

Five Year Strategic Plan for:

**Nevada Infrastructure for Climate Change
Science, Education, and Outreach**

National Science Foundation Cooperative Agreement EPS-0814372

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Executive Summary

The Challenge for Nevada

Accelerated changes in climate are occurring now in Nevada and will continue into the future, leading to complex changes and feedbacks among climate, biophysical, and human systems. Most efforts to address these issues are directed at the global scale, and understanding of regional impacts and processes is limited. Developing improved understanding of global climate change on a regional scale is imperative since a major scientific challenge is how best to downscale global climate predictions. An integrated approach in which biophysical and human responses to climate change are studied will provide quantitative understanding of feedbacks among water resources, ecosystems, as well as atmospheric and human systems.

Nevada's Vision

The vision of this project is to create a statewide interdisciplinary program and virtual climate change portal that will stimulate transformative research, education, and outreach on the effects of regional climate change on ecosystem resources (especially water) and support use of this knowledge by policy makers and stakeholders.

Achieving the Vision

To achieve its vision, Nevada's Climate Change RII project includes six capacity-building components that will fill infrastructure gaps in climate modeling; ecological change; water resources; policy, decision-making, and outreach; cyberinfrastructure; and education. These components will build capacity to model regional climate change, evaluate methods to downscale model output, understand and quantify key ecological and hydrological processes, translate climate change science into formats usable by decision-makers, integrate models and data, and transform how students learn about climate change. Diversity strategies are woven throughout the components, and a comprehensive evaluation plan will involve external reviewers. An overarching management structure includes a leadership council, external research and technical advisory board, stakeholder working group, other ad-hoc working groups, and a Nevada Climate Change Forum.

An Integrated Approach

To achieve an integrated approach, several mechanisms will be employed to address two broad fundamental scientific questions: *How will climate change affect water resources and linked ecosystem services and human systems?* and *How will climate change affect disturbance regimes and linked systems?* Related questions to be pursued by interdisciplinary teams include identification of forcing factors underlying recent climate changes; feedback mechanisms between climate and vegetation; impact of locally generated aerosols on climate; and effects of change in precipitation type on hydrology. This integrated approach in the unique natural laboratory of the Great Basin has the potential to transform climate change studies at regional and sub-regional scales.

Outreach and Education are Essential

Outreach to diverse stakeholders will be accomplished by identifying important needs in climate change research, as well as informing and involving the public in climate change science. Policy makers who need to make prompt and prudent decisions on how to respond in the face of these impacts will be supported by scientific findings. A key strategy is to make results available

from this enhanced capacity via an accessible, on-line data portal. Nevada has a strong history of involvement in 6–12 outreach as well as undergraduate and graduate research. This will continue with summer research programs, academic year scholarships, mentorship programs for graduate students, and a Summer Institute to broaden participation in 6–12 education in which teachers will be trained in climate change science. Recruitment of new faculty and graduate students will target underrepresented groups. Communication of climate change science will be enhanced by use of cyberinfrastructure and involvement of a broad range of students and faculty. A statewide virtual information portal for climate change will be created to focus on outreach, and visualization strategies will be employed to communicate findings to the public and policy makers. Partnership with the Nevada Small Business Development Center will assist businesses to address state and federal science and technology needs related to climate change and increase their competitiveness for federal Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) grants.

The Path Forward: Project Goals, Strategies and Actions

The project has six programmatic science goals, one business outreach goal, and one programmatic goal to facilitate integration and synergy of the project. Goals 2 and 3 were merged in the 2011 revision since these two efforts have been working in synergy since the project started.

Programmatic Science Goals and Associated Strategies

Goal 1:– *Promote climate change scientific discovery by carrying out nationally competitive collaborative capacity building in climate modeling.*

Primary Strategy: Develop a capability to model climate change at a regional and sub-regional scale and its effects to evaluate different future scenarios and strategies (Climate Modeling Component). This will be accomplished by the following actions:

- Augment existing faculty.
- Develop computing and technical support structure.
- Develop methods to dynamically and statistically downscale data for regional/local application.
- Develop visualization and GIS systems for model outputs.
- Interact with other project components to create linkages.
- Link regional climate models with other models (e.g., hydrology, ecology, urbanization)
- Develop methodologies for paleoclimate modeling.
- Investigate uncertainties and errors in climate modeling.
- Establish global climate modeling capabilities for process studies of response of regional climate to aerosol forcing.

Goals 2&3 – *Promote climate change scientific discovery by carrying out nationally competitive collaborative capacity building in ecological change and water resources.*

Primary Strategy: Develop data collection, modeling, and visualization infrastructure to determine and analyze effects on ecosystems and disturbance regimes (Ecological Change Component). This will be accomplished by the following actions:

- Augment existing faculty.
- Develop observational networks.
- Develop collection, modeling and analysis tools.
- Interact with community stakeholders.
- Collaborate with all project components.

Goal 4 – *Document, interpret, and communicate institutional and societal impacts of the project’s climate change research findings to all interested and affected parties including decision-makers, businesses, educators, and the public.*

Primary Strategy: 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 (Policy, Decision-Making, and Outreach Component). This will be accomplished by the following actions:

- Augment existing faculty.
- Develop infrastructure and mechanisms to enable two-way flow of multidisciplinary data and information between scientists and interested and affected parties.
- Create capacity and facilities for educational outreach and decision-support tools.

Goal 5 – *Facilitate and support interdisciplinary climate change research, policy, decision-making, outreach, and education by using cyberinfrastructure to develop and make available integrated data repositories and intelligent, user-friendly software solutions.*

Primary Strategy: Develop a data portal and software to support interdisciplinary research via integration of data from observational networks and modeling (Cyberinfrastructure Component). This will be accomplished by the following actions:

- Create climate change data portal.
- Design software environments/interaction solutions.
- Develop a computing and technical support structure.
- Augment technical staff support.

Goal 6 – Create a scholarly environment to promote research skills and intellectual development for Nevada educators and students (K–12, undergraduate, and graduate).

Primary Strategy: Develop educational infrastructure to train students at all levels and provide public outreach in climate change issues (Education Component). This will be accomplished by the following actions:

- Develop 6-12 teacher professional development programs develop materials to support curriculum.
- Provide annual/ongoing undergraduate and graduate awards, fellowships, NV undergraduate research symposium.
- Create climate change education conference.
- Research climate change education praxis and opportunities.
- Create courses and curricula for graduate and undergraduate students.
- Provide Summer Fellowships for Community College Faculty.

Business Outreach Goal and Associated Strategy

Goal 7 – Encourage innovation in the State of Nevada through business development and the Small Business Innovative Research (SBIR) and the Small Business Technology Transfer (STTR) programs.

Primary Strategy: Assist companies and individuals to understand the SBIR/STTR proposal process and the transition from proposal development, to project implementation, to commercialization (SBIR Component). This will be accomplished by the following actions:

- Assist companies and individuals to understand the SBIR proposal process.
- Help companies to understand the transition from proposal development, to project implementation, to commercialization.
- Provide clearing house for information about the SBIR budget process.
- Offer limited research on technology.
- Develop and distribute promotional materials, especially news releases and flyers and revised web pages.

Programmatic Goal and Associated Strategy to Facilitate Project Integration and Synergy

Goal 8 – Promote climate change scientific discovery and project integration and synergism by conducting interdisciplinary research on climate change and its effects.

Primary Strategy: Form interdisciplinary science teams comprised of faculty and students from different disciplines, backgrounds and campuses and promote use of new project infrastructure and data. This will be accomplished by the following actions.

- Form interdisciplinary teams comprised of faculty and students from different disciplines, backgrounds and campuses.
- Provide seed grants for innovative research that use or support new project infrastructure.
- Promote use of new project infrastructure and data (e.g. observational networks, computer clusters, SSCCN, geovisualization facility, web portal).
- Involve students and stakeholders throughout project.

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Introduction

On September 1, 2008, the Nevada System of Higher Education (NSHE) received a five year, \$15M, Research Infrastructure Improvement (RII) Award from the National Science Foundation's Experimental Program for the Stimulation of Competitive Research (NSF EPSCoR) for Climate Change research in Nevada. This award creates a statewide interdisciplinary program focused on understanding the effects of regional climate change on ecosystems, improving communication between researchers and policy makers, and better educating the public on climate change in Nevada. The program has six science areas of interest: Climate modeling; Ecological change; Water resources; Education; Cyberinfrastructure; and Policy, decision making and outreach. Additionally there is a business outreach component as well as a mechanism for attaining project integration and synergy. The project encompasses a wide range of disciplines, including (but not limited to) Biology, Civil Engineering, Climatology, Computer Science, Ecology, Education, Environmental Studies, Geography, Hydrology, Journalism, Natural Resources, and Political Science. The goal is for interdisciplinary science teams to build capacity in climate change research to measure environmental changes, develop climate models, translate climate-change science for decision makers, create computer systems to make climate data more accessible, and develop new ways to teach about climate change.

Brief History

NSHE's planning process for selecting the climate change theme was multi-faceted. It started with bottom-up planning to ensure faculty commitment to new initiatives. The NSF EPSCoR Project Director issued a statewide call for infrastructure-improvement ideas in fall 2006. All of the 60 submitted ideas were made available to Nevada faculty on the NSF EPSCoR Web site; interested faculty were encouraged to form statewide collaborative groups with common goals based on these ideas. This process resulted in 40 infrastructure-improvement pre-proposals, which were reviewed by an external panel using four criteria resulting from a review of Nevada's EPSCoR programs by the American Association for the Advancement of Science (AAAS): (1) areas of relevance to NSF in which Nevada already has significant *strength*; (2) areas of *uniqueness* that take advantage of Nevada's specific circumstances or constitute a well-defined niche; (3) areas related to new government or private *funding opportunities*; and (4) areas *consistent with strategic plans* of DRI, UNLV, and UNR.

Following AAAS guidance, the review panel included five researchers from outside Nevada – three of whom have led successful NSF EPSCoR state programs. The other two researchers were from targeted disciplines represented in the pool of pre-proposals. The Nevada EPSCoR Committee reviewed the proposals and recommendations from the external panel. After considering state and institutional objectives, including priorities set forth in the State Science and Technology Plan, the Nevada EPSCoR Committee selected one research theme, climate change, which encompassed five of the pre-proposals. In making this selection, emphasis was placed on: (1) combining existing research capacity to add value to the R&D enterprise; (2) establishing unique positions in focused research fields; (3) selecting a focal area with a high probability of operating independently of NSF EPSCoR after three – five years; (4) alignment with state and institutional research and economic development goals; and (5) potential for inter-institutional and interdisciplinary collaborations. This approach has served Nevada well in previous NSF-EPSCoR-funded programs.

The proposed climate change research focus is in close alignment with Nevada's State Science and Technology Plan, which lists climate change as a priority area of research for the state. Other targeted areas in the Plan – water resources and policy, informatics, education – also are prominent components of the climate change theme presented in this proposal. Focusing on improving its competitiveness in climate change science comes at an opportune time for Nevada, which is just “waking up” to the potential ramifications of climate change for the state. In April 2007, Nevada's Governor Gibbons created a Climate Change Advisory Committee with the primary goal of making recommendations on reducing Nevada's greenhouse gas emissions. In February 2007, Nevada joined as an official observer of the Western Climate Initiative, which formed to enable Western states to collaborate in identifying, evaluating, and implementing ways to reduce greenhouse gas emissions and achieve co-benefits.

Purpose of the Plan

A strategic planning meeting, and planning document, is required by the Programmatic Terms and Conditions set forth by NSF for Nevada's RII award to ensure efficient and effective performance of all project responsibilities by the governing components throughout the award period. A strategic plan can increase the likelihood of meeting and exceeding goals of the project by incorporating well thought out goals, strategies, activities, outputs, outcomes, and metrics. The plan should provide a clear path forward for the project and be revisited and updated annually. The strategic plan may also be used by NSF for presentation to Congress.

Nevada convened its one-day strategic planning meeting in Las Vegas, NV on November 21, 2008. In all 33 people attended, including: Dr. Henry Blount (Head, NSF EPSCoR); Dr. James Coleman (Chair of the Project's External Research and Technical Advisory Board); Dr. Rose Shaw (the Project's External Evaluator); Dr. Gayle Dana (Nevada's NSF EPSCoR Project Director and Lead PI of the project); Drs. Nick Lancaster, Tom Piechota, and Scott Mensing (Project Co-PI's); 19 project members (Component Leads and Steering Committee members); and four Nevada EPSCoR staff members. The meeting was facilitated by two professional facilitators, Rebecca Tuden and Peter Bluhon (CONCUR, Inc.). CONCUR is a San Francisco Bay-area based firm that specializes in strategic planning and agreement focused-facilitation on complex natural resource issues. Mr. Bluhon and Ms. Tuden are both trained in the substantive science and policy aspects of environmental decision-making and in the process skills of negotiation and dispute resolution. The meeting started with overview presentations of the project and evaluation, but most of the day was spent in breakout sessions to affirm, and revise/and or amend if necessary, project goals, strategies, activities, outputs, outcomes and metrics. The meeting ended with a report back of breakout session results and outlining the next steps forward.

Document Organization

The plan is short and succinct so that it can be easily used by project participants, NSF, and a variety of stakeholders and audiences. Project information can also be found on Nevada's NSF EPSCoR Climate Change Program web site: <http://www.nevada.edu/epscor/nsf/climate1/>, or by contacting:

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Key Science Assumptions and Drivers

Regionally, temperatures have increased significantly during the past 30 years leading to multiple effects (Cayan et al., 2001; McCabe and Wolock, 2007; Westerling et al., 2006). This drier and warmer climate pattern could be a precursor to what the arid West will experience in the future, but improved measurements, modeling, and experiments are necessary to form a clearer picture of the direction and magnitude of climate change and its effects. Recently, the Intergovernmental Panel on Climate Change (IPCC) noted that in the U.S. there would be stresses on water systems, more heat waves, and increased forest fires in the coming decades with the Southwest experiencing the largest temperature increases in the lower 48 states (IPCC, 2007). Modeling of future change suggests that the region will be drier, with important implications for water resources (Dettinger and Earman, 2007; Seager et al., 2007): droughts similar to those in the 1930s and 1950s could become the norm and water supplies from the Colorado River, a major water source for southern Nevada, could be reduced by 10–20% (e.g., Christensen and Lettenmaier, 2004; NRC, 2007; McCabe and Wolock, 2007). Increases in winter and spring temperatures have resulted in earlier spring snow melt throughout the Sierra Nevada and reduced dry-season flows (e.g., Knowles et al., 2006). Future temperature changes are projected to lead to an increase in the proportion of winter precipitation falling as rain, resulting in greater winter runoff and a decrease in the snowpack (Dettinger, 2005), upon which much of the region depends for water supply and support of riparian ecosystems.

Why Build Infrastructure for Climate Change Research in Nevada?

As ongoing and future climate change and variability affect the Great Basin, complex and poorly understood changes and feedbacks between climate and biophysical systems (e.g., vegetation change leading to increased fire frequency) are likely to affect ecosystems and their ability to provide needed resources. These effects are compounded by Nevada's rapidly growing urban population. Research needs include: (1) improved knowledge of past and present climate variability to provide a baseline against which to evaluate future changes; (2) modeling and visualization of interacting effects of climate change and ecosystem resources; (3) observations of regional climate, ecosystems, and hydrology to provide data to calibrate models, understand responses, and detect change; and (4) development of management tools (CIRMOUNT, 2006; Chambers et al., 2006; GAO, 2007; NAS, 2007.).

Developing infrastructure for providing a scientific basis for environmental management in Nevada will enable NSHE faculty to use the Great Basin to address fundamental scientific questions about effects of climate change, integrate across disciplines (Moore et al., 2001), bridge the gap between science and decision-making (National Research Council, 2007), and address key priorities in the state's Science and Technology Plan. Questions include identification of large-scale forcing factors that underlie recent changes in temperatures; understanding feedback mechanisms between regional climate and vegetation change; understanding effects of climate change on disturbance regimes, assessing effects of locally generated aerosols on regional climate; and understanding effects of change in precipitation type on hydrologic processes.

Vision

The vision of this project is to create a statewide interdisciplinary program and virtual climate change portal that will stimulate transformative research, education, and outreach on the effects of regional climate change on ecosystem resources (especially water) and support use of this knowledge by policy makers and stakeholders.

Five Year Major Strategic Goals and Strategies

The project has six programmatic science goals, one business outreach goal, and one programmatic goal to facilitate integration and synergy of the project. Goals 2 and 3 were merged in the 2011 revision since these two efforts have been working in synergy since the project started.

Programmatic Science Goals and Associated Strategies

Goal 1:– *Promote climate change scientific discovery by carrying out nationally competitive collaborative capacity building in climate modeling.*

Primary Strategy: Develop a capability to model climate change at a regional and sub-regional scale and its effects to evaluate different future scenarios and strategies (Climate Modeling Component).

Goals 2 and 3 – *Promote climate change scientific discovery by carrying out nationally competitive collaborative capacity building in ecological change and water resources.*

Primary Strategies: Develop data collection, modeling, and visualization infrastructure to: 1) determine and analyze effects on ecosystems and disturbance regimes (Ecological Change Component) and 2) to better quantify and model changes in water balance and supply under climate change (Water Resources Component).

Goal 4 – *Document, interpret, and communicate institutional and societal impacts of the project's climate change research findings to all interested and affected parties including decision-makers, businesses, educators, and the public.*

Primary Strategy: 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 (Policy, Decision-Making, and Outreach Component).

Goal 5 – *Facilitate and support interdisciplinary climate change research, policy, decision-making, outreach, and education by using cyberinfrastructure to develop and make available integrated data repositories and intelligent, user-friendly software solutions.*

Primary Strategy: Develop a data portal and software to support interdisciplinary research via integration of data from observational networks and modeling (Cyberinfrastructure Component).

Goal 6 – *Create a scholarly environment to promote research skills and intellectual development for Nevada educators and students (K–12, undergraduate, and graduate).*

Primary Strategy: Develop educational infrastructure to train students at all levels and provide public outreach in climate change issues (Education Component).

Business Outreach Goal and Associated Strategy

Goal 7 – *Encourage innovation in the State of Nevada through business development and the Small Business Innovative Research (SBIR) and the Small Business Technology Transfer (STTR) programs.*

Primary Strategy: Assist companies and individuals to understand the SBIR/STTR proposal process and the transition from proposal development, to project implementation, to commercialization (SBIR Component).

Programmatic Goal and Associated Strategy to Facilitate Project Integration and Synergy

Goal 8 – *Promote climate change scientific discovery and project integration and synergism by conducting interdisciplinary research on climate change and its effects.*

Primary Strategy: Form interdisciplinary science teams comprised of faculty and students from different disciplines, backgrounds and campuses and promote use of new project infrastructure and data.

Five Year Strategic Activities, Outputs, Outcomes, and Metrics (by Component)

The following seven graphic diagrams show strategic activities, outputs, outcomes, and metrics as well as the goals and strategies previously described, for each project component. Table versions of these diagrams can be found in Appendix 1.

1. CLIMATE MODELING

Strategies

- Augment existing faculty
- Develop computing and technical support structure
- Develop methods to dynamically & statistically downscale data for regional/local application
- Develop visualization and GIS systems for model outputs
- Interact with other project components to create linkages
- Link regional climate models with other models
- Develop methodologies for paleoclimate modeling
- Investigate uncertainties and errors in climate modeling
- Establish global climate modeling capabilities for process studies of response of regional climate to aerosol forcing

Goal: Promote climate change scientific discovery by carrying out nationally competitive collaborative capacity building in climate modeling.

INPUTS

- Existing NSHE faculty and computing resources (e.g. CAVCAM, NSCEE)
- Partnerships (national climate modeling organizations like NCAR, WRCC)

Activities

Year 1

- Hire postdocs, grad students.
- Install regional climate model(s).
- Assess models for statistical downscaling.

Years 2 - 3

- Hire 2 new faculty (climate modeler & paleoclimate modeler).
 - Model CC impacts on water resources.
 - Conduct RCM efficiency studies.
 - Link climate and hydrological models.
 - Install global climate model software on Linux cluster; run GCMs
- See Appendix 1 for complete list of activities*

Years 4 - 5

- Initiate jurisdictional partnerships on global climate forecasts.
 - Link climate & hydrological models
 - Link hydrologic and urban growth needs models
 - Develop hybrid dynamical-statistical downscaling method
 - Run urban growth models to IPCC scenarios
- See Appendix 1 for complete list of activities*

Ongoing

- Convene steering committee biannually.
- Attend Tri-state collaboration annual meeting.

- Collaborate with national climate modeling organizations like NCAR.
- Invite Natl. C.M. experts to present seminars at

DRI.

- Purchase software, computer clusters, backup/archive system.
- Ensure data interoperability.

- Increased understanding of climatic, hydrologic, and paleoclimatic processes.
- Guidance to scientists on uncertainties in climate predictions.
- Guidance to policy makers and educators on communicating CC impacts.
- New methods of statistical & dynamical global climate downscaling.
- Nationally recognized research in climate modeling.

Outcomes

OUTPUTS

- Climate/paleoclimate predictions at multiple scales.
- New faculty, computing tools, resources, tech support in CM
- Strengthened partnerships with national climate modeling orgs.
- New collaborations b/t CM group and other components
- Outputs usable by policy and decision makers
- Graduate students educated in regional climate modeling
- Evolution of Great Basin pluvial lake systems under CC scenarios
- Est. of uncertainties & errors in global/regional climate results
- Quantification of aerosol forcing in global/regional climate models

- Peer reviewed publications (especially in prestigious journals)
- Proposals, new funding

- New equipment/technology
- Intra-/inter-jurisdictional collaborations, collaborations with national efforts;

- Use of new modeling tools by other scientists; outputs used by policy and decision makers

Evaluation Metrics

2-3. ECOLOGICAL CHANGE AND WATER RESOURCES

Goal: Promote climate change scientific discovery by carrying out nationally competitive collaborative capacity building in ecological change and water resources.

Strategies

- Augment existing faculty.
- Develop observational networks.
- Develop collection, modeling, and analysis tools.
- Interact with community stakeholders.
- Collaborate with all project components

INPUTS

- Existing NSHE faculty and expertise
- SNWA, WRCC, NEON, WATERS, CUASHI database models/standards.
- NSHE Boulder City Lysimeter Facility, UNR DendroLab, UNLV Urban Water Conservation Center.

Activities

Year 1

- Hire field technician and graduate students.
- Purchase instrumentation for install obs. Networks
- Determine locations & install observational networks
- Collaborate with NM/ID on observational network compatibility.

Years 2 - 3

- Hire faculty (Ecohydrologist, Ecoclimatologist & Ecosystem Mod.).
- Purchase instruments/continue installation obs. networks
- Interface with CI on CC portal development.
- Initiate discussion with modelers on data needs.
- Initiate simplified modeling (water balance, bioclimatic envelope models, SIMPPLLE landscape & disturbance vegetation model).
- Collaborate on integrative EPSCoR CC RFP

Years 4 - 5

- ID data layers for multi-media web & educational opportunities.
- Complete obs. network installation & begin annual sensor audits.
- Cont. working with CI on devel./enhancement of CC Portal.
- Devel. plan for sustainable funding/utilization of obs. networks.
- Establish baseline conditions and conceptual linkages.
- Cont. model devel., incl. collaborations with external modelers.
- Communicate with stakeholders (seminars, access to data)
- Participate in Interactive Science Projects

Ongoing

- Convene steering committee biannually.
- Attend Tri-state collaboration annual meeting.

- Ensure instr/data are compatible with similar monitoring networks (e.g., NEON, CZO, LTER, CIRMOUNT)
- Collaborate with other monitoring networks, & local,

- state, federal agencies.
- Interact with Policy group to develop future scenario models
- Develop proposals to utilize and support new

OUTPUTS

- Observational network database.
- Partnerships with other obs. networks (NEON/Waters/CZO)
- New faculty and new partnerships
- Improved and new conceptual modeling systems.

Outcomes

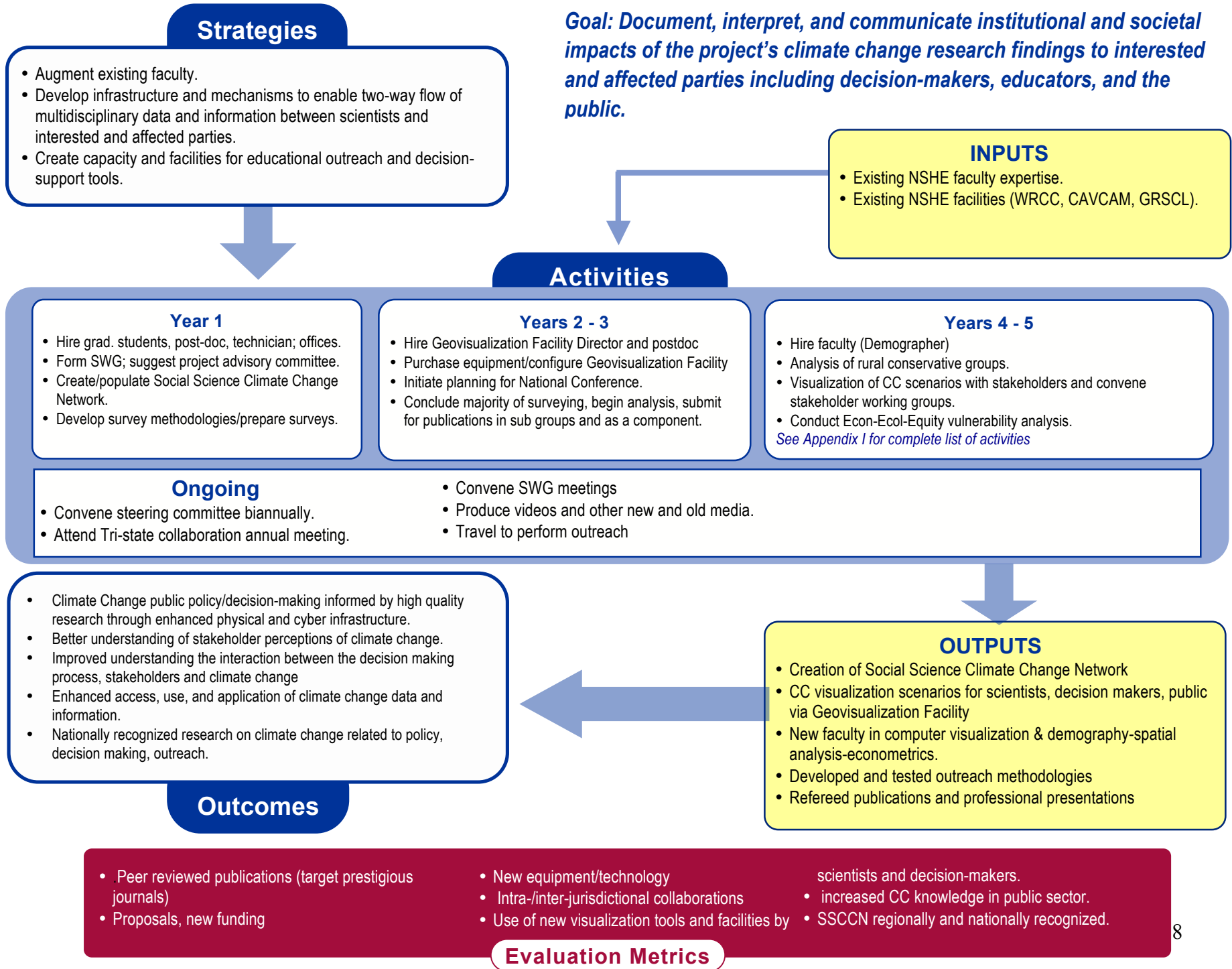
- Obs. Netwks coupled with planned future modeling efforts will provide improved understanding of climate change impacts on ecosystems, groundwater recharge, and surface-groundwater interactions.
- Infrastructure building and development of an expertise base will enable a greater understanding of linkages/interactions between climate change, water resources and ecologic processes.
- Nationally recognized research in water resources and ecological change.

- Peer reviewed publications
- Proposals, new funding

- New equipment/technology and/or technology
- Intra-/inter-jurisdictional, national collaborations
- New modeling tools

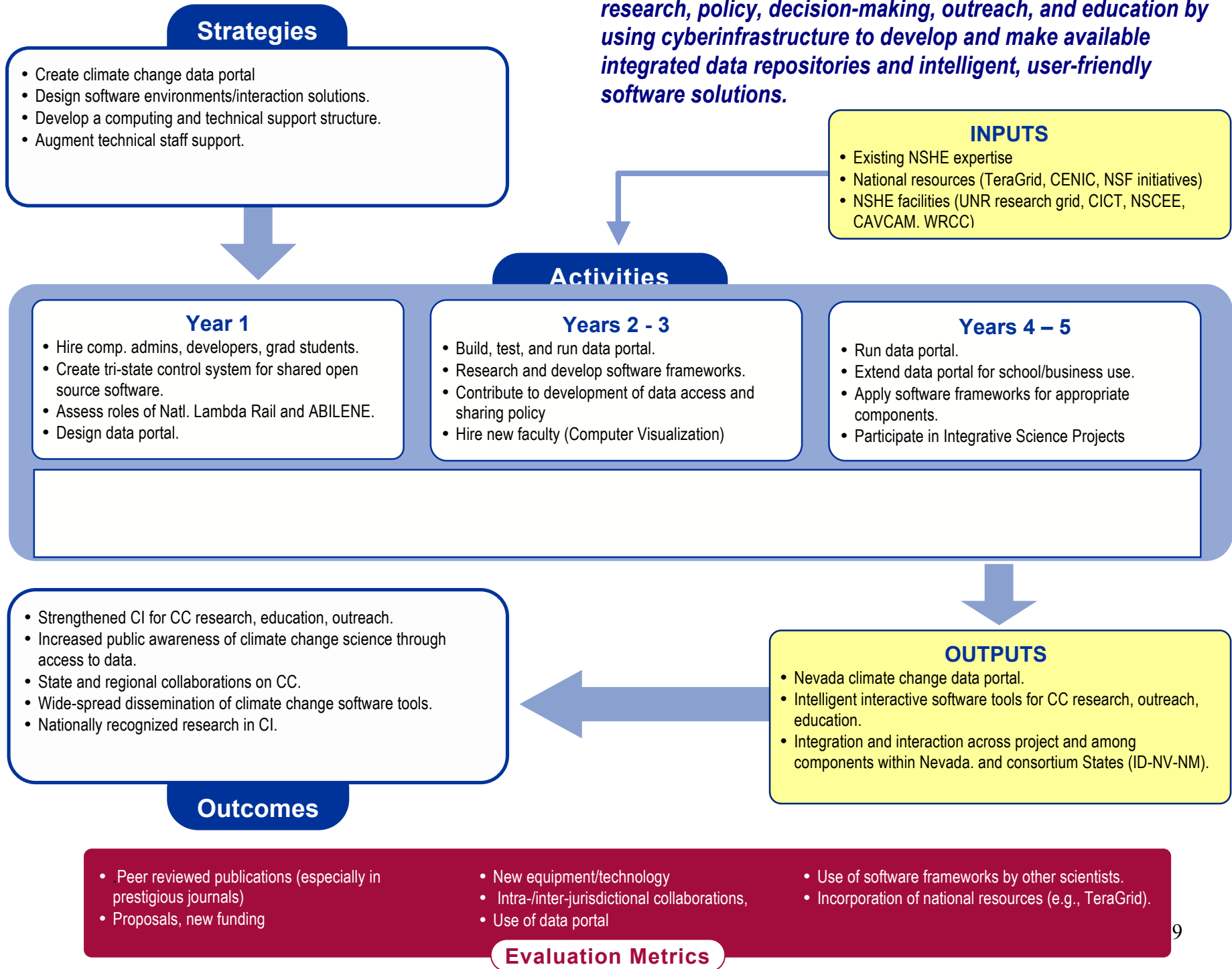
Evaluation Metrics

4. POLICY, DECISION MAKING, AND OUTREACH



5. CYBERINFRASTRUCTURE

Goal: Facilitate and support interdisciplinary climate change research, policy, decision-making, outreach, and education by using cyberinfrastructure to develop and make available integrated data repositories and intelligent, user-friendly software solutions.



6. EDUCATION

Goal: Create a scholarly environment to promote research skills and intellectual development for Nevada educators and students (K–12, undergraduate, and graduate).

Strategies

- Develop 6-12 teacher professional development programs, develop materials to support curriculum
- Provide annual UG/grad awards, fellowships, NV UG Research Symposium.
- Create CC education symposium.
- Create courses & curricula for graduate and undergraduate students.
- Create courses and curricula for graduate & undergraduate students.
- Provide Summer Fellowships for Community College Faculty.

INPUTS

- Existing NSHE expertise and courses in climate change.
- NSHE UG research program.
- Previous NV K-12 NSF EPSCoR programs.

Activities

Year 1

- Hire grad students, K-12 coordinator, Admin Asst.
- Develop/implement 6-12 Summer Inst., Reno/LV
- Inventory CC courses taught in NV & CC ed. nationally.
- Create/implement intro. CC online course for middle school teachers.
- Develop (6th) middle/high school CC lesson plans.

Years 2 - 3

- Hire UNLV postdoc (climate change outreach/education).
- Submit GK12, REU grants.
- Convene Climate Change Education Conference

Years 4 – 5

- Create additional undergraduate and graduate courses related to climate change and sustainability.
- Create curriculum materials for high school teachers involving project data.
- Participate in Integrative Science Projects.

Ongoing

- Convene steering committee meetings biannually.
- Attend Tri-state collaboration annual meeting.
- Run education programs: UG research/symposium;

- college curriculum devel. competition; 6-12 Summer Inst; Comm Coll Faculty Fellowships.
- Develop: courses on CC/sustainability; 6-12 curr./outreach; mid. school lesson modules

- Partner with recruiting and mentoring efforts at NSHE inst. to attract underrepresented groups to STEM fields; mechanisms to engage Comm. Coll.
- Provide salary support for DRI faculty to teach at UNLV/UNR.

OUTPUTS

- Professional development for 6-12 teachers.
- New classroom materials and resources for 6-12 school.
- New courses related to climate change and sustainability.
- Curriculum materials for high school teachers involving project data.
- Research papers, presentations, theses on CC education.

Outcomes

- Strengthened K-12, undergraduate and graduate education in CC.
- Increased number of Nevada teachers with professional development in STEM.
- Strengthened relationships between educators and researchers.

- Peer reviewed publications (target prestigious journals)
- Proposals, new funding

- CC courses and resource materials/programs
- Teacher pedagogical content knowledge/skills
- # UG and graduate students

- # students participating in new and continuing CC courses and courses containing CC content

Evaluation Metrics

7. SMALL BUSINESS INNOVATION RESEARCH (SBIR)

Strategies

- Assist companies/individuals to understand SBIR proposal process.
- Help companies to understand the transition from proposal development, to project implementation, to commercialization.
- Provide clearing house for information about SBIR budget process.
- Offer limited research on technology.
- Develop and distribute promotional materials.

Goal: Encourage innovation in the State of Nevada through business development and the Small Business Innovative Research and the Small Business Technology Transfer (SBIR/STTR) programs.

INPUTS

- Small Business Innovation Research Program Manager.
- State and county Nevada Small Business Development Center representatives.

Activities

Year 1

- Plan and implement fall 2009 National SBIR Conference in Reno/Sparks.

Years 2 - 3

- Follow up on interest generated by 2009 SBIR national conference.
- Determine how best to utilize implementation of limited scale database of funded projects and programs (TechNet by the Sm. Bus. Admin.)

Years 4 - 5

- Promote availability of SBIR/STTR awards by publicizing successful companies in Nevada on a continuing basis.

Ongoing

- Grow mailing list for SBIR workshops/general info.
- Solicitation research/ locate funders of SBIR ideas.

- Attend business development meetings (e.g., DAWN) to foster informal contacts with companies.
- Conduct workshops on SBIR and STTR programs

- for Nevada businesses.
- Sustain on-going activities.

- Increased understanding of how Nevada businesses can capitalize on Federal funds available.
- Public understanding of broad scientific problems such as climate change and energy renewal.

Outcomes

OUTPUTS

- Increased numbers of successfully funded SBIR/STTR proposals.

- Attendance at Natl. 2009 SBIR conference and at NV Workshops.
- # of proposals submitted by NV businesses

- # of successful Phase II and Phase II proposals.

Evaluation Metrics

8. PROJECT INTEGRATION AND SYNERGY

Strategies

- Form interdisciplinary teams comprised of faculty and students from different disciplines, backgrounds and campuses.
- Provide seed grants for innovative research that use or support new project infrastructure.
- Promote use of new project infrastructure and data (e.g. observational networks, computer clusters, SSCCN, Geovisualization facility, web portal).
- Involve students and stakeholders throughout project.

Goal: Promote climate change scientific discovery and project integration and synergism by conducting interdisciplinary research on climate change and its effects.

INPUTS

- Existing NSHE expertise.
- Stakeholder needs for climate change information
- New infrastructure for climate change research.

Activities

Year 1

- Conduct workshops to inform NSHE faculty about seed grants and new science teams.
- System-wide competition for first cohort of seed grants and Interdisciplinary Science Teams (IST).
- Evaluate proposals and fund Interdisciplinary Science

Years 2 - 3

- Implementation of seed grants and IST research.
- Evaluation of team progress through annual and final reports.
- PIs develop and fund integrative science projects in collaboration with project members and stakeholders (Yr 3)

Years 4 – 5

- Integrative Science Teams conduct research and other activities
- 1-Day Conference: All teams report results of research to Leadership Council and Stakeholders (Yr 5).

Ongoing

- Team meetings
- Climate Change Seminar Series

- Collaboration with stakeholders, outreach, education at all levels.

OUTPUTS

- New products for use by decision makers.
- Obs. network that documents changes in climate/hydrology/ecosystems.
- Linked integrated water resources and ecosystem models.
- Water demand data and models for evaluating changes in water associated with shifts in land use (e.g., rural to urban) and CC scenarios.
- Downscaled climate models for use in NV and Great Basin.
- Historical range of ecological variability data for evaluating fire & restoration, management alternatives and future changes in ecological patterns and processes.
- Integrated models of climate impacts on vegetation & disturbance for generating a range of land use options for managers/policy makers.

- New, transformative capability for interdisciplinary research on climate change.
- New cohort of graduate students trained in interdisciplinary Climate Change research.

Outcomes

- Peer reviewed publications (target prestigious journals)
- Interdisciplinary proposals, external funding

- Inter-jurisdictional proposals and projects
- Use of data and models by other scientists and decision makers.

Evaluation Metrics

Commitments

1. **Mission Centered.** We will continuously stay focused on our core vision, goals, and strategic actions and not be distracted from them.
2. **Excellence.** We will undertake all activities at the highest levels of excellence.
3. **Competent.** We will stay current on developments in climate change science, education, and outreach.
4. **Collaborative.** We will be strategic in our partnerships with others.
5. **Quantification.** We will seek to measure our progress and work, to learn from the results, and to seek improvement as a result.
6. **Accountable.** We will be fully responsible for our work and own up to the inevitable mistakes we will make.

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Appendix I: Component Tables

1. CLIMATE MODELING	
Goal	<i>Promote climate change scientific discovery by carrying out nationally competitive collaborative capacity building in climate modeling.</i>
Strategies	<ul style="list-style-type: none"> • Augment existing faculty. • Develop computing and technical support structure. • Develop methods to dynamically and statistically downscale data for regional/local application. • Develop visualization and GIS systems for model outputs. • Interact with other project components to create linkages. • Link regional climate models with other models (e.g., hydrology, ecology, urbanization) • Develop methodologies for paleoclimate modeling • Investigate uncertainties and errors in climate modeling • Establish global climate modeling capabilities for process studies of response of regional climate to aerosol forcing
Year 1 Activities	<ul style="list-style-type: none"> • Hire PDs, grad students • Install regional climate model(s). • Assess models for statistical downscaling.
Ongoing Activities	<ul style="list-style-type: none"> • Convene steering committee biannually. • Attend Tri-state collaboration annual meeting. • Collaborate with national climate modeling organizations like NCAR. • Invite nationally recognized experts to present seminars at DRI. • Purchase software, computer clusters, backup/archive system. • Ensure data interoperability.
Year 2-3 Activities	<ul style="list-style-type: none"> • Hire 2 new faculty (climate modeler – DRI; paleoclimate modeler - UNR). • Model CC impacts on water resources. • Conduct RCM efficiency studies. • Link climate and hydrological models • Install global climate model software on the Linux cluster; run GCMs • Run statistical downscaling models • Derive regional scenarios from IPCC scenarios • Develop hydrologic models of several pluvial lake systems in the Great Basin (yr3) • Utilize hydrologic models to simulate climatic conditions needed to maintain steady state high and low paleo lake levels (yr3) • Utilize hydrologic models to evaluate pale GCM model results over Great Basin (yr3) • Utilize a hydrologic model to study the hydrological impacts of climate change in the Colorado River Basin • Develop urban growth model
Year 4-5 Activities	<ul style="list-style-type: none"> • Initiate jurisdictional partnerships on global climate forecasts. • Link climate and hydrological models • Develop a hybrid dynamical-statistical method for downscaling • Link hydrologic and urban growth needs • Develop hydrologic models of several pluvial lake systems in the Great Basin. • Utilize hydrologic models to simulate climatic conditions needed to maintain steady state high and low paleo lake levels • Utilize hydrologic models to evaluate pale GCM model results over Great Basin. • Utilize a hydrologic model to study the hydrological impacts of climate change in the Colorado River Basin. • Run urban growth models to IPCC scenarios

	<ul style="list-style-type: none"> Participate in Integrative Science Projects
Inputs	<ul style="list-style-type: none"> Existing NSHE faculty and computing resources (ACES, CAVCAM, NSCEE). Partnerships (national climate modeling organizations like NCAR, WRCC).
Outputs	<ul style="list-style-type: none"> Climate/paleoclimate predictions at multiple scales. New faculty, computing tools, resources, tech support in climate modeling. Strengthened partnership with national climate modeling organizations like NCAR. New collaborations between Climate Modeling group and other components. Outputs usable by policy and decision makers. Graduate students educated in regional climate modeling. Evolution of pluvial lake systems in the Great Basin in climate change scenarios Estimates of uncertainties and errors in global and regional climate results Quantification of aerosol forcing in global and regional climate models
Outcomes	<ul style="list-style-type: none"> Increased understanding of climatic, hydrologic, and pale climatic processes. Guidance to scientists on uncertainties in climate predictions. Guidance to policy makers and educators on communicating CC impacts. New methods of statistical & dynamical global climate downscaling. Nationally recognized research in climate modeling.
Eval. Metrics	Peer-reviewed publications (target prestigious journals); proposals, new funding, new equipment/technology, intra-/inter-jurisdictional collaborations, collaborations with national efforts; use of new modeling tools by other scientists; outputs used by policy and decision makers.

Reasons for 2011 changes in the Climate Modeling Strategic Plan:

Strategies:

- Develop methodologies for paleoclimate modeling (Output: Evolution of pluvial lake systems in the Great Basin in climate change scenarios)

UNR established strong links with NCAR and a new hired faculty Douglas Boyle has developed an interest in using paleo climate modeling to study hydrological resources in past climate and their evolution.

- Investigate uncertainties and errors in climate modeling (Output: Estimates of uncertainties and errors in global and regional climate results)

Our up to date analysis and climate modeling simulations indicate significant roles of uncertainties, biases, and errors in simulations of climate change. A proposed GRA study on that topic submitted by a Ph.D. candidate (Kristien King) was accepted by the EPSCoR committee.

- Establish global climate modeling capabilities for process studies of response of regional climate to aerosol forcing (Output: Quantification of aerosol forcing in global and regional climate models)

Our new hired faculty in climate modeling Eric Wilcox has a strong interest and expertise in aerosol research and their effect on climate. He has been leading efforts to establish global climate modeling capability using our EPSCoR computer facility and study aerosol forcing on climate on global and regional scales.

2-3. ECOLOGICAL CHANGE AND WATER RESOURCES	
Goal	<i>Promote climate change scientific discovery by carrying out nationally competitive collaborative capacity building in ecological change and water resources.</i>
Strategies	<ul style="list-style-type: none"> • Augment existing faculty. • Develop observational networks. • Develop collection, modeling and analysis tools • Interact with community stakeholders. • Collaborate with all project components.
Year 1 Activities	<ul style="list-style-type: none"> • Hire field technicians and graduate students. • Determine locations and install observational networks. • Purchase instrumentation/install observational networks. • Collaborate with NM/ID on observational network compatibility
Ongoing Activities	<ul style="list-style-type: none"> • Convene steering committee meetings biannually. • Attend Tri-state collaboration annual meeting. • Ensure instruments/data are compatible with similar monitoring networks (e.g., NEON, CZO, LTER, CIRMOUNT, etc.). • Collaborate with other monitoring networks and local, state and federal agencies. • Interact with Policy Component to develop future scenario models. • Develop proposals to utilize and support new infrastructure.
Year 2-3 Activities	<ul style="list-style-type: none"> • Hire faculty (Ecohydrologist, Ecoclimatologist, and Ecosystem Modeler). • Purchase instrumentation/continue installation of observational networks. • Interface w/ Cyber on data portal development • Initiate discussion with modelers on data needs • Initiate simplified modeling (water balance, bioclimatic envelope models, SIMPPLLE landscape and disturbance vegetation model) • Collaborate with other components on integrative EPSCOR CC RFP
Year 4-5 Activities	<ul style="list-style-type: none"> • Identify data "layers" for multi media web and educational opportunities • Continue working with Cyber on development and enhancement of the Data Portal • Complete transect installation and begin annual sensor audits • Develop plan for sustainable funding and utilization of transect obs. network • Establish baseline conditions and conceptual linkages. • Continue model development, including collaborations with external modelers • Address climate variability and past effects • Communicate with stakeholders (seminars, access to data) • Participate in Integrative Science Projects
Inputs	<ul style="list-style-type: none"> • Existing NSHE faculty expertise. • SNWA, WRCC, NEON, WATERS, CUASHI database models/standards. • NSHE Boulder City Lysimeter facility, UNR DendroLab, and UNLV Urban Water Conservation Center.
Outputs	<ul style="list-style-type: none"> • Observational network data base. • Partnerships with other observational networks (NEON/Waters/CZO) • New faculty/new partnerships. • Improved and new conceptual modeling systems.
Outcomes	<ul style="list-style-type: none"> • Operation of the transects coupled with planned future modeling efforts will provide improved understanding of climate change impacts on ecosystems, groundwater recharge, and surface-groundwater interactions. • Infrastructure building and development of an expertise base will enable a greater understanding of linkages/interactions between climate change, water resources and ecologic processes. • Nationally recognized research in water resources and ecological change.
Eval. Metrics	<ul style="list-style-type: none"> • Peer-reviewed publications; proposals, new funding, new equipment and/or technology, intra-/inter-jurisdictional collaborations, new modeling tools

Reasons for 2011 Changes to Water/Ecology Strategic Plan

Most changes were tweaking of wording to better describe activities taking place

While transect installation is mostly complete, there is one station still to be installed in year 4; it was delayed due to the extensive time taken to obtain permitting.

4. POLICY, DECISION MAKING, AND OUTREACH	
Goal	<i>Document, interpret, and communicate institutional and societal impacts of the project's climate change research findings to interested and affected parties, including decision-makers, businesses, educators, and the public.</i>
Strategies	<ul style="list-style-type: none"> • Augment existing faculty. • Develop infrastructure and mechanisms to enable two-way flow of multidisciplinary data and information between scientists and interested and affected parties. • Create capacity and facilities for educational outreach and decision-support tools.
Year 1 Activities	<ul style="list-style-type: none"> • Hire 4 graduate students, recruit 1 post-doc, 1 technician, obtain office for them. • Form Stakeholder Working Group (SWG), suggest project advisory committee. • Create/populate Social Science Climate Change Network. • Develop survey methodologies and prepare surveys.
Ongoing Activities	<ul style="list-style-type: none"> • Convene steering committee meetings at least biannually. • Attend Tri-state collaboration annual meeting. • Convene SWG meetings once coherent data and information are ready for exchange. • Produce videos and other new and old media . • Travel to perform outreach.
Year 2-3 Activities	<ul style="list-style-type: none"> • Hire Geovisualization Facility Director and post-doc • Purchase equipment/configure Geovisualization Facility • Planning begins for National Conference. • Conclude most surveying, begin analysis, submit for publications in sub-groups and as a component.
Year 4-5 Activities	<ul style="list-style-type: none"> • Search and hire new faculty: Demographer (UNLV) expert • Conduct qualitative analysis of rural conservative groups (Futrell Ph.D. student). • Multidisciplinary outputs from project integrated into functional clusters. • Convene National Conference (Yr 5) • Conduct Econ-Ecol-Equity vulnerability analysis. • Finalize data to exchange with SWGs • Conduct visualization C.C. scenarios with stakeholders and convene stakeholder working groups. • Disseminate findings through peer reviewed publications • Establish capacity for outreach and policy studies (e.g., in UNR/UNLV libraries). • Participate in Integrative Science Projects
Inputs	<ul style="list-style-type: none"> • Existing NSHE faculty expertise. • Existing NSHE facilities (WRCC, CAVCAM, GRSC).
Outputs	<ul style="list-style-type: none"> • Creation of SSCCN. • CC visualization scenarios for scientists, decision makers, public via Geovisualization Facility • New faculty in comp. visualization & demography-spatial analysis-econometrics. • Developed and tested outreach methodologies. • Refereed publications. • Professional presentations.
Outcomes	<ul style="list-style-type: none"> • Climate Change public policy/decision-making informed by high quality research through enhanced physical and cyber infrastructure. • Better understanding of stakeholder perceptions of climate change. • Improved understanding the interaction between the decision making process,

	<p>stakeholders and climate change.</p> <ul style="list-style-type: none"> • Enhanced access, use and application of climate change data and information.. • Nationally recognized research on climate change related to policy, decision making, outreach.
Eval. Metrics	<ul style="list-style-type: none"> • Peer-reviewed publications (target prestigious journals); proposals, new funding, new equipment/technology, intra-/inter-jurisdictional collaborations, use of new visualization tools and facilities by scientists and decision-makers, increased CC knowledge in public sector. SSCCN regionally and nationally recognized.

Reasons for 2011 Changes to Policy Strategic Plan

- 1) Moving collaboration with libraries to raise the profile of our research and broaden impacts occurs in years 4/5, as doing so makes more sense when the data portal begins to reach its potential.
- 2) National conference is in year 5, as networks to make the conference successful are in place then.

5. CYBERINFRASTRUCTURE	
Goal	<i>Facilitate and support interdisciplinary climate change research, policy, decision-making, outreach, and education by using cyberinfrastructure to develop and make available integrated data repositories and intelligent, user-friendly software solutions.</i>
Strategies	<ul style="list-style-type: none"> • Create climate change data portal. • Design software environments/interaction solutions. • Develop a computing and technical support structure. • Augment technical staff support.
Year 1 Activities	<ul style="list-style-type: none"> • Hire computing administrators, developers, grad students. • Create tri-state control system for shared open source software. • Assess roles of Natl. Lambda Rail and ABILENE. • Design data portal.
Ongoing Activities	<ul style="list-style-type: none"> • Convene steering committee meetings biannually. • Attend Tri-state collaboration annual meeting & CI tech. working group • Leverage TeraGrid, CENIC, NSF initiatives. • Purchase computing equipment/software licenses. • Coordinate with Track 2 developments on data archives and model interoperability
Year 2-3 Activities	<ul style="list-style-type: none"> • Build, test, and run data portal. • Research and develop software frameworks. • Contribute to the development of the data access and sharing policy • Search and hire new Computer Visualization faculty (UNLV)
Year 4-5 Activities	<ul style="list-style-type: none"> • Run data portal. • Extend data portal for school/business use. • Apply software frameworks for appropriate components. • Participate in Integrative Science Projects
Inputs	<ul style="list-style-type: none"> • Existing NSHE expertise. • National resources (TeraGrid, CENIC, and NSF initiatives). • NSHE facilities (UNR research grid, CICT, NSCEE, CAVCAM, WRCC).
Outputs	<ul style="list-style-type: none"> • Nevada climate change data portal. • Intelligent interactive software tools for CC research, outreach, education. • Integration and interaction across project and among components within Nevada and consortium States (ID-NV-NM).
Outcomes	<ul style="list-style-type: none"> • Strengthened CI for CC research, education, outreach. • Increased public awareness of climate change science through access to data. • State and regional collaborations on CC. • Wide-spread dissemination of climate change software tools. • Nationally recognized research in CI.
Eval. Metrics	<ul style="list-style-type: none"> • Peer-reviewed publications (target prestigious journals); proposals, new funding, new equipment/technology, intra-/inter-jurisdictional collaborations, use of data portal, use of software frameworks by other scientists, incorporation of national resources (e.g., TeraGrid).

6. EDUCATION	
Goal	<i>Create a scholarly environment to promote research skills and intellectual development for Nevada educators and students (K–12, undergraduate, and graduate).</i>
Strategies	<ul style="list-style-type: none"> • Develop 6-12 teacher professional development programs, develop materials to support curriculum. • Provide annual/ongoing UG/graduate awards, fellowships, NV UG Research Symposium • Create CC education conference. • Create courses and curricula for graduate and undergraduate students. • Provide Summer Fellowships for Community College Faculty.
Year 1 Activities	<ul style="list-style-type: none"> • Hire grad students, K-12 coordinator, Admin Asst. • Develop and implement summer institute for 6-12 in Reno and Las Vegas. • Inventory CC courses taught in Nevada and CC education nationally. • Create/implement intro. CC online course for middle school teachers. • Develop (6th) middle/high school CC lesson plans.
Ongoing Activities	<ul style="list-style-type: none"> • Convene steering committee meetings biannually. • Attend Tri-state collaboration annual meeting. • Run education programs: UG research/symposium; college curriculum development competition RFP; 6-12. • Summer Inst. • Develop: courses on CC/sustainability; 6-12 curriculum/outreach; middle school lesson modules; partner with recruiting and mentoring efforts at NSHE Institutions to attract underrepresented groups to STEM fields; mechanisms to engage Comm Coll. • Provide salary support for DRI faculty to teach at UNLV/UNR.
Year 2-3 Activities	<ul style="list-style-type: none"> • Hire UNLV postdoc (climate change outreach/education). • Submit GK12, REU grants. • Climate Change Education Conference convened
Year 4-5 Activities	<ul style="list-style-type: none"> • Create additional undergraduate and graduate courses related to climate change and sustainability. • Create curriculum materials for high school teachers involving project data. • Participate in Integrative Science Projects
Inputs	<ul style="list-style-type: none"> • Existing NSHE expertise and courses in climate change. • NSHE UG research program. • Previous NV K-12 NSF EPSCoR programs.
Outputs	<ul style="list-style-type: none"> • Professional development for 6-12 teachers • New classroom materials and resources for 6-12 school. • New courses related to Climate Change and sustainability. • Curriculum materials for high school teachers involving project data. • Research papers, presentations, theses on CC education.
Outcomes	<ul style="list-style-type: none"> • Strengthened K-12, undergraduate and graduate education in CC. • Increased number of Nevada teachers with professional development in STEM. • Strengthened relationships between educators and researchers.
Eval. Metrics	Peer-reviewed publications (target prestigious journals); proposals, new funding, climate change courses and resource materials and programs; teacher pedagogical content knowledge/skills; # UG and graduate students: # students participating in new and continuing CC courses and courses containing CC content.

Reasons for 2011 Changes to Education Strategic Plan

Specifically, the goals of developing an undergraduate minor and graduate certificate (GC) program in climate change were replaced with the following:

Create additional undergraduate and graduate courses related to climate change and sustainability.
Create curriculum materials for high school teachers involving project data.

The reasons for these changes are the following: Work on development of the minor/GC was delayed due to turnover in the education component lead position, organizational turmoil at UNLV and UNR due to budget cuts, and especially elimination of the environmental studies department at UNLV. Although the situation has stabilized, we determined that it was no longer practical or politically feasible to create new programs at this time. The creation of climate change courses would serve much of the same need as a minor/GC—educating students about climate change—but would potentially serve a larger audience, given that this activity could be tied to university general education initiatives and undergraduate/graduate education broadly conceived and not so exclusively focused on a minor/GC. So we argue that this change would have positive implications for achieving component goals.

The creation of curriculum materials for high school teachers involving project data further expands the education component's work with in-service teachers, and is supported by unused resources in the component budget. The implications of this change are also therefore positive for achieving component goals. We anticipate creating several curricular modules that high school teachers could use in their classes which involve project data. This would also further enhance the impact of the other components. The activity would also involve translating the findings of some of the other components into lay terms, with short summaries placed in the data portal, thereby making the portal more accessible to the general public and to teachers.

7. SMALL BUSINESS INNOVATION RESEARCH (SBIR)

Goal	<i>Encourage innovation in the State of Nevada through business development and the Small Business Innovative Research and the Small Business Technology Transfer (SBIR/STTR) programs.</i>
Strategies	<ul style="list-style-type: none"> • Assist companies and individuals to understand the SBIR proposal process. • Help companies to understand the transition from proposal development, to project implementation, to commercialization. • Provide clearing house for information about the SBIR budget process. • Offer limited research on technology. • Develop and distribute promotional materials, especially news releases and flyers and revised web pages.
Year 1 Activities	<ul style="list-style-type: none"> • Plan and implement fall 2009 National SBIR Conference in Reno/Sparks.
Ongoing Activities	<ul style="list-style-type: none"> • Grow mailing list to receive future SBIR workshop and general information. • Conduct solicitation research and locating potential funders of SBIR project ideas. • Attend business development meetings (e.g., DAWN, Center for Entrepreneurship and Technology) to foster informal contacts with companies. • Conduct workshops on SBIR and STTR programs for Nevada businesses. • Sustain on-going activities.
Year 2-3 Activities	<ul style="list-style-type: none"> • Follow up on interest generated by the 2009 SBIR national conference. • Determine how best to utilize implementation of limited scale database of funded projects and programs (TechNet by the Small Business Administration).
Year 4-5 Activities	<ul style="list-style-type: none"> • Promote availability of SBIR/STTR awards by publicizing successful companies in Nevada on a continuing basis.
Inputs	<ul style="list-style-type: none"> • Small Business Innovation Research Program Manager. • State and county Nevada Small Business Development Center representatives.
Outputs	<ul style="list-style-type: none"> • Increased numbers of successfully funded SBIR/STTR proposals.
Outcomes	<ul style="list-style-type: none"> • Increased understanding of how Nevada businesses can capitalize on Federal funds available. • Public understanding of broad scientific problems such as climate change and energy renewal.
Eval. Metrics	<ul style="list-style-type: none"> • Attendance at the national 2009 National SBIR Conference and at NV workshops; · Numbers of proposals submitted by Nevada businesses and successful Phase I and Phase II proposals.

8. PROJECT INTEGRATION AND SYNERGY

Goal	<i>Promote climate change scientific discovery and project integration and synergism by conducting interdisciplinary research on climate change and its effects.</i>
Strategies	<ul style="list-style-type: none"> • Form interdisciplinary teams comprised of faculty and students from different disciplines, backgrounds and campuses. • Provide seed grants for innovative research that use or support new project infrastructure • Promote use of new project infrastructure and data (e.g. observational networks, computer clusters, SSCCN, geovisualization facility, web portal). • Involve students and stakeholders throughout project.
Year 1 Activities	<ul style="list-style-type: none"> • Conduct workshops to inform NSHE faculty about seed grants and new science teams. • System-wide competition for first cohort of Interdisciplinary Science Teams (IST). • System-wide competition for seed grants related to focused activities using new infrastructure • Evaluate proposals and fund Interdisciplinary Science Team and seed grants.
Ongoing Activities	<ul style="list-style-type: none"> • Team meetings. • Climate change seminar series • Collaboration with stakeholders, outreach, education at all levels.
Year 2-3 Activities	<ul style="list-style-type: none"> • Implementation of Interdisciplinary Science Teams and Seed grants. • Evaluation of team progress through annual and final reports. • PI's develop and fund integrative science projects in collaboration with project members and stakeholders (Yr 3) •
Year 4-5 Activities	<ul style="list-style-type: none"> • Integrative Science Teams conduct research and other activities • 1-Day Conference: All teams report results of research to Leadership Council and Stakeholders (Yr 5). •
Inputs	<ul style="list-style-type: none"> • Existing NSHE expertise • Stakeholder needs for climate change information • New infrastructure for climate change research.
Outputs	<ul style="list-style-type: none"> • New products for use by decision makers. • Monitoring network that documents changes in climate, hydrology, and ecosystems. • Linked integrated water resources (surface/groundwater) and ecosystem models. • Water demand data and models for evaluating changes in water associated with shifts in land uses (e.g., rural to urban) and climate change scenarios. • Downscaled climate models for use in NV and the Great Basin. • Historical range of ecological variability data for evaluating fire and restoration. management alternatives and future changes in ecological patterns and processes. • Integrated models of climate impacts on vegetation and disturbance dynamics for generating a range of land use options available to managers and policy makers.
Outcomes	<ul style="list-style-type: none"> • New, transformative capability for interdisciplinary research on climate change. • New cohort of graduate students trained in interdisciplinary CC research.
Eval. Metrics	<ul style="list-style-type: none"> • Peer-reviewed publications (target prestigious journals); interdisciplinary proposals; external funding; inter-jurisdictional proposals and projects; use of data and models by other scientists and decision makers.