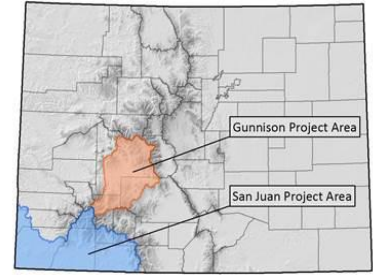


## **A. Proposal Cover Page and Summary**

### **Project title: Natural Resource Management Decision-Making under Climate Uncertainty: Building Social-Ecological Resilience in Southwestern Colorado**



**Principal investigator (PI):** Nina Burkardt (U.S. Geological Survey - USGS)

**Co-PIs:** Renée Rondeau (Colorado State University, Colorado Natural Heritage Program); Betsy Neely (The Nature Conservancy- TNC); Marcie Bidwell (Mountain Studies Institute - MSI); Laurie Yung (University of Montana - UM); Carina Wyborn (UM); Rudy M. Schuster (USGS); John Sanderson (TNC); William Travis (University of Colorado - CU); Daniel Williams (USDA Forest Service Rocky Mountain Research Station); Daniel Murphy (University of Cincinnati)

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**Names/Affiliations of other cooperators and partners** Cameron Aldridge (USGS); Jill Baron (USGS Powell Center); Chris Bove (Natural Resources Conservation Service); Jim Cochran (Gunnison County); Molly Cross (Wildlife Conservation Society - WCS); Brad Dodd (BLM Tres Rios); Gretchen Fitzgerald (USFS San Juan); Gregg Garfin (University of Arizona); Mark Hatcher (USFS); Gunnison Climate Working Group; Corrie Knapp (University of Alaska); Shannon McNeeley (NCCSC); Dennis Ojima (NCCSC); Kelly Palmer (USFS San Juan); Doug Ouren (USGS); Imtiaz Rangwala (CU Western Water Assessment); San Juan Climate Initiative; George San Miguel (Mesa Verde National Park); Amy Seglund (Colorado Parks and Wildlife); Ken Stahlnecker (Black Canyon of the Gunnison National Park); Brian St. George (Bureau of Land Management – BLM Gunnison).

**Proposed start date and estimated duration of project:** June 15, 2013; 36 months

**Total project funding requested from the CSC:** \$553,985

**Funding from other sources to be applied to this project:** The USGS Fort Collins Science Center will contribute \$89,593 in combined salary costs for Nina Burkardt, Rudy Schuster, and Doug Ouren. CU Western Water Assessment will contribute a portion of Imtiaz Rangwala's time (funded by NOAA). The USDA Forest Service Rocky Mountain Research Station will also contribute a portion of Daniel R. Williams's time. BLM, Tres Rios Field Office, in collaboration with San Juan National Forest, has obligated (contracts pending) (1) \$10,000 to the Colorado Natural Heritage Program for the climate change vulnerability assessment in the Colorado portion of the San Juan watershed and (2) \$7000 to Mountain Studies Institute for San Juan Climate Initiative conference as the first meeting for this project (September 2013).

**Keywords:** adaptation, scenario planning, integrated social-ecological planning, institutional analysis, natural resource management

**Summary:**

To address the significant challenges the climate change poses for both natural and social systems in the Gunnison and San Juan Basins, we propose to work with decision-makers from eight land management agencies (USFS, BLM, NPS and tribes), private landowners, and other stakeholders to develop and implement an innovative adaptation planning process. This process integrates a number of methods, including iterative scenario building, climate modeling, the Adaptation Conservation Targets (ACT) Framework, and institutional analysis. Working with Gunnison Climate Working Group and the San Juan Climate Initiative, this project will advance current climate change adaptation efforts that are facilitating social-ecological resilience, ecosystem and species conservation, and sustainable human communities. More specifically, this project will advance methods that enable scientists, land managers, and residents to learn from each other and to identify actions that each can take individually or collectively, now or in the future to reduce the negative impacts of climate change. These adaptation strategies and the process whereby they were created will be documented by the project team to assist communities and scientists elsewhere who are grappling with the challenges posed by climate change.

To accomplish these objectives, this project will develop and pilot an integrated adaptation planning framework that will generate practical strategies and scientific knowledge to advance climate change adaptation in the study sites. Unless specified otherwise, all steps will be carried out for two river basins in Colorado: San Juan and upper Gunnison. Methods include: an ecosystem vulnerability assessment for the San Juan, climate and ecological modeling to guide planning, an iterative scenario process to build knowledge of social vulnerabilities and adaptive capacities, institutional analysis to better understand pathways for implementation, and the Adaptation for Conservation Targets (ACT) process for identifying intervention points and feasible, actionable adaptation strategies. This project utilizes cutting edge science and participatory processes to integrate expert knowledge and local needs, building scientifically robust, locally-relevant adaptation. Uncertainty is built into all phases of the process and adaptation strategies are specifically designed to be robust to uncertainty.

For this project, information transfer is not a final step that happens after the research is complete, but rather an integral part of an iterative participatory approach that brings researchers and stakeholders together to co-produce knowledge. The participatory nature of the project involves partners in all steps of the process, ensuring that questions asked, analyses conducted, and products produced meet the needs of managers and other users. Our primary product will be an integrative social-ecological adaptation framework that can be applied in other landscapes. Specific products include: (1) an ecosystem vulnerability assessment for the San Juan, (2) narrative scenarios and conceptual models for use in adaptation planning, (3) a report on social vulnerabilities and adaptive capacity, (4) an institutional analysis, (5) a specific set of actionable adaptation strategies, and (6) guidelines and a toolkit for other users to employ integrated adaptation planning in other landscapes. Project results will be disseminated through multiple interactive websites, online and printed reports, meetings with user groups, and peer-reviewed publications.

PIs and key personnel bring diverse strengths to the project, including long-term relationships with local stakeholders, involvement in existing initiatives in the study sites, and expertise in vulnerability assessment, climate and ecological models, social science research on rural communities and institutions, and climate change adaptation planning. The project will build on existing partnerships with the Gunnison Climate Working Group and the San Juan Climate Initiative, federal and state agencies, tribes, landowners, and other stakeholders.

## **B. Proposal Body**

**Objectives and Project Justification.** The goal of this project is to facilitate climate change adaptation that contributes to social-ecological resilience, ecosystem and species conservation, and sustainable human communities in southwestern Colorado. This project will develop and pilot an integrated adaptation planning framework that merges the strengths of the iterative scenario process, the Adaptation for Conservation Targets (ACT) planning framework, institutional analysis, and climate modeling. This project blends science and participatory approaches to integrate expert knowledge, land management decision making, and local needs. More specifically, we will:

1. Build knowledge of social-ecological vulnerabilities to inform adaptation planning.
2. Create scenarios and ecological models to facilitate decision-making under uncertainty.
3. Develop a detailed set of actionable and prioritized adaptation strategies designed to conserve key species, ecosystems, and resources, and to address the needs of local communities and natural resource managers.
4. Identify the adaptive capacities and the institutional arrangements needed to move these strategies into decision-making arenas.
5. Document best practices for effectively bringing climate science into decision-making.
6. Provide feedback to ReVAMP and the National Technical Training Center (NTTC).

Climate change adaptation in southwest Colorado has been identified as a priority for the Southern Rockies Landscape Conservation Cooperative (SRLCC) and our land management partners, including six units of the BLM, NPS, and USFS. Like Colorado as a whole, this region is experiencing larger and more severe wildfires, prolonged drought, and earlier snowmelt (Ray et al. 2008). Climate scientists predict heat waves in the summer, moderated winter temperatures, decreased late season snowpack, declines in river flow and soil moisture, and longer-lasting and more frequent droughts (Overpeck et al. 2012). These shifts challenge resource management, established business models, employment and recreational opportunities, species conservation, and provision of ecosystem services. Our highest priority is to work with decision-makers to develop strategies and coordinate actions to reduce the impacts of a changing climate on nature and people.

**Background.** Initial analyses indicate that a number of ecosystems in the Gunnison and San Juan Basins are vulnerable to climate change, including low elevation sagebrush shrublands (and the associated Gunnison Sage Grouse), alpine, aspen forests, mixed conifer forests, spruce-fir forests, and riparian/wetland ecosystems (Neely et al. 2011; Rondeau, et al. 2011, Nydick et al. 2012; Bidwell et al. 2013). The region has experienced severe droughts, type conversion in low elevation pinyon-juniper, large insect outbreaks, an increase in fire frequency and size, and reduced water tables and storage (thereby limiting potential responses to drought, fire, etc.). Changes in the southwest Colorado ecosystems have and will increasingly impact local communities, local livelihoods, and natural resource management. While we know that these landscapes are changing in response to climate change, the specific responses of ecosystems, species, and human communities are uncertain. Natural resource management is particularly challenging in the context of this uncertainty (e.g. allocating water resources when drought is anticipated but unpredictable, designing forest treatments in the context of changing fire and disease regimes, and managing habitat for threatened species when environmental conditions are shifting). In southwest Colorado, anticipatory adaptation will require unprecedented cooperation among public land managers, tribes, private landowners, and rural communities, necessitating

new models of governance and institutional collaboration that account for uncertainty, multiple interests, and long temporal scales. Because both basins have established public-private partnerships focused on climate change, the Gunnison Climate Working Group (GCWG) and San Juan Climate Initiative (SJCI), on which this project can build, southwest Colorado provides an ideal arena to advance the knowledge and practice of collaborative adaptation and cross-scale governance in the face of climate change (Neely et al.. 2011; Neely et al.. 2010; Knapp 2011; Nydick, 2008).

Adaptation planning frameworks that effectively inform resource management decision-making while incorporating local social and ecological dynamics are critical to effective conservation, especially when addressing the high levels of uncertainty inherent in projecting future conditions. While many disparate planning frameworks have been proposed, they have not been integrated or applied at this scale. This project brings together an interdisciplinary team to integrate the strengths of climate modeling, iterative scenario building, the ACT Framework, and institutional analysis, and apply them to build scientific knowledge of climate change adaptation and actionable adaptation strategies specific to these landscapes.

This project addresses the key priority of the NCCSC, integrating climate science into resource management decision-making. In keeping with NCCSC goals, this project builds on existing work, helps managers understand the implications of climate change, and ensures that projects are usable. This work will also meet key science needs identified by the SRLCC, including protection of riparian and wetland species, vulnerability assessments and adaptive management, and connectivity of migration corridors. By contributing to REVAMP, this project will share a process by which other groups can develop robust adaptation strategies that integrate social and ecological needs.

Scientifically, this project will examine the outcomes from an innovative adaptation process that integrates existing science, scientific research, and planning. We will also build knowledge of (1) how to utilize climate models to produce useful information about landscape-scale change, (2) how to integrate different planning frameworks to produce knowledge of anticipatory adaptation and actionable adaptation strategies (i.e. how to generate scientific knowledge and practical outputs through the same process), (3) how models of ecosystem change and social-ecological interactions can be utilized in stakeholder processes, and (4) how institutional analysis can contribute to implementation strategies.

**Procedures/Methods.** We propose to develop, pilot, and evaluate an integrated adaptation planning framework building on the strengths of iterative scenario building, ACT Framework (Cross et al.. 2012a; Cross et al.. 2012b), climate modeling, and institutional analysis, to produce actionable adaptation strategies and knowledge of adaptation that can be transferred to other sites. This integrated process will be embedded in a social-ecological approach and build resilience for both natural and human communities. Working with an interdisciplinary team of social scientists, climate scientists, ecologists, conservation planners, tribes, public land managers, private landowners, and community members, with assistance from NCCSC's Adaptation and Decision-Making Working Group, we will pilot this adaptation framework in the Gunnison and San Juan Basins. Below we describe the distinct steps in our process and some of the interactions between them, based on a conceptual model developed to ensure integration.

1. Complete vulnerability assessment of the primary (17) ecosystems in the San Juan Basin utilizing a qualitative approach by assessing nine key variables that climate change is most likely to impact, e.g., sensitivity to increased fires and droughts, barriers to migration (MCCS

& MDFW 2010). Along with the existing and comparable Gunnison vulnerability assessment, use these assessments to inform development of narrative landscape scenarios and to narrow down the list of conservation targets. The prioritization will be accomplished in collaboration with ecologists, natural resource managers, and stakeholders.

2. Develop mid-century climate scenarios that are specific to the Gunnison and San Juan Basins. Climate scientists and stakeholders will collaborate to integrate local knowledge and climate model outputs (including CMIP3, CMIP5, and NARCCAP project), identifying the metrics and thresholds relevant to the conservation targets and quantifying the range of changes and level of confidence.
3. For the prioritized conservation targets, using the results from step #2, ecologists and climate scientists, in collaboration with social scientists and stakeholders, will draft management objectives and build conceptual ecological models for a minimum of six conservation targets (Foundations of Success 2009, Morgan 2005) to document assumptions about current and future ecological, physical, climatic, and social drivers that affect the conservation targets, and their interaction with other stressors. Conceptual models help to build a shared understanding of the known current and potential future effects of climate change. Conceptual models will be used to assess climate change impacts by examining how specific changes in climate variables might directly or indirectly influence selected targets, for each of 2-3 representative scenarios of future climate change. Models also consider how human responses to climate change (e.g. thinning of forests to address changing fire regimes) might influence conservation targets.
4. Building on steps #1, 2, and 3, historic data, and current trends, develop three narrative scenarios (similar to those used by the National Park Service) of medium-term (20 years) landscape-scale change. These scenarios will chart out possible futures for the basins that take into account uncertainty in the way that precipitation patterns and hydrology could change in response to warming. Using published science and other data, the scenarios will outline the ecological changes likely to occur under each scenario, including impacts to conservation targets.
5. Utilize narrative scenarios (step #4) to gain detailed knowledge of local community and management agency views, priorities, and likely responses to change. Conduct 40-50 in-depth interviews (20-25 in each landscape) with landowners, resource managers, and other community members to build knowledge of social vulnerability, anticipated adaptation strategies, and decision-making under uncertainty. Integrate likely adaptation actions and their ecological consequences into revised scenarios (building initial social-ecological models) and engage focus groups to validate social-ecological models, rethink and prioritize conservation targets, and identify the resources, networks, and governance arrangements that are necessary to effectively adapt (i.e., adaptive capacities). Scenario interviews also identify potential disputes and tensions as well as pathways and opportunities to alleviate these obstacles by key elements of adaptive capacity such as collaboration, trust-building, and leadership. Interview and focus group data will be analyzed using an open coding system, assisted by Nvivo 10 ([www.qsrinternational.com/default.aspx](http://www.qsrinternational.com/default.aspx)). Rapid analysis will provide results to other parts of the process, including identifying, prioritizing and validating adaptation strategies, and understanding the institutional context for implementation.
6. Conduct and evaluate an institutional analysis of adaptation efforts in the two basins to develop an understanding of governance structures (social, legal, and political) in which adaptation actions may be, or are currently, undertaken. This information will be used to

identify opportunities for, and obstacles to, implementation of adaptation actions. Methods for institutional analysis include research to identify stakeholders, decision makers, rules, policies, and other factors that affect governance and decision making to learn how institutions function and interact. Interviews and focus groups conducted in step #4 will provide inputs into the institutional analysis, along with legal and policy research to understand the regulatory and statutory setting of the study areas. Other data sources will include charters, websites, and published reports of stakeholder groups and other involved parties (federal, state, NGOs, and others). The analysis will be guided by the Institutional Analysis and Development (IAD) framework developed by Ostrom (1990) (see, for example, Hardy and Koontz 2009; Imperial 1999; Korfmacher 2000).

7. Hold workshops with stakeholders to evaluate and refine models developed in steps #2, 3, 5, and 6, identify management intervention points (places in the system that managers can influence through management and conservation actions in light of climate change), and document critical assumptions behind specific management actions. Develop a list of possible adaptation strategies/actions to achieve management objectives under different scenarios, including a detailed set of adaptation strategies for six targeted ecosystems and/or species that can be incorporated into management decision-making. Evaluate feasibility of potential strategic actions and prioritize according to cost, social desirability and political feasibility, potential for positive effects or risk of unintended negative consequences, and robustness to uncertainty. Identify the adaptive capacities required to implement priority adaptation strategies (building on results from steps #5 and 6) and develop action plan. Strategies selection will champion options that minimize regrets, maximize benefits, and work across a number of scenarios.
8. Conduct an analysis to determine how to effectively scale up an existing pilot project to enhance the resilience of brood-rearing habitat for the Gunnison Sage Grouse. This analysis will help determine how many and what type of sites are needed to ensure the long-term viability of Gunnison Sage Grouse under different climate scenarios, especially drought. The results will enable the Gunnison Climate Working Group to expand initial habitat restoration efforts, a high priority for the group.
9. Develop a process for facilitating implementation, building on knowledge of adaptive capacities (step #5) and institutional analysis (step #6). Identify the specific actors or networks of actors who would implement specific strategies (e.g. federal, state, and tribal land managers, local government, landowners, community groups), key methods to engage specific actors, groups, or agencies, and the resources, networks, knowledge, and institutions required to implement strategies, including the policy and/or management changes needed for implementation. Work with the BLM and Forest Service to integrate strategies into project planning and priority setting.
10. Document lessons learned and best practices for transfer of process to other landscapes. Conduct ongoing evaluation of the integrated adaptation framework to document the strengths, weaknesses, and insights gained. Develop guidelines that outline effective processes to build knowledge, engage stakeholders, and identify adaptation actions.
11. Integrate results and new knowledge into ReVAMP and NTTC.

**Geographic Scope.** Our project encompasses much of the Gunnison and San Juan Basins in southwest Colorado and ranges in elevation from 5,000 to 14,000 feet. It consists of federal, tribal, state, and private lands with the majority held and managed by USFS and BLM.

Ranching, farming, and recreation are the primary economic drivers of the region. These two areas are representative of rural communities and watersheds across the NCCSC and SWCSC area, with opportunities to replicate in other communities.

**Expected Results and Products.** In addition to knowledge of social-ecological vulnerabilities, downscaled climate projections, and information about institutions and adaptive capacities, this project will generate the following specific products:

1. An innovative, effective, integrated social-ecological adaptation planning framework that can be applied in other landscapes (as documented through a report that provides guidelines and a toolkit for other users).
2. An ecosystem vulnerability assessment for the San Juan.
3. Narrative scenarios of landscape change in southwestern Colorado and conceptual ecological models that can be used in adaptation planning.
4. A set of adaptation strategies for both basins that include specific conservation targets and action steps/paths to implementation. These will include strategies for six priority ecosystems and/or species (e.g. Gunnison Sage Grouse).
5. Manuscripts focused on (1) social vulnerability and adaptive capacity, (2) the institutional analysis, and (3) the results and lessons learned from integrated adaptation framework.

**Technology/Information Transfer.** In this project technology/information transfer is an ongoing aspect of the integrated adaptation planning process. Rather than view knowledge transfer as a final step that happens after the research is complete, our iterative and participatory approach brings researchers and stakeholders together to co-produce knowledge at multiple points in the process. This approach integrates the best available science with local knowledge, concerns, and context in an on-going process to ensure that knowledge generated remains relevant to and feeds directly into the management decisions. Intended users include federal agencies (BLM, Forest Service, NRCS, USFWS), state agencies (Colorado Division of Wildlife), the Ute Mountain Ute and Southern Ute tribes, county governments, private landowners, rural communities, the Gunnison Climate Working Group, and the San Juan Climate Initiative. In addition, project results will be disseminated through multiple websites, printed reports, and meetings with specific user groups (e.g. meetings with BLM or Forest Service staff) and across user groups (e.g. meetings with multiple agencies and stakeholders). Results of interest to the broader scientific community will be disseminated through peer-reviewed publications.

**Documentation of Management Application /Relevance.** In 2012, the Southern Rockies LCC identified the primary management concerns as wildfire, species of concern, invasive species, and altered hydrologic regime; all of these are affected by climate change and will be addressed through our proposed project via the ACT framework and the scenario process. BLM and USFS are finalizing land management plans that include climate change objectives; in addition, they are moving forward with a collaborative Climate Adaptation Plan in the San Juan region which will set desired future condition guidelines, identify refuge areas for species that are vulnerable to climate change, and establish best management practices utilizing the “Scanning the Conservation Horizon” and ACT framework.

Developing basin-wide social-ecological adaptation strategies has been a high priority for the Gunnison Climate Working Group (coordinated by The Nature Conservancy) since the completion of a climate vulnerability assessment and initiating an on-the-ground climate

adaptation demonstration project, funded by the Southern Rockies LCC. To ensure that project deliverables will respond to needs of natural resource managers in the region, we will meet with the Gunnison Climate Working Group and other stakeholders to review the list of conservation targets, methods, and products, and to discuss work planning and timelines.

### **Cooperators/Partners**

Gunnison Stakeholders and Land Managers: Ian Billick, Rocky Mountain Biological Laboratory, PO Box 519, Crested Butte, CO 81224, [ibillick@gmail.com](mailto:ibillick@gmail.com), 970-349-7231; Chris Bove, District Conservationist, NRCS, 216 N. Colorado St., Gunnison, CO 81230, [chris.bove@co.usda.gov](mailto:chris.bove@co.usda.gov), (970) 765-1079; Jim Cochran, Wildlife Coordinator, Gunnison County, 200 E. Virginia Street, Gunnison, CO 81230, [JCochran@gunnisoncounty.org](mailto:JCochran@gunnisoncounty.org), (970) 641-7604; Mark Hatcher, Staff Officer, Range and Wildlife and Noxious Weeds, Gunnison National Forest, 216 N. Colorado, Gunnison, CO 81230; [mchatcher@fs.fed.us](mailto:mchatcher@fs.fed.us) (970) 970-642-4410; Ken Stahlnecker, Chief of Stewardship Resources and Science, NPS, 102 Elk Creek, Gunnison, CO 81230, [Ken\\_Stahlnecker@nps.gov](mailto:Ken_Stahlnecker@nps.gov) (970) 641-2337; Brian St. George, Manager, Gunnison Field Office, BLM, 650 South 11th St., Gunnison, CO 81230, [Brian\\_St\\_George@blm.gov](mailto:Brian_St_George@blm.gov) (970) 642-4941; Pat Magee, Thornton Chair of Biology, Western State Colorado University, 143A Hurst Hall, Western State College, Gunnison, 81231, [pmagee@western.edu](mailto:pmagee@western.edu), (970) 943-7121; Amy Seglund, Species Conservation Coordinator, Colorado Parks and Wildlife, 2300 South Townsend, Montrose, CO 81401, [amy.seglund@state.co.us](mailto:amy.seglund@state.co.us), 970-252-6014.

San Juan Stakeholders and Land Managers: Gretchen Fitzgerald, climate adaptation coordinator, San Juan National Forest (SJNF), 367 Pearl Street, Bayfield, CO, [gfitzgerald@fs.fed.us](mailto:gfitzgerald@fs.fed.us), (970)884-1435; Kelly Palmer, climate coordinator/hydrologist, SJNF, 15 Burnett Court, Durango, CO 81301, [kapalmer@fs.fed.us](mailto:kapalmer@fs.fed.us), (970) 385-1232; Matt Janowiak, SJNF Columbine District Ranger, 367 Pearl Street, Bayfield, CO, [mjjanowaik@fs.fed.us](mailto:mjjanowaik@fs.fed.us), (970) 884-1438; Brad Dodd, BLM Tres Rios Field Office Associate Field Manager, [William\\_dodd@blm.gov](mailto:William_dodd@blm.gov), (970) 385-1378; George San Miguel, Mesa Verde National Park, P.O. Box 8, Mesa Verde, CO, 81330, [George\\_San\\_Miguel@nps.gov](mailto:George_San_Miguel@nps.gov), (970) 529-5069.

Other Cooperators/Advisors/Reviewers: Cameron Aldridge (USGS); Jill Baron (USGS); (Molly Cross (WCS), Gregg Garfin (University of Arizona), Dennis Ojima (NCCSC); Doug Ouren (USGS); Shannon McNeeley (NCCSC); Chris Pague (TNC); Meg White (TNC)

**Facilities/Equipment/Study Areas.** Software, computing systems, and printing hardware will be provided by the University of Montana, USGS, CU, CSU, and NOAA.

### **Work and Reporting Schedule**

Summer 2013	Complete vulnerability assessment for San Juan Basin Refine climate model for SW Colorado Prioritize conservation targets for Gunnison Basin
Fall 2013	Prioritize conservation targets for San Juan Basin Build conceptual ecological models for conservation targets Develop conceptual framework for institutional analysis
Winter 2014	Create narrative scenarios of landscape change
Spring 2014	Conduct scenario interviews and focus groups



	Identify social vulnerabilities and adaptive capacities
	Identify likely responses to change
	Build knowledge of decision-making under uncertainty
	First annual report due to NCCSC
Summer 2014	Refine conservation targets and adaptation strategies
	Conduct institutional analysis
Fall 2014	Build models of social-ecological interactions
Winter 2015	Work with stakeholders to identify specific adaptation strategies
	Compare adaptation strategies to institutional capacity, as determined by institutional analysis.
Spring/Summer 2015	Develop pathways for implementation
	Second annual report due to NCCSC
Fall 2015	Reports and manuscripts
Winter/Spring 2016	Outreach and communication
	Final report due to NCCSC

**Qualifications of Project Personnel.** *Please see attached CVs for more information on project personnel.* **Marcie Bidwell**, M.L.A., Executive Director, and Program Manager for Climate Planning, Mountain Studies Institute and San Juan Climate Initiative Coordinator; **Nina Burkardt**, Research Social Scientist, USGS; **Corrie Knapp**, Ph.D. Candidate, University of Alaska Fairbanks, Resilience and Adaptation Program; **Daniel Murphy**, Ph.D., Assistant Professor of Anthropology, University of Cincinnati; **Betsy Neely**, M.S., Senior Conservation Planner, The Nature Conservancy and Coordinator, Gunnison Climate Working Group; **Imtiaz Rangwala**, Ph.D., Climate Scientist Research Associate, University of Colorado Western Water Assessment; **Renée Rondeau**, M.S., Conservation Planning Team Leader and Ecologist, Colorado Natural Heritage Program, Colorado State University; **John Sanderson**, Ph.D., Co-Director, Center for Conservation Science and Strategy, The Nature Conservancy and Director, Colorado Chapter Water Program; **Rudy Schuster**, Ph.D., Branch Chief, Policy Analysis and Science Assistance, Fort Collins Science Center, USGS; **William Travis**, Director, Center for Science and Technology Policy Research, Cooperative Institute for Research in Environmental Science, University of Colorado; **Carina Wyborn**, Ph.D., Postdoctoral Fellow, Department of Society and Conservation, College of Forestry and Conservation, University of Montana; **Daniel Williams**, Ph.D., Research Social Scientist, USDA Forest Service Rocky Mountain Research Station; **Laurie Yung**, Ph.D., Associate Professor of Natural Resource Social Science and Resource Conservation Program Director, College of Forestry and Conservation, University of Montana.

**Legal and Policy Sensitive Aspects.** There are no permits or approvals required for this project, nor restrictions on dissemination of results. Access to federal or private lands is not required.

**Animal Use or Human Subjects.** All human subjects research (e.g. surveys, interviews, and focus group research) will be approved by the Institutional Review Boards of participating universities prior to data collection and comply with all ethical and procedural requirements.

***GENERAL PUBLIC SUMMARY:***

In southwestern Colorado, climate change includes higher temperatures, more frequent and prolonged drought, accelerated snowmelt, larger and more intense fires, more extreme storms, and the spread of invasive species. These changes put livelihoods, ecosystems, and species at risk. To help communities cope, this project will create opportunities for scientists, land managers, and affected residents to learn from each other and identify actions that each can take individually or collectively to reduce the negative impacts of climate change in the San Juan and Gunnison Basins. These adaptation strategies and the process whereby they were created will be documented by the participating scientists to assist communities elsewhere to identify goals and actions that conserve key species, ecosystems, and resources, and address the needs of local communities and natural resource managers in the face of a changing climate.

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