals include “provides funding for graduate students in NSF-supported science, technology, engineering, and mathematics (STEM) disciplines to bring their leading research practice and findings into K-12 learning settings.”

**Response to Recommendation 2:** In future solicitations for both graduate fellowships and undergraduate scholarships we will encourage,

proposals that include or focus on K-12 outreach, and that the next rounds of seed grants also include this sort of language.

3. There may be potential to better leverage existing efforts across campuses (e.g., NSF REUs, NSF RETs, McNair Scholars programs, and cooperative extension offices) into the educational and outreach components. For example, the extension network can be very helpful in engaging stakeholder groups, particularly ranchers. ERTAB encourage you to explore such opportunities.

**Response to Recommendation 3:** We propose to include an emphasis on leveraging existing efforts across campuses in future Seed Grant Competitions.

4. A focus of the interdisciplinary award (“Losing the Lake”) involves games and simulations to teach children. A suggestion is to consider the use of new educational environments, such as Scratch (from MIT) and Alice (from Carnegie-Mellon), which allow students to create their own video games and movies by writing computer programs in an environment that is easy for them to use. This has been done in several STEM areas, where children create and play their own games that they created, with each game focused on issues related to any of the components of the project. This has been done recently with Scratch, whereby elementary school students created games and videos focused on health science issues (e.g., games that are based on an informed understanding of infectious diseases).

**Response to Recommendation 4:** The primary objectives of Scratch and Alice are to teach students computer programming. As such, these systems are not well aligned with the instructional goals of the Losing the Lake project, which are to develop student’s mental models of both water supply/demand and climate change through a web-based computer game. The use of alternative instructional environments would have to be part of a more extensive curriculum, the development of which is beyond the scope of this two-year project. However, the project’s PIs plan on preparing an NSF-grant proposal for development of such a curriculum, and will consider the use of other learning environments and systems as part of that curriculum.

5. A suggestion to the Cyberinfrastructure team is to consider using metamodeling and domain-specific modeling tools as a technology for building the interface for the data portal. Such a technology allows an end-user, who is not a computer programmer, to specify their desires in a way that is very close to the notation and abstractions that are most appropriate to their understanding (the lower-level details can then be generated from the higher-level specifications). This will allow the end-user to focus on the key essence of the problem they want to solve, without getting overwhelmed by the technical details of the technology solution space. Such an approach has been shown to offer large advantages in many scientific and engineering domains.

**Response to Recommendation 5:** This is an excellent suggestion. It is something we will definitely look into as part of pursuing the research and

development of the software framework for model interoperability. The idea of using meta-modeling and domain-specific modeling tools certainly appeals to our CI group. In particular, our group's software developer, Eric Fritzinger, will explore and apply using such tools for building the graphical user interface of the software framework on which he is currently working. Furthermore, during his February-March 2010 visit to the University of Alabama (UA), the CI Component Lead Dr. Sergiu Dascalu discussed the initiation of a research collaboration with members of Dr. Jeff Gray's group at UA, who have expertise in these areas. The plan is to start joint work in Fall 2010 with the involvement of one graduate student from UA and one from UNR.

6. The target year of the Nevada Climate Change study is not specified. The target year of a climate model is usually more than 100 years, but most of policy models have the target year of 20 or 30 years. To integrate the physical model with the policy model which the Nevada Climate Change study intends to do, the target year needs to be consistent.

**Response to Recommendation 6.** The Climate Modeling Component is currently planning three segments of climate simulations with 20 years each including years 2000-2020, 2040-2060, and 2080-2100 to cover 20 yrs periods. Additionally, to investigate decadal oscillations, the simulations will include years 2060-2080, which would provide a continuous series from 2040 to 2100.

In the meantime, the Policy Component will be gathering information on the planning time horizon of managers and policy makers. This will also be useful for identifying relevant time frames for geovisualizations of research from the project. As this information is gathered, it will be used to inform the Climate Modeling efforts. Policy Component personnel Haroon Stephens and Zhongwei Liu will facilitate these discussions.

7. ERTAB has a few Specific Comments related to the Policy, Decision-Making and Outreach Component

#### 7.1 Survey

Survey is an important undertaking in the Policy and Decision-Making Component, but it would be helpful if the following questions are considered:

- What are the main purposes of the survey?
- What kinds of information do you expect to acquire?
- How can the survey results be used in the policy analysis including a geospatial analysis and/or alternative future scenario?
- How do you assess the change in perception of the stakeholders once the results of the impacts of regional climate change identified by the Ecological and Water Resources Component?

In addition, we encourage the Policy, Decision-Making and Outreach Component to work closely with the Education Component, and all should be closely integrated into the Communication Plan, which has not to our knowledge been completed. Formal and informal education, outreach and engagement, and communication are all overlapping parts of a continuum and must be treated as integral to the overall science and cyberinfrastructure goals.

**Response to Recommendation 7.1:** The main purpose of the survey is to obtain a baseline understanding of stakeholder perceptions and understandings of climate change. We expect to be able to identify items under these subheadings for the rancher/farmer and Native American groups:

1. Demographic information
2. Consideration of Future Consequences
3. General Understanding and Perceptions
4. Concerns and Mitigation
5. Local Impacts and Concerns

We hope to compare and contrast biophysical outputs of future scenarios from the various types research data being collect in the project. For example, what are stakeholder groups planning for and what do the population models predict (the demographics new faculty hire will help in this activity)? We also hope to do geospatial analysis to investigate whether or not spatial patterns of perceptions result and if relations to certain features and demographic profiles may be revealed. Presently the Policy Component is conducting a pilot geovisualization for a specific project on the Newburry Mountains in Southern Nevada with the possibility of doing a pre and post stakeholder focus group that might reveal changes in preferences. As the biophysical data from the Ecology and Water Components become available we can start adding these data into the analysis.

## 7.2 Best Management Practices

The first year task of reviewing best management practices has been moved to the second year. The review of the best management practices will be critically important, because the team will find out what has been working and what has not elsewhere, and can then pick the best approach. ERTAB recommends that your review should not only elucidate success stories but also any reasons for failure. Dissemination of the compiled information on the best management practices to policymakers and decision-makers will be very important for policymakers because they will appreciate knowing that what you are suggesting has a positive track record. It would be good if the Nevada team addressed the following questions:

- What kinds of best management practices do you have in mind? Depending on the goals of addressing climate change (i.e., prevention, mitigation or adaptation), your review of the best management practices will differ.

- Do you have any specific cases of best management practices? Are you looking for them from some states of the U.S. or other countries?

**Response to Recommendation 7.2:** This is another excellent comment. The Policy Component is now working to have graduate student Ross Guida do his thesis on this subtopic. The UNLV Policy Component lead, Bill Smith, is also looking for external funding to bring on another student to work on this theme as well. They will focus on states first, and then perhaps other Northern industrialized countries.

### 7.3 Capacity Building

Nevada's policy/outreach component sets up many organizations including SSCCN (Social Science Climate Change Network), SWG (Stakeholder Working Group), NCCF (Nevada Climate Change Forum), SAC (Stakeholder Advisory Committee), etc. Institutional capacity building of your component is expected to address a host of institutional barriers to successful climate change policies. The Component includes excellent efforts, but the following questions can be considered:

- What are their functions or roles of these organizations?
- How do the organizations contribute, and link, to the process of policy decision-making?
- How do the organizations influence the actions of policy-makers?

**Response to Recommendation 7.3:** The SSCCN is the collective of our outreach efforts to obtain a baseline on statewide, diverse stakeholder perceptions and understandings of climate change. The linkages we establish are our human sensors on the community. The SAC is a group of around 10 that is representative of the overall stakeholder population to the extent that is possible, and we will use this group for focus group meetings. We have smaller SWG(s) depending on the faculty member involved, as some faculty funded through the Policy Component made more connections in this regard than others. However, the point of the SWG is for us to have small groups of folks we can have a little deeper relationship with, that we can rely on for guidance, have potential to write grants with, and question more often. As of right now, the NCCF is not formally established due to it being beyond the initial scope of the project. Some SAC or SWG members will have policy influence, but this is not a prerequisite. The SAC, as well as policy makers, will be invited to participate in geovisualization of future scenario workshops towards the end of the grant. By working with NGOs, they may consider our work in relation to their policy impacting activities.

We also need to make outputs from the other project components digestible and pertinent to stakeholder needs. Our surveys can help the other components consider how their work might be received and issues and perceptions stakeholders have, as well as how they might alter their outputs as well for specific audiences. To accomplish this, the other

project components need to be willing to strongly consider our results from years 2 and 3. The PIs will likely have to help facilitate some of these interactions.

#### 7.4 Linkage with the Goal

Nevada's Policy, Decision-Maker and Outreach Component indicated its goal as to "Document, interpret, and communicate institutional and social impacts of the project's climate change research findings to all interested and affected parties including decision-makers, businesses [through Small Business Innovation Research (SBIR)], educators, and the public." "The main goal is to develop data collection and modeling infrastructure to assess effects on human systems, responses to institutional and societal aspects, and enhance policy making and outreach to communities and stakeholders."

- How do your sub-components (e.g., surveys, best management practices, institutional arrangement such as SSCCN, SWG, NCCF, and model building) contribute to the achievement of the above goal?

**Response to Recommendation 7.4:** A summary of how the SSCCN, SWG and SAC feed in data and create partnership opportunities was provided above. All of these human infrastructure pieces noted above are geared towards developing data collection (the first wave of which we are now analyzing), understanding institutional and societal aspects of climate change, and all of this serves as infrastructure for outreach. As a result of this project we now have a Climate Change Research Lab on the UNLV campus, where our project research efforts are concentrated. Outputs will build knowledge and contribute to the literature on perceptions of climate change for numerous groups: Nevadan sub groups (e.g., ranchers), Southwestern U.S. (i.e. regional applicability), and stakeholders in general (i.e. the public sphere). Since adaptation to climate change is a matter of impacting both mass behavior and industrial/economic practice, contributing in this area is absolutely essential academically and in an applied sense. We introduce our research through surveying and partnering using multiple methods such as web-based and hard copy mailings, focus groups, phone calls, one on one interviews, attending events, and doing public workshops. As a result, we are laying the foundation for understanding societal dimensions of climate change. This should be of generic use to those doing biophysical research on climate change and related matters in Nevada, as they consider how to communicate with an audience that we will have helped them to understand far better. The geovisualization modeling will be interesting because it will offer an opportunity to explore how stakeholders will receive and respond to our integrated outputs.

8. ERTAB strongly encourages the education/outreach/communication (EOC) component to: 1) learn more about what is going on around the country with efforts such as the Climate Literacy Network, the Climate Leadership Initiative at the University of Oregon and related efforts, and 2) submit a strong proposal to the upcoming NSF Climate

Education inter-directorate solicitation that would help buttress and integrate the EOC efforts. That would go a long way toward helping develop a truly integral national model for other regions

**Response to Recommendation 8:** (1) We will include this as an explicit topic in the 2010 May Education Conference being sponsored by the NSF EPSCoR Climate Change project. In addition, we can consider shifting some of the curriculum development grant funds to allow faculty to spend some time over the summer learning about these sorts of activities. We could make this part of the call for proposals. Note that this would draw resources from the curriculum development funding, which is quite limited.

The Education Component Lead, David Hassenzahl (UNLV), will be working with the Climate Literacy Network during his 2010 – 2011 sabbatical, and will return with considerable familiarity with other climate education efforts around the country.

(2) Helen Neill (UNLV) is preparing an NSF-CCEP proposal that focuses on water resource management in the southwest; her partners include ASU and Brookings.

9. The Project Director indicated that the State's funding is supposed to help with the education component. The budget issues in the state did concern ERTAB - the education piece is particularly vulnerable, especially since it is not as integrated across the project as well as it might be. Also, there was concern expressed that the policy/outreach pieces of the program are also vulnerable. This part of the project is led by a very talented junior faculty member from UNLV- there is a lot on his plate and the budget cuts may make him feel vulnerable. ERTAB recommends that Nevada take proactive steps to decrease the vulnerability of the education, policy and outreach pieces in this highly unstable fiscal climate. ERTAB's overall concern is that the Education, Policy and Outreach components must be an integral part of the overall effort. Yet, a year from now if the state budget woes hits them, they could be gone, which would be an enormous loss to the overall project.

**Response to Recommendation 9:** The NSHE System Sponsored Projects Office (SSPO), under which all Nevada's EPSCoR programs reside, will be subjected to the same 7% budget cut as the campuses for the coming fiscal year 2011. The Assistant SSPO Director has assured me that most of the 7% percent cut will come from state funds targeted for other State programs under that office. If there are any cuts from state funds targeted for the NSF EPSCoR project it will come from NSHE administration. Therefore, I have been assured the state funded education activities of the project (e.g., GRAs, Fellows, undergraduate research scholars) will not be affected by the budget cuts. Other state funded research and outreach activities (including those in the policy component) in the project will not be affected by the state budget cuts. The State EPSCoR Director (who is also the NSHE Vice Chancellor for Academic and Student Affairs), Dr. Jane Nichols, is also very aware of the

critical importance of state funds to the education and outreach aspects of the Climate Change project and is committed to reducing the risk of budget cuts on the project.

10. A significant infrastructure investment of this project is the hydrologic observatory building along two transect networks in northern and southern Nevada. Each transect through its multiple sensors will generate streams of data that need to be fused in a manner to maximize the amount of information in support of testing the scientific hypothesis. ERTAB is impressed with the progress made in the planning and execution of the two observatory networks. We urge the team to devote more thoughts to integrating the datasets across temporal and spatial scales and strategies of data sharing across the team and beyond. To make more significant use of the data, the team also needs to strategize on how such data can be used to address the climate-hydrology interface, and to strengthen the data development efforts with hydrologic modeling efforts for hypothesis testing. ETRAB feels Nevada is well positioned to make big stride in advancing the body of knowledge if the collaboration between the atmospheric group and the hydrology/ecology group is more effectively facilitated by the cyberinfrastructure (computer science) group. One suggestion to bring these three groups closer is for the Nevada team to submit an IGERT proposal by the end of the third year of the project to train future scientists with working background in all three science areas.

The observatories also hold strong education and outreach potential and the Education team should be involved with helping develop strategies to make data from the networks easily accessible and meaningful to non-technical audiences.

**Response to Recommendation 10:** This subject is certainly a top priority for the project, but it is also one of the most elusive and difficult issues that arise in any large-scale environmental analysis effort. A discussion on how to integrate datasets across temporal and spatial scales was proposed by Ecology Component Lead Franco Biondi (UNR) to Jim McNamara (Boise State), who organized a session on “Climate Trends in Western Watersheds” for the NSF EPSCoR Tri-state Consortium meeting (April 6-8, 2010). Notes on discussions from that session will be forthcoming at a future date. A data policy is currently under development and was the topic of a session at the Tri-State Meeting. Data (level and format TBD) from the observational transect sensors will be made available to the public through the data portal being designed by the Cyberinfrastructure component. The combination of hydrological and climate modeling will be facilitated by the establishment of the data portal, although details on its components are still under development.

The Component Leads have agreed in principle that submitting an IGERT proposal would provide an ideal opportunity to pursue these objectives. The strong education and outreach potential of the transects has been recognized, and plans are in place to have guided tours for the most accessible site near Las Vegas (about an hour drive from UNLV). A

member of the Education group (Paul Buck) has submitted proposals to involve high school teachers from Las Vegas, Ely, Elko, and Reno/Sparks and take them to visit the monitoring station during the summer.

11. Additionally, making best use of the instrumented transects for science, education and outreach will depend on there being accepted organizing principles that do not limit future flexibility in adapting to Nevada's needs. At the level of basic science, there is much to be gained from focusing on the annual and diurnal cycles as they vary along and between the instrumented transects. How do these cycles vary from year to year, and in which components of the system at each location? Why do they vary as they do? As indicated in the project's response to last year's ERTAB recommendation, much remains poorly described concerning how regional climate projects down onto our actual, mountainous, terrain at spatial scales relevant to hydrology, geomorphology and ecology. Better descriptions and understanding of the local annual and diurnal cycles in turn provide essential information for evaluating the likely effects of climate variability and change on the provision of ecosystem services in Nevada.

**Response to Recommendation 11:** We agree with the observations of the ERTAB and would state further that understanding how climate variability (daily and interannual) affects ecological signals is a vital part of the research we intend to conduct. We also agree that the climate modeling needs to be projected downward to the scale of the measurements, so a more complete understanding of atmospheric drivers can be ascertained. Through enhanced collaboration between the water and climate components (see response to Point #2), we hope to better connect these processes. We will also be focusing our efforts on understanding diel and annual patterns, for each process being monitored both within each transect and between the eastern and southern transects.