Responding to Climate Change Impacts in the Sky Island Region: From Planning to Action

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***Abstract**—Addressing the increasing effects of climate change on natural resources requires multiple organizations, agencies, and institutions working cooperatively to incorporate climate change into resource management. In the Sky Island region of the southwestern United States and northern Mexico, Sky Island Alliance, a non-governmental organization, has convened a series of climate change adaptation workshops in cooperation with a variety of partners. This paper describes a process and methodology for bringing together federal and state agencies, local governments, non-profit organizations, tribal representatives, private landowners, and academic researchers in order to develop, on-the-ground and policy-level actions through climate change adaptation planning. Key outcomes of the workshops include: identification of climate change threats to and vulnerabilities of Madrean forest, riparian, desert, and grassland ecosystems in the Sky Island region; analysis of the effects of those changes in the region (both direct and indirect) and interacting factors; a list of ecosystem specific adaptation options for the region; a plan for implementation of an adaptation strategy; and development of a regional network of professionals working cooperatively to improve natural resource management under changing conditions. This paper highlights one approach for addressing the management and conservation challenges posed by climate change through collaborative engagement at a regional scale.*

Introduction

The global oceans and atmosphere have changed due to human activities, resulting in a warmer and moister atmosphere (Trenberth 2012). As a result, the southwestern United States is among the fastest warming regions in the nation (Karl and others 2009). In the past 10 years, parts of the Southwest have warmed more than 2 °F relative to average 20th century temperatures (fig. 1). Nestled in the heart of this rapid warming is the Sky Island region of southeastern Arizona, southwest New Mexico, and northern Mexico. Sky Islands are isolated, forest-topped, mountain ranges, surrounded by lowland desert and grasslands. Characterized by steep elevation gradients, commonly from 600 m at their bases to 3,000 m at their summits, they span the gap between the Sierra Madre in Mexico and the Rocky Mountains and overlap the boundary between the Sonoran and Chihuahuan desert (fig. 2). They harbor some of the most biologically diverse ecosystems in North America.

In: Gottfried, Gerald J.; Ffolliott, Peter F.; Gebow, Brooke S.; Eskew, Lane G.; Collins, Loa C., comps. 2013. Merging science and management in a rapidly changing world: Biodiversity and management of the Madrean Archipelago III; 2012 May 1-5; Tucson, AZ. Proceedings. RMRS-P-67. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Effects associated with observed regional warming include a decrease in the fraction of winter precipitation falling as snow, less soil moisture, changes in timing of species' life cycle events, widespread vegetation mortality, and increased frequency of large wildfires (Robles and Enquist 2010). Temperature increases interact with other factors, such as decadal-scale drought, land use and land cover changes, habitat fragmentation, and complex ecosystem interactions.

In the U.S. portion of the Sky Island region, land tenure is a patchwork, with approximately 34 percent managed by federal agencies, 30 percent by state agencies, 27 percent in private ownership, and smaller portions managed by Native nations, local jurisdictions, and conservation interests. Although plans and mandates exist for considering climate change, individual management agencies and private entities in the region are at different stages of incorporating it into management. Many questions remain about how to implement adaptation strategies at the local level across different land management boundaries. Moreover there is a constantly expanding body of scientific information, yet it is still a challenge for natural resource managers to access science useful for planning and decision-making. In this context, work to establish cross-jurisdictional and regional coordination and to foster knowledge exchange within and across an international border is essential for building the institutional adaptive capacity needed to lessen the potential impacts of climate change (Hansen and Hoffman 2010).

Addressing these myriad challenges is the goal of *Adapting to a Changing Climate in the Sky Island Region*, a project initiated by

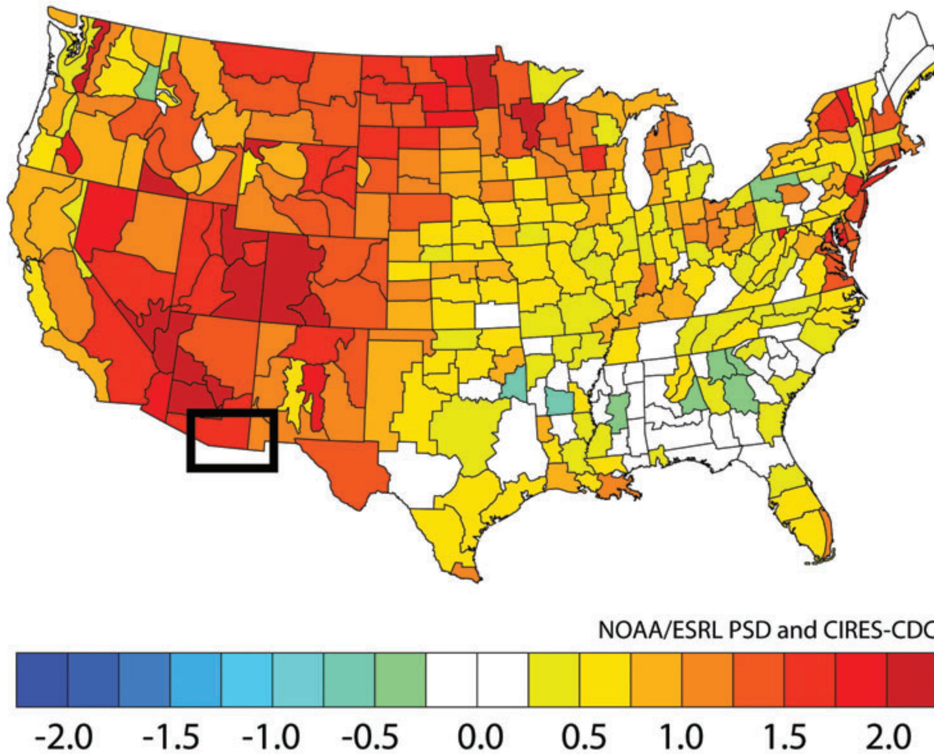

Figure 1—Composite temperature anomalies (F) Jan to Dec 2000 to 2009 Versus 1895-2000 longterm average.

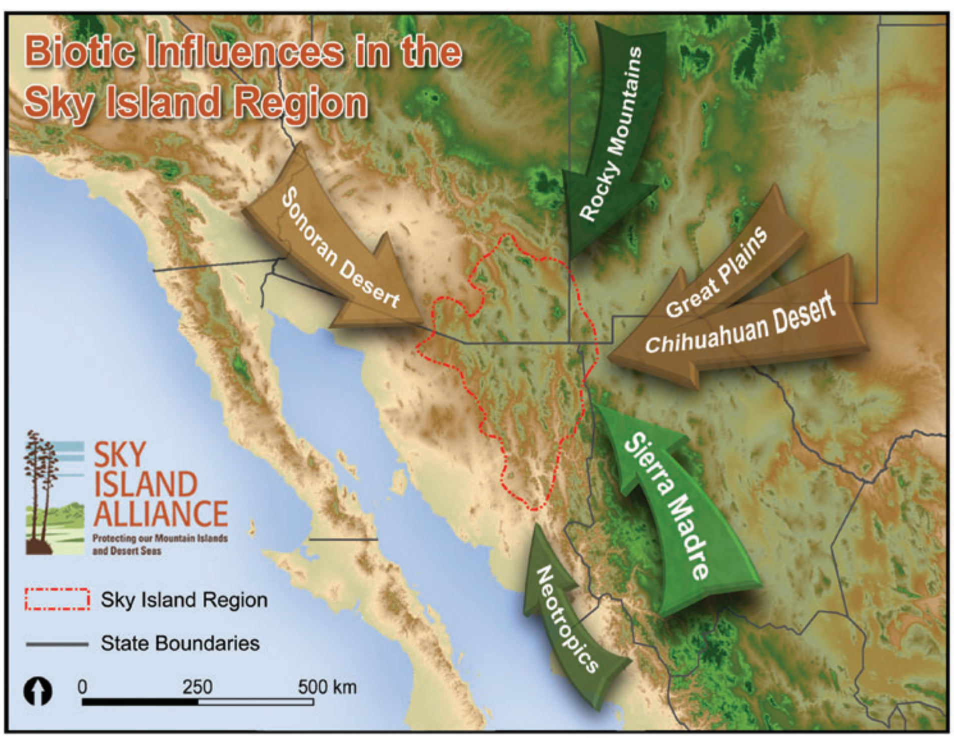

Figure 2—Map of Sky Island Region.

Sky Island Alliance (SIA) in 2009, the principle elements of which include a series of regionally focused climate change adaptation workshops. Objectives of the three-part workshop series include (1) develop and implement on-the-ground and policy-level adaptation strategies that address key ecosystem management vulnerabilities, and (2) integrate climate change information into participants' planning and work. To support these objectives, a regional knowledge-action network of professionals (e.g., Jacobs and others 2010), working co-operatively to improve natural resource management under changing conditions, was created. The first two workshops in the series were convened in 2010 and 2011 and the third workshop will be convened in 2013. Participants at the first two workshops included personnel from federal, state, and local agencies; non-governmental organizations; universities; and Native nations and private landowners (table 1). Results include development and implementation of adaptation strategies that span U.S jurisdictions. This paper describes the process used to develop and convene workshops, key workshop results, and status of post-workshop implementation.

Process and Methodology

Climate change adaptation for natural systems can be defined as a dynamic management strategy that involves identifying, preparing for, and responding to predicted climate change in order to promote system resilience, maintain system function, and provide the necessary elements to support biodiversity, human communities and sustainable ecosystem services (Theoharides 2009). To support development of climate change adaptation strategies for the Sky Island region, we worked with partners to develop and convene two workshops of a three-part series. The series was designed to involve the same agencies and individuals to provide continuity and allow for increasing depth of involvement with each successive workshop and to be of mutual benefit across jurisdictions and management mandates.

Before the first workshop, we surveyed selected natural resource managers (table 2) to assess how potential participants gather and use climate information, and to learn about their current work on climate change adaptation, and what they see as the most pressing regional climate change threats and vulnerabilities including barriers to and needs for reducing vulnerabilities. In this context, reducing vulnerability means reducing exposure and sensitivity, and increasing adaptive capacity. The survey was developed by SIA with the Climate Assessment for the Southwest (CLIMAS), Ecoadapt and the U.S. Institute for Environmental Conflict Resolution. The survey allowed us to initiate contact with potential workshop participants and gauge interest in our workshops and an Arizona Climate Change Network—our concept for a forum for communication with colleagues about adaptation and cooperative work. Of 44 question respondents, 85% indicated strong interest in both attending a climate change adaptation workshop and joining the Network. Respondents identified the following greatest threats in the region: water scarcity and drought, human pressures on ecosystems, invasive and non-native species, and fire. The greatest management needs included stable funding, a framework for dealing with uncertainty, translation of science, and effective communication among colleagues, partners and stakeholders.

Table 1—Climate change adaptation workshop attendees by affiliation.

	Workshop 1	Workshop 2
Federal	31 (35%)	24 (35%)
NGO	17 (20%)	22 (32%)
State	7 (8%)	2 (3%)
University	15 (17%)	10 (15%)
Other	17 (20%)	10 (15%)
Total	**87**	**68**
Repeat attendees		**34 (50%)**

Table 2—Affiliation of climate change adaptation survey respondents

Government agency	18 (33%)
NGO	17 (32%)
University	15(28%)
Other	4 (7%)
Total	**54**

In addition to our survey-development partners, we worked with the University of Arizona School of Natural Resources and the Environment and Institute of the Environment, Sonoran Joint Venture, the U.S. Bureau of Reclamation, and the U.S. Fish and Wildlife Service through the Desert Landscape Conservation Cooperative (LCC) to develop workshops that foster movement from climate change planning to action. A 2-day structure was created to deliver regionally relevant climate science and adaptation case studies (information push), followed by an interactive breakout group process (information exchange). The science delivery component addressed threats and greatest current needs identified in survey responses, while breakout groups addressed the need for better communication and coordination between jurisdictions within agencies and among different agencies and organizations in the region.

We co-convened Workshop 1, *Climate Change in the Arid Southwest* (September 2010), with the newly formed Desert Landscape Conservation Cooperative (LCC), a public-private partnership providing scientific and technical support and coordination to resource managers to address climate change and other landscape-scale stressors. Although the area encompassed by the Desert LCC (Mohave, Sonoran and Chihuahuan Deserts) is much larger than the Sky Island region, it had similar landscape-scale objectives and an overlapping group of participants. The first half-day of the workshop was dedicated to presenting region-specific information on projected climate changes, fire, water, wildlife range shifts, adaptation efforts, pre-workshop survey results, and background about the Desert LCC. Participants were pre-assigned into three facilitated breakout groups to address the following vulnerabilities and needs: water scarcity, species and habitat conservation, and research and monitoring. Each group included a diverse mix of disciplines, organizations, and management jurisdictions. The groups discussed the following series of questions:

1. What is your management goal?
2. How might climate change affect your goal?
3. How might it affect your existing strategies and methods?
4. Brainstorm actions that can be taken to reduce vulnerability.

Each group then chose two vulnerabilities for in-depth discussion of adaptation strategies.

In Workshop 2, *Between a Rock and a Hot Place* (April 2011)—co-convened with EcoAdapt—participants were assigned to ecosystem-specific facilitated breakout groups as follows: Madrean forest, semi-desert grassland, desert, and riparian. The first half-day of the workshop was dedicated to presenting information on (a) likely climate changes in the region, (b) how those changes may affect hydrology, fire, invasive species, and connectivity and corridors, (c) vulnerabilities of species in the region, (d) a framework for dealing with uncertainty, and (e) case studies of managers incorporating climate change considerations into current work. We presented a framework for dealing with climate uncertainty in the same manner that managers and planners deal with other uncertainties. Informal scenario planning was used to consider the range of possible futures by using the models that best capture climate processes in the region of interest, noting areas of agreement while also considering extreme but plausible projections to give a sense of the potential range and direction of change. We shared an adaptive management example that specifies key uncertainties and research needed to address them, triggers for action, and necessary science and institutional structures. For the remainder of the workshop, participants developed preliminary adaptation plans in ecosystem-specific breakout groups. Groups worked through the following activities: (1) identify a specific management effort for adaptation planning and prioritize a common goal, (2) determine vulnerabilities of your goal to climate change, (3) identify a suite of potential adaptation responses, and (4) create a set of adaptation actions and next steps. They then developed hypotheses of change by answering the following questions:

1. How might climate change affect your common goal or ecosystem directly?
2. How might it affect them indirectly (e.g., ecological effects, interactions with existing stressors)?
3. How might changes outside your ecosystem influence your common goal or ecosystem?
4. Which interacting factors influence vulnerability to climate change (e.g. other physical stressors)?

At the end of the first day, there was an opportunity for each breakout group to exchange information with other groups by sharing their progress in a marketplace of ideas about key vulnerabilities and means of addressing them. We structured the second day to facilitate participants' discussion of interactions across ecosystems, landscapes, and stressors to ensure that each breakout group thought about ways in which different ecosystems and strategies influence one another. We did this to prevent groups from developing "maladaptive strategies"—i.e., strategies that addressed issues pertaining to their ecosystem, but which might adversely affect adjacent ecosystems. For the concluding session of the workshop, each breakout group presented summaries of their ecosystem goal, top five vulnerabilities, and a fully formed plan for implementing one adaptation strategy. Each plan included actions to make the ecosystem less vulnerable, identification of resources to bring the plan to fruition (e.g. data, skills, funding, materials, infrastructure, permits), identification of partners with important resources or involvement necessary for plan implementation, a timeline, and actions for monitoring success. The workshop process is summarized in figure 3.

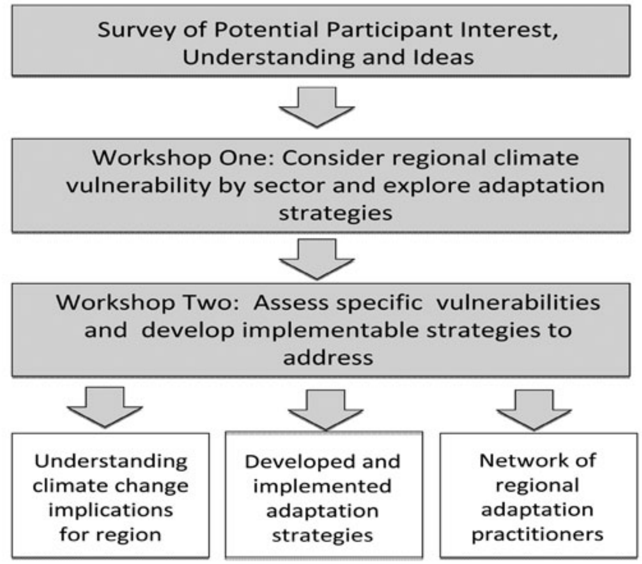

Figure 3—Flow chart of workshop process.

Key Outcomes

The chief outcomes of the first two workshops included enhanced awareness of Sky Island climate change issues, an improved social network for communication and coordination, cross-agency/cross-jurisdictional discussion and common agreement on impacts and adaptation options. Workshop participants identified (a) elements of climate change likely to occur in the region; (b) the effects of those changes in the region (both direct and indirect) and vulnerabilities these effects may cause; (c) non-climate stressors, interactions between climate and non-climate factors, and interactions between distinct ecosystems; and (d) prioritized initial adaptation strategies (table 3) (reports available at www.skyislandalliance.org/adaptation-workshops.htm).

The main climate threats identified by each group included increasing temperatures; precipitation factors, including amount, seasonal timing, and intensity; and interactive effects on exposure to climate through drought. The impact of the timing of seasonal precipitation is of concern because of the implications of an extended pre-monsoon arid fore-summer season: increased fire risk in all ecosystems, decreased connectivity in stream reaches, decreased dissolved oxygen in bodies of water and riparian pools, increased grass mortality, impacts on migrating birds that rely on riparian vegetation, and shifts in species composition. Participants highlighted the threat of "megadrought" to which the Southwest—which is at the *fringe* of both winter and summer moisture-bearing atmospheric circulation patterns and at the center of strong interior West temperature increases—is particularly sensitive. It was noted that megadrought could be a game changer for ecosystems, due to the potential for rapidly crossing ecosystem thresholds to new quasi-equilibrium states, such as from pine-oak forests to oak scrub woodlands, or from productive Chihuahuan Desert grasslands to semi-woody shrublands.

We note that uncertainties in climate change projections did not impede discussions about climate change effects and identification of adaptation strategies. Participants did identify critical uncertainties about what to monitor, and the necessary frequency and timing of monitoring. Through thoughtful discussion, participants identified actionable adaptation strategies (table 3) that build on existing management, restoration, and public education priorities, and—with sufficient resources—can be implemented in the short-term using familiar management tools. These are "win-win, no regrets" options for Sky Island ecosystem management.

In this brief paper, we cannot give an exhaustive accounting of the nuanced articulations of vulnerabilities, impacts, and adaptation options for each of the four Sky Island ecosystems; however, the following overview touches on important common factors and gives examples of some unique challenges. In a nutshell, Sky Island ecosystem vulnerabilities center on maintenance of ecosystem health

Table 3—Key workshop outcomes.

	Madrean Forest	Riparian Areas	Semi-Desert Grassland	Desert
Threats	↑temperatures; ↑frequency of warmer and drier winters; ↑summer precipitation variability and mega droughts	↑temperature; ↑frequency of warmer and drier winters; hotter and longer foresummers; changes in monsoon season precipitation	↑dry winters; ↑temperatures; ↑variability in precipitation events, changes in seasonality	↑temperatures; changes in hydrology
Vulnerabilities	Forest health and function; ↑fire risk; shifts in wildlife and vegetation; loss of soil and potential for forest regeneration; ↑insect infestations	Habitat fragmentation; ↓biodiversity; alterations in physical processes, stream morphology, and water table; ↓recharge; ↓ecosystem services	Altered or diminished land use practices; flossing; ↓viable ranching; soil loss & erosion; lack of community concern for climate change effects on grasslands	Public disconnect with climate change impacts; changes in land pressure; ↑water use, ↑temperature and energy use: ↑invasive species
Adaptation Options	Manage for resilience on a landscape scale; Manage human uses of public lands; Focus resources on maintaining, and protecting resilient areas; Protect corridors for species connectivity; Close sensitive areas to prevent further disturbance; Plan for beetle detection and treatment	Capitalize on drought to reduce invasive species; Promote restoration, work with planners to build and design infrastructure that helps maintain ecosystem processes; Pursue different water policies	Show communities alternative futures (climatic/ landscape changes); Incorporate past water &land allocation information, with potential climate changes into future management; Harness mass flooding events for water reserves, ↓channelization; Change grazing time and location; and Install stabilizing features	Conduct a climate change education and awareness campaign; Engage public through citizen science projects, Harvest rainwater, Increase public transportation and bike lanes, Increase energy efficiency; Develop awareness campaign to explain relationship between fire and invasive species
Selected Adaptation Goal	Maintain ecosystem services and function of montane forests and woodlands to preserve biodiversity and adaptation potential where possible, or facilitate transition	Conserve the function and integrity of riparian systems in a changing climate for the Upper San Pedro basin	To maintain and restore grasslands and the species in them through community empowerment and engagement	Reduce human impact on desert ecosystems by awareness and outreach
Adaptation Strategy	Initiate a process to manage the Sky Island region at a landscape scale through the National Environmental Policy Act (NEPA)	"Stop the Stupid, Start the Smart" outreach campaign that places the value of water and riparian systems in terms that all different groups of people can understand	Work together to cultivate resilient, native seed sources to prepare for likely flooding and soil loss associated with climate change impacts in the region	Incorporate climate change into the Saguaro National Park BioBlitz event of 2011, specifically into the Biodiversity University

and function, keystone ecological processes (e.g., fire), species shifts, erosion, habitat fragmentation, and maintaining traditional economic land-use practices (e.g., grazing). It is interesting to note that discussions of low elevation ecosystems (grassland and desert) raised concerns about the human community's indifference to climate change. Development of alternative land uses (e.g., energy development) was identified as increasing the vulnerability of these ecosystems and as a potential impediment to development of sufficient biological adaptive capacity. Certainly desert and riparian environments have greater exposure to human activities, such as development, recreation, immigration, and infrastructure.

Participants' articulations of direct and indirect impacts and adaptation options accounted for much of the workshop activity. The following example from the Madrean Forest group illustrates a workshop output. The group identified more than a dozen unique direct and indirect impacts and interactive factors, related to each of four climate threats (increased temperature, increased frequency of warm/dry winters, increased summer precipitation variability, and megadrought). A sample cascade of impacts and interactions follows:

Direct impacts: increased frequency of warm/dry winters leads to altered snow hydrology (more winter rain), diminished watershed moisture retention, increased insect invasions, increased fire risk, and vegetation shifts that favor woody species

Indirect impacts: altered phenology of aquatic at springs and increased grazing pressures

Interacting factors: policy shifts to address lack of precipitation through cloud seeding

To address this set of issues, which participants classified as "decreased forest health and ecosystem services," six options were identified: (1) transition from project-specific planning and implementation of National Environmental Policy Act (NEPA) requirements to landscape level planning and implementation, (2) evaluate ecosystem function to prioritize management strategies, (3) restore fire appropriate regimes, (4) shift fire damage liabilities, (5) manage invasive grasses, and (6) protect resilient areas. Adjusting the scope of NEPA assessments was identified as the highest priority adaptation strategy, and a feasible plan was laid out (table 4).

A "marketplace of ideas" session, in which participants were able to interact between breakout groups, yielded insights on cross-cutting issues and interactions between ecosystems. Many ideas echoed those raised during the first workshop, but in the more action-focused context of the second workshop, they were honed and articulated more specifically. For instance, riparian areas, which exist in each of the ecosystems, are affected by watershed uplands. Disturbance to uplands and upstream reaches, such as wildland fire and water extraction, affect downstream reaches through erosion, sedimentation, and decreases in the number and extent of perennial segments. Another theme common to all ecosystems was intervention of non-climate stressors, such as water law and policy, land use and development, energy and mining policy, recreation and tourism. These stressors can increase exposure to climate changes by fragmenting habitat and reducing connectivity (as in the case of alternative energy development), or increasing fire area and intensity (as in the case of expanding wildland-urban interface). Non-climate factors are also important determinants of biological adaptive capacity. Participants identified hindrances to developing adequate institutional capacity to prepare for and respond to climate changes, including (1) attitudes of the public and key decision makers toward climate change; (2) lack of coordination and information exchange between isolated efforts to restore ecosystem function and/or prepare for climate change; (3) lack of consistency in data collection, coupled with a lack of coordination in sharing data; (4) lack of staffing, resources, and expertise to plan for and implement experimental treatments and initiatives; and (5) ineffective water and land use laws that impede efforts to enhance ecosystem resilience.

Implementation

Other outcomes from the first two workshops include the incorporation of climate change considerations into planning and project development and a more coordinated approach to preparing for climate change and restoring ecosystem function. There are a variety of adaptation planning and implementation processes currently underway in the region (table 5). Our workshops and the Arizona Climate Change Network have created a regional nexus for information sharing, project planning, and cooperative implementation that did not previously exist. For example, funding was secured to complete a *Spring and Seep Inventory, Assessment, and Management Planning Project* to gather data on biological, hydrological, geomorphological, and management status of springs and seeps in the Sky Island region. Information will then be applied to the management of sensitive and invasive aquatic species, the prioritization of restoration and conservation monies, and management of wildlife that rely on surface water. The project is being implemented by SIA in coordination with regional resource managers, including Pima County, the U.S. Forest Service, and the Spring Stewardship Institute and is receiving funding through the Desert LCC. The project seeks to reduce the vulnerability of water resources and species of concern by developing in-depth knowledge of regional spring resources, fostering cross-jurisdictional management of those resources, and prioritizing where to focus restoration and protection (table 6).

Conclusions and Next Steps

Our workshops have filled a void of regional coordination and communication about climate change effects and management responses. Assessing natural resource managers' needs and knowledge before developing the workshops ensured effective engagement and a focus on the issues of highest importance to participants. We took a unique approach, focusing adaptation planning efforts on the entire Sky Island region rather than individual management units. This approach was beneficial in that it generated discussion and subsequent coordination across jurisdictions and management types, and resulted in identifying key common vulnerabilities and resource issues across

Table 4—Madrean forest adaptation plan.

Goal	Maintain ecosystem services and function of montane forests and woodlands to preserve biodiversity and adaptation potential where possible, or facilitate transition.
Strategy:	Manage the Sky Island region at a landscape scale by implementing a programmatic National Environmental Policy Act (NEPA) analysis. Conduct a landscape vulnerability assessment, define project areas, and use a facilitated process with a conflict resolution expert.
Rationale:	Consider landscape scale instead of single places in specific jurisdictions. Develop a programmatic NEPA analysis to manage for resilience. The FireScape model could inform management at a landscape scale.
Resources Needed:	Working group for coordination: State agencies, Government agencies, Counties, Non-profit organizations, such as Sky Island Alliance, Land Conservation Trusts, Tribes, Sonoran Joint Venture, Universities, such as the University of Arizona, State forestry groups, Private land owners
Lead:	U.S. Forest Service
6-9 months: **6-24 months:** **24-36 months:**	Define and assess landscape using FireScape tool, identify resources, build partnerships. Organize and engage working group to develop landscape NEPA analysis. Draft programmatic NEPA analysis, stakeholder outreach, implement public comments, and prepare final.
Monitor Success:	Track the timeline and process in getting the NEPA decision adopted in the region. Track implementation and revise if necessary.

Table 5—Related adaptation efforts.

Adaptation Efforts	Lead Organization
Sonoran Desert Conservation Plan	Pima County
Climate Change and Natural Resources in Pima County	Pima County
Las Cienegas National Conservation Area Climate Change Adaptation and Scenario Planning	Bureau of Land Management and The Nature Conservancy
Greater Southlands Habitat Conservation Plan	City of Tucson Office of Conservation and Sustainable Development
Cuenca Los Ojos –Restoration	Cuenca Los Ojos
Firescape	University of Arizona and Coronado National Forest
Coronado National Forest Land and Resource Management Plan Revision	U.S. Forest Service Rocky Mountain Research Station and Coronado National Forest
Sky Island Region Climate Change Adaptation Workshop Series	Sky Island Alliance
Sky Island Spring and Seep Inventory, Assessment and Management Planning Project	Sky Island Alliance

Table 6—Implementation case study.

Spring and Seep Inventory, Assessment, and Management Planning	
Threats	↑temperatures, ↑ aridity, ↑ scarcity of water that supports wildlife and biological diversity
Vulnerabilities	Lack of data on condition of springs/seeps, alteration of springs/seeps for human uses, likely inability of managers to maintain water where it currently exists
Adaptation Strategy	Conduct field-based assessment of spring/seep condition, species present, water quality and quantity, solar exposure and human alteration; identify appropriate restoration and protection activities
Project Partners	Lead- Sky Island Alliance, Spring Stewardship Institute, Pima County, Pima Association of Governments, Arizona Game and Fish Department, The National Park Service, The Nature Conservancy, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, Ft. Huachuca, Coronado National Forest, U.S. Geological Survey, Arizona Water Resources Research Center, Desert LCC
Implementation Activities	
Nov 2011 – May 2012	Determine areas of high management priority for conducting assessments with project partners
Apr 2012	Train volunteers and agency personnel in spring/seep assessment protocols
May 2012 - Aug 2013	Utilize volunteers to assess 50 springs in high-priority areas
Apr 2012 – Ongoing	Work with agency personnel and complementary projects to assess springs/seeps being visited for other projects
Nov 2011 – Aug 2013	Develop a regional spring/seep online database accessible to all jurisdictions
Aug 2012 - Ongoing	Direct restoration and protection money and efforts to newly prioritized springs, and incorporate new spring data in project planning (e.g. prescribed fire)
Jan 2013	Implement restoration of natural flow and vegetative structure on 12 priority sites

the region. It also afforded managers a sense of how their activities may affect neighboring resources. Convening workshops and creating a knowledge-action network has fostered ongoing sharing of project work, information and expertise. One year after the 2011 workshop, it is clear that adaptation project implementation is most successful when there is a dedicated lead organization with time and resources to advance the project. Continually integrating emerging science on regional climate change and its impacts into management planning and project implementation will be an ongoing challenge.

The next steps for this initiative include: a final workshop in 2013 to share updates on project implementation from the previous two workshops, further development and expansion of the Arizona Climate Change Network to the entire Sky Island region, and further implementation of adaptation projects, and incorporation of climate change information into regional management.

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The content of this paper reflects the views of the authors, who are responsible for the facts and accuracy of the information presented herein.