



**DESERT LANDSCAPE
CONSERVATION COOPERATIVE**

2013 Annual Report



Genevieve Johnson, Desert LCC Coordinator

Aimee Roberson, Desert LCC Science Coordinator

Sally Holl, Desert LCC Data Coordinator

<http://www.usbr.gov/dlcc/>

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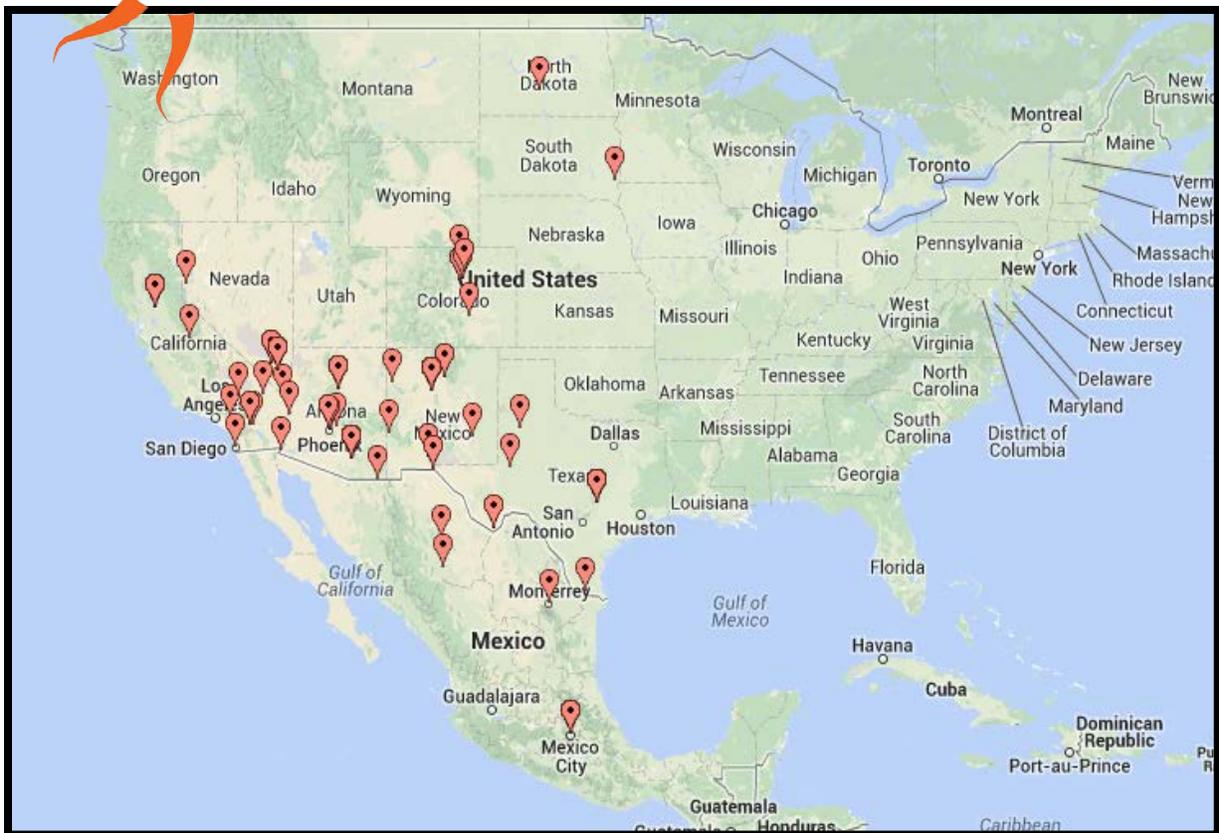
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Geographic Extent of Desert LCC Partners

Letter from the Incoming Chair

It is my pleasure to congratulate the Desert Landscape Cooperative for its many accomplishments over the past year. These accomplishments were in large part due to the fantastic work being done by our Coordinator, Genevieve Johnson, and our Science Coordinator, Aimee Roberson. Our many accomplishments and the progress we've made can also be attributed to the leadership of outgoing Steering Committee Chair, Dr. Duane Pool, and the contributions of the Steering Committee, the various sub-committees, and our many partners.



One of the major accomplishments has been to increase our Information Technology capacity within the Cooperative with the addition of Sally Holl, our Data Coordinator. This additional capacity will benefit many of our initiatives, but one in particular that is especially important to me is our Communications Plan, another one of this past year's major accomplishments. There are many stresses and threats to our natural resources, and the impacts from them will only increase over time. The magnitude of the issues surrounding conservation planning is also enormous, and to span the gap between the time and money it will take to effect meaningful conservation will require resources we in the natural resource business don't have. The LCC provides a vehicle for pooling our resources together. Our science, our expertise, our data, and our experiences can certainly help span the gap, but realistically it will never be enough. We prioritize and triage and still manage to do some amazing things. This annual report describes what we've accomplished over the past year together.

One thing that I learned over the past year is that if we want to make meaningful progress on conservation priorities, we will need the help of the public. The public can support our efforts through volunteering, donating, and influencing elected officials. They can also be informed and become more understanding of how their actions may be unwittingly contributing to some of the problems we face. From the spread of invasive species to incompatible recreation, there are many activities the public does that, if done differently, could help natural resources, or at least not make problems worse. To do this, they need to be educated. Effective outreach and education have the potential to contribute towards our goals for conservation and resource management and implementation of our science by communicating key messages broadly to the public. We need effective communication, and our new communications plan will help us get the word out about what we hope to accomplish in the LCC--what science we have supported in the past and what science we are committing to in the future--and be a tool for reaching out to new partners. Two major initiatives we will work on this year are reaching out to tribes and to our neighbor to the south, Mexico. It's an exciting time, and we can make huge strides working together through the Desert LCC and even bigger strides through effective communication.

Armand Gonzales
Desert LCC Steering Committee Chair
California Department of Fish and Wildlife

Executive Summary

The Desert Landscape Conservation Cooperative (LCC) is a bi-national, self-directed, collaborative, public-private partnership that collectively impacts landscape conservation in five states across the major desert regions of the Southwestern United States and 10 states in Northern Mexico. Established in 2011, we are one of 22 such cooperatives functioning as a network to develop a coordinated, science-based response to climate change and other landscape-scale stressors on land, water, human, cultural and wildlife resources. Through our partnerships, we in the Desert LCC seek to provide scientific and technical support, coordination, communication and capacity to assist resource managers and the broader Desert LCC community in addressing problems that are too large in scope for any one agency, organization, or individual to solve alone. We operate on the philosophy that to create lasting results, effective collaboration must incorporate both human and ecological considerations.

In 2013, the Desert LCC made major strides in our organizational development and our contribution to landscape conservation science. Under the guidance of our Steering Committee, we brought science and management together by identifying six questions of critical management importance to our partners. Our Critical Management Questions (CMQs) define the Desert LCC's niche within the conservation community and meet the collective science priorities of our conservation partners. Our CMQs address: Environmental water flows and climate change; Monitoring species/processes relative to climate change and related threats/stressors; Grassland/Shrubland restoration and management; Physiological stress due to climate change; Changing wildfire regimes and riparian ecosystems; and Reptiles/Amphibians sensitivity to climate change. Our CMQs serve as the foundation for establishing our shared goals across our desert landscape.

In the past year, we increased and leveraged our human and financial resources for conservation efforts that reflect our CMQs. We built collaborative, interdisciplinary teams that function as applied-science think tanks to work on our CMQs and who operate on clearly defined work plans with Steering Committee members serving as sponsors. To date, the Desert LCC has more than 100 committed and talented scientists and managers working across our landscape to develop the science and tools that will inform landscape conservation design and delivery. To meet the needs addressed in the CMQs, the Desert LCC funded 11 applied-science projects in 2013, with a total of \$2,375,977 in project funding provided by the Bureau of Reclamation and U.S. Fish and Wildlife Service, and the leveraged work of our Desert LCC partners.

Over the past year, we have established a process to coordinate GIS and data management activities, linking theory and practice through dialogue and deliberation with help from a newly hired Desert LCC Data Coordinator. By creating the foundation for shared data management, we can leverage Desert LCC monitoring work on changes in freshwater temperatures and evaluating adaptive management in Big Ben (Rio Grande-Rio Bravo). The Desert LCC began working with partners on a business plan that lays the foundation for a freshwater temperature monitoring and data-sharing project to increase efficiency in freshwater monitoring efforts. In the Big Bend reach of the Rio Grande-Rio Bravo watershed, the Desert LCC is helping to conserve a critical

binational protected area by facilitating development of scientific information that will improve the ability of managers to conserve the river for the benefit of fish, wildlife, and people.

In 2013, our Steering Committee approved the charters created by the Local Governments Working Group and the Mexico Working Group and the Communication Working Group's Desert LCC Communications Plan. We created a new Desert LCC website to expand access to information about critical science and partner efforts, as well as forums and channels for information sharing and idea exchange using collaborative online tools, such as Confluence and a YouTube channel. We began translating key Desert LCC materials into Spanish to increase outreach to our partners in Mexico. We approved a logo for the Desert LCC to help promote a public identity for our work.

In 2013, we agreed to explore the role of the Desert LCC in addressing the National Fish, Wildlife, and Plants Climate Adaptation Strategy and to report on alignments between the Strategy and the current activities of the Desert LCC. We promoted national collaboration and coordination with the LCC Network and with U.S. Geological Survey Climate Science Centers. Desert LCC partnered with the USFWS National Conservation Training Center and others within the LCC and CSC communities to provide the Climate Smart Conservation training to LCC partners.

In December, we expressed gratitude for the dedicated leadership of outgoing Chair, Duane Pool (Rocky Mountain Bird Observatory) and welcomed our past Vice-chair Armand Gonzales (California Department of Fish and Wildlife) into his new role as Chair of the Desert LCC. We also welcomed new Vice-chair, Robert Mesta (Sonoran Joint Venture).

Looking ahead in 2014, our focus will be on showcasing how we as the Desert LCC can have greater collective impact, which we define as "the commitment of a group of important actors from different sectors to a common agenda for solving a specific problem" (Kania and Kramer). We will build on the greater clarity we achieved in 2013 by focusing on our unique identity as an LCC and considering how we as partners might leverage that to have collective impact by driving member and partner understanding, engagement, and advocacy. Shifting from isolated impact to collective impact is not merely a matter of encouraging more collaboration, but rather requires a focus on the relationships between organizations and the progress toward shared objectives. We believe the Desert LCC offers the unique opportunity, skills, and resources to assemble and coordinate the specific elements necessary for collective action to succeed.



El Carmen, Big Bend National Park

Introduction

The Desert LCC is a bi-national, self-directed, collaborative, public-private partnership that collectively impacts landscape conservation in five states across the major desert regions of the Southwestern United States and 10 states in Northern Mexico. The Desert LCC area includes the Mojave, Sonoran, and Chihuahuan deserts, grasslands and valley bottoms, isolated mountain ranges, and large river systems, ranging in elevation from near sea level to more than 10,000 feet.

The Desert LCC is one of two landscape conservation cooperatives that are jointly led by the Bureau of Reclamation (Reclamation) and the U.S. Fish and Wildlife Service (USFWS). Along with Genevieve Johnson (Reclamation) and Aimee Roberson (USFWS) who serve as the Coordinator and Science Coordinator for the Desert LCC, respectively. Sally Holl joined the



From left to right: Genevieve Johnson, Sally Holl, and Aimee Roberson, at December 2013 Steering Committee meeting.

team in June as our Data Coordinator. Sally is a geographer with the U.S. Geological Survey's Texas Water Science Center in Austin and an Associate Professor of Geographic Information Systems (GIS) at Austin Community College. She is helping the Desert LCC establish a firm foundation for data stewardship and sharing that is consistent with international standards while also producing high-quality GIS products for research and outreach.

The mission of the Desert LCC is to use collaborative partnerships to provide scientific and technical support, coordination, and communication to resource managers and the broader Desert LCC community to address climate change and other landscape-scale ecosystem stressors.

The goals of the LCC are to support, facilitate, promote and add value to landscape-scale conservation to build resource resilience in the face of climate change and other ecosystem stressors through the following strategic efforts:

- **Collaboration and Communication**
Promote and facilitate collaboration and communication among conservation partnerships and entities to support and add value to their efforts to respond to climate change and

other stressors and to integrate scientific information into resource management plans and conservation projects.

- **Science Development and Delivery**

Identify science needs of LCC partners related to climate change and ecosystem stressors at broad spatial scales, and facilitate the development, integration and application of scientific information (including decision support tools) that will inform resource management decisions.

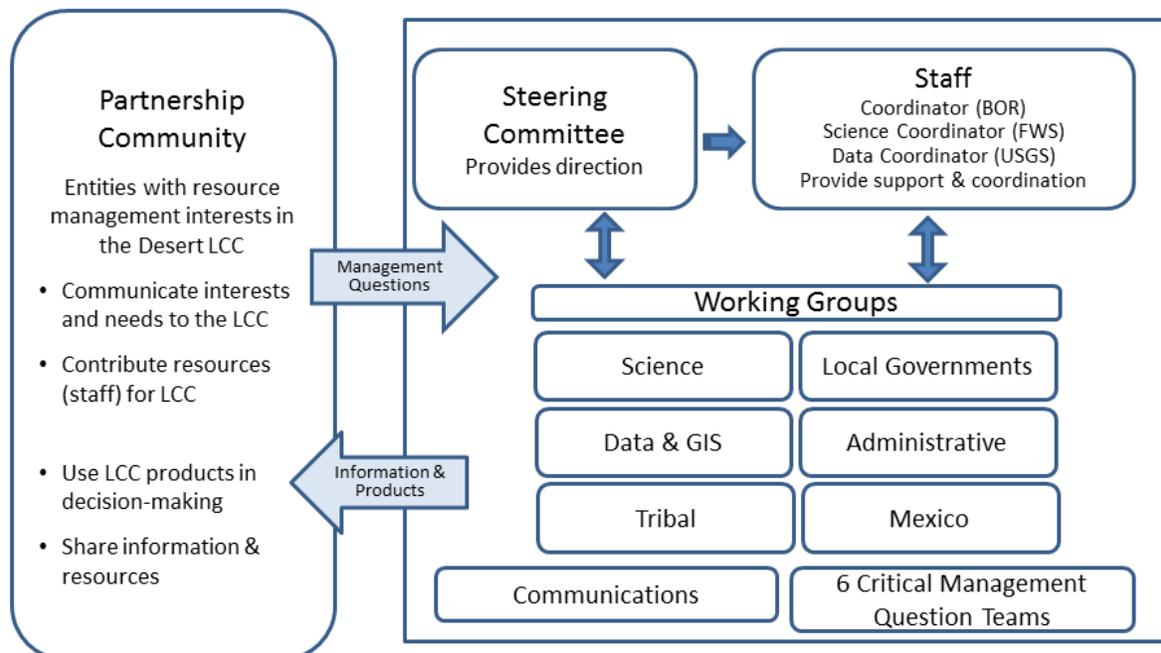
- **Monitoring and Evaluation**

Provide expertise and opportunities to enhance and add value to climate change and other monitoring programs of various partners through such activities as coordinated data collection, data analysis and information management, and data dissemination, when such actions are mutually agreed to by the partners involved.

- **Outreach and Education**

Provide information and application tools that educate and apprise resource managers and the public about the effects of climate change and ecosystem stressors.

Participants in the Desert LCC may serve as Steering Committee members, on working groups, on critical management question teams, or as interested partners (see figure below).





December 2013 Steering Committee meeting, from left to right, back row: Sally Holl, Armand Gonzales, Duane Pool, Jeff Raasch, Louise Misztal, David Palumbo, James Leenhouts, Aimee Roberson. Center row: John Longworth, Genevieve Johnson, John Stewart, Stephanie Dubois, Esther Rubin, Amy Heuslein. Front row: Dana Roth, Robert Mesta.

The Desert LCC Steering Committee is composed of leaders from 25 agencies and organizations representing diverse conservation and resource management interests. The Steering Committee serves as the executive body for decision making to accomplish the Desert LCC mission. Members develop the vision, goals and priorities of the Desert LCC and promote communication, coordination, and collaboration relative to activities and functions. They provide leadership, direction and guidance to the coordinators and working groups.

The Science Working Group has the primary responsibility for coordinating input on science and information needs. They recommended priority needs to the Steering Committee using a process of soliciting Critical Management Questions (CMQs) of relevance to our partners. The Science Working Group has expanded its membership through the formation of six **CMQ Teams** that act as applied science think tanks to collaboratively solve problems that are too complex for any one natural and cultural resource manager to solve alone.

The Mexico Working Group has the primary responsibility for supporting the development of Desert LCC conservation initiatives in Mexico: facilitating partner input and participation; initiating and maintaining coordination on LCC bi-national projects and programs; and coordinating outreach and education strategies in Mexico, which includes translation of Desert LCC documents into Spanish.

The Data & GIS Management Working Group has the primary responsibility for identifying existing resources of GIS mapping and other data, and for developing a strategy for making data accessible to Desert LCC stakeholders.

The Local Governments Working Group has the primary responsibility for facilitating local government input and participation and coordinating outreach and education strategies in relation to local governments.

The Administrative Working Group has the primary responsibility for proposing revisions to the Desert LCC Governance Document and Operations Plan and for developing the Annual Work Plan and Annual Report. The Administrative Working Group will provide overall sideboards and guidance for working groups' scope and structure, including effective engagement with the Steering Committee.

The Tribal Working Group has the primary responsibility for leading outreach and coordination with the 27 Desert LCC tribal communities. They will help facilitate tribal perspectives and support the other standing working groups in integrating specific tribal needs.

The Communications Working Group has the primary responsibility for creating the Desert LCC Communications Plan. They will help facilitate implementation of the plan and support the Desert LCC in identifying specific communication needs.

Our Approach and Operational Philosophy

Over the last year, we have worked to bring science and management together by identifying six questions of critical management importance to our partners. These Critical Management Questions (CMQs) serve as the foundation for establishing shared goals across our desert landscape. The Desert LCC is working to collectively impact the sustainable management of our cultural and environmental resources by bridging the gaps between different sectors and disciplines.



Desert tortoise

We operate on the philosophy that to create lasting results, effective collaboration must incorporate both human and ecological considerations. To support this process, we have increased and leveraged our human and financial resources for conservation efforts that reflect our CMQs. In 2013, we also established a process to coordinate GIS and data management activities, linking theory and practice through dialogue and deliberation. Our teams and working groups are identifying barriers to effective collaboration, and we share experiences so that we can effectively develop management tools and science that allow managers to respond to a changing climate and other landscape-level stressors. By identifying opportunities to coordinate and integrate the efforts of our separate organizations and conservation initiatives, we strengthen and magnify our ability to have collective impact on our desert landscape in a way that matters to people.

2013 Accomplishments

In 2013, the Desert LCC's Steering Committee, Working Groups, and CMQ teams met regularly, either in person or by teleconference, to move our mission and goals forward. The following is a compilation of some of the key accomplishments of the Desert LCC and our partners. We share these with admiration and gratitude to all who have contributed to the Desert LCC's successful year.

Collaboration and Communication

In January 2013, the Desert LCC Steering Committee adopted six Critical Management Questions (CMQs) that define the Desert LCC's niche within the conservation community and meet the collective science priorities of our conservation partners. The Desert LCC Science Working Group made these recommendations to the Steering Committee after developing a collaborative approach to solicit and prioritize our partners' critical issues as they related to the Comprehensive Science Needs Assessment completed in June 2012.

The Science Working Group started with 60 questions collected from partnerships and programs across the Desert LCC landscape. They prioritized questions that:

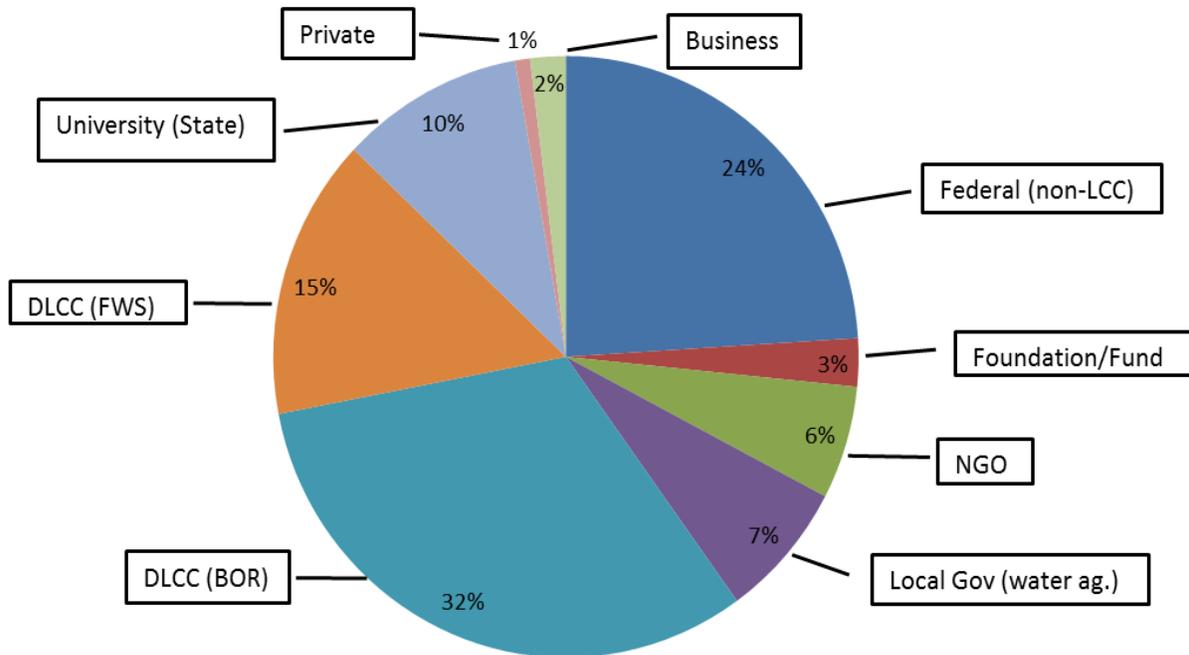
- have broad relevance across the full Desert LCC geography and among many conservation partners;
- relate to one or more of the science priorities in the Comprehensive Science Needs Assessment; and
- provide an opportunity to directly inform on-the-ground decisions and actions led by conservation design and delivery partnerships or programs.

These CMQs address urgent management issues of relevance to multiple partners and focus on aquatic, riparian, and grassland ecosystems and species that are sensitive to climate change.

The Science Working Group and the Steering Committee quickly recognized that we would need to seek input from additional scientists and managers to handle the workload and acquire the expertise needed to answer these questions. To address this issue, we built collaborative, interdisciplinary CMQ teams that function as applied-science think tanks. To date, the Desert LCC has more than 100 committed and talented scientists and managers working across our landscape to help solve problems too complex for individual managers to solve alone. Their names and organizations appear at Appendix 1. The science and tools that are being developed by these teams will inform landscape conservation design and delivery.

To meet the needs addressed in the CMQs, the Desert LCC funded 11 applied-science projects in 2013. The U.S. Fish and Wildlife Service (USFWS) provided \$360,009 and Bureau of Reclamation (Reclamation) provided \$757,497 in project funding. In addition, the Desert LCC was able to leverage the work of our partners, who contributed more than \$1.25 million to help fund this work that meets our collective needs (see figure below).

Total 2013 Desert LCC Funding for Science = \$2,375,977



In April 2013, the Desert LCC held a Steering Committee meeting to promote collaboration among our partners. At this meeting, the Steering Committee approved the charter created by the Local Governments Working Group. This Group provides an avenue of communication for discussing local government activities and perspectives related to landscape-scale conservation, as well as disseminating relevant science and information that helps meet LCC goals.

The Steering Committee also approved the **Communication Working Group's** Desert LCC Communications Plan. The Plan identifies key Desert LCC audiences, communication resources, communication objectives and messages associated with each LCC goal, and specific tasks to move towards accomplishing our goals. This past year, we focused on creating a new Desert LCC website (www.usbr.gov/dlcc) to expand access to information about critical science and partner efforts. We've engaged partners by creating forums and channels for information sharing and idea exchange by using collaborative online tools, such as Google Apps, Confluence (<https://my.usgs.gov/confluence/display/DLCC/Desert+LCC+Collaboration+Home>), and a YouTube channel (<http://www.youtube.com/user/DesertLCC>). We began translating key Desert LCC materials, such as our CMQs, into Spanish to increase outreach to our partners in Mexico (<http://www.usbr.gov/dlcc/science/docs/2013/DLCCCMQs-handoutSPA.pdf>).

At the December 2013 Steering Committee meeting, we brought greater clarity to our communications efforts by focusing on our unique identity as an LCC and considering how we as partners might leverage that to have collective impact. This identity work will help us as we

implement our Communications Plan by driving member and partner understanding, engagement, and advocacy.

We thank **Meredith Fleener**, California Department of Fish and Wildlife, for volunteering her time to work with our Communications Working Group and for designing a logo for the Desert LCC, which appears on the front of this document. This contribution from our partner was critical in helping the Desert LCC promote a public identity for our work. Meredith said “I was so excited when approached to help develop the logo for the DLCC. What a great opportunity to collaborate with various groups and organizations to help create something that would reach so many people! Brainstorming ideas really helped shape the direction of where we wanted to go, and having people from so many different backgrounds and perspectives enabled us to consider ideas that otherwise would never have surfaced. We worked hard to separate the good from the great, and I am very proud of the result and appreciate the chance I had to be involved in this process.”



The Steering Committee also committed additional resources to ensure the success of the CMQ teams this year. Each CMQ team created a work plan to track efforts and success in meeting the needs of our partners. Steering Committee members agreed to sponsor CMQs that are highly relevant to their agency or organization (see table below). As a CMQ sponsor, the Steering Committee member helps ensure the groups are on track and that they have the necessary resources to accomplish their tasks. In July, the Steering Committee reviewed CMQ team composition and approaches for meeting the goals of each CMQ with the intent of ensuring that work of the CMQ teams links back to management decisions and that we consider the influence of social and economic concerns on the management questions.

| Critical Management Question | Steering Committee Sponsors |
|--|--|
| 1: Environmental Flows and Climate Change | Bob Davis, U.S. Forest Service David Palumbo, Bureau of Reclamation |
| 2: Monitoring Species/Processes Relative to Climate Change and Related Threats/Stressors | Armand Gonzales, California Department of Fish and Wildlife Dana Roth, U.S. Fish and Wildlife Service |
| 3: Grassland/Shrubland Restoration and Management | Mary Gustafson, Rio Grande Joint Venture Robert Mesta, Sonoran Joint Venture |
| 4: Physiological Stress Due to Climate Change | Mary Gustafson, Rio Grande Joint Venture |
| 5: Changing Wildfire Regimes and Riparian Ecosystems | Julie Decker, Bureau of Land Management Louise Misztal, Sky Island Alliance |
| 6: Reptiles/Amphibians Sensitivity to Climate Change | Benjamin Tuggle, U.S. Fish and Wildlife Service |

In September 2013, the Steering Committee agreed to explore the role of the Desert LCC in addressing the National Fish, Wildlife, and Plants Climate Adaptation Strategy (<http://www.wildlifeadaptationstrategy.gov/>) and to report on alignments between the Strategy and the current activities of the Desert LCC. The Committee agreed to refer to the Strategy in developing future work plans for the LCC and to help facilitate a climate adaptation strategy by providing a forum for dialogue in the Southwest.

The Science Working Group and six CMQ teams met in December to discuss actions and make recommendations on science projects for 2014. Their recommendations were approved by the Steering Committee at its December meeting. Science Coordinator Aimee Roberson reported that the face-to-face meeting accomplished six months' work in two days, noting the value of ongoing communication and in-person meetings. The meeting also revealed synergies and overlap in the CMQs that are emerging from ongoing dialogue with managers and experts.



Science Working Group and Critical Management Question Team members, from left to right, back row: John Arnett, Wayne Robbie, Maaike Schotborgh, Jeff Bennet, Jon Karges, Jeff Raasch, Carol Beardmore, Alfonso Sanchez-Munoz, Duane Pool, Noe Santos, Jim Weigand, Gerardo Bezanillo. Front row: Suzan Klein, Julie Shapiro, Dana Roth, Debra Hughson, Sally Holl, Aimee Roberson.

The Steering Committee elected a new Chair, Armand Gonzales, California Department of Fish and Wildlife, and Vice-chair, Robert Mesta, Sonoran Joint Venture. We thank our out-going Chair, Duane Pool, Rocky Mountain Bird Observatory, for his service and leadership in guiding the LCC over the past two years. As Armand Gonzales assumed the 2014 Chair, he acknowledged how he is benefitting from Duane Pool's hard work.

The Steering Committee supported the GIS Working Group's data management recommendations. This document outlines actions and considerations in establishing a data management framework for the Desert LCC and for sharing Desert LCC-supported science.

The Steering Committee also approved the Mexico Working Group Charter. The Mexico Working Group was established by the Desert LCC Steering Committee to address the additional coordination needs required to engage and maintain Mexico as a full-time partner.



Genevieve Johnson, Coordinator, thanking Duane Pool, out-going Chair

Climate Science Centers and Neighboring LCC Collaboration

The Desert LCC has actively promoted national collaboration and coordination with the LCC Network. Kevin Johnson, **Southern Rockies LCC** Coordinator, showcased their process of using conservation focus groups to explore five priority resources, including cultural resources, mule deer and elk, native fish, sage grouse and stream flows. The Desert LCC Steering Committee noted the similar approach between our LCCs in focusing on key topics of priority to partners and agreed that a next step would be to further develop indicators of success in addressing these priorities.

Ken McDermond, **South Atlantic LCC** Coordinator, and Rua Mordecai, South Atlantic LCC Science Coordinator, presented their *Conservation Blueprint* for landscape conservation and the expert/stakeholder process it has used to identify shared objectives (goals, indicators, and targets including natural, cultural and socioeconomic resources); evaluate indicators; and develop a spatially explicit plan for meeting objectives. It is anticipated that the Blueprint will have broad application, including for decisions related to funding programs. The SA LCC is determining how it will report progress on meeting indicators as a collective. The Desert LCC Steering Committee noted the importance of having a map product that showcases the work of the SA LCC and would like to further explore how to incorporate some of the SA LCC's process into the Desert LCC's work in the next couple of years.

Steve Jackson, **Southwest Climate Science Center**, described the Center's overall vision to foster collaboration between research managers and scientists and how they developed their research priorities by cross-walking research themes with stakeholder information needs. He also described their inventory and assessment of mission-relevant research projects to avoid

duplication and identify gaps. The Desert LCC Steering Committee was interested in how the Desert LCC could similarly depict our research with our partners' information needs.

The Steering Committee approved LCC Coordinator Genevieve Johnson and Science Coordinator Aimee Roberson to represent the Desert LCC on the **Southwest and South Central Climate Science Center** (CSC) Stakeholder Advisory committees. Genevieve attended a Southwest CSC meeting in June, where the committee agreed on the importance of coordinating the science needs and projects from the LCCs and the other CSCs with the Southwest CSC Science Plan. Genevieve and Aimee also attended science planning meetings for the South Central CSC. As a result of these interactions, the science needs of the Desert LCC have been incorporated into the South Central CSC Science Plan and thematically addressed in the Southwest CSC Science Plan. The coordinators and the CSC staff continue to work closely to ensure we are collectively identifying and addressing the relevant and critical climate science needs of our partners.

Science Development and Delivery

In coordinating the relationships, processes, and capacity to successfully answer Critical Management Questions, we have relied on our partners to work in interdisciplinary, multi-organizational teams that engage managers and experts from various sectors of the conservation community. Developing these “applied-science think tanks” has increased the capacity needed for integrated problem-solving among diverse partners. These focused efforts are producing information and decision support tools that resources managers need to address large scale stressors, such as climate change. These teams are working together to:

- assess and understand needs related to the CMQs;
- develop and support opportunities to collaborate on new applied-science research;
- develop and advance new science products and decision support tools; and
- inform and communicate with a broad group of managers and experts throughout this process.

Critical Management Question 1: Environmental Water Flows and Climate Change

The interactions of climate change, water management, habitat and human needs are highly complex, and these issues are pervasive across the Desert LCC. The challenges and solutions vary based on the scale, setting, and goals of each particular situation. While there have been many efforts to date that establish water need requirements to support healthy ecosystems, consideration of climate change introduces new challenges and uncertainties. Water is a precious

CMQ 1

What are successful strategies and methodologies for evaluating and implementing recommendations for environmental flows and associated water levels? How can managers effectively integrate information into these recommendations about hydrologic responses to climate change and the influence of this on ecosystems and species? What are viable management options to increase resiliency of ecosystems and species and help them adapt to climate change?

commodity in desert environments, and a changing climate is likely to further strain the resource.

To address this critical need, the CMQ 1 team is focusing on strategies and methodologies for evaluating environmental flows and providing recommendations that integrate information related to climate change. The team has reviewed related environmental flow quantification efforts, and is evaluating the associated needs and challenges. They will offer recommendations for improving environmental flow science and making the information relevant and available for resource managers to use in adaptive management decision-making. The team is identifying opportunities for transferring valuable scientific knowledge, data, technology, or decision support tools that can be applied to specific geographical locations, such as the Rio Bravo and the Colorado River, within the Desert LCC. The goal is to develop a Desert LCC-wide environmental water needs database and a methodology guidebook for environmental flows that considers climate change.

Science Funded in 2013 to meet CMQ 1 Needs

Developing a Geodatabase and Geocollaborative Tools to Support Springs and Springs-dependent Species Management in the Desert LCC (Museum of Northern Arizona -Springs Stewardship Institute)

Springs are among the most biologically diverse and culturally important ecosystems on Earth, supporting an estimated 20 percent of the nation's endangered species, and a vast, poorly known array of rare species and cultural resources (Stevens and Meretsky 2008). Most Native Americans on the Colorado Plateau consider springs to be sacred. Springs also are important as historical sites, and to federal, state and local resource managers as water sources for administrative operations, cities and towns, wildfire control, critical aquatic habitat, and recreation. Land managers have begun to recognize the need for accurate, accessible information on springs distribution, ecological integrity, the rare species they support, and the risks to these resources presented by climate change and other ecological stressors. Improving stewardship requires understanding springs distribution, condition, uses, and threats. The conspicuous lack of basic springs mapping data renders management efforts for these irreplaceable resources erratic and incomplete.

Dr. Lawrence Stevens, Museum of Northern Arizona - Springs Stewardship Institute, is working to provide land managers with comprehensive, current information regarding springs distribution and springs-dependent species across the US areas of the Desert LCC in a secure, accessible, and user-friendly format that will

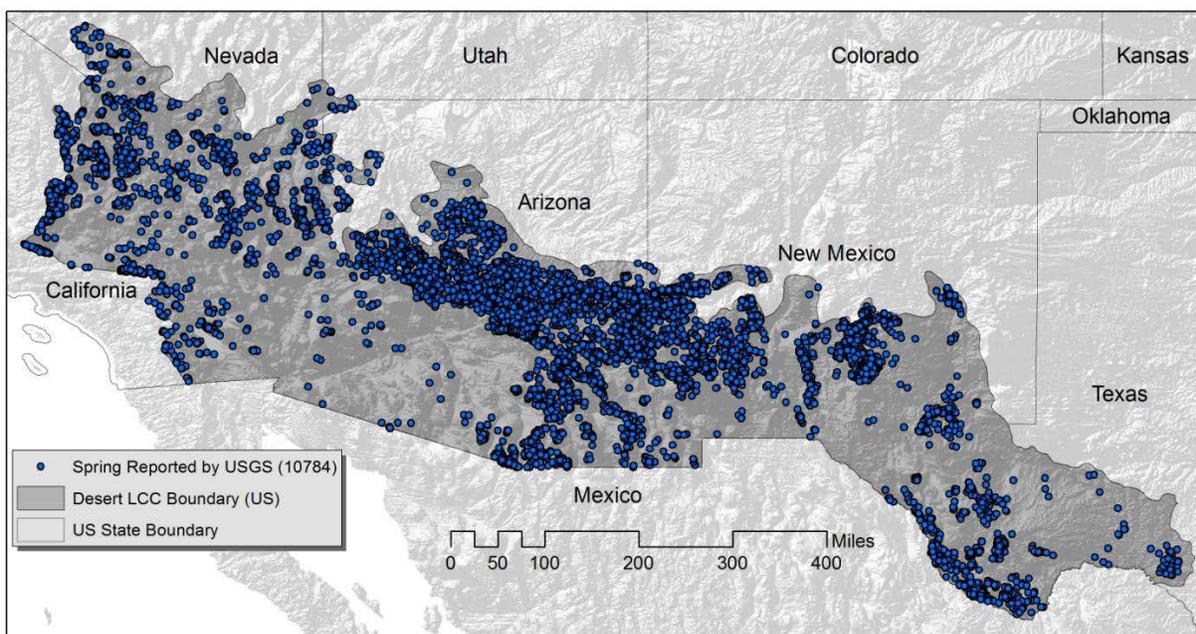
Supporting Partners:

Arizona Game & Fish Department
 National Park Service, Grand Canyon
 National Park Service, Southern
 Colorado Plateau Inventory &
 Monitoring Network
 U.S. Forest Service, Spring
 Mountains National Recreation
 Area
 U.S. Forest Service, Kaibab National
 Forest
 Northern Arizona University,
 Landscape Conservation Initiative
 Hualapai Tribe
 Hualapai Department of Natural
 Resources
 Grand Canyon River Guides
 Sky Island Alliance
 NatureServe
 Bureau of Land Management,
 Safford
 Private, S. Scannell
 ESRI Conservation Program
 Christensen Fund
 Prescott College
 Stevens Ecological Consulting, LLC
 J. Ledbetter, MGIS

allow for analysis of springs ecosystem vulnerability to land management practices and climate change.

This project will provide resource managers in the U.S. areas of the Desert LCC with information and collaborative tools designed to identify and effectively manage springs resources. This project will 1) compile existing springs-related information and make it available online through secure web mapping services; 2) develop a list of interactive online maps of springs-dependent sensitive plant and animal species; 3) develop an outreach and training program for tribes, agency staff, students, and nongovernment organizations throughout the U.S. portion of the DLCC in the use of these geocollaborative tools; and 4) demonstrate the application of these tools through development of a climate change risk assessment model to improve prediction and decision support about climate change impacts.

Springs in the Desert LCC within the United States



The NHD geodatabases contain 10,784 springs within the US portion of the Desert LCC boundary, with more than half located in Arizona (USGS 2013, US FWS 2011).

Predicting Snow Water Equivalence (SWE) and Soil Moisture Response to Restoration Treatments in Headwater Ponderosa Pine Forests of the Desert LCC (Northern Arizona University)

The U.S. Forest Service, through the Four Forest Restoration Initiative (4FRI) will be treating hundreds of thousands of acres of ponderosa pine forest along the Mogollon Rim of Arizona to promote a healthier and more resilient forest ecosystem. One of 4FRI's desired conditions is for

Supporting Partners:

U.S. Forest Service, Rocky Mountain Research Station
Northern Arizona University, Centennial Forest

thinning and burning to create within-stand openings that “promote snowpack accumulation and retention which benefit groundwater recharge and watershed processes at the fine (1 to 10 acres) scale.” However, little is known about how these openings created by restoration treatments affect snow water equivalence and soil moisture, which are key parts of the water balance that greatly influence water availability for healthy trees and for downstream water users in the Sonoran Desert.

Understanding key relationships between the patterns of restored forest and snow water equivalence of snowpack and subsequent soil moisture is critical to inform adaptive management so that restoration treatments can better enhance soil water storage and promote healthier and more resilient trees.

Dr. Temuulen Sankey and Frances O’Donnell, Northern Arizona University, are coupling remotely sensed satellite data with field measurements and geostatistical analysis to model relationships among forest pattern, topography, snow water equivalence, and soil moisture in the Verde River basin of northern Arizona. The outcome will enable predictions of snow water equivalence, and soil moisture response to forest restoration treatments. This project will also identify treatments that are optimal from a water-balance perspective for sustaining water availability for plants as well as downstream water users in Verde Valley and the Phoenix metropolitan area.

A Study of Climate Change Impacts on Water Quality and Internal Nutrient Recycling in Lake Mead, Arizona-Nevada (Southern Nevada Water Authority)

Ecosystems provide a wide range of services that are important to human wellbeing, including economic benefits, protection of human health and safety, and support of recreational or aesthetic enjoyment. Water quality is one critical ecosystem service that impacts our drinking water, as well as recreational opportunities and quality of habitat for wildlife. Previous work has identified that warmer water temperatures arising from climate change will lead to lower dissolved oxygen levels in Lake Mead, Arizona-Nevada and, subsequently, increases in release of nutrients from the sediments. Increased internal nutrient recycling may ultimately have serious and significant impacts on the water quality and trophic status of Lake Mead and downstream Colorado River stakeholders, and on other lakes within the Desert LCC geographic area.

Dr. Todd Tietjen, Southern Nevada Water Authority, is building on previous modeling efforts by including and examining the effects of internal nutrient recycling to understand how water quality characteristics in Lake Mead may change under future climate conditions. This project is addressing gaps in current knowledge regarding climate change impacts on lake and reservoir water quality and how beneficial uses of those waters are likely to be impacted. The project will also provide an understanding of anticipated changes to raw water quality that will affect drinking water treatment.

Supporting Partners:

City of Henderson
Nevada Department of
Conservation and Natural
Resources
City of Las Vegas Public Works
Department
Metropolitan Water District of
Southern California

The proposed project enhances the management of natural resources in the Desert LCC by informing managers dependent upon Lake Mead and the Lower Colorado River because organizations with water supply responsibilities will be able to evaluate the likely quality of raw water in the future and plan for infrastructure or treatment changes to mitigate these future changes. Additionally, organizations that discharge into Lake Mead or the Lower Colorado River can use the model results to assess whether target nutrient loads for the point-source discharges may have to be reduced to offset the increased internal nutrient loading driven by climate change. In addition, recreation and ecosystem managers on the Colorado River can use information from this effort to guide their efforts with regard to endangered species management, impediments to recreation, and water contact suitability.

Managing Water and Riparian Habitats on the Bill Williams River with Scientific Benefit for Other Desert River Systems (U.S. Army Corps of Engineers)

The importance of riparian ecosystems in semiarid and arid regions has generated interest in understanding processes that drive the distribution and abundance of dominant riparian plants. Changes in streamflow patterns downstream of dams have profoundly affected riparian vegetation composition and structure. For example, in the Southwestern United States, flow regulation has contributed to the replacement of many riparian forests historically dominated by the native *Populus fremontii* (Fremont Cottonwood) and *Salix gooddingii* (Goodding's Willow) by the exotic species *Tamarix spp.* (Salt Cedar).

Restoring natural processes downstream of dams through controlled flow releases (“environmental flows”) is a recommended approach to restore native riparian vegetation, including cottonwood and willow forests (Rood et al. 2005; Merritt and Poff 2010; Shafroth et al. 2010). Nevertheless, little attention has been placed on development and testing of flexible computer simulation tools that water managers could readily use to plan and optimize environmental flows while balancing other water management needs.

John Hickey (USACE), Andrew Hautzinger (USFWS), Steven Sesnie (USFWS), Patrick Shafroth (USGS), and Dick Gilbert (USFWS) are helping to guide reservoir release decision making to enhance downstream recruitment of native cottonwood and willow stands below Alamo Dam on the Bill Williams River in Arizona.

The goals of this project are to: 1) codify flow-ecology relationships for riparian species of the Bill Williams River as operational rules for water managers, 2) test rules under different climate scenarios, and 3) revise rules as needed to mitigate the effects of climate change such that rules will allow responsible and adaptive management of water and riparian habitats.

Supporting Partners:

U.S. Fish and Wildlife Service
U.S. Geological Survey
Bill Williams River Corridor
Steering Committee (AZ
Game & Fish Department, AZ
State Parks, U.S. Army Corps
of Engineers, (USACE),
Bureau of Land
Management, U.S. Fish and
Wildlife Service (USFWS),
City of Scottsdale, The
Nature Conservancy, Bureau
of Reclamation)

The project builds on more than 20 years of partnership-supported flow-biota science, and represents a significant contribution to management-driven questions associated with how dam operations can be optimized to benefit water-dependent ecological resources while meeting other project purposes such as flood control, and water quantity and quality requirements in the context of a changing climate.

Development of a Decision Support Tool for Water and Resource Management Using Biotic, Abiotic, and Hydrological Assessments of Topock Marsh (U.S. Geological Survey Fort Collins Science Center)

Topock Marsh is a large wetland adjacent to the Colorado River and main feature of Havasu National Wildlife Refuge in southern Arizona. In 2010, U.S. Fish and Wildlife Service and Bureau of Reclamation began a project to improve water management capabilities at Topock Marsh and protect habitats and species. Initial construction required a drawdown, which caused below-average inflows and water depths in 2010-2011.

Monitoring of Topock Marsh during the drawdown and immediately after provided information on *immediate* effects, however, stress from the drawdown may have a delayed effect on aquatic resources. Additionally, significant changes to the infrastructure and water operations have since occurred.

Dr. Joan S. Daniels, USGS FORT, is building upon FORT's previous work by providing an assemblage of biotic, abiotic, and hydrologic data needed to better understand the health and function of Topock Marsh under various hydrologic conditions. This project will develop a Decision Support System using a spatially-explicit GIS package of historical data, habitat indices, and analytical tools to synthesize outputs for hydrologic time periods. This project integrates ecological and hydrologic information into a GIS-based decision framework to assist managers in making more informed decisions about effective water management strategies and identifying related sensitive species and processes.

Supporting Partners:

U.S. Fish and Wildlife Service,
Southwest Region

U.S. Fish and Wildlife Service,
Havasu National Wildlife

Critical Management Question 2: Monitoring Species/Processes Relative to Climate Change and Related Threats/Stressors

Monitoring of species and processes is required to understand the effects of threats/stressors on species and ecosystems, effectiveness of management actions, and hypothesis testing related to whether the selected monitoring targets are effective indicators. Due to limitations on human and financial resources, the species and processes to be monitored must be carefully selected. The CMQ2 Team determined that because CMQ 2 is so wide-ranging, it is important to first identify which threats or stressors are of high priority and coalesce effort around a common understanding and language related to those threats and/or stressors. Team members agreed that the focused/prioritized set of stressors should drive the selection of species or processes to recommend for long-term monitoring.

The CMQ 2 Team has prioritized a list of threats and stressors related to climate change using *A Standard Lexicon for Biodiversity Conservation: Unified Classifications of Threats and Actions* (Salafsky et al., 2008). This document merges separate efforts into unified classifications of threats and actions that affect biodiversity in order to describe work and learn from one using agreed-upon terms and definitions.

Using nine criteria to score Salafsky Level 2 threats, the team prioritized the following list of threats and stressors for the Desert LCC:

- Fires and fire suppression
- Habitat shifting and alteration
- Drought
- Indirect ecosystem effects (fragmentation and isolation)
- Temperature extremes
- Invasive, nonnative/alien species
- Dams and water management/use
- Renewable energy
- Storms and flooding
- Livestock, farming and ranching

CMQ 2

What species and ecological processes are sensitive to climate change and other large scale stressors and/or threats (e.g., water management, invasive species, altered fire regime, wind erosion) and can be effectively monitored to understand the overall effects of these stressors on ecosystems, habitats, and species, thus helping managers detect, understand, and respond to these changes? What are the best monitoring designs and protocols to detect changes to these processes and species at temporal and geographic scales suitable for providing adequate and reliable metrics?

The team will next identify species and ecological processes that are sensitive to these threats and stressors and which can be monitored effectively to understand the effects of these and to evaluate the effectiveness of adaptation. After species and/or processes have been selected, the team will gather information to determine what are the best monitoring designs and protocols to detect changes to these processes and species at temporal and geographic scales suitable for providing adequate and reliable metrics.

Science Funded in 2013 to meet CMQ 2 Needs

Reducing Uncertainty Regarding Impacts of Climate Change on Biodiversity in the California Desert (University of California Riverside's Center for Conservation Biology)

Dr. Cameron W. Barrows, University of California Riverside's Center for Conservation Biology, has begun a partnership with Joshua Tree National Park aimed at reducing the unknowns associated with climate change and sustaining biodiversity. This project will provide direction about the uncertainty and how to prepare for it by identifying resources that can be effectively

Supporting Partners:

National Park Service, Joshua Tree National Park

monitored to understand the effects of environmental change brought on by stressors, including climate change. These data will reduce uncertainty and enable managers to take appropriate steps to reduce the effects of those stressors. The project will 1) identify gaps in focal species coverages and add additional monitoring stations to ensure the focal species are being adequately

tracked; 2) define monitoring methods/protocols to be employed at the monitoring stations; 3) field test the species/natural community protocols for efficiency and effectiveness; 4) facilitate citizen science participation; 5) begin pilot monitoring with citizen scientists; and 6) design and populate the database structure for archiving the collected monitoring data. Longer-term outcomes will come from citizen scientists acting as advocates for the scientific process to answer complex questions about climate change.

An Ecosystem Conservation Assessment for the lower San Pedro Watershed in Arizona (University of Arizona)

Dr. Scott Wilbor, University of Arizona, is conducting an ecosystem conservation assessment for the lower San Pedro watershed. The assessment will provide a science-based landscape conservation design for prioritizing where conservation efforts are most needed for high-value biodiversity conservation and offer insights on conservation actions practical for implementation. The assessment will include an evaluation of high-value biodiversity, hydro-ecological processes, protected areas, landscape connectivity, and climate change adaptation. The study will suggest approaches for developing a new conservation

Supporting Partners:

U.S. Fish and Wildlife Service,
Southwest Region
Lower San Pedro River
Collaborative Conservation
Initiative

framework for watershed conservation planning.

Protection areas and especially landscape connectivity design will consider climate change adaptation and ecosystem ecological processes. Local landowners will provide input on conservation priorities, fostering a “working landscape” approach to implementation actions. This methodology for ecosystem conservation design can then be exported to other watersheds where land uses are diverse, acreage for protected areas is limited, climate change requires adaptation strategies, and private landholder perspectives and support of conservation actions are critical.

Critical Management Question 3: Grassland and Shrubland Management

Arid grasslands and shrublands are vital ecosystems within the Desert LCC and stretch from Canada to Mexico. The CMQ 3 team identified the need to strengthen the network of conservation professionals working on arid grassland and shrubland conservation. They have worked to improve understanding of the definition and locations of grasslands that are resilient or have high potential for restoration and to identify related information gaps to improve the sustainable management of grasslands and shrublands through integrated conversations with managers and scientists. They are prioritizing needs related to landscape conservation design, taking into account the social and economic importance of these landscapes. In doing so, the team will identify on-the-ground opportunities to collaborate on grassland science and conservation.

The CMQ 3 Team determined that a significant quantity and quality of data related to grasslands and shrublands already exists for the United States,, whereas less data is available related to Mexico grassland geography, ecological state, and management. They determined, therefore, that developing additional information and maps of Mexico grasslands is a high priority for the Desert LCC in 2014, along with the creation of better information and tools to increase the usefulness of existing grasslands and shrublands data from both the United States and Mexico. The Desert LCC will work to integrate these data and tools to promote enhanced grassland management and restoration/rehabilitation across the Desert LCC geography.

The team is also developing a process for shared conservation targets and indicators as a mechanism for identifying and targeting habitat conservation and measuring success. This will

CMQ 3

What and where are the greatest threats to native desert grassland and shrubland conservation targets (e.g., endangered species, migratory birds, other species of concern)? Where are desert grassland and shrubland habitats resilient and where are priority areas with high potential for restoration? What are the most appropriate management and restoration techniques for desert grassland and shrubland habitats for conservation targets, site-specific conditions (e.g., soil type, precipitation, elevation, slope, invasive species), and socio-economic constraints?

provide a mechanism for linking the explicit values of landowners to intrinsic values of ecosystems.

Science Funded in 2013 to meet CMQ 3 Needs

Remote Sensing to Segregate Grass and Shrub Mixed Habitats in Janos Grassland Priority Conservation Area (Rocky Mountain Bird Observatory)

Grassland and specifically desert grasslands often contain a mix of shrub and grassland. Grassland endemic species from herptiles to birds are attracted to different proportional mixes of grassland and shrub. Density and overwinter survival have also been correlated with percent shrub cover in grasslands. Grassland land cover classifications lose accuracy in grassland habitats with less than 20% shrub, however for many species, it is specifically these low shrub grasslands that are their preferred habitats and the level of shrub component in this landscape can significantly influence habitat suitability.

Supporting Partners:

Sonoran Joint Venture
Sky Island Alliance

Dr. Greg Levandoski, Rocky Mountain Bird Observatory, is using a pilot area, the Janos Grassland Priority Conservation Area (which contains the majority of the Janos Biosphere Reserve) to identify the best techniques for decomposing grass-shrub intermix at low densities and to identify the best approaches for large scale application of remote sensing to classify the desert grasslands and shrub lands.

This project will provide a land cover database that is consistent across the Desert LCC and provides sufficient class resolution with regard to grassland and shrub mixtures to assess, plan, and target habitats for upland species. This project will provide a process and class signatures so that as partner capacity becomes available, neighboring grasslands can be efficiently and sufficiently classified in unison with this product.

Critical Management Question 4: Physiological Stress of Climate Change

The CMQ 4 team has worked diligently this year to ensure that the necessary expertise in the physiological impacts of climate change on a variety of species – including birds, mammals, reptiles/amphibians, fish, and plants – is available to the Desert LCC. They have conducted outreach and educational efforts through a webinar about the state of the science, key science gaps/needs, and potential adaptation actions.

The team is communicating the importance of considering this emerging science to managers and other scientists and working towards developing

CMQ 4

What species will be impacted by physiological stress due to climate change (e.g., temperature, water) and to what extent? What adaptation strategies might be applied to lessen the impact?

management strategies to ameliorate the impacts of physiological stress on key species. Over the next year, they will conduct a literature review and work with managers to determine which species/species groups will be impacted by physiological stress. Next, they will develop and perform a vulnerability analysis on these species/species groups to determine which of these species will be most vulnerable to physiological stress from climate change and host a workshop with managers and physiology experts to develop appropriate management strategies.

Science Funded in 2013 to meet CMQ 4 Needs

Assessing Large-Scale Effects of Wildfire and Climate Change on Avian Communities and Habitats in the Sky Islands, Arizona (Rocky Mountain Research Station, U.S. Forest Service)

Rocky Mountain Research Station scientists initiated a study in the 1990s on avian distribution and habitat associations within the Sky Islands region. Since then, the region has been under increased stress from ongoing droughts and wildfires, likely associated with climate change.

Dr. Jamie S. Sanderlin, Rocky Mountain Research Station, is re-measuring vegetation and bird populations following wildfires and applying climate-change models to assess the effects of climate change and wildfire to provide strategies for managing resilient forests and conserving the avian community structure. This project will continue and expand citizen science efforts to develop a long term avian monitoring plan, as well as simulation studies to provide optimal monitoring designs for avian species to detect changes from large-scale stressors.

This study will provide viable management options to mitigate potential effects of climate change and provide predictive models to evaluate potential future effects of climate change on avian species. By evaluating what avian species are most vulnerable to climate change and wildfire, the project will determine appropriate temporal and spatial sampling designs for effective monitoring and provide adaptation and management strategies to lessen the impact.

Supporting Partners:

U.S. Forest Service,
Southwestern Region
Arizona Game and Fish
Department

Critical Management Question 5: Changing Wildfire Regimes and Riparian Habitat Management

Trends suggest increasing fire size, frequency, and severity in riparian ecosystems in the Desert LCC region could affect a range of ecosystem services due to altered ecological structure, function, and resilience. While other partnerships and efforts are focused on changing wildfire regimes in upland ecosystems, there has been relatively little focus on this issue in riparian ecosystems. The Desert LCC is filling this knowledge gap through the efforts of our CMQ 5 team.

The CMQ 5 team is identifying science and management practices to better quantify the magnitude and scale of this issue and to help inform and mitigate potential threats from changing wildfire regimes to biodiversity and ecosystem function and services. Specifically, the team is identifying priority science needs related to how altered fire regimes are affecting riparian habitats already impacted by altered hydro-ecological function, exotic species, and climate change. They will be identifying land stewardship practices can be used to reduce future wildfire impacts to riparian ecosystem resources.

CMQ 5

Under what conditions or circumstances are changes in wildfire regimes (e.g., frequency, size, and severity), influenced by climate change, land use practices, and invasive species, likely to have significant impacts on the biodiversity and ecosystem function and services of riparian ecosystems? What management practices might be most effective for addressing changing wildfire regimes in riparian systems?

Science Funded in 2013 to meet CMQ 5 Needs

Fire and Water: Assessing Springs Ecosystems and Adapting Management to Respond to Climate Change (Sky Island Alliance)

Spring ecosystems are crucial resources for wildlife and plants, including a variety of sensitive, threatened and endangered water-dependent species, and for traditional human uses. Louise Misztal, Sky Island Alliance, is working to enhance the conservation and restoration of keystone springs in the Sky Island region by developing science- and conservation-based guidance to assist natural resource managers in effectively responding to expected climate changes and non-climate stressors on springs, including increased scarcity of water, prolonged drought, and catastrophic wildfires.

Sky Island Alliance is collecting new baseline information on previously unassessed springs in areas of high priority; cataloguing and analyzing effects of recent fires on springs ecology; developing springs monitoring approaches for detecting climate change impacts; and developing guidance and best management practices for protecting and restoring springs through publication of an Arizona Springs Restoration Handbook.

Supporting Partners:

Pima County
 U.S. Forest Service, Coronado
 U.S. Fish and Wildlife Service,
 Arizona Ecological Services
 National Park Service,
 Sonoran Desert Network
 Bureau of Land Management,
 Safford
 University of Arizona, Water
 Resources Research Center
 Museum of Northern Arizona,
 Springs Stewardship
 Institute

Specifically related to CMQ 5, this project will improve regional understanding of changing water availability and how changing fire regimes – particularly, increased size of high-severity burn patches and more intense precipitation events post fire – affect springs ecosystems. To accomplish this, new data will be collected on springs location, ecology and status using citizen science inventory and assessment methodologies.

Through this project, we will inform and enhance management of springs in the Desert LCC region, which will contribute to landscape-level resilience and promote climate change adaptation practices at the landscape scale.

Critical Management Question 6: Amphibians and Reptiles and Vulnerability to Climate Change

Herpetofauna provides an excellent indicator of changes to functioning of desert wetlands and uplands, particularly in regard to climate, fire, vegetation, and water supply. Departures in historical ranges and populations of common or widespread reptiles and amphibians are likely to be sensitive to cumulative effects of climate change and human alterations of desert landscapes. These species are of concern to a dedicated group of professional and amateur herpetologists. Organizing information from these many herpetologists (which they creating through research, modeling, and citizen science endeavors) may be a comparatively low-cost way to provide managers with cautions about the need to modify management practice to avoid impacts to species.

CMQ 6

What are the species of amphibians and reptiles that are currently considered not vulnerable but are likely to experience negative changes in their population sizes and/or extents of distribution due to future changes in climate, fire regime and water availability in the Southwestern deserts?

The CMQ 6 team is informing herpetofauna conservation and management decisions by highlighting the potential impacts of climate change and human change agents on this taxonomic group. This team is engaging a robust network of experts to identify a broad range of expert opinion on specific taxa. With the GIS Working Group, they developed an online tool that allows managers and scientists to contribute knowledge concerning the vulnerability of native amphibian and reptile species in the Mojave, Sonoran, and Chihuahuan deserts resulting from

effects of continuing climate change and human change agents
<https://my.usgs.gov/confluence/display/DLCC/Herpetology+Data+Request>).

Once data from the online survey has been analyzed, the team will frame and design an appropriate sensitivity analysis and vulnerability assessment for taxa. They will work with managers and experts to identify how land and resource management affects vulnerability of species and their habitats; and provide recommendations for actionable adaptive management to reduce vulnerability resulting from climate change, altered fire regimes, and water availability. The team is working with partners to specifically promote citizen science inventories, monitoring, and research that continuously inform the vulnerability assessments.

Science Funded in 2013 to meet CMQ 6 Needs

Landscape Connectivity of Isolated Water for Wildlife in the Sonoran Desert (Texas Tech University)

Dr. Kerry L. Griffis-Kyle and Dr. Nancy E. McIntyre, Texas Tech University, are working to enhance resource managers' abilities to manage isolated desert waters for various species of wildlife by evaluating landscape connectivity as a function of climate change and habitat quality. This project will provide a quantitative and predictive analysis of landscape connectivity for 20 focal wildlife species over the Sonoran Desert ecoregion. Focal species include most amphibians in the region due to their vulnerability to changes in ephemeral water, as well as those species of interest to managers (i.e., invasive species, game species and threatened and endangered species).

This work will identify areas of low connectivity, areas where connectivity could threaten the persistence of threatened and endangered species, and areas where connectivity is threatened by climate change. This work will identify opportunities for improving the management of desert wildlife, from large mammals to amphibians.

This research will identify current probable dispersal routes (i.e., habitat corridors) and current weak linkages in landscape connectivity for target species. By simulating wetland losses under projected climate change, the research will identify those corridors that are vulnerable to climate change and those corridors that are of high-value areas for current management or future restoration activities. By prioritizing waters according to their importance in maintaining overall system connectivity for wildlife and isolation for the invasive bullfrog, the researchers will create a prioritized list for conservation and management allocations.

Supporting Partners:

U.S. Fish and Wildlife Service,
Sonoran and Chihuahuan
Deserts
 U.S. Fish and Wildlife Service,
Kofa NWR
 U.S. Fish and Wildlife Service,
Cabeza Prieta NWR
 U.S. Fish and Wildlife Service,
Buenos Aires NWR
 Bureau of Land Management,
Sonoran Desert and New
Mexico
 National Park Service, Natural
Resources Stewardship and
Science, Water Resources
Division

This project will evaluate the following species:

Desert bighorn (*Ovis canadensis mexicana*)
 Mule deer (*Odocoileus hemionus crooki*)
 Sonoran pronghorn (*Antilocapra americana sonoriensis*)
 Masked bobwhite (*Colinus virginianus ridgwayi*)
 Gambel's quail (*Callipepla gambelii*)
 Colorado River toad (*Incilius alverius*)
 American bullfrog (*Lithobates catesbeianus*)
 Chiricahua leopard frog (*Lithobates chiricahuensis*)
 Lowland leopard frog (*Lithobates yavapaiensis*)
 Couch's spadefoot (*Scaphiopus couchii*)
 Plains spadefoot (*Spea bombifrons*)
 Mexican spadefoot (*Spea multiplicata*)
 Great Plains toad (*Anaxyrus cognatus*)
 Red-spotted toad (*Anaxyrus punctatus*)
 Sonoran green toad (*Anaxyrus retiformis*)
 Lowland burrowing treefrog (*Smilisca fodiens*)
 Western narrow-mouth toad (*Gastrophryne olivacea*)
 Arizona tiger salamander (*Ambystoma mavortium nebulosum*)
 Southwestern Woodhouse's toad (*Anaxyrus woodhousii australis*)
 Sonoran tiger salamander (*Ambystoma mavortium stebbinsi*)



Chiricahua leopard frog

Information, Data and Tools

GIS Working Group

This year, the Desert LCC worked towards adding value to our partners by focusing on a coordinated and collaborative data platform. The GIS Working Group authored Data Management Recommendations needed to establish a data management framework for Desert LCC. The team explored multiple methods for coordinated data collection and information management and presented their recommendations to the Steering Committee. In December, the Steering Committee approved the Data Management Plan.

To document and disseminate successes and findings of Desert LCC-supported science, the Data Management Recommendations include:

- specific workflows for metadata creation and delivery,
- protocols and infrastructure recommendations to document and share Desert LCC science with stakeholders and the public,
- LCC planning guidance,
- platform and training for GIS, and
- infrastructure for delivery.

To facilitate sharing data and LCC-supported science, the Desert LCC created space within ScienceBase (<http://www.sciencebase.gov>), a platform, for data management sharing and storage. We are also looking to leverage 2014 funding provided by the U.S. Fish and Wildlife Service's Office of the Science Advisor for DataBasin, a platform for data analysis and

visualization. DataBasin developers are creating GIS data “gateways” for nine LCCs, including the Desert LCC. The GIS Working Group created a prototype Desert LCC Conservation Planning Atlas using DataBasin (<http://dlcc.databasin.org>). The Conservation Planning Atlas will be a collaborative GIS data access and analysis platform that integrates access to data.

Data Coordinator Sally Holl expanded the GIS Working Group this year to include an expert on GIS and tribes, the GIS lead for the International Boundary and Water Commission, and the head of the Borderlands Information at the Texas Water Development Board. The group established or strengthened participation and partnership with the Conservation Biology Institute (CBI), USGS ScienceBase, the Department of Interior Climate Science Center Data Management Working Group, the LCC Data Management Working Group, and the Sonoran Desert GIS Group.

For the first time, the Desert LCC community has the ability to collaborate with partners in real time in managing, sharing, authoring and reviewing documents using Desert LCC-branded Google Apps for Business platform. The Desert LCC is also now able to record and disseminate Webinars via a Desert-LCC branded YouTube Channel (<http://www.youtube.com/user/DesertLCC>). To provide unified access to these types of collaboration and communication tools, we leveraged access to an open-source collaboration platform to establish a Desert LCC Collaboration Site (<https://my.usgs.gov/confluence/display/DLCC/>). This site empowers Desert LCC teams to more effectively communicate, collaborate, and locate important information by offering integrated access to the platforms mentioned above, as well as productivity tools such as customizable team pages, calendars, task lists, document libraries, and crowd-sourced content creation.



Sonoran Desert near Tucson, AZ

Monitoring and Evaluation

Monitoring Changes in Freshwater Temperatures and Their Impacts

Monitoring and modeling of stream temperature is vital to the assessment of water temperature impacts on fish, amphibians, and other aquatic species and potential future impacts due to climate change. Currently, stream temperature monitoring in the Southwest is of limited scope and is composed of many separate projects and study areas. This results in fragmented agency and political jurisdictions and uneven mandates for coordination and consolidation of monitoring data.

To increase efficiency in freshwater monitoring efforts, the Desert LCC began working with partners on a business plan that lays the foundation for a freshwater temperature monitoring and data-sharing project that expands existing monitoring networks and suggests new efforts to improve the state of knowledge on this topic. The plan includes goals to:

- Develop the base standards for water temperature data collection in the Mojave, Sonoran, and Chihuahuan deserts for use in regional-scale analysis of ecosystem status and trends.
- Develop an implementation strategy for the coordination of a voluntary water temperature monitoring network within the Desert LCC geography.
- Develop a strategy to determine the impacts of changes in water temperature on important resources in the Desert LCC through synthesis of existing data, integrative research, and/or vulnerability assessments.

Implementing this plan would result in the development and implementation of a year-round stream/spring temperature monitoring program. By tracking changes in stream/spring thermal conditions across the Desert LCC geography, managers could more readily identify where critical ecological thresholds exist (e.g., maximum temperature spikes = risk of fish kill event); and if adverse impacts are occurring, identify mitigation measures to reduce vulnerability of sensitive species.

Evaluating Adaptive Management in Big Bend (Rio Grande-Rio Bravo)

By building on and complementing existing partnerships, the Desert LCC is helping to conserve a critical binational protected area complex in the Big Bend reach of the Rio Grande-Rio Bravo watershed. In 2010, President Barack Obama and then Mexican President Felipe Calderon agreed that the Big Bend reach of the Rio Grande flows through one of the largest and most significant ecological complexes in North America. However, as a result of upstream dams and diversions and invasive vegetation that lines its banks, the Rio Grande is not the river it used to be.

Water quality and quantity have declined, affecting riverside communities, farmers, recreational users, and others who rely on its ecosystem services. Native fish and wildlife have also declined or even disappeared, including the Rio Grande silvery minnow.

With numerous state, federal, and Mexican partners, including the National Park Service, Comisión Nacional de Áreas Naturales Protegidas, and the Trilateral Commission on Environmental Cooperation, the Desert LCC is facilitating development of scientific information that will improve the ability of managers to conserve the river for the benefit of fish, wildlife, and people. This information will be used to create an adaptive management framework which the USFWS calls Strategic Habitat Conservation. The framework includes monitoring the effects of management actions so that they can be continuously improved to better meet partners' shared objectives. Working together in this way, partners can evaluate if they are achieving desired outcomes for the Rio Grande silvery minnow and other natural resources that people value, such as clean water.



Rio Grande silvery minnow

Outreach and Education

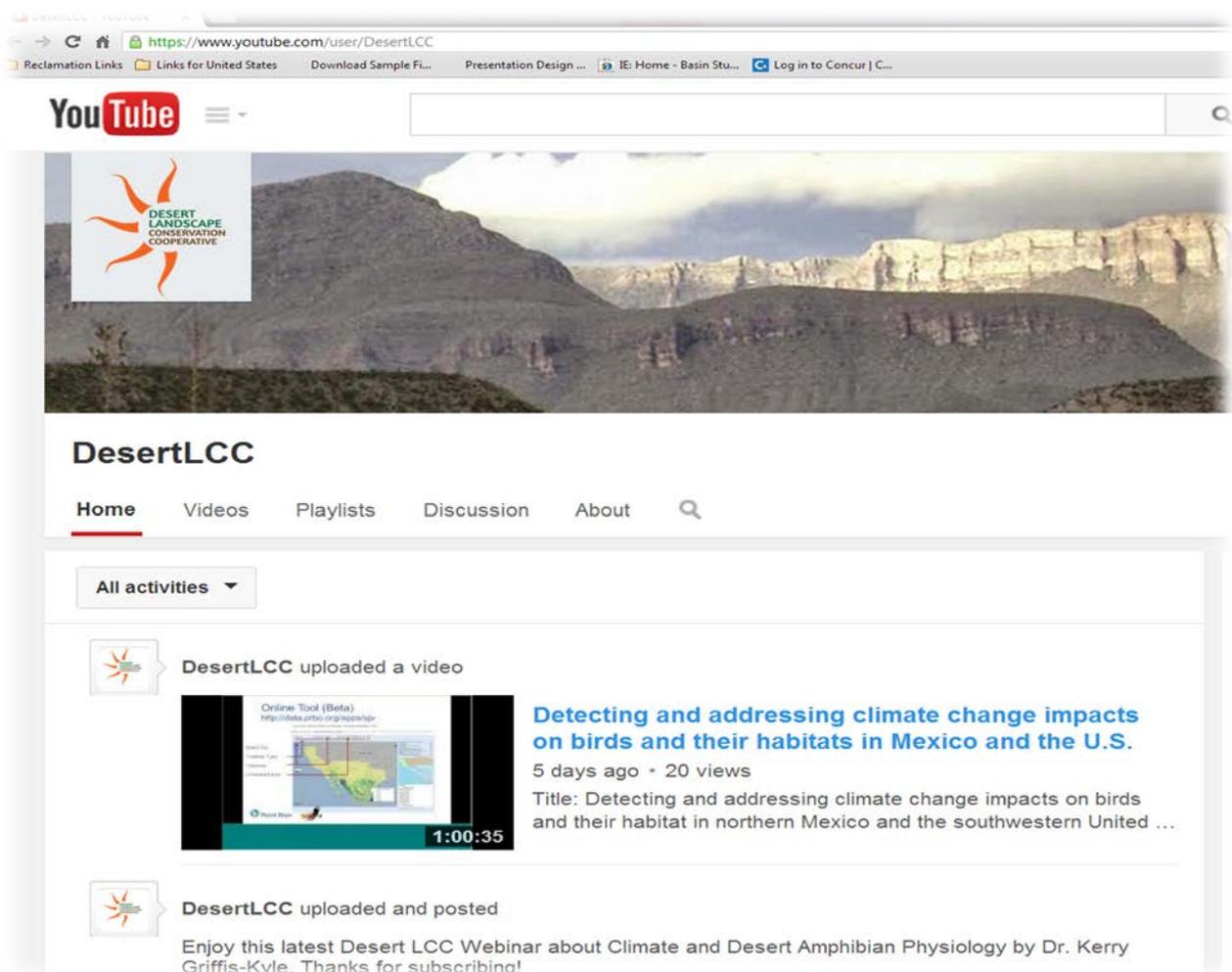
This year, the Desert LCC partnered with the USFWS National Conservation Training Center, Plains and Prairie Potholes LCC, Great Plains LCC, Appalachian LCC and the Southwest Climate Science Center on a project that was funded by the USFWS Office of the Science Advisor to provide the Climate Smart Conservation training to LCC partners. “Landscape Conservation Toolbox Boot Camp – A Train-the-Trainer Approach to Provide Services to Landscape Conservation Cooperatives” addresses the complexity of decision-making related to landscape-scale ecosystem stressors and multi-jurisdictional, interdisciplinary conservation efforts across and within LCCs.

As a result of this additional support and funding, the Desert LCC will be hosting a Climate-Smart Conservation workshop at the University of Arizona May 13-16, 2014 in Tucson. The course will provide guidance in how to:

- Design adaptation planning processes that are relevant at multiple scales (e.g., place-based to large landscape level)
- Evaluate conservation goals from a climate change perspective, and align adaptation strategies with climate-informed goals
- Explain how climate change vulnerability assessments, scenario planning, and downscaled climate models inform adaptation
- Describe the process for identifying possible adaptation options based on vulnerability information and other management considerations, and
- Integrate climate adaptation into existing planning and decision making processes and policies.

In an effort to ensure relevant science and management efforts are brought to the attention of resource managers, the Desert LCC hosted several webinars this year. Elroy Masters (Bureau of

Land Management) introduced our partners to the BLM's *Rapid Ecoregional Assessment* effort for the Sonoran and Mojave Basin and Range areas. Dr. Blair Wolf, University of New Mexico, described how increased temperatures affect bird communities. Michael Margo, USDA Natural Resource Conservation Service, introduced partners to *Ecological Sites: Classifying Landscapes for Management*. Carly Jerla, Bureau of Reclamation, provided an overview of the *Colorado River Basin Water Supply and Demand Study*. Dr. Greg Garfin and Dr. Holly Hartman, University of Arizona, explained how to use climate change scenario planning to inform resource management decisions. For more information about these educational webinars, please visit our YouTube channel at <http://www.youtube.com/user/DesertLCC> or link to the channel on our website, <http://www.usbr.gov/dlcc/>.



The screenshot displays the YouTube channel page for DesertLCC. At the top, there is a banner image of a desert landscape with a logo for the Desert Landscape Conservation Cooperative. Below the banner, the channel name 'DesertLCC' is prominently displayed. Navigation tabs for 'Home', 'Videos', 'Playlists', 'Discussion', and 'About' are visible. A dropdown menu for 'All activities' is shown. The main content area features a video upload notification: 'DesertLCC uploaded a video'. The video thumbnail shows a map of the region and the text 'Online Tool (Beta)'. The video title is 'Detecting and addressing climate change impacts on birds and their habitats in Mexico and the U.S.', posted 5 days ago with 20 views. Below this, another notification states 'DesertLCC uploaded and posted' with a message: 'Enjoy this latest Desert LCC Webinar about Climate and Desert Amphibian Physiology by Dr. Kerry Griffis-Kyle. Thanks for subscribing!'.

[Desert LCC YouTube channel](http://www.youtube.com/user/DesertLCC)

Local Governments Working Group

The Desert LCC Local Governments Working Group was formed in 2013 to provide an avenue of communication for discussing local government activities and perspectives related to landscape-scale conservation, as well as disseminating relevant science and information that helps meet LCC goals. Local governments include individual counties and cities; state associations of local governments; and umbrella organizations of groups of local governments, tribes, and other governmental units with an interest and connection to Desert LCC activities, such as resource conservation districts and water or irrigation districts in the United States and Mexico.



Desert bighorn sheep

Members of the Local Governments Working Group help identify the science needs of local governments that are of joint interest with the Desert LCC; facilitate the integration of social and local ecological knowledge into landscape conservation efforts; and facilitate communication between the Desert LCC and the diverse and numerous local governments in the LCC geography on such topics as monitoring programs, data collection and dissemination, and information and tools. In addition, the group is identifying opportunities and case studies for linking local

conservation efforts to broader conservation efforts within the Desert LCC.

Mexico Working Group

The Mexico Working Group was formed this year to define strategies to further engage and maintain the 10 Desert LCC Mexican States as partners in the collaborative. This group is supporting the identification and prioritization of Mexican science needs related to climate change and developing strategies to fulfill bi-national climate change conservation initiatives. To promote education and outreach in Mexico, Robert Mesta (Sonoran Joint Venture) contributed resources from World Class Translators & Interpreters to translate the fact sheet and critical management question handouts into Spanish. The group has defined key barriers to conducting work with Mexican partners beyond the need for bi-lingual translation capacity, including logical and monetary support for travel between Mexico and the United States, policy barriers related to spending federal funds in Mexico, and data sharing barriers. For 2014, the group is coordinating an outreach meeting in Mexico that will allow us to further engage by identifying specific on-the-ground projects and methods for landscape conservation.



Looking Ahead

Large-scale change requires broad cross-sector coordination, yet resource managers have frequently been focused on isolated and opportunistic intervention and restoration activities. This approach often results in isolated impacts because it is oriented toward finding and funding a solution embodied within a single organization, combined with the hope that the most effective organizations will grow or replicate to extend their impact more widely. In 2014, the Desert LCC will place a greater focus on showcasing our *collective impact*, the commitment of a group of important actors from different sectors to a common agenda for solving a specific problem (Kania and Kramer, 2011, http://www.ssireview.org/blog/entry/understanding_the_value_of_backbone_organizations_in_collective_impact_1). Shifting from isolated impact to collective impact is not merely a matter of encouraging more collaboration, but rather requires a focus on the relationships between organizations and the progress toward shared objectives. Landscape Conservation Cooperatives offer the unique opportunity, skills, and resources to assemble and coordinate the specific elements necessary for collective action to succeed.

The Desert LCC has worked for the past two years to create the infrastructure and processes that will produce true alignment of partnership goals. Components necessary for leading to powerful landscape conservation results include a common agenda, shared measurement systems, mutually reinforcing activities, continuous communication, and backbone support organizations.

A Common Agenda | All participants must have a shared vision for change, one that includes a common understanding of the problem and a joint approach to solving it through agreed-upon actions.

In 2014, the Desert LCC Steering Committee will engage in a process to develop our shared vision, which includes building on our common understanding of the Critical Management Questions and our collaborative approach to solving them.

A Shared Measurement Systems | All participants must have agreement on the ways success will be measured and reported.



Datura blossom

In 2014, Desert LCC coordinators will work with our partners to identify common conservation goals and desired outcomes that support future strategic planning for the Desert LCC that also links to national efforts, such as the National Fish, Wildlife, and Plants Climate Adaptation Strategy. We will use these goals and outcomes to develop indicators and benchmarks that define the contribution of the Desert LCC beyond what partners can accomplish by themselves. These performance metrics will further guide the work of our Working Groups and Critical Management Question Teams to ensure our work is linked to on-the-ground results.

Mutually Reinforcing Activities | The power of collective action comes from the coordination of a diverse group of stakeholders working through a mutually reinforcing plan of action.

In 2014, the Desert LCC will prioritize the integration and sharing of data through ScienceBase and DataBasin, building on the extensive work of our partners. We will use this platform to showcase how we are linking to other landscape scale efforts in the Desert LCC geography, such as Bureau of Reclamation's Basin Studies, Western Governors' Association Crucial Habitat Analysis Tool (CHAT), U.S. Fish and Wildlife Service Surrogate Species efforts, Bureau of Land Management's Rapid Ecoregional Assessments, and U.S. Forest Service Watershed Condition Assessment.

Continuous Communication | Developing trust among nonprofits, corporations, and government agencies is a monumental challenge and requires several years of regular meetings to build up enough experience with each other to recognize and appreciate the common motivation behind different efforts.

A big push for 2014 will be to establish the Desert LCC's core identity and role in science translation and delivery for managers. We will prioritize outreach to partners in Mexico and on tribal lands, which comprise the majority of the LCC geography. We will focus specifically on communicating the collective impact of the Desert LCC by implementing our communications strategy and building a framework for easily communicating common landscape conservation design objectives through a process such as the South Atlantic LCC Conservation Blueprint.

Backbone Support Organizations | Creating and managing collective impact requires a separate organization and staff who can plan, manage, and support the initiative through ongoing facilitation, technology and communications support, data collection and reporting, and logistical and administrative details.

This year, the Desert LCC will continue to build our partnership through coordination and support of our extensive working groups and teams. The continuing financial support of Bureau of Reclamation, USFWS, and USGS provides dedicated staff to plan and support the Desert LCC. We will continue our inter-agency agreement to support Sally Holl, our Data Coordinator. We will continue support for facilitation services through Keystone Center and for communications support through McCoy Communications and Training.



Rio Bravo - Rio Grande

Acknowledgements

We would like to thank all of our partners for their continued support and dedication, which allows us to use the extensive knowledge and expertise of resource managers and scientists to collaboratively identify and solve complex problems too big for any of us to solve alone. Specifically, we would like to thank our many Science Working Group and Critical Management Question Team members for their hard work in defining the science needs of the Desert LCC and establishing the logistical details for us to accomplish our goals. We would like to thank the GIS Working Group for their dedication in determining the best path forward for the Desert LCC to collect, support, and report on our science and data efforts. We would like to thank the Communications Working Group for their diligent work in defining the tasks necessary to ensure we can communicate effectively with an incredibly diverse audience and for starting us down the path of showcasing the Desert LCC's work. We would like to thank the Mexico Working Group and the Local Governments Working Group for ensuring that we are reaching critical partners across our landscape, which will allow us to be successful in the true spirit of collective impact. Lastly, the support of our Steering Committee members has been outstanding, especially in providing for themselves and their staffs to participate in and travel to Desert LCC activities. As author and speaker Guy Kawasaki has said, "The best reason to start an organization is to make meaning; to create a product or service to make the world a better place." Without you, our Steering Committee, we would not have the motivation and support to create innovative and critically needed solutions for successful landscape conservation that allows us to adapt to and shape our changing future.



Mojave desert sunset

Appendix 1: Desert LCC Partners

Steering Committee

| Member | Alternate | Agency/Organization |
|------------------------------|------------------|---|
| Amy Heuslein | William Walker | Bureau of Indian Affairs |
| Armand Gonzales (Chair) | Whitney Albright | California Department of Fish and Wildlife |
| Benjamin Tuggle | Dana Roth | U.S. Fish and Wildlife Service |
| Carol Klopatek | | Fort McDowell Nation |
| Duane Pool | Arvind Panjabi | Rocky Mountain Bird Observatory |
| Fon Duke | Russell Scofield | Desert Managers Group |
| Grant Buma | Johnny Hill | Colorado River Indian Tribes |
| Jeanne Higgins | Bob Davis | U.S. Forest Service |
| | Jeff Raasch | Texas Parks and Wildlife |
| Jill McCormick | | Cocopah Indian Tribe |
| John Longworth | Mike Johnson | New Mexico State Engineers Office |
| John Stewart | | California Association of Four Wheel Drive Clubs |
| Jon Sjoberg | Cris Tomlinson | Nevada Department of Wildlife |
| | Joyce Francis | Arizona Game and Fish Department |
| Jim Leenhouts | Dave Busch | U.S. Geological Survey |
| Julie Decker | Tom Pagacnik | Bureau of Land Management |
| Keisha Tatem | | Natural Resources Conservation Service |
| Louise Misztal | Jenny Neeley | Sky Island Alliance |
| | Margarita Caso | Instituto Nacional de Ecología y Cambio Climático |
| Mary Gustafson | Jeff Raasch | Rio Grande Joint Venture |
| Robert Mesta (Vice-chair) | Geoffrey Geupel | Sonoran Joint Venture |
| Sharon Pinto | | Bureau of Indian Affairs, Navajo |
| Stephanie Dubois | Pam Benjamin | NPS |
| Tony Madrigal | Kurt Russo | Native American Land Conservancy |
| Terrance Fulp | David Palumbo | Bureau of Reclamation |

Science Working Group

| Member | Agency/Organization |
|-----------------------------|--|
| Aimee Roberson (Chair) | U.S. Fish and Wildlife Service |
| Carol Beardmore (co-Chair) | U.S. Fish and Wildlife Service |
| Abe Springer | Northern Arizona University |
| Andrew Rhodes | Comisión Nacional de Áreas Naturales Protegidas |
| Breton Bruce | U.S. Geological Survey |
| Deborah Finch | U.S. Forest Service, Rocky Mountain Research Station |
| Debra Hughson | National Park Service |
| Esther Rubin | Arizona Game and Fish Department |
| Megan Bean | Texas Parks and Wildlife Department |
| James Weigand | Bureau of Land Management |
| Kelly Brooks / Jeff Johnson | Southern Nevada Water Authority |
| Jeff Bennett | National Park Service |
| John Bradford | U.S. Geological Survey |
| Juan Carlos Guzmán | Chihuahuan Desert Grassland Alliance |
| Ken Nowak | Bureau of Reclamation |
| Lisa Soo | Bureau of Land Management |
| Margarita Caso | Instituto Nacional de Ecología y Cambio Climático |
| Mark Briggs | World Wildlife Fund |
| Matt Levias | Chemehuevi Tribe |
| Sergio Avila | Sky Island Alliance |
| Teresa Lewis | U.S. Fish and Wildlife Service |
| Wayne Robbie | USDA Forest Service |

CMQ Team 1: Environmental Water Flows and Climate Change

| Member | Agency/Organization |
|----------------------------|---|
| Abe Springer | Northern Arizona University |
| Aimee Roberson (Team Lead) | U.S. Fish and Wildlife Service, Science Applications |
| Andrew Hautzinger | U.S. Fish and Wildlife Service, Refuges |
| Barb Ray | U.S. Geological Survey, National Geospatial Program, Southwest Region Director's Office |
| Bret Bruce | U.S. Geological Survey, Southwest Region |

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| Bob Davis (Steering Committee sponsor) | U.S. Forest Service, Southwest Region |
| David Palumbo (Steering Committee sponsor) | Bureau of Reclamation |
| Debra Hughson | National Park Service, Mojave Desert parks |
| Jeff Bennett | National Park Service, Big Bend National Park and Rio Grande Wild and Scenic River |
| Jeff Johnson | Southern Nevada Water Authority |
| Jessica Fraver | Arizona Land and Water Trust |
| Keely Brooks | Southern Nevada Water Authority |
| Kelly Mott Lacroix | University of Arizona, Water Resources Research Center |
| Ken Nowak (Team Lead) | Bureau of Reclamation, Boulder Canyon Operations Office, River Operations Group |
| Noe Santos | Bureau of Reclamation, Boulder Canyon Operations Office, River Operations Group |
| Sharma Hammond Torrens | Arizona Land and Water Trust |
| Sonja Kokos | Bureau of Reclamation |
| Wayne Robbie | U.S. Forest Service, Southwest Region |

CMQ 2 Team: Monitoring Species/Processes Relative to Climate Change and Related Threats/Stressors

| Member | Agency/Organization |
|---|---|
| Armand Gonzales (Steering Committee sponsor) | California Fish and Wildlife Department |
| Aimee Roberson | U.S. Fish and Wildlife Service, Science Applications |
| Arvind Panjabi | Rocky Mountain Bid Observatory |
| Bill Radke | U.S. Fish and Wildlife Service, Refuges |
| Bret Bruce | U.S. Geological Survey, Southwest Region |
| Carol Beardmore (Team Lead) | U.S. Fish and Wildlife Service, Sonoran Joint Venture |
| Charlotte Reemts | The Nature Conservancy, Texas |
| Claire Aslan | Arizona-Sonora Desert Museum |
| Dana Roth (Steering Committee sponsor) | U.S. Fish and Wildlife Service, Science Applications |
| Esther Rubin (Team Lead) | Arizona Game and Fish Department |
| Ken Nowak | Bureau of Reclamation, Boulder Canyon Operations Office, River Operations Group |

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| Lisa Soo | Bureau of Land Management, Arizona |
| Lisa Williams | The Nature Conservancy, Texas |
| Megan Bean | Texas Parks and Wildlife Department |
| Rich Kostecke | The Nature Conservancy, Texas |
| Teresa Lewis | U.S. Fish and Wildlife Service, Fisheries |

CMQ 3 Team: Grassland and Shrubland Management

| Member | Agency/Organization |
|--|---|
| Aimee Roberson | U.S. Fish and Wildlife Service, Science Applications |
| Arvind Panjabi | Rocky Mountain Bird Observatory |
| Duane Pool | Rocky Mountain Bird Observatory |
| Gerardo Arturo Bezanilla Enriquez | Universidad Autonoma de Chihuahua |
| Greg Levandoski | Rocky Mountain Bird Observatory |
| Jeff Bennett | NPS, Big Bend National Park and Rio Grande Wild and Scenic River |
| Jim Weigand | Bureau of Land Management |
| Juan Carlos Guzman-Aranda | Chihuahuan Desert Grassland Alliance |
| Jurgen Hoth | Fundación Biósfera del Anáhuac |
| Ken Boykin | New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University |
| Lisa Soo | Bureau of Land Management, Arizona |
| Mary Gustafson (Steering Committee sponsor) | Rio Grande Joint Venture |
| Michael Margo | USDA, Natural Resources Conservation Service |
| Paulette Ford | U.S. Forest Service, Rocky Mountain Research Station |
| Ray Lister | Bureau of Land Management, Las Cruces District, New Mexico |
| Robert Mesta (Steering Committee sponsor) | Sonoran Joint Venture |
| Wayne Robbie | U.S. Forest Service, Southwest Region |

CMQ 4 Team: Physiological Stress of Climate Change

| Member | Agency/Organization |
|----------------------------------|---|
| Blair Wolf | University of New Mexico |
| Carol Beardmore (Team Leader) | U.S. Fish and Wildlife Service, Sonoran Joint Venture |

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| Dylan Schwilk | Texas Tech University |
| Gary Roemer | New Mexico State University |
| George Koch | Northern Arizona University |
| James Stolberg | Bureau of Reclamation |
| John Arnett | Department of Defense - Luke AFB |
| John Bradford | U.S. Geological Survey |
| Mary Gustafson (Steering Committee Sponsor) | Rio Grande Joint Venture |
| Teresa Lewis (Team Leader) | U.S. Fish and Wildlife Service |

CMQ 5 Team: Changing Wildfire Regimes and Riparian Habitat Management

| Member | Agency/Organization |
|--|---|
| Barbara Satink Wolfson | Southwest Fire Consortium – Joint Fire Science Program |
| Citlali Cortés Montaña | TREES |
| Julie Decker (Steering Committee sponsor) | Bureau of Land Management |
| Ken Boykin | New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University |
| Lisa Soo | Bureau of Land Management |
| Louise Misztal (Steering Committee sponsor) | Sky Island Alliance |
| Mark Briggs (Team Lead) | World Wildlife Fund |
| Matt Brooks | U.S. Geological Survey |
| Mark Kaib (Team Lead) | U.S. Fish and Wildlife Service, Southwest Region |
| Richard Gatewood | Big Bend National Park |

CMQ 6 Team: Amphibians and Reptiles and Vulnerability to Climate Change

| Member | Agency/Organization |
|---|---|
| Benjamin Tuggle (Steering Committee sponsor) | U.S. Fish and Wildlife Service |
| Bruce Jones | Desert Research Institute |
| Esther Rubin (Team Lead) | Arizona Game and Fish Department |
| Jim Weigand (Team Lead) | Bureau of Land Management, California State Office |
| John Karges | The Nature Conservancy, Texas |
| Ken Boykin | New Mexico Cooperative Fish and Wildlife Research Unit, New |

| | |
|-----------------|---|
| | Mexico State University |
| Laura Patterson | California Fish and Wildlife Department |

Administrative Working Group

| Member | Agency/Organization |
|------------------|--|
| Amy Heuslein | Bureau of Indian Affairs |
| Dana Roth | U.S. Fish and Wildlife Service |
| John Longworth | New Mexico State Engineers Office |
| John Stewart | California Association of Four Wheel Drive Clubs |
| Louise Misztal | Sky Island Alliance |
| Mary Gustafson | U.S. Fish and Wildlife Service, Rio Grande Joint Venture |
| Pam Benjamin | National Park Service |
| Robert Mesta | U.S. Fish and Wildlife Service, Sonoran Joint Venture |
| Russell Scofield | Desert Managers Group |

Communications Working Group

| Member | Agency/Organization |
|---------------------|---|
| Jennifer Duberstein | U.S. Fish and Wildlife Service, Sonoran Joint Venture |
| John Stewart | California Association of Four Wheel Drive Clubs |
| Meredith Fleener | California Department of Fish and Wildlife |
| Peter Soeth | Bureau of Reclamation |
| Robert Mesta | U.S. Fish and Wildlife Service, Sonoran Joint Venture |

GIS and Data Management Working Group

| Member | Agency/Organization |
|------------------|------------------------------|
| Amy Duffy | Western Regional Partnership |
| Barbara Ray | U.S. Geological Survey |
| Carol Ostergren | U.S. Geological Survey |
| Christian Black | U.S. Air Force |
| Claire DeVaughan | U.S. Geological Survey |
| Cynthia Wallace | U.S. Geological Survey |
| Daniel Pearson | U.S. Geological Survey |

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| Delbert Humberson | International Boundary and Water Commission |
| Drew Decker | U.S. Geological Survey |
| Duane German | Texas Parks and Wildlife |
| Duane Pool | Rocky Mountain Bird Observatory |
| Eric Wood | U.S. Geological Survey Eros Data Center, Climate and Land Use Change Mission Area /Native American Tribal Liaison |
| Fon Duke | Desert Managers Group |
| Joyce Francis | Arizona Game and Fish Department |
| Ken Boykin | New Mexico State University |
| Louise Misztal | Sky Island Alliance |
| Miguel Pavon | Texas Natural Resource Information Service (TNRIS) of the Texas Water Development Board (TWDB)/Texas Borderlands Information Center |
| Mitchel Hannon | The Trust for Public Land |
| Natalie Latysh | U.S. Geological Survey |
| Ric Riester | U.S. Fish and Wildlife Service |
| Seshu Vaddey | Bureau of Reclamation |
| Terry Arundel | U.S. Geological Survey |
| Thomas Dinardo | U.S. Geological Survey |
| Tim Kern | U.S. Geological Survey |
| Valda Terauds | Bureau of Reclamation |

Local Governments Working Group

| Member | Agency/Organization |
|-------------------|--|
| Amy Heuslein | Bureau of Indian Affairs |
| Armand Gonzales | California Department of Fish and Wildlife |
| Avra Morgan | Bureau of Reclamation |
| David Palumbo | Bureau of Reclamation |
| Duane Pool | Rocky Mountain Bird Observatory |
| Gerry Hillier | QuadState Local Governments Authority |
| Howard Hutchinson | Coalition of Arizona/New Mexico Counties |
| Jennifer Pokorski | Maricopa County Flood Control District |
| Les Owen | New Mexico Department of Agriculture |
| Rick LoBello | El Paso Zoo |

Mexico Working Group

| Member | Agency/Organization |
|-----------------|--|
| Armand Gonzales | California Department of Fish and Wildlife |
| Mary Gustafson | U.S. Fish and Wildlife Service, Rio Grande Joint Venture |
| Robert Mesta | U.S. Fish and Wildlife Service, Sonoran Joint Venture |
| Sergio Avila | Sky Island Alliance |