

**Department of the Interior
U.S. Geological Survey
Southwest Climate Science Center**

2015 Science Workplan



Introduction

The mission of the Southwest Climate Science Center (SW CSC) is to provide the region's resource managers with essential scientific knowledge and tools to anticipate and adapt to climate change. The SW CSC is committed to providing the best science available, and to working in partnership with stakeholders in the Department of the Interior and other agencies and organizations to identify critical knowledge needs and to share information. Although the SW CSC is primarily focused on the southwestern United States, it collaborates with other CSCs across the country to develop capacity at the national level and address regional challenges.

The general science objectives, staffing needs, and operating principles for the SW CSC over a five-year span starting in 2013 are described in the Science Agenda. This Annual Science Workplan details the specific research priorities and planned actions for the SW CSC during federal fiscal year 2015 (FY 15).

Stakeholder Engagement

The SW CSC has been in regular contact with the Landscape Conservation Cooperatives (LCCs) and has participated, when possible, in LCC Steering Committee meetings. Participation in these meetings and other LCC activities will increase in FY15 when a second staff member is added to the SW CSC. The Stakeholder Advisory Committee (SAC) has been kept informed of major SW CSC activities. It will meet in Tucson in April 2014, and part of the agenda will be directed toward more effective communication and engagement among SAC members and the SW CSC. The SAC meeting will be followed immediately by a meeting of the SW CSC with staff (Coordinators and Science Coordinators) of the five LCCs in the Southwest region. A major goal of that meeting will be to develop strategies and plans for effective engagement between the SW CSC and the LCCs, individually, in groups, and as a whole. The SW CSC has also been in contact with other stakeholders in the region as necessity and opportunity arise. Much of this contact has been through university and USGS Principal Investigators (PIs) sponsored by the SW CSC.

The climate-science information needs expressed in the Science Agenda and the research themes intended to meet those needs (see below) reflect guidance provided in 2011 and 2012 by the SAC, the LCCs, and other resource-management agencies. The April 2014 meetings will build on the previous discussions to clarify stakeholder needs and priorities, present scientific capacities and uncertainties, and identify gaps and emerging needs for scientific knowledge. The meetings also will provide opportunities for the SAC and LCCs to review and provide feedback on research priorities and to ensure that the SW CSC is on track to address stakeholder needs. Plans for stakeholder engagement for FY15 will be adjusted and adapted based on discussions at those meetings.

Research Priorities

The SW CSC Science Agenda describes 5 research themes, based on climate-science information needs that have been communicated by the resource-management agencies with which the SAC members and LCCs are affiliated. Given limited resources and needs for particular information in a given fiscal year, the SW CSC prioritizes research objectives annually. All themes may not be addressed in a given year.

Theme 5 (*Establishing best practices*) is particularly critical to success of the SW CSC. Accordingly, starting in FY 13, the SW CSC is sponsoring integrative projects aimed at understanding, testing, and assessing approaches to scientist-stakeholder engagement that produce effective management and scientific outcomes. The ultimate objective is to identify a set of best practices for collaboration and knowledge exchange between researchers and stakeholders. This initiative reflects the high priority the SW CSC places on effective stakeholder collaboration, as indicated in the SW CSC Goals outlined in the Science Agenda.

Funding Commitments for FY13 and FY14

Two projects, both starting in FY13 and both directly invited by the SW CSC, have been funded under this general heading:

- *Evaluating the impact of climate science produced in the Southwest Climate Science Center on resource management agency decisions* (3 yrs, University of Arizona and Desert Research Institute)
- *Preliminary assessment of the landscape of climate relevant resource management decisions in the southwest* (2 yrs, University of California – Davis)

A third project, jointly funded by the SW CSC and the Northwest CSC, has been recommended for FY14 funding:

- *Assessing climate change vulnerability and adaptation in the Great Basin: a policy perspective on resource managers and the use of science in decision making* (2 yrs, Boise State University)

Emphasis on Theme 5 (*Establishing best practices*) will continue in FY15, as an overarching theme in the FY15 Request for Proposals (RFP) on more specific topics related to other themes.

The SW CSC released RFPS in FY 13 and FY 14, soliciting projects that addressed other research themes identified in the Science Agenda. These projects not only provide new knowledge for resource managers, but also test potential best practices. All are directed toward providing timely information on specific issues to resource managers. All involve direct engagement with and participation by relevant stakeholders in project

development and design of research products. The SW CSC anticipates that all will contribute to identification of best practices and communicate results in ways that inform management actions.

Projects funded in FY13, targeting three science priorities identified in the 2013 Science Workplan, include:

- *Colorado River Basin streamflow projection under IPCC-CMIP5 scenarios: from the global to basin scale using an integrated dynamic modeling approach.* (2 yrs, University of Arizona)
- *Natural climate variability in the changing climate: how interannual, decadal, and century timescales affect daily weather patterns.* (2 yrs, Scripps Institute of Oceanography and U.S. Geological Survey)
- *Linking climatic, hydrological, and ecological changes at intermediate timescales in a Great Basin watershed.* (2 yrs, Desert Research Institute)
- *Influence of interannual North Pacific Jet variability on Sierra Nevada fire regimes.* (2 yrs, University of Arizona and U.S. Geological Survey)

Five projects have been recommended for funding starting in FY14, targeting six science priorities identified in the 2013 Science Workplan:

- *Linking interannual variations of extreme storms with ecological and hydrological disturbances in the Sierra Nevada* (2 yrs, U.S. Geological Survey and University of California-Davis)
- *A coastal site network for advancing understanding and prediction of climate change effects on nearshore ecosystems: integrating interdisciplinary process studies* (2 yrs, U.S. Geological Survey and University of California-Los Angeles)
- *How does climatic stress at intermediate timescales influence fire severity?* (2 yrs, U.S. Geological Survey and University of Arizona)
- *Disentangling the influence of antecedent temperature and soil moisture on Colorado River water resources* (3 yrs, University of Arizona, U.S. Geological Survey, and University of Nevada-Reno)
- *Development, delivery, and application of data on climate extremes for the southwestern United States* (3 yrs, University of California-Davis, University of Arizona, Desert Research Institute, Scripps Institute of Oceanography, and U.S. Geological Survey)

The last of these projects addresses 2013 Science Workplan priorities, and was directly invited by the SW CSC. It aims to develop an integrated climate-knowledge network and data exchange for the region that will allow scientists and stakeholders to both obtain and contribute information, focusing particularly on climate extremes with demonstrable impacts on management planning and decision-making.

Funding Plans for FY15

The FY15 RFP will be directed at the six science priorities identified in the 2013 Science Workplan and covered in the FY14 RFP. The projects funded to date do not cover all aspects of these broad priorities, and experience with responses to the FY13 and FY14 RFPs indicate that considerable capacity exists in the research sector (universities and USGS) to make important contributions that target these priorities. Projects to be funded will comprise targeted, short-term efforts that apply directly to specific management challenges, either locally or broadly across the landscape. Each project will target one or more issues faced by stakeholders, generate knowledge to address that challenge, and communicate the results to stakeholders in actionable ways. The six major priorities to be identified in the RFPs include:

1. Anticipating climate change and variability at intermediate timescales.

Current forecasting ability is concentrated on short time spans of weeks to months, and long time spans of a few decades, with a major gap at intermediate time spans. Yet the strong variability and changes that occur at annual to decadal frequencies in the Southwest will modulate longer-term trends, and profoundly affect hydrological and ecological realizations in the coming decades. Intermediate-scale climate variability poses challenges and opportunities for resource managers. Assessments of how annual to decadal climate variability might influence climate extremes, including prolonged droughts, and long-term trends are needed. These assessments may include original research or reviews of the state of the science and prospects for intermediate-scale forecasting.

2. Linking climatic, hydrological and ecological changes at intermediate timescales.

Climate variation at annual to decadal timescales has a large influence on hydrological and ecological systems. Hydrological extremes, both high and low, pose challenges for managers of water and other natural resources. Composition and structure of terrestrial ecosystems are strongly influenced by annual to decadal variability in spatially extensive disturbances (wildfires, mass mortality of trees) and recruitment, which in turn reflect climatic variability. Effects of such variation in disturbances and recruitment can persist for decades or longer in terrestrial ecosystems across the Southwest. Furthermore, geographic ranges and population sizes of many species are highly sensitive to interannual to decadal climate variability, which will affect their responses to longer-term climate trends. Hydrological and ecological responses to intermediate-scale climate variability need careful study. These dynamics will occur regardless of climate change, and they will influence ecological trajectories during the longer-term changes in climate over the next century. An important scientific challenge is to anticipate the array of

intermediate-scale hydrological and ecological outcomes. That will in turn help resource managers identify threats and opportunities posed by alternative intermediate-scale scenarios.

- 3. Hydrological effects of climate change in the Southwest.** Projections of 21st-century hydrological changes represent a critical need for stakeholders in the Southwest. The most recent results from the Coupled Model Intercomparison Project (CMIP5) provide an opportunity to update and improve forecasts of long-term trends in precipitation, snowpack, runoff, soil moisture, and groundwater in the region. The long-term projections (circa 2035 – 2100 CE) can be integrated and validated using observational and paleohydrological data. Projections of future hydroclimate and hydrology, with accompanying specifications of uncertainties, will be invaluable for stakeholder planning and decision-making, particularly if closely coordinated with one or more groups of stakeholders.
- 4. Effects of climate change on coastlines, estuaries, and wetlands.** Coastal regions and estuaries will be affected by sea-level rise, which will interact with changes in ocean and atmospheric circulation to alter land cover and species habitats along the California coast. The recent identification of transient ‘atmospheric rivers’ highlights the potential vulnerability of coastal regions and freshwater wetlands to extreme events. The most recent generation of climate projections (e.g., CMIP5), sea-level assessments, and research on climate extremes can be brought to bear in determining vulnerability of coastal, estuarine, and freshwater-wetland ecosystems, and developing effective management strategies.
- 5. Design and implementation of monitoring strategies.** Multiple arrays of monitoring programs and networks exist in the Southwest and adjacent regions. These networks are useful for diagnosing trends, identifying emerging threats and opportunities, determining success of past and ongoing management initiatives, and assessing accuracy of past projections. Many networks have developed haphazardly or opportunistically, and systematic assessment of existing monitoring networks and their utility for current decision-making is timely. Such assessment should be closely coordinated with stakeholders to determine how monitoring data are used, whether existing networks and data streams are adequate for decision-making, and ways in which monitoring can be improved. Emphasis will not be on supporting monitoring programs *per se*, but on determining how monitoring strategies can best meet the needs of stakeholders.
- 6. Hydroclimatic change and terrestrial ecosystems.** Changes in hydroclimate are expected to cause substantial changes in terrestrial ecosystem properties, ranging

from fundamental attributes of land cover and species habitats (e.g., vegetation composition and structure) to ecosystem functions (carbon storage, primary productivity, runoff and infiltration, forage, fuel accumulation, local to regional climate *via* albedo, evapotranspiration, and latent heat flux). Such changes can be assessed using a variety of approaches, including field observation, remote sensing, state-and-transition models, and simulations. In some settings, paleoecological and paleoclimatic studies can contribute to sensitivity assessment and model validation. Local to regional studies of terrestrial ecosystem responses to hydroclimatic change, developed in close coordination with stakeholders, will provide valuable information for decision-making and planning.

Proposals addressing these 6 priorities may be local or regional in scope, and may incorporate one or multiple complementary approaches. However, all proposals are expected to be developed in coordination with local or regional stakeholders, and to include a clear plan for engagement and communication with stakeholders throughout the project. Furthermore, all recipients of funds will be expected to work with the SW CSC and partners to complement the long-term integrative project regardless of when the short-term or long-term projects are initiated. The SW CSC is prepared to dedicate travel funds toward meetings among principal investigators of the short-term projects and the long-term integrative project.

Because the SW CSC has relatively few tribal projects in its current portfolio (one major project started in FY12 will be completed at the end of FY14), the FY15 RFP will include language to encourage submission of proposals involving partnerships with tribes, or direct relevance to tribes. Language will also be included to encourage proposals with a strong component of training and participation by 'next-generation' scientists (graduate students and post-docs).

Workforce Planning

The SW CSC aims to build capacity to meet major research challenges while minimizing redundancy with existing capacity within USGS Science Centers and the SW CSC host institutions. A second staff position, Deputy Director and Research Coordinator, will be filled during FY 14. This person will bring much-needed assistance to the SW CSC Director in implementing the Strategic Science Agenda (SSA), planning for development of the next SSA, and distributing the workload of coordinating and overseeing the various activities of the Center. A staff position, Communications Coordinator, will also be filled starting in FY 14. This person will be employed by University of Arizona, supported by funds from the SW CSC, and will be responsible for maintaining the SW CSC website, preparing fact sheets, press releases, and other documents, and facilitating dialogues between researchers and stakeholders. The Communications Coordinator will work

closely with the SW CSC Director (USGS) and the university team. Additional hires are not anticipated during FY15, but discussions will take place among the staff, SAC members, and university partners of the SW CSC, together with the National Climate Change and Wildlife Science Center, to identify priority areas for future staffing in FY15 or beyond.