SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

Funded Projects Booklet

2012-2019

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Overview of Project Themes

Drought Monitoring and Response
Ecology and Wildlife
Water Resources
Climate Data for Decision Making
Resilience in Indian Country
Workforce Development

Acronyms

CAPS	Center for Analysis and Prediction of Storms	**SRCC**	Southern Regional Climate Center
GCJV	Gulf Coast Joint Venture	**TAMU**	Texas Agricultural and Mechanical University
GCP LCC	Gulf Coast Prairie Landscape Conservation Cooperative	**TTU**	Texas Tech University
GCPO LCC	Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative	**UNM**	University of New Mexico
LSU	Louisiana State University	**US ACE**	US Army Corps of Engineers
NIDIS	National Integrated Drought Information System	**USDA**	United States Department of Agriculture
NOAA GFDL	National Oceanic Atmospheric Administration Geophysical Fluid Dynamics Laboratory	**USGS**	United States Geological Survey
OCS	Oklahoma Climatological Survey	**USGS CERC**	USGS Columbia Environmental Research Center
OSU	Oklahoma State University	**USGS CIDA**	USGS Center for Integrated Data Analysis
OU	University of Oklahoma	**USGS EROS**	USGS Earth Resource Observation and Science Center
SC CSAC	South Central Climate Adaptation Science Center	**USU**	Utah State University
SCIPP	Southern Climate Impacts Planning Program		

Fiscal Year 2019

Approaches to Evaluate Actionable Science for Climate Adaptation

Principal Investigator: Aparna Bamzi (NCCASC)
Co-Investigator: Renee McPherson (OU/SCCASC)
Project Topic: Science Tools for Managers
Geographic Location: North & South Central Regions

Project Summary

Science produced by the National and Regional Climate Adaptation Science Center (CASC) network must ideally be scientifically sound, relevant to a management decision, fair and respectful of stakeholders' divergent values, and produced through a process of iterative collaboration between scientists and managers. However, research that aims to produce usable knowledge and collaborative approaches that boost usability are not common in academia or federal research programs. As a result, neither the process of creating such research nor the impacts to stakeholders are well understood or well documented. This lack of attention to the processes and impacts of collaborative scientist-stakeholder knowledge production also limits our ability to evaluate research outcomes beyond standard academic metrics such as number of peer reviewed journal publications, conference presentations, or students trained.

CASC-funded researchers have previously proposed a cohort of 45 indicators for evaluating the co-production of climate knowledge by conducting a review of the academic literature, examining metrics used by other agencies to evaluate usable science, and compiling insights from experienced researchers and managers. While this research has resulted in a rich set of data, constraints on resources, such as time and funding, have limited the team to working with a small sample of case study projects from the Southwest and Northwest CASCs.

Project Impact

This project will address the issue of scalability in evaluation, both in terms of number of projects evaluated and number of stakeholders targeted. An evaluation approach that encompasses a center's full portfolio of projects will better enable the intercomparison of funding choices and co-production approaches. This evaluation will focus on completed projects from the North Central and South Central CASCs. Researchers will distribute a survey to targeted stakeholders in order to learn more about their interactions with project teams and their use of specific products. Results from this project will inform decisions made by the CASC network about future projects in order to ensure good stewardship of federal funds.

Science Base Link :

https://www.sciencebase.gov/catalog/item/5d35fcc9e4b01d82ce8a61bd

Organizing and Synthesizing Ogallala Aquifer Data to Facilitate Research and Resource Management

Principal Investigators: Renee McPherson (SCCASC) & Caitlin Rottler (USDA-ARS)
Co-Investigator(s): Paulette Ford (USFS) & Amy Kremen (CSU)
Project Topic: Water, Coasts and Ice, Science Tools for Managers
Geographic Location: South Central Region

Project Summary

The Ogallala Aquifer lies beneath 111 million acres of land in Wyoming, South Dakota, Nebraska, Kansas, Colorado, Oklahoma, Texas, and New Mexico. The aquifer provides water for approximately 1.9 million people and has been instrumental in the development of the robust agriculture economy of the Great Plains region. It is also vitally important to the ecology of the region, serving as a critical source of groundwater and sustaining creeks and streams that would otherwise run dry during periods of water scarcity. However, the various social, economic, and ecological challenges of managing this aquifer are expected to increase with climate change as hotter, drier summers exacerbate already unsustainable water demands.

Regional water managers have requested scientific information to assist in the planning process for future use and management of the aquifer. Much of this information is currently available but is unorganized and difficult to access. This project will organize and synthesize information on datasets from the Ogallala Aquifer region into a single, searchable database. The Ogallala Data Directory will act as a virtual "phone book" of Ogallala region data. It will allow users to easily locate and integrate datasets relevant to their area of interest, and to address emerging issues within the region, such as the effects of climate change and reduced aquifer water availability on human health or ecosystem services. Researchers will also create targeted visualizations using the data in the directory, to display information such as the economic impacts of aquifer depletion for land management agencies and agriculture.

Project Impact

The directory will be built with the help of Colorado State University's Natural Resources and Ecology Laboratory and an advisory committee of stakeholders from the region who will provide input and feedback to ensure that the final product is both useful and user-friendly. This project will provide water resource managers in the Ogallala Aquifer region with easy access to information about the aquifer that will support science-informed water management decisions in the Great Plains region.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5d49b777e4b01d82ce8de6f2

Regional Graduate Student, Post-Doc, and Early Career Researcher Training IV

Principal Investigator: Derek Rosendahl (SCCASC)
Co-Investigator(s): David Gutzler(UNM), Renia Ehrenfeucht (UNM), John Fleck (UNM), Emma Kuster (SCCASC), Renee McPherson (SCCASC)
Project Topic: Science Tools for Managers
Geographic Location: South Central Region

Project Summary

Led by universities of the South Central CASC, this project builds on the successes of three prior workshops to mentor a cohort of early-career environmental professionals in the South Central U.S. to serve as part of the next generation of USGS leaders and partners. The workshop objectives are to: (1) develop the participants' knowledge, leadership skills, and interdisciplinary collaboration with an eye toward filling future USGS (or partner organization) positions; (2) introduce participants to the goals, structure, and unique research-related challenges of the South Central CASC and the larger CASC network; (3) guide participants to discuss their research beyond their disciplinary niche and with managers across the region; and (4) facilitate interdisciplinary interactions among participants to foster future collaborative opportunities.

Project Impact

The workshop will offer participants insight into how their research fits into the USGS's research priority goals and its eventual applicability to management needs across the region. Providing these early-career researchers with the skills needed to conduct stakeholder-initiated research and effectively communicate their work to those who will use it will help build a diverse workforce that can produce relevant, actionable science and provide the USGS a talent pool of future leaders.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5d486709e4b01d82ce8ddc6d

Research Symposium:
Culturally Significant Plants and Climate Change

Principal Investigator: April Taylor (Chickasaw Nation)
Project Topic: Native Communities,, Wildlife and Plants, Science Tools for Managers
Geographic Location: South Central Region

Project Summary

The loss or decline of culturally significant plants is a major concern for many tribal managers. Culturally significant plants are essential to many aspects of life for tribal members, including medicine, ceremonial practices, and traditional food dishes. In many parts of the U.S., droughts, floods, and changes in the timing of frost events are stressing these plants and in some cases have led to decreases in their areas of suitable habitat or a reduction in their resistance to disease.

Project Impact

The goal of this project is to hold a research symposium that will bring together tribal resource managers and scientists from a range of disciplines in the South Central region to identify which culturally significant species are of most concern, how those species are being affected by climate change, and the potential application of climate adaptation planning tools. In the face of changing climate conditions, this symposium will develop a network for climate-related science focused on culturally significant plants, resulting in new collaborations geared towards addressing tribal climate science priorities.

Science Base Link :

https://www.sciencebase.gov/catalog/item/5d49b794e4b01d82ce8de6fd

Strategies for Reducing the Vulnerability of Grassland Birds to Climate Change within the Central Flyway

Principal Investigator: Benjamin Zuckerberg (UW Madison)
Co-Investigator(s): Christine Ribic (USGS) & Neal Niemuth (Fish & Wildlife)
Project Topic: Grassland Birds, Climate Change Vulnerability, Climate Change Adaptation
Geographic Location: Central U.S.

Project Summary

Prairies were once widespread across North America, but are now one of the most endangered and least protected ecosystems in the world. Agriculture and residential development have reduced once extensive prairies into a patchwork of remnant prairies and "surrogate" grasslands (e.g., hayfields, planted pastures). Grassland ecosystems and many grassland-dependent birds are also particularly vulnerable to rapid shifts in climate and associated changes in drought and extreme weather.

The Central Flyway is a vast bird migration route that comprises more than half of the continental U.S., and extends from Central America to Canada, and harbors the greatest diversity of grassland birds in North America. Throughout this region, numerous agencies and organizations are entrusted with the management of grassland ecosystems and the species that depend on them in landscapes extensively altered by human activities. Today, they face the additional challenge of managing these ecosystems in the face of a rapidly changing climate.

Project Impact

The goal of this project is to synthesize the vulnerability of grassland ecosystems to climate change across the Central Flyway, with an emphasis on grassland-dependent migratory birds. Researchers will synthesize the state of the science, including providing a robust assessment of how climate variables directly and indirectly (via land use change) affect grassland habitats and migratory bird populations. Researchers will also review current and future adaptation strategies for the conservation of grassland ecosystems and grassland-dependent birds. This effort will result in a synthesis of key management strategies and future research needs related to the conservation of migratory grassland bird populations in the Central Flyway in the face of climate change.

Science Base Link :

https://www.sciencebase.gov/catalog/item/5d40ac88e4b01d82ce8d9db9

Understanding New Paradigms for "Environmental Flows" and Water Allocation in the Middle Rio Grande Basin in a Changing Climate

Principal Investigator: Ali Mirchi **(**OSU)
Co-Investigator(s): David Gutzler, Frank Ward (NMSU), Zhuping Sheng (TAMU), Gregory Torell (TAMU), William Hargrove (UTEP), Alex Mayer (MTU)
Project Topic: Science Tools for Managers, Drought, Fire and Extreme Weather, Water, Coasts and Ice
Geographic Location: South Central Region

Project Summary

Water management in the middle portion of the Rio Grande Basin (between Elephant Butte Reservoir in New Mexico and Presidio, Texas) is challenging because water demand has continued to increase over time despite limited river water and dropping groundwater levels. While urban and agricultural users can cope with frequent droughts by using a combination of river water and pumping groundwater, little to no water reaches living river ecosystems in this region. Improving this situation requires a good understanding of river water and groundwater availability, now and in the future, as well as advantages and disadvantages of water management options to sustain these ecosystems. In particular, there is a need to determine how frequently river water would be available to provide minimum "environmental flows", or the quantity, timing, and quality of water flows needed to support ecosystems and human communities, along the Rio Grande. It is also important to estimate economic gains and losses from using water for ecosystem protection instead of using it for other purposes.

Project Impact

To help provide a scientific basis for understanding these issues, the project researchers will provide scientifically plausible future scenarios of climate and river water and will conduct a systematic assessment of potential impacts to environmental water flows using state-of-the-art hydrologic and economic models. They will assess the impacts of different environmental flow scenarios in terms of changes in Rio Grande flow, crop production, and groundwater sustainability. Furthermore, the project will offer science-based insights about the economic cost of securing water for ecosystems by compensating water rights holders. The results of the project will be shared with water management organizations and interested stakeholders in the Middle Rio Grande Basin for their evaluation, feedback, and use in decision making. The outcomes of the project will inform sustainable water resources management dialogues in the southwestern U.S. and other regions facing similar challenges of providing minimum environmental flows to ecosystems.

Science Base Link :

https://www.sciencebase.gov/catalog/item/5d49b75ee4b01d82ce8de6e8

Assessing Future Changes to Spring Phenology and False Springs in the South Central United States

Principal Investigator: Adrienne Wootten (OU/SCCASC)
Co-Investigator: Keith Dixon (NOAA GFDL)
Project Topic: Ecology and Wildlife, Climate Data for Decision Making
Geographic Location: South Central Region

Project Summary

The first leaf and first bloom are indicators of spring growth and are crucial to gauge the health and change in ecosystems. Studies have shown that these indicators of spring have shifted to earlier in the year across the United States. This can lead to mismatches between plants and animals which depend on each other (pollinators and flowers, predators and prey, etc.,). False spring occur when a hard freeze follows several warm days and can cause damage to ecosystems and agriculture alike. Some projections of future climate have shown that false springs will increase, and others have shown that it will decrease in the future. However, these studies used climate projections which were not designed for South Central United States. This project will use pre-existing climate projections created specifically for this region to assess the projected changes to the first leaf, first bloom, and false spring occurrence.

Project Impact

This project will provide projections of first leaf, first bloom, and false spring using climate projections created specifically for the southcentral United States. In addition, this pilot project will provide recommendations to USGS regarding how sensitive these ecological indices are to the climate projections and appropriate use in the future. Available results and data from this project will inform ecologists with critical interest in spring phenology and false springs, improving impact assessments and adaptation decision making in the southcentral United States.

Science Base Link :

Waiting on website to post project

Hydrometeorological and Hydroclimatological Whiplashes and Boomerangs in Central Texas: Impacts on Freshwater Mussels

Principal Investigator: Elinor Martin (OU/SCCASC)
Co-Investigator(s): Astrid Schwalb (TSU), Thom Hardy (TSU MCWE), Adam Zerrenner and Chris Harper (USFWS Austin)
Project Topic: Ecology and Wildlife, Climate Data for Decision Making, Water Resources
Geographic Location: South Central Region (Central Texas)

Project Summary

The quality and quantity of water resources in the Lower Rio Grande Valley (LGRV) are strongly tied to precipitation and snowpack in the Southern Rio Grande Basin. Yet changing climate conditions are impacting these water sources. Recent analyses of the weather before and after drought and flood events in the south central U.S. indicate a more frequent occurrence of rapid weather shifts from one extreme to another (rapid wet-dry or dry-wet transitions). If these trends continue, a new type of resiliency to these shifts may be necessary to safeguard crucial water resources in the area. This project will investigate the needs for and possible ways to enhance such resiliency in the coastal sections of the LRGV. It will investigate the breadth of options available to land and water managers to adapt to changing environmental conditions by presenting them with possible future conditions. This same information about environmental conditions will be used to conduct vulnerability assessments for species of concern in the coastal LRGV.

Project Impact

Information gathered in discussions with these resource managers will include identification of critical risks posted to vulnerable species, habitat, and ecosystem functions in the region. The products of this research will include scientific information developed in collaboration with local, state, and Federal resource managers to inform water management and improve resilience in the region.

Science Base Link :

Waiting on website to post project

Fiscal Year 2018

Analyzing the Response of Waterflow to Projected Climate Conditions in the Upper Rio Grande Basin

Principal Investigator: C David Moeser (USGS)
Co-Investigator(s): Adrienne Wootten (OU/SCCASC), Toby Welborn (TX WSC), Shaleene Chavarria (NM WSC)
Project Topic: Drought, Fire and Extreme Weather, Water, Coasts and Ice
Geographic Location: Upper Rio Grande Basin

Project Summary

Water availability in the upper Rio Grande Basin is dependent on winter and monsoon season precipitation. Consecutive years of drought and above average temperatures have diminished water supply and increased demand for water in this region. The increasing gap between water supply and demand is cause for concern. Climate projections for the southwestern and south central United States suggest that temperatures will continue to increase, affecting seasonal precipitation and water availability. To better manage current water supply and prepare for possible future changes, water managers need projections of future streamflow and landscape conditions that may affect future water supply.

Project Impact

The project researchers are currently calibrating the U.S Geological Survey's Precipitation-Runoff Modeling System (PRMS) to represent the natural state of the basin without managed water operations such as reservoirs or diversions. The calibrated PRMS model will be used to estimate how water flow will respond to projected future temperature and precipitation. Several model outputs, including streamflow, evapotranspiration, and soil moisture, will also be used to help provide a clear picture of how hydrologic changes affect the water resources we use for farming, municipal water supply, healthy ecological streamflow, and other uses. Also, because the future is uncertain, the project researchers will integrate multiple future climate conditions to project a range of likely future hydrologic conditions. The team will use stakeholder meetings and an interactive web page to disseminate results and provide water managers with useable information about the magnitude, uncertainty, and implications of hydrologic response to climate change in the future.

Science Base Link :

https://www.sciencebase.gov/catalog/item/5b5a2fe0e4b0610d7f4dcd11

Assessing Climate Variability and Adaptation Strategies for the Rio Grande Basin

Principal Investigator: Samuel Sandoval Solis (UC Davis)
Co-Investigator: Victoria Sissac (US Big Bend Nat. Park), Mark Briggs (WWF)
Project Topic: Drought, Fire and Extreme Weather, Water, Coasts and Ice
Geographic Location: Rio Grande Basin

Project Summary

The Rio Grande is naturally a water-scarce basin in which droughts have been classified as severe (with almost no rain during some years) and extended (lasting more than 10, or even 15 years). Severe and persistent droughts in the Rio Grande basin reduce water availability, which triggers economic, environmental, and social impacts, and effects compliance with interstate compacts and international treaty commitments. In contrast, the Rio Grande basin is also affected by flood events that cause major losses to lives, properties, and economies. Understanding each of these periods of water scarcity and water abundance can help water managers to design adaptation strategies that cope with these two extremes while still supporting human and environmental water management needs.

Project Impact

The overall goal of this project is to assess the climate variability of the southern branch of the Rio Grande basin and characterize the periods of historical drought and water abundance for 110 years [1900 – 2010]. Results will help to understand extreme climatic events in the past to inform predictions of near future conditions of drought and floods. This study will also explore adaptation strategies relevant for agriculture, urban and rural communities, water management agencies, and environmental restoration to cope with extreme events.

This study addresses two chronic problems (droughts and floods) that have affected water users in the basin for the last 150 years and will continue to affect them in the future. Products from this research include documentation and brochures that explain possible adaptation strategies to cope with extreme climatic events and short videos for public outreach and education for communities and organizations in the Rio Grande basin.

Science Base Link :

https://www.sciencebase.gov/catalog/item/5b5a35cee4b0610d7f4dcd42

Mapping Conservation Management Efforts to Increase Coordination in the Rio Grande Basin

Principal Investigator: Victoria G. Stengel (USGS)
Co-Investigator: Genevieve Johnson (USBR), Jeffrey Bennett (NPS), Mark Briggs (WWF), Matthew Grabau (USFWS), Aimee Roberson (RGJV/ABC), Delbert Humberson (USGS)
Project Topic: Water, Coasts and Ice, Rivers, Streams and Lakes
Geographic Location: South Central U.S.

Project Summary

The Rio Grande provides drinking water for more than six million people, irrigation water for two million acres of land in the United States and Mexico, and supports riparian ecosystems that are home to endangered species like the ocelot and Rio Grande silvery minnow. Climate variability and anthropogenic activities continue to stress this already limited water resource. This project was developed in response to a request from a group of stakeholders who work in the Basin and represent federal, state and local agencies, private industry, farmers, ranchers, and NGOs. These stakeholders identified the need for a comprehensive data resource that spatially depicts where conservation activities are occurring on the ground. By developing this resource, this project will help to improve communication between resource managers, increase efficiency for managers seeking to understand where future conservation activities should be implemented for the most effective outcome, and help managers understand which conservation techniques have proved most useful in responding to changing conditions throughout the basin.

Project Impact

The project researchers will work closely with partners and stakeholders and will seek information from over 500 organizations. This information will be incorporated into a public, online resource and will be used in web mapping applications to show the locations of different efforts. This project will improve how resource managers in the Rio Grande Basin coordinate their conservation efforts to help ensure that the river meets municipal, industrial, and environmental needs into the future.

Science Base Link :

https://www.sciencebase.gov/catalog/item/5b5a327ee4b0610d7f4dcd30

Susceptibility of Rio Grande Cutthroat Trout to Displacement by Non-Native Brown Trout and Implications for Future Management

Principal Investigator: Colleen Caldwell (USGS)
Co-Investigator(s): Brock Huntsman (WVU), Abigail Lynch (NGASC), Lauren Flynn (NMSU)
Project Topic: Water, Coasts and Ice, Wildlife and Plants
Geographic Location: South Central U.S.

Project Summary

The Rio Grande Cutthroat Trout is New Mexico's state fish; but habitat loss and non-native trout invasions threaten the persistence of this fish throughout the remaining 12% of its historic range. Stakeholders, including state agencies, federal agencies, Tribal nations, Pueblos, and private groups are particularly concerned about the impact that non-native Brown Trout have on native cutthroat trout.

This project will be the first to demonstrate how non-native Brown Trout negatively affect Rio Grande Cutthroat Trout populations. The project has two primary objectives: 1) compare the health and characteristics of native Rio Grande Cutthroat Trout in areas both with and without invasive Brown Trout in cold and warm streams; and 2) determine if competition with invasive Brown Trout for food resources is associated with reductions in Rio Grande Cutthroat Trout populations. Understanding the relationship between temperature and non-native species invasion for this southernmost subspecies of cutthroat trout will benefit all cutthroat subspecies into the future as northern latitudes endure the effects of both a warming climate and continued non-native trout invasions.

Project Impact

Although the Rio Grande cutthroat trout is not at immediate risk of extinction according to the U.S. Fish and Wildlife Service, more than half of the remaining populations are considered to be in fair or poor condition. Results from this project will be valuable and useful for managers tasked with balancing Rio Grande Cutthroat Trout restoration efforts while maintaining popular sportfish destinations. This science, for example, could help stakeholders identify and focus restoration efforts on streams with the greatest potential to support Rio Grande Cutthroat Trout into the future.

Science Base Link :

https://www.sciencebase.gov/catalog/item/5b5a322ce4b0610d7f4dcd26

Synthesizing Climate Change Impacts on Wildlife Health and Identifying Adaptation Strategies

Principal Investigator: Erik Hofmeister
Co-Investigator: Jonathan Sleeman (USGS NWHC)
Project Topic: Wildlife and Plants
Geographic Location: South Central Region

Project Summary

Changing climate conditions could have significant impacts on wildlife health. Shifts in temperature and precipitation may directly affect the occurrence of disease in fish and wildlife by altering their interactions with pathogens (such as the bacterium that causes Lyme disease), helping vectors like mosquitoes and ticks expand their range, or speeding up the time it takes for a parasite to develop from an egg to an adult. Climate change can also indirectly affect the health of fish and wildlife as their habitats change. For example, reduced food availability could lead to overcrowding and increased disease transmission, or warmer temperatures might increase stress levels, weakening immune systems and making animals more susceptible to disease.

Project Impact

The goal of this project is to review and synthesize existing information on the impacts of climate change on fish and wildlife health across North America. Researchers will develop a searchable database containing this information, and will use that database to identify gaps in knowledge and unique areas of concern. Through a symposium with DOI scientists and stakeholders, including resource managers, state agencies, and tribes, researchers will define near-term science priorities for better understanding the impacts of climate change on wildlife health and will identify potential adaptation strategies.

Science Base Link :

https://www.sciencebase.gov/catalog/item/5b4f654ce4b06a6dd184402a

Fiscal Year 2017

Balancing Water Usage and Ecosystem Outcomes Under Drought and Climate Change: Enhancing an Optimization Model for the Red River

Principal Investigator: Thomas Neeson (OU)
Co-Investigator(s): Hernan Moreno (OU) & Hamad Zamani Sabzi (OU)
Project Topic: Water Resources, Ecology and Wildlife
Geographic Location: South Central Region (Red River)

Project Summary

Hydrologic drought and declining water availability are among the foremost stressors of stream ecosystems in the Red River basin. Resource managers face the challenge of apportioning scarce water resources among competing uses, but they lack a systematic framework for comparing the costs and benefits of proposed water management decisions and conservation actions.

Project Impact

In 2016, Co-PIs Neeson and Moreno were funded by the Great Plains LCC to develop a decision support model for identifying the most cost-effective water conservation alternatives across the Red River basin. Here, we propose to extend this optimization model in three significant ways to support cost-effective conservation decisions in the face of climate change and drought. First, we will incorporate SC CSC-developed predictions of rainfall, runoff, and stream flows through the year 2099 into our hydrologic database. Using this database, our enhanced optimization model will enable decision-makers to visualize and evaluate multiple competing water use scenarios under future drought conditions. Second, we will use SC-CSC predictions of stream flows and temperature through the year 2099 to estimate the future distributions of 28 fish species of conservation concern across the Red River. These future distribution maps will enable conservation practitioners to proactively manage species projected to be at greatest risk from declining water availability. Third, we will extend our optimization model to enable decision-makers to explicitly quantify trade-offs between competing water uses and ecological outcomes under multiple use scenarios. In doing so, our optimization model will provide resource managers with a means to identify conservation strategies that maximize outcomes for Great Plains stream ecosystems while meeting growing societal needs for water.

Science Base Link :

https://www.sciencebase.gov/catalog/item/594aa28de4b062508e36f450

Cultivating a Climate Science Learning Community Amongst Tribal Water Managers

Principal Investigator: Molly Yunker (OU)
Co-Investigator(s): Renee McPherson (OU), April Taylor (SCCASC), Roger Fragua (Flower Hill Institute), Kim Merryman (SCCASC)
Project Topic: Native Communities
Geographic Location: South Central Region (NM and OK)

Project Summary

In previous climate trainings conducted for tribes and pueblos in Oklahoma and New Mexico, impacts to water resources have emerged as a priority concern. Building on the success of past South Central CSC trainings such as Climate 101, this project will provide opportunities for water managers from 20 tribes to exchange knowledge in a series of workshops. These workshops, some virtual and some face-to-face, will allow water management professionals to discuss emerging issues with climate scientists, cultivate a community of practice, and increase their capacity for successful climate adaptation.

Project Impact

Through the workshops, water resource professionals will collaborate to understand the latest developments in climate science. Additionally, they will develop an understanding of effective ways to cultivate a community of learning professionals, with an awareness of best practices of other Nations. The Native American Nations – with people vulnerable to climate change, and governments that can greatly empower regional adaptation efforts – will benefit from the establishment of a learning community. The project participants, future tribal water managers, and their tribes can more effectively help the region seek sustainable solutions as a cohesive group of tribal professionals.

Science Base Link :

https://www.sciencebase.gov/catalog/item/594aa2f0e4b062508e36f46e

Evaluation of Sustainable Water Availability in Drought Prone Watersheds in Southeastern Oklahoma

Principal Investigator: Wayne Kellogg (Chickasaw Nation)
Co-Investigator(s): Robert Mollenhauer (OSU), Shannon Brewer (OCFWRU), Tye Baker (Choctaw Nation), Joshuah Perkin (Tenn. Tech. Univ), Duane Smith (Chickasaw Nation), Barney Austin (Chickasaw Nation)
Project Topic: Water Resources, Drought
Geographic Location: South Central Region (TX)

Project Summary

During the severe drought of 2010-2015, several communities in southeast Oklahoma almost ran out of water. Some of these communities rely on streams and rivers as their sole source of water and when these sources almost ran dry, it left them searching for alternatives and wondering how to continue growing, economically, with this water uncertainty. The possibility of climate change has these communities further concerned, primarily because they do not know what to expect. Previously, the USGS, both Chickasaw and Choctaw Nations collaborated on a project to apply a range of possible climate change scenarios to the Red River watershed to determine future water availability. This study will focus specifically on southeast Oklahoma, refining existing numerical models and identifying specific communities and water bodies most at risk. The previous project provided watershed-wide estimates of future impacts to water resources, but not at the level of detail needed to make decisions at the local scale. This study will build on the results of the previous study, developing water demand supply projections for the most water vulnerable communities, helping them with long range planning. In addition, this study will look at the likelihood and environmental implications of rivers in southeast Oklahoma drying out – specifically impacts on fish populations – and the ability of these species to return to the rivers once normal flow conditions are restored.

Science Base Link :

https://www.sciencebase.gov/catalog/item/594aa2bce4b062508e36f45a

Regional Graduate Student, Post-Doc, and Early Career Researcher Training III

Principal Investigator: Derek Rosendahl (SCCASC)
Co-Investigator(s): Victor Rivera-Monroy (LSU), Esther Mullens (SCCASC), Kristine DeLong (LSU), Renee McPherson (SCCASC)
Geographic Location: South Central Region

Project Summary

Led by members of the South Central Climate Science Center (SC CSC) consortium, this project builds upon the successes of the 2014 and 2016 trainings to develop and implement professional development training for graduate students, postdocs, and early-career researchers within the SC CSC region. The objectives were: (1) introduce a new cohort of early-career researchers to the research challenges of the SC CSC, offering them insight into how their research fits into the broader priorities of the SC CSC and applicability to end user needs; (2) facilitate interdisciplinary interactions to discuss research with peers and foster collaborative opportunities; and (3) generate a syllabus, knowledge tests, and specific curricular materials designed for a formal classroom setting. Curricular materials included digitally recorded presentations on the SC CSC enterprise, a "how to" guide for conducting similar trainings, and real-world case studies that illustrate the science-to-policy interface. Our desire was to remove the institutional barriers, or "silos," at an influential time of development for these early-career professionals and to build a cohort who can continue networking across the SC CSC through their research pathways and who will eventually lead outcome-oriented, interdisciplinary research.

Science Base Link :

https://www.sciencebase.gov/catalog/item/594aa223e4b062508e36f42d

The Effects of Wildfire on Snow Water Resources under Multiple Climate Conditions

Principal Investigator: C. David Moeser (NMWSC)
Project Topic: Drought, Fire and Extreme Weather
Geographic Location: South Central Region (NM)

Project Summary

The Colorado and Rio Grande Rivers provide drinking water to millions of people in the Southwest and South Central U.S. Snowmelt accounts for 70% of streamflow in these rivers, meaning that water use downstream is directly impacted by snow accumulation and snowmelt patterns in the mountains. Mountain forests are a critical part of the hydrologic cycle that feeds these rivers, providing water supply and storage. However wildfire, which is becoming more common as temperatures rise, can disrupt the role of mountain forests in the hydrologic cycle. Uncertainty about the interactions between wildfire and snow-water, and how these interactions may change as climate conditions shift, impedes effective water resource planning in the region.

Project Impact

Until recently, there has been no method available to characterize the potential effects of forest fire on snow-water (water from melted snow) resources. This project will combine two newly developed models that will for the first time allow an accurate analysis of the effects of wildfire on snow-water resources, under current and possible future climate conditions. Researchers will focus on the Las Conchas Fire burn zone in New Mexico's Jemez Mountains, where approximately 156,000 acres were burned in 2011. However, the framework developed to complete this study will be relevant to forested regions throughout the world where snow-water resources overlap potential burn areas.

The results of this project will improve snow-water forecasting, and therefore water resource planning. For example, the National Weather Service plans on using the results to improve their forecasting capabilities in snowmelt-driven basins that have been impacted by wildfire.

Science Base Link :

https://www.sciencebase.gov/catalog/item/594aa2dfe4b062508e36f465

Wildfire Probability Mapping Based on Regional Soil Moisture Models

Principal Investigator: Tyson Ochsner (OSU)
Co-Investigator(s): Erik Krueger (OSU), Laura Norman (WGSC), Matthew Levi (USDA-ARS NM), Miguel Villarreal (WGSC), Brandon Bestelmeyer (USDA-ARS), Emile Elias (USDA-ARS NM), David Brown (USDA-ARS S. Plains Clim. Hub)
Project Topic: Drought, Fire and Extreme Weather
Geographic Location: South Central Region

Project Summary

Wildfires scorched 10 million acres across the United States in 2015, and for the first time on record, wildfire suppression costs topped $2 billion. Wildfire danger modeling is an important tool for understanding when and where wildfires will occur, and recent work by our team in the South Central United States has shown wildfire danger models may be improved by incorporating soil moisture information. Advancements in wildfire danger modeling may increase wildfire preparedness, and therefore decrease loss of life, property, and habitat due to wildfire. Still, soil moisture—an important determinant of wildfire risk—is not currently used for wildfire danger assessments because data are generally unavailable at the appropriate scales of space and time.

Project Impact

Our project addresses this knowledge gap by developing and disseminating improved wildfire danger assessments that are rooted in high precision estimates of soil moisture. Primary goals are (1) develop an effective model of soil moisture for the Red River and Rio Grande basins using soil maps and climate data; (2) quantify the relationships between modeled soil moisture and wildfire probability; and (3) distribute soil moisture and wildfire probability maps for both basins. Primary outcomes of this work include new web-based tools for exploring soil moisture dynamics in near real-time and relating those dynamics to wildfire probability. We will initiate an aggressive outreach program to ensure our results will have practical applications relevant to a wide range of stakeholders interested in drought, flooding, and fire monitoring and prediction. The intended users of research outcomes include hydrologists, soil scientists, fire planners, land management personnel from universities, state and federal agencies and stakeholder groups including landscape conservation cooperatives and Tribal organizations. In addition to using soil moisture data for wildfire probability models, the maps will be applicable to decisions for planning prescribed fire treatments and post-fire reclamation activities.

Science Base Link :

https://www.sciencebase.gov/catalog/item/594aa23de4b062508e36f43c

Fiscal Year 2016

Building a Decision-Support Tool for Assessing the Impacts of Climate and Land Use Change on Ecological Processes

Principal Investigator: Terry L. Sohl (Geographic Science Team, EROS)
Project Topic: Science Tools for Managers
Geographic Location: South Central Region

Project Summary

Scientists, planners, policy makers and other decision-makers in the South Central U.S. want to understand the potential impacts of changes in climate, precipitation, and land-use patterns on natural and cultural resources. Though the potential impacts of climate change can be modeled to help decision-makers plan for future conditions, these models rarely incorporate changes in land-use that may occur. Climate change and land-use change are often linked, as shifts in precipitation and temperature can alter patterns in human land-use activities, such as agriculture.

Project Impact

This project sought to address this gap by developing new software tools that enable stakeholders to quickly develop custom, climate-sensitive land-use projections to satisfy a range of application needs. Stakeholders from across the region participated in the development of the model through two workshops, designed to first gather stakeholder needs and then to apply and evaluate the model to ensure that it maximizes potential use across all stakeholder groups.

Users of the end-product will be able to build customized, scenario-based projections of landscape change, including landscape response to climate change, such as wildfires or altered vegetation patterns. The projections generated with these tools will enable decision-makers and land-use planners to visualize potential future landscapes, optimize land management practices, and adapt to negative impacts of climate and land-use change on ecological and economic systems.

Science Base Link :

https://www.sciencebase.gov/catalog/item/580faee6e4b0f497e7960104

Characterizing Uncertainties in Climate Projections to Support Regional Decision-Making

Principal Investigator: Adrienne Wootten (SCCASC, OU)
Project Topic: None
Geographic Location: South Central Region

Project Summary

Global Climate Models (GCMs) use our understanding of atmospheric physics and other earth processes to simulate potential future changes in climate on a global scale. However, these large scale models are not fit for predicting smaller scale, local changes. Downscaling methods can be applied to the outputs of GCMs to give guidance appropriate for a more regional level. No standard approach to downscaling currently exists, however, and the process often results in climate projections that suggest a wide array of possible futures. It is critical that decision-makers looking to incorporate climate information understand the uncertainties associated with different downscaling approaches and can evaluate downscaled data to determine which datasets are appropriate for addressing their questions.

Project Impact

The goal of this project is to provide decision-makers with this information by evaluating the uncertainties associated with different downscaled datasets. Materials will then be developed to communicate these uncertainties to managers and explore how they can be incorporated into risk decision-making. The results will enable managers across the country to better understand possible climate futures in their jurisdictions, allowing them to make more informed planning decisions in the face of uncertainty.

Science Base Link :

https://www.sciencebase.gov/catalog/item/580e45d5e4b0f497e794b5dc

Developing Tools for Improved Water Supply Forecasting in the Rio Grande Headwaters

Principal Investigator: David Clow (Colorado WSC)
Co-Investigator(s): Colin Penn & Graham Sexstone (USGS Colorado WSC)
Project Topic: Water Resources, Science Tools for Managers
Geographic Location: South Central Region

Project Summary

The Rio Grande River is a critical source of freshwater for 13 million people in Colorado, Texas, New Mexico, and Mexico. More than half of the Rio Grande's streamflow originates as snowmelt in Colorado's mountains, meaning that changes in the amount of snowmelt can impact the water supply for communities along the entire river. Snowmelt runoff is therefore an important component of water supply outlooks for the region, which are used by a variety of stakeholders to anticipate water availability in the springtime.

It is critical that these water supply outlooks be as accurate as possible. Errors can cost states millions of dollars due to mis-allocation of water and lost agricultural productivity. There is a perception that runoff forecast accuracy has declined over the last several decades in Colorado and New Mexico, making water supply outlooks less reliable. Declines in accuracy could be related to changes in climate and land cover; however, potential sources of error have not yet been examined in the upper Rio Grande basin.

Project Impact

This study aims to improve runoff forecast models for the upper Rio Grande. Researchers will identify potential sources of error in existing models, improve the representation of snowpack in models of the watershed, develop a new hydrologic model for the basin, and test this model's ability to forecast runoff. The end product of this study will be a tool for making improved runoff forecasts for the upper Rio Grande basin. The tool will be transferable to other snowmelt-dominated basins in the region that have similar characteristics. These improved runoff forecasts, in turn, can be used to develop more accurate water supply outlooks in the region, empowering stakeholders in the basin to plan their water use more effectively.

Science Base Link :

https://www.sciencebase.gov/catalog/item/580a8ea6e4b0f497e7906c84

Enhancing to Capacity of Coastal Wetlands to Adapt to Sea-Level Rise and Coastal Development

Principal Investigator: Michael J Osland (USGS Wetland and Aquatic Research Center
Project Topic: Water Resources, Wetlands
Geographic Location: South Central Region, Southeast

Project Summary

Coastal wetlands provide a suite of valuable benefits to people and wildlife, including important habitat, improved water quality, reduced flooding impacts, and protected coastlines. However, in the 21st century accelerated sea-level rise and coastal development are expected to greatly alter coastal landscapes across the globe. The future of coastal wetlands is uncertain, challenging coastal environmental managers to develop conservation strategies that will increase the resilience of these valuable ecosystems to change and preserve the benefits they provide.

Project Impact

One strategy for preparing for the effects of sea-level rise is to ensure that there is space available for coastal wetlands to adapt by migration. In a recent study, researchers identified areas where coastal wetlands may move inland along the northern Gulf of Mexico coast, one of the most wetland-rich and sea-level rise sensitive regions of the world. Building on these findings, this project will produce customized landscape conservation-design products focused on identifying landward migration routes for coastal wetlands. The resulting products will provide environmental managers with information to make decisions to enhance the capacity of coastal wetlands to adapt to sea-level rise and coastal development, protecting these ecosystems and the critical economic and ecological benefits that they provide.

Science Base Link:

https://www.sciencebase.gov/catalog/item/580a8e71e4b0f497e7906c7a

Identifying Best Agricultural Management Practices for Maintaining Soil Health and Sustainability Under Changing Climate Conditions

Principal Investigator: John Zak (TTU)
Project Topic: Landscapes
Geographic Location: South Central Region

Project Summary

The role of soil temperature in agricultural health is largely understudied, but recent research suggests that it can affect soil health in important ways. Researchers at Texas Tech University found that lower daily temperature ranges of soil in the Southern High Plains were associated with higher levels of soil microbes (which help make critical nutrients available for plants) and decreased nitrogen availability. These results suggest that climate variability may have implications for soil health and microbial content. In the South Central U.S., a more developed understanding of how management practices, climate variability, and soil health interact is essential for sound agricultural decision-making.

Project Impact

This project implemented demonstration fields in which various sustainable management practices can be tested and their impacts on soil temperature and health can be monitored. The demonstration fields focused on cotton production and will test management practices related to water use efficiency, carbon storage, and soil health. In addition to demonstrating the effects of various management practices, these plots were designed to determine how much variability cotton production systems can tolerate before ecosystems and the services they provide are negatively affected.

This demonstration system is in high demand amongst regional stakeholders and was implemented with the support of the South-Central USDA Climate Hub, NRCS scientists, and Cotton Inc. It was expected to contribute substantially to our collective understanding of the interactions between climate variability, soil health, and agricultural productivity in the Southern High Plains while equipping stakeholders with the knowledge they need to make appropriate management decisions for optimal agroecosystem health.

Science Base Link:

https://www.sciencebase.gov/catalog/item/580e3d04e4b0f497e79480aa

Identifying Conservation Objectives for the Gulf Coast Habitats of the Black Skimmer and Gull-Billed Tern

Principal Investigator: James Cronin (USGS Wetland and Aquatic Research Center)
Project Topic: Water Resources, Wildlife and Plants
Geographic Location: South Central Region, Southeast

Project Summary

Many shorebirds and nearshore waterbirds are of conservation concern across the Gulf of Mexico due to stressors such as human disturbance, predation, and habitat loss and degradation. Conservation and protection of these birds is important for the functioning of healthy ecosystems and for maintaining biodiversity in North America. Consequently, resource managers along the gulf need decision-aiding tools that can efficiently help to answer important conservation questions for different species (e.g. which areas and how much area should be targeted by management actions to meet a particular species' needs).

Project Impact

To address this need, project researchers are developing statistical models that will help identify habitat conservation objectives and actions for bird species taking into account different gulf coast conservation scenarios that might occur in response to sea-level rise. The project will focus specifically on the Black Skimmer (*Rynchops niger*) and Gull-billed Tern (*Gelochelidon nilotica*), two species identified as representative of sustainable gulf habitats and designated as U.S. Fish and Wildlife Service Species of Conservation Concern and Gulf Coast Joint Venture Priority Species. These two birds are also representative of a variety of other beach and barrier-island nesting birds whose nesting habitats are threatened by sea-level rise (e.g., Least Tern, Snowy and Wilson's Plover). The statistical models will link each bird's population abundance to habitat characteristics that could be influenced by different management actions and will use this information to identify conservation objectives under different conservation scenarios.

This project was co-funded by the South Central and Southeast Climate Adaptation Science Centers and the Gulf Coast Prairie, Gulf Coastal Plains and Ozarks, and Peninsular Florida Landscape Conservation Cooperatives. An alternate reference to this project can be found here.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5813ac7de4b0d63fd467bb68

Improving Predictions of Water Supply in the Rio Grande under Changing Climate Conditions

Principal Investigator: David Gutzler (UNM)
Project Topic: Water Resources
Geographic Location: South Central Region, Rio Grande

Project Summary

On its southbound course from Colorado to the Gulf of Mexico, the Rio Grande provides water resources for more than 13 million people. The quantity of water flowing into the northern section of the river depends on how much snowpack from the Rocky Mountains melts into runoff and on seasonal precipitation rates. Models describing the relationship between winter snowpack quantity and springtime snowmelt runoff quantities for the basin are combined with models describing long-term natural variation in precipitation to create water supply outlooks. The outlooks developed by the U.S. Natural Resources Conservation Service are currently used by stakeholders to make critical water allocation decisions in the basin. Improvements to water supply outlooks could be worth millions of dollars associated with better water allocation strategies.

Project Impact

In order to ensure that these outlooks are as accurate as possible for water management planning, there is a need to better understand how snowpack and snowmelt runoff are related to each other and how both may be influenced by large climatic variation such as El Niño and global climate change. To address this need, this project will combine historical data and climate model projections to develop enhanced prediction models relating winter snowpack to subsequent snowmelt runoff in the upper Rio Grande.

The results of this research will identify changes to streamflow predictability over the past several decades (a period of rapid observed warming), and assess future predictability. This work will also help to inform the development of more reliable water supply outlooks essential for planning purposes in the Rio Grande Basin, such as reservoir management and irrigated agriculture.

Science Base Link:

https://www.sciencebase.gov/catalog/item/580e2a3ae4b0f497e7946c7c

Fiscal Year 2015

Assessing the State of Water Resource Knowledge and Tools for Future Planning in the Lower Rio Grande-Rio Bravo Basin

Principal Investigator: Samuel Sandoval Solis (UC Davis)
Co-Investigator: Sarah Null (USU)
Project Topic: Water Resources, Science Tools for Managers
Geographic Location: South Central Region

Project Summary

The Rio Grande-Rio Bravo River is the second longest river in the US and is a critical drinking water source for more than 13 million people. It flows south from the snow-capped mountains of Colorado through the New Mexico desert, forms the border between Texas and Mexico, and empties into the Gulf of Mexico at Brownsville, Texas. The multi-national, multi-state, ecologically diverse nature of this river makes management of the resource a complex task, especially in the context of more frequent droughts, changes in land use patterns, and increasing water use needs.

Project Impact

The main objective of this project was to assess the state of water resources management policies and planning tools for the Lower Rio Grande-Rio Bravo Basin. The project researchers developed an inventory of water management information and compiled a list of all the available models that can be used to evaluate human and environmental water management objectives. As part of this effort, the team identified the applicability of those models to evaluating trade-offs for meeting societal and environmental flow requirements to restore native ecosystems. They also identified information gaps that merit additional research and resources and described promising future steps to integrate and improve existing systems models.

Findings from this research show that there are a variety of models that can assist planning activities to implement environmental flows across the Basin. However, no models with the appropriate spatial extent and the necessary time-step exist for developing operational environmental flow targets in the basin. This work provides water resource managers with valuable insight as they work to balance human and ecological water needs throughout the basin.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5601b51de4b03bc34f5445e0

Assessing the State of Water Resource Knowledge and Tools for Future Planning in the Lower Rio Grande-Rio Bravo Basin

Principal Investigator: John Schmidt (USU) & Phaedra Budy (USGS- Utah CFWR Coop Unit)
Project Topic: Water Resources, Science Tools for Managers
Geographic Location: South Central Region

Project Summary

The Rio Grande-Rio Bravo River is the second longest river in the US and is a critical drinking water source for more than 13 million people. It flows south from the snow-capped mountains of Colorado through the New Mexico desert, forms the border between Texas and Mexico, and empties into the Gulf of Mexico at Brownsville, Texas. The multi-national, multi-state, ecologically diverse nature of this river makes management of the resource a complex task, especially in the context of more frequent droughts, changes in land use patterns, and increasing water use needs.

Project Impact

The purpose of this project was to review scientific monitoring and research reports and provide an overview of the state of the knowledge of the Upper Rio Grande-Rio Bravo Basin. The project researchers developed a report that synthesizes historical and geomorphic studies that describe the river's characteristics in the 1800s, its subsequent transformation caused by consumptive water use, dams, and physical manipulation of the channel, and a modern understanding of the natural and transformed flow regime. An extensive second section of the report focuses on aquatic ecology of the four major river segments of the Basin. In that section, the researchers summarize current understanding of the historical state compared to the contemporary state of the ecosystem, identify causes of ecosystem degradation, with an emphasis on those factors most affected by flow, and identify existing efforts to reverse ecosystem degradation, however intractable and dynamic these efforts may be. Finally, the project team summarized the state of knowledge of potential "knobs" that can be "turned" relating an ecological response to some component of flow management. They also seek to identify information gaps.

Realizing the need to define novel, new targets for desirable ecosystems places a great challenge on applied river science. To date, river science is pursued piece meal and focused on discrete segments of the watershed. This work helps to build a connection between politically-acceptable water management compromises, and the environmental flows needed to achieve river ecosystem objectives.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5ca62befe4b0c3b0064c24f1

Climate Training for Native Tribes of Louisiana and New Mexico

Principal Investigator: Kristine DeLong (LSU)
Co-Investigator: Micha Rahder (LSU)
Project Topic: Native Communities, Tribes and Tribal Organizations
Geographic Location: South Central Region

Project Summary

Tribal nations are one of the most vulnerable populations to climate change in the United States, because of their reliance upon the natural environment to sustain traditional ways of life and current lack of training and resources to respond to climate change impacts. This project sought to increase south-central U.S. tribes' basic knowledge of climate science, connect them with tools to assess their communities' vulnerabilities, and build their skills to develop adaptation and mitigation strategies. Researchers conducted multiple two-day climate training sessions for Native American tribes in Louisiana and New Mexico. The trainings emphasized regionally specific scientific and social scientific aspects of climate change that are relevant to the tribal nations' land management and planning decisions. By participating in these training sessions, participants were expected to gain knowledge that will help them better manage their resources in the context of a changing climate.

Science Base Link:

https://www.sciencebase.gov/catalog/item/551ebe97e4b027f0aee3b924

Developing and Analyzing Statistically Downscaled Climate Projections for the South Central U.S.

Principal Investigator: Adrienne Wootten (OU)
Co-Investigator: Renee McPherson (OU), Berrien Moore III (OU), John Lanzante (NOAA-GFDL), Keith Dixon (NOAA-GFDL)
Geographic Location: South Central Region

Project Summary

Global climate models (GCMs) are a tool used to model historical climate and project future conditions. In order to apply these global-scale datasets to answer local- and regional-scale climate questions, GCMs undergo a process known as "downscaling". Since there are many different approaches to downscaling there associated sources of uncertainty; however, downscaled data can be highly valuable for management decision-making if used with a knowledge of its limitations and appropriate applications.

Project Impact

In order to use downscaled data appropriately, scientists and managers need to understand how the climate projections made by various downscaling methods are affected by uncertainties in the climate system (such as greenhouse gas emissions and observed data). This project will produce 243 climate projections using three different downscaling methods, giving researchers insight into how each of these methods responds to various sources of climate uncertainty. This analysis will allow researchers to assist managers in selecting the best downscaled data for their specific management questions. This project will also result in foundational downscaled climate projections for the South Central region, assisting stakeholders in identifying the potential impacts of climate on a range of systems, from water to ecosystems to agriculture.

Science Base Link:

https://www.sciencebase.gov/catalog/item/551ebeb0e4b027f0aee3b92d

Helping Fire Professionals Understand and Manage Changing Fire Regimes

Principal Investigator: Mark Shafer (OU)
Co-Investigator: John Weir (OSU), Brian Hays & Amy Hays (TAMU)
Project Topic: Drought, Fire and Extreme Weather
Geographic Location: South Central Region

Project Summary

Fire is a natural and necessary component of the South Central Plains ecosystem. However, fire suppression and more frequent droughts in the region have resulted in a build-up of dry fuels loads such as dead wood, resulting in fires that burn hotter and impact the landscape more severely. Uncontrolled wildfires have cost the region several billion dollars over the past five years. Further, fire suppression has resulted in substantial losses in native plant biodiversity and wildlife habitat, which also has costly implications. In Oklahoma alone, it's estimated that $157 million will be required to restore rangelands to their native conditions. Of further concern is the fact that projected changes in climate indicate that the region will continue to experience hotter and drier conditions, meaning that fire risks will continue to increase unless proper management strategies, such as prescribed fire, are implemented.

Project Impact

In order to develop effective fire management responses, ongoing research into the changing scope and intensity of fire regimes in the region needs to be better connected to management practitioners and their expertise. This project was designed to help managers respond to changing fire regimes by analyzing historical climate observations and future projections to identify days which are suitable for prescribed burns as well as days of high wildfire potential. Results from the analysis were presented and discussed at a fire summit convening leading researchers, agencies, and land owners. The summit also brought together fire experts to discuss the safe and proper application of fire in a changing and variable climate, along with management strategies for fire and its role in combating invasive plant species, maintaining productive landscapes, and enhancing wildlife habitat.

Science Base Link:

https://www.sciencebase.gov/catalog/item/551ec027e4b027f0aee3b952

Informing Hydrologic Planning in the Red River Valley through Improved Regional Climate Projections

Principal Investigator: Ming Xue (CAPS, OU)
Project Topic: Water Resources
Geographic Location: South Central Region

Project Summary

Across the Southern Great Plains, increasing temperatures are expected to alter the hydrological functioning of the region by contributing to severe droughts, more intense rainfall events, and more severe flooding episodes. These changes could adversely affect human and ecological communities. The ability to better predict future changes in precipitation and the response of hydrologic systems in the region could help mitigate their negative impacts. Yet while today's global climate models provide large-scale projections of future temperature and precipitation patterns that can be broadly useful for large-scale water resource planning, they are often not appropriate for use at a smaller, more local scale.

Project Impact

This research aimed to develop high-resolution climate projections for the Southern Great Plains that are better suited to informing water management at the local scale, with a focus on the Red River Valley. High resolution weather models can be used to downscale global climate model forecasts to provide more accurate local projections of future climate conditions for the Valley. These models are meant to be run multiple times, creating a spread of model outcomes that will provide insight into the range of possible climate futures for the region and reveal any uncertainties managers should be aware of when using the projections. The very high-resolution projections are expected to be used in the context of long-term hydrological modeling and management to inform cost-effective flood control planning, water supply management, hydroelectric power generation, and ecosystem conservation.

Science Base Link:

https://www.sciencebase.gov/catalog/item/551ec03ee4b027f0aee3b95b

Informing the Management and Coordination of Water Resources in the Rio Grande Basin

Principal Investigator: Jack Friedman (OU)
Co-Investigator(s): Jadwiga Ziolkowska & Jennifer Koch (OU)
Project Topic: Water Resources, Science Tools for Managers
Geographic Location: South Central Region, Rio Grande

Project Summary

Understanding how to manage scarce water during drought is one of the great challenges we face as a society, particularly for communities in the Rio Grande Basin. Severe drought coupled with human development have profoundly impacted the quantity and quality of water in the basin. Running through Colorado, New Mexico, Texas, and Mexico, the Rio Grande is a multi-national resource that is managed by many different state, federal, and local authorities and used by diverse stakeholders. Developing the basin-wide responses necessary for drought resilience throughout the Basin can be challenging in such a complex management context.

Project Impact

This project seeks to understand how different human and environmental factors affect ten sections of the Rio Grande in order to identify how management strategies and human uses of the river can be better coordinated. The end product will be a tool allowing stakeholders to examine the costs and benefits of their decisions for themselves and for upstream and downstream users. Overall, the results of this research will help stakeholders improve future drought resilience and facilitate the sustainable use of water resources throughout the Basin.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5601b4ffe4b03bc34f5445d6

Online Climate Change Impacts Course to Inform Managers about Planning for the Future

Principal Investigator: Elinor Martin (OU)
Co-Investigator(s): Renee McPherson (OU), Jeff Muehring (NextThought LLC)
Project Topic: Science Tools for Managers
Geographic Location: South Central Region

Project Summary

Most resource managers need to take climate impacts into account when making decisions during the course of their career, whether their work protects native species populations, reduces the impact of extreme storms on infrastructure, or improves water quality in a watershed. Professional training that develops an understanding of the climate system, how it is changing, and what that means for various natural and cultural resources can help improve long-term management outcomes. However, not all agencies or organizations have the capacity to provide this important training, limiting the ability of managers to interpret complex climate data and address climate-related questions.

Project Impact

Therefore, this project developed an online, interactive course titled "Managing for a Changing Climate." The course is free and available worldwide for anyone with an internet connection through the Janux platform. Course content and assignments provide students with an integrative understanding of the climate system, the role of natural variability in the climate system, external drivers of climate change, and the implications of climactic shifts for natural and cultural resources. Resources managers, tribal environmental professionals, staff and students at other Climate Science Centers and Landscape Conservation Cooperatives, and members of the general public can participate freely.

Material for this course was developed in partnership with NextThought LLC, NASA through the Oklahoma Space Grant Consortium, and the University of Oklahoma College of Atmospheric and Geographic Sciences. The course is also offered as a 3-credit upper division undergraduate course in the Department of Geography and Environmental Sustainability at the University of Oklahoma.

Science Base Link:

https://www.sciencebase.gov/catalog/item/551aa76ee4b0323842783721

Quantifying Future Precipitation in the South Central U.S. for Water Resources Planning

Principal Investigator: Jung-Hee Ryu (TTU)
Co-Investigator(s): Sharmistha Swain & Katharine Hayhoe (TTU), Luigi Romolo, Kevin Robbins, Barry Keim (LSU)
Project Topic: Drought, Fire and Extreme Weather
Geographic Location: South Central Region

Project Summary

The South Central U.S. is home to diverse climates and ecosystems, strong agricultural and energy sectors, and fast-growing urban areas. All share a critical need for water, which is becoming an increasingly scarce resource across the region as aquifers are overdrawn and populations grow. Understanding what brings rain to this region, and how the timing and amount of precipitation may be affected by climate change, is essential for effective water planning and management, yet community planners and managers have indicated that currently available precipitation forecasts for the South Central are insufficient, due largely to the high levels of uncertainty associated with precipitation projections for the region.

Project Impact

This project aims to improve scientific understanding of the local and large-scale atmospheric processes that bring moisture to the region and drive precipitation. The project will analyze long-term historical weather station records and atmospheric dynamics, improving our ability to interpret global climate model simulations and apply them to regional management questions. Researchers will project future changes in seasonal rainfall and drought risk to assist water resources planning and preparedness efforts.

Lessons learned from this work will be used to inform long-term projections for our region, making complex climate information and analyses more approachable, understandable, and actionable for regional policy-makers, planners, and managers.

Science Base Link:

https://www.sciencebase.gov/catalog/item/551ebfd5e4b027f0aee3b936

Regional Graduate Student and Early Career Researcher Training II

Principal Investigator: Derek Rosendahl (SCCASC)
Co-Investigator(s): John Zak (TTU), Aparna Bamzai & Renee McPherson (SCCASC)
Geographic Location: South Central Region

Project Summary

Investigating the complex natural and cultural resource management challenges we face today requires building diverse, interdisciplinary research teams. Robust stakeholder engagement is also critical for ensuring that publicly funded science answers questions that are relevant to natural and cultural resource management decisions. Early career scientists who learn how to engage with multi-disciplinary research teams and stakeholders in the early stages of their career have a competitive advantage in the workforce and can help develop actionable science that addresses critical management questions.

Project Impact

This project built upon the successes of the 2014 Early Career Training to develop and host a week-long professional development training for graduate students, postdoctoral researchers, and early-career environmental professionals within the South Central Climate Science Center (SC CSC) region. The training provided a foundation for working in today's interdisciplinary, stakeholder-driven research contexts and removing institutional barriers at an influential time of development for participants. Participants were encouraged to continue networking across the SC CSC through their research pathways and be leaders in outcome-oriented, interdisciplinary research that addresses stakeholder-driven research questions.

Science Base Link :

https://www.sciencebase.gov/catalog/item/551ec008e4b027f0aee3b948

Soil Moisture-Based Drought Monitoring for the South Central Region

Principal Investigator: Tyson Ochsner (OSU)
Co-Investigator(s): Steven Quiring (TAMU) & Erik Krueger (OSU)
Project Topic: Drought, Fire and Extreme Weather
Geographic Location: South Central Region

Project Summary

Soil moisture is a critical variable for understanding the impacts of drought on ecological, hydrological, and agricultural systems. Yet, key research gaps currently prevent existing soil moisture measurements from being used to assess drought conditions and mitigate drought impacts such as wildfire outbreaks, lost agricultural production, and degraded wildlife habitat. In fact, most scales used to characterize the severity of drought, known as "drought indices", don't include soil moisture measurements, relying instead on atmospheric data. Current barriers to the incorporation of soil moisture data include a lack of consensus regarding how to best construct soil moisture-based drought indices, the challenges associated with integrating existing soil moisture data collected from diverse networks, and a lack of guidelines on how to apply these indices to different crop types.

Project Impact

The objective of this project was to build the necessary scientific foundation for soil moisture-based drought monitoring in the South Central region and beyond. This project was expected to produce effective soil moisture-based drought indices that decision-makers can use retrospectively or in real-time with data from existing monitoring networks to assess drought severity in the South Central region or across the US. Researchers also sought to create the first regional soil moisture database for the South Central US, which aimed to further support drought monitoring and other climate-related research efforts in this drought-prone region. This improved monitoring capability may facilitate early detection and the implementation of adaptive management strategies, which research has shown are key to reducing the economic and ecological impacts of drought.

Science Base Link:

https://www.sciencebase.gov/catalog/item/551ebff1e4b027f0aee3b93f

Fiscal Year 2014

Community Resilience to Drought Hazard: An Analysis of Drought Exposure, Impacts, and Adaptation in the South Central U.S.

Principal Investigator: Nina Lam (LSU)
Co-Investigator(s): Robert Rohli & Margaret Reams (LSU)
Project Topic: Drought, Fire and Extreme Weather
Geographic Location: South Central Region

Project Summary

The threat of droughts and their associated impacts on the landscape and human communities has long been recognized in the United States, especially in high risk areas such as the South Central region. There is ample literature on the effects of long-term climate change and short-term climate variability on the occurrence of droughts. However, it is unclear whether this information meets the needs of relevant stakeholders and actually contributes to reducing the vulnerability or increasing the resilience of communities to droughts. For example, are the methods used to characterize the severity of drought – known as drought indices – effective tools for predicting the actual damage felt by communities?

Project Impact

As droughts continue to increase in frequency and severity, the need to understand community vulnerability and resilience to drought is only growing. Focusing on New Mexico, Texas, Oklahoma, and Louisiana, this study sought to answer several key questions. First, researchers examined whether existing drought indices are effective in predicting the occurrence of drought events and their actual damages. Second, researchers explored why some communities suffer less damage from drought and recover faster than others. Finally, researchers identified strategies for encouraging the adoption of water conservation behaviors among residents. So far, results show that drought indices are overall useful tools for predicting drought damage and that a community's resilience to drought is often tied to socioeconomic conditions.

This research was conducted in partnership with two Landscape Conservation Cooperatives. In addition to gaining the scientific knowledge of the linkages between drought indices, damages, and community resilience, this research (1) developed tools to measure drought resilience, (2) identified key indicators of resilience, (3) identified the gaps between drought indices and actual damages, and (4) identified the factors that influence residents' decisions to adopt adaptive measures.

Science Base Link :

https://www.sciencebase.gov/catalog/item/529d1211e4b00602d02de196

Developing Effective Drought Monitoring Tools for Farmers and Ranchers in the South Central U.S.

Principal Investigator: Mark Shafer (SCIPP)
Co-Investigator: Steven Quiring (TAMU)
Project Topic: Drought, Fire and Extreme Weather, Science Tools for Managers
Geographic Location: South Central Region

Project Summary

The South Central U.S. is one of the main agricultural regions in North America: annual agricultural production is valued at more than $44 billion dollars. However, as climate conditions change, the region is experiencing more frequent and severe droughts, with significant impacts on agriculture and broader consequences for land management. For example, in 2011 drought caused an estimated $7.6 billion in agricultural losses in Texas and an additional $1.6 billion in Oklahoma. Although there are many drought monitoring tools available, most of these tools were developed without input from the stakeholders, such as farmers and ranchers, who are intended to use them.

Project Impact

The goal of this project was to assess the information needs of farmers, ranchers, and local land managers in the South Central region and to develop drought monitoring tools that are effective and responsive to their needs. The results of this project are meant to be directly and immediately applicable to land management decisions in the region. Further, this approach to improving drought monitoring could be applied to other regions of the country facing similar challenges. Finally, in addition to advancing our knowledge of how drought information is used, this project aimed to contribute to our understanding of how private land owners and agronomists make decisions related to landscape-scale change.

Science Base Link:

https://www.sciencebase.gov/catalog/item/529d1306e4b00602d02de1b1

Examining Soil and Drought Dynamics to Improve Fire Forecasting in the Southern Great Plains

Principal Investigator: John Zak (TTU)
Project Topic: Drought, Fire and Extreme Weather
Geographic Location: South Central Region

Project Summary

The need to improve fire weather predictions for the southern Great Plains has grown in recent years, following a number of extreme fire events. While on-the-ground conditions that promote fire development in the region are still not well understood, research suggests that fire-friendly conditions are determined by more than just precipitation amounts or wind speeds. They are also influenced by soil characteristics such as moisture content, temperature, and human use. Therefore, fire weather forecast predictions could be improved by developing a better understanding of the relationship between soil characteristics and fire occurrence.

Project Impact

With a hotter and drier future unfolding in the southern Great Plains, the time is now to consider how soil moisture dynamics are expected to change and what influence, if any, this will have on fire potential. This project aimed to fine-tune fire weather forecast predictions using soil temperature and soil moisture for a variety of managed and unmanaged systems in West Texas and Oklahoma. Accounting for these conditions improves our understanding of what regions and time periods are and will be favorable to fire conditions. This information is meant to give managers a more complete picture of fire risk, thus helping to inform fire prevention, crop production, and conservation decisions across the region.

Science Base Link :

https://www.sciencebase.gov/catalog/item/529d13d7e4b00602d02de1cb

Identifying Tribal Vulnerabilities and Supporting Planning for Extreme Weather Events

Principal Investigator: Dawn Jourdan (OU)
Co-Investigator: John Harris (OU)
Project Topic: Drought, Fire and Extreme Weather, Native Communities
Geographic Location: South Central Region

Project Summary

Climate change is poised to increase the frequency and intensity of extreme weather events – such as tornadoes, flooding, drought, and snowstorms – which may damage buildings and other structures, cause economic hardship, disrupt plant and wildlife communities, and endanger people's physical and emotional health.

Project Impact

The purpose of this project was to enhance the knowledge of local tribal environmental professionals in Oklahoma related to planning for extreme weather events as a result of climate change. Researchers hosted a one-day workshop at the University of Oklahoma (OU) that was attended by professionals representing at least five tribes, as well as interdisciplinary scholars and students engaged in climate change research. Participants were provided with background information on climate change, led through a simple process for identifying their community's vulnerabilities, and pointed toward data sources available to support planning efforts.

This workshop was a vital part of increasing local tribes' knowledge regarding planning for climate change. In addition, Division of Regional and City Planning faculty and students were introduced to tribal communities' planning needs related to climate change. The workshop was used to leverage funding from the Bureau of Indian Affairs for OU's Planning Division to work with five tribes (Citizen Potawatomie Nation, Kaw Nation, Otoe-Missouria Tribe, Fort Sill Apache Nation, and Wichita and Affiliated Tribes) interested in pursuing a deeper understanding of the potential impacts of climate change on their communities and lands.

Science Base Link :

https://www.sciencebase.gov/catalog/item/54341298e4b095098ca896e8

Science to Assess Future Conservation Practices for the Mississippi River Basin

Principal Investigator: Jack Waide (Upper Midwest Env. Sciences Center)
Project Topic: Drought, Fire and Extreme Weather, Science Tools for Managers, Water Resources
Geographic Location: South Central Region, Northeast

Project Summary

USFWS Landscape Conservation Cooperatives (LCCs) throughout the Mississippi River Basin (MRB) have identified high nutrient runoff, a major contributor to Gulf hypoxia, and declines in wildlife populations (especially grassland and riparian birds), as conservation challenges requiring collaborative action. This project aimed to develop a spatial decision support system (DSS) to address these issues. The DSS was designed to identify MRB watersheds where application of conservation practices can (1) reduce nutrient export to the Gulf hypoxia zone and (2) enhance conservation for grassland and riparian birds, based on (3) identifying landowners willing and capable of implementing these practices. The DSS is expected to identify appropriate conservation practices to be implemented, and quantify resulting benefits for both nutrient export and bird habitat. The DSS is also expacted to enable analyses of whether landowner willingness to implement desired practices is affected by perceptions of climate extremes. This project was supported by and included contributions from LCCs and agencies throughout the MRB, including federal and state resource management agencies and universities. The project, a pilot for a larger future effort, sought to move current conservation approaches to a more strategic level, by identifying where to locate projects in critical watersheds for the greatest overall conservation benefit.

Science Base Link :

https://www.sciencebase.gov/catalog/item/529e2c55e4b0516126f68ef5

Understanding Future Fire Frequency and Impacts on Species Distribution in the South Central U.S.

Principal Investigator: Esther Stroh (USGS CERC)
Project Topic: Drought, Fire and Extreme Weather, Wildlife and Plants
Geographic Location: South Central Region

Project Summary

Fire is critical to maintaining and restoring temperate ecosystems in the South Central U.S. As precipitation patterns and temperatures change in the region, managers require information on how these changes will impact fire frequency, and thus the species and ecosystems within the landscape.

Project Impact

To address this need, researchers will use climate model data to predict and map future changes in fire frequency for Texas, Oklahoma, and New Mexico. Researchers will then examine species and ecosystem distribution data to understand the relationship between climate, fire frequency, and species occurrence. This analysis will enable researchers to identify potential future distributions of woody ecosystems and species such as mesquite and eastern red cedar.

The results of this project will help resource managers understand where on the landscape they can expect more frequent and less frequent fires due to changes in climate, and which areas may transition toward other ecosystem types as a result of these changing conditions. Information gathered from this project will assist planning for activities such as fuels management and prescribed fire over the long term.

Science Base Link :

https://www.sciencebase.gov/catalog/item/529d12e5e4b00602d02de1a4

Fiscal Year 2013

Assessing the Drivers of Water Availability for Historic and Future Conditions in the South Central U.S.

Principal Investigator: Lauren Hay (USGS)
Project Topic: Science Tools for Managers, Water Resources
Geographic Location: South Central Region

Project Summary

Understanding the changes in the distribution and quantity of, and demand for, water resources in response to a changing climate is essential to planning for, and adapting to, future climatic conditions. In order to plan for future conditions and challenges, it is crucial that managers understand the limitations and uncertainties associated with the characterization of these changes when making management decisions. Changes in consumptive water use (water removed without return to a water resources system) will change streamflow, impacting downstream water users, their livelihoods, as well as aquatic ecosystems. Historical changes in available water may be attributed to changes in precipitation; but these changes may also be attributable to changes in consumptive use. Understanding the roles of natural and anthropogenic influences on the water cycle is an important component of this project. The objective of this project was to provide an automated methodology and data products that the public can view, work with, and download through ScienceBase to assess: the accuracy of available climate data and climate projections, the hydrologic effects of these drivers on runoff for historical and future conditions, and the role of consumptive water use on available water supply.

Science Base Link :

https://www.sciencebase.gov/catalog/item/521cf64fe4b01458f7858019

Establishing a Foundation for Understanding Climate Change Impacts on Coastal Wetland Ecosystems

Principal Investigator: Michael J Osland (USGS)
Project Topic: Water Resources
Geographic Location: South Central Region (Coast)

Project Summary

Coastal wetlands are one of the most economically valuable ecosystems in the world. In the United States, the ecosystem services provided by wetlands are worth billions of dollars and include flood protection, erosion control, seafood, water quality enhancement, carbon storage, recreation, and wildlife habitat. Unfortunately, these ecosystems are also highly sensitive to changing climate conditions. Past research on climate impacts to coastal wetlands have concentrated primarily on sea-level rise, largely ignoring the important influence of changing temperature and precipitation patterns. Understanding the impact of temperature and precipitation on coastal wetlands can help natural and cultural resource managers account for these factors when making decisions or developing adaptation plans.

Project Impact

This study advances understanding of how temperature and precipitation influence coastal wetland ecosystems. The study models the relationships between wetland plant community structure and climate in the northern Gulf of Mexico and identifies potential impacts of future climate conditions on these ecosystems. The researchers identify critical ecological thresholds and demonstrate that transformative ecological changes due to climatic shifts are probable throughout the Gulf of Mexico within this century. In certain areas, small changes in temperature or rainfall are expected to trigger large ecological changes and affect certain ecosystem services. Because coastal wetland ecosystems in other parts of the world are also sensitive to changes in temperature and rainfall, the findings of this research have global implications, helping to inform the management of these highly valuable ecosystems under a changing climate.

Science Base Link :

https://www.sciencebase.gov/catalog/item/521cf699e4b01458f785805c

Impacts of Climate Change on Water Flows in the Red River Basin

Principal Investigator: Wayne Kellogg (Chickasaw Nation)
Co-Investigator(s): Renee McPherson & Yang Hong (OU)
Project Topic: Native Communities, Water Resources
Geographic Location: South Central Region (Red River)

Project Summary

The Red River Basin is a vital source of water in the South Central U.S., supporting ecosystems, drinking water, agriculture, tourism and recreation, and cultural ceremonies. Stretching from the High Plains of New Mexico eastward to the Mississippi River, the Red River Basin encompasses parts of five states – New Mexico, Texas, Oklahoma, Arkansas, and Louisiana. Further, 74% of the jurisdictional boundaries of the Chickasaw and Choctaw Tribes are located within the basin.

Water resources in the basin have been stressed in recent years due to a multi-year drought and increasing demands for consumptive use by metropolitan areas in Oklahoma and Texas. Unfortunately, currently available projections of future precipitation across the region show a high degree of uncertainty, making it difficult for water managers to plan for the future.

Project Impact

The goal of this project is to provide resource managers with critical information on the impacts of climate change on flow in the Red River Basin. Researchers (1) used global climate models to make climate projections for the basin, and (2) developed models to determine the impacts of projected future climate conditions on stream flow. The modeling results can be used to evaluate future water supplies for water providers and flows for the environment.

The Red River Basin lies within the boundaries of three Landscape Conservation Cooperatives (LCCs), and the results of this project will help the LCCs and other managers reduce the impacts of floods and droughts and make decisions regarding the potential need for additional reservoirs or diversions of water into the Red River Basin. The tools developed for this study can also be used to evaluate the impacts of different flow conditions on aquatic life or water quality in the basin.

Science Base Link:

https://www.sciencebase.gov/catalog/item/521cf67ce4b01458f7858040

Improving Representation of Extreme Precipitation Events in Regional Climate Models

Principal Investigator: Ming Xue (OU)
Project Topic: Drought, Fire and Extreme Weather
Geographic Location: South Central Region

Project Summary

The South Central U.S. encompasses a wide range of ecosystem types and precipitation patterns. Average annual precipitation is less than 10 inches in northwest New Mexico but can exceed 60 inches further east in Louisiana. Much of the region relies on warm-season convective precipitation – that is, highly localized brief but intense periods of rainfall that are common in the summer. This type of precipitation is a significant driver of climate and ecosystem function in the region, but it is also notoriously difficult to predict since it occurs at such small spatial and temporal scales. While global climate models are helpful for understanding and predicting large-scale precipitation trends, they often do not capture many of the smaller atmospheric and earth surface processes that influence local and regional precipitation trends, like convective precipitation.

Project Impact

To address this gap in climate modeling capabilities, researchers developed regional climate models that are better able to project small-scale precipitation patterns and localized extreme precipitation events. Researchers combined information about land surface and water conditions with weather and climate models in order to quantify the local-scale impacts of climate on water resources. This highly localized information is expected to assist regional decision-makers in addressing the challenge of predicting precipitation in the South Central U.S., leading to a better understanding of potential future impacts on agriculture, fish and wildlife, water quality and availability, and cultural resources.

Science Base Link:

https://www.sciencebase.gov/catalog/item/526812ade4b0c24c90857598

Modeling the Effects of Climate and Land Use Change on Crucial Wildlife Habitat

Principal Investigator(s): Colleen Caldwell (NMCF and WRU), Kenneth Boykin (NMSU), Keith Dixon (NOAA GFDL)
Co-Investigator: Nicole Harings (NMSU)
Project Topic: Wildlife and Plants
Geographic Location: South Central Region

Project Summary

Changing temperature and precipitation patterns in the South Central U.S are already having an impact on wildlife. Hotter and drier conditions are prompting some species to move in search of cooler conditions, while other species are moving into warmer areas that were once unsuitable for them. These changes in the distribution of wildlife populations present challenges for wildlife managers, hunters, tribal communities, and others who are making decisions about wildlife stewardship.

Project Impact

This project examined the effect of shifting climate conditions on 20 species of conservation concern in the South Central United States. These species, which include the black-tailed prairie dog and the lesser prairie-chicken, were selected according to several criteria, including their expected sensitivity to climatic change. Researchers examined where these species currently occur in order to better understand the environmental, especially climate, conditions necessary for their survival. Climate and land use change projections for 2050 and 2070 were used to assess the potential future distributions of conditions suitable for these species.

Maps evaluating patterns of loss of suitable conditions for the species were developed and incorporated into the publicly accessible New Mexico state-level CHAT (Crucial Habitat Assessment Tool). CHATs are being used by states across the western U.S. to facilitate conservation and project planning, and are useful to decision-makers at all levels of government. Therefore, incorporating information about the potential impact of climate and land use change on species distributions into this tool will ensure that this important information is accessible to managers.

Science Base Link:

https://www.sciencebase.gov/catalog/item/521cf66ae4b01458f7858033

Predicting Sky Island Forest Vulnerability to Climate Change: Fine Scale Climate Variability, Drought Tolerance, and Fire Response

Principal Investigator: Dylan Schwilk (TTU)
Co-Investigator: Scott Holaday (TTU)
Project Topic: Landscapes, Drought, Fire and Extreme Weather
Geographic Location: South Central Region

Project Summary

The sky island forests of the southwestern United States are one of the most diverse temperate forest ecosystems in the world, providing key habitat for migrating and residential species alike. Black bear, bighorn sheep, mule deer, and wild turkey are just a few of the species found in these isolated mountain ecosystems that rise out of the desert landscape. However, recent droughts have crippled these ecosystems, causing significant tree death. Climate predictions suggest that this region will only face hotter and drier conditions in the future, potentially stressing these ecosystems even further. Simple models predict that vegetation will move to cooler and wetter locations in response to this warming. However, species responses will likely be more complex than these models show, as vegetation navigates other ecological stressors such as elevation change and water availability.

Project Impact

In order to better predict how vegetation will move in response to future warming, a more robust understanding of how drought and temperature impact tree survival is needed. Focusing on three sky island habitats in western Texas, this project sought to identify the key traits influencing current distributions of forest tree species, determine the susceptibility of these species to drought and temperature, and develop fine-scale, localized climate projections that model future conditions for the study area. This information is meant to be used to predict how species might shift location in response to warmer and drier future climates, enabling managers to make more robust decisions that will preserve sky island forests in the face of a changing climate.

Science Base Link:

https://www.sciencebase.gov/catalog/item/521cf65fe4b01458f7858026

Regional Graduate Student, Post-Doc, and Early Career Researcher Workshop

Principal Investigator: Renee McPherson (OU)
Co-Investigator(s): Derek Rosendahl & Aparna Bamzai (OU)
Geographic Location: South Central Region

Project Summary

Led by the consortium of the South Central Climate Science Center (SC CSC), this project developed and implemented a professional development workshop for graduate students, post-docs, and early career researchers within the SC CSC region. The objectives were to: (1) introduce participants to the goals, structure, and unique research-related challenges of the SC-CSC and its place within the U.S. Department of the Interior and the larger CSC network, offering them insight into how their research fits into the broader research priority goals and its eventual applicability to end user needs across the region; (2) provide an opportunity for participants to present their research to fellow peers; (3) facilitate interdisciplinary interactions between participants within the SC-CSC purview in an effort to foster collaboration opportunities; and (4) generate a set of digitally recorded presentations on the SC CSC enterprise, a "how to" guide for conducting similar workshops, and a collection of project outlines from small group discussions for internal use. The desire is to remove the institutional barriers, or "silos," at an influential time of development for early career professionals and to build a cohort who can continue networking through their research pathways and who can understand and eventually lead outcome-oriented, interdisciplinary research.

Science Base Link:

https://www.sciencebase.gov/catalog/item/521cf637e4b01458f785800b

Testing Downscaled Climate Projections: Is Past Performance an Indicator of Future Accuracy?

Principal Investigator: John Lanzante (NOAA GFDL)
Co-Investigator: Anne Stoner(TTU), Keith Dixon (NOAA GFDL), Venkatramani Balaji (Princeton University)
Geographic Location: South Central Region

Project Summary

When climate models are developed, researchers test how well they replicate the climate system by using them to model past climate. Ideally, the model output will match the climate conditions that were actually recorded in the past, indicating that the model correctly characterizes how the climate system works and can be used to reliably project future conditions. However, this approach assumes that models that reliably project past climate conditions will accurately predict future climate conditions, even though the climate system might have changed.

Project Impact

This research contributes to generating more reliable local-scale climate projections by testing the assumption that the climatological relationships which existed in the past will continue to exist in the future. To do this, researchers developed a novel approach in which very high-resolution climate model data were used as a surrogate for historical and future "observations", allowing researchers to test how well the more commonly-used coarse-scale global climate models project future climate conditions.

Findings suggest that the assumption holds reasonably well in many cases, but there are some instances (for example in particular geographic locations, such as coastal regions, and at certain times of year, especially summer) when the assumption is not as robust. This research also explores the conditions under which the assumption does not hold, and develops ways to make the methods used to generate local information about climate change more reliable. The results of this research can improve the reliability of the climate models used by resource managers to inform vulnerability assessments, adaptation planning, and other important climate-related decisions.

Science Base Link:

https://www.sciencebase.gov/catalog/item/521cf689e4b01458f785804f

Understanding the Nexus between Climate, Streamflow, Water Quality, and Ecology in the Arkansas-Red River Basin

Principal Investigator(s): William J Andrews (USGS OWSC), Christopher R Harich (OWSC)
Project Topic: Water Resources
Geographic Location: South Central Region (TX)

Project Summary

Currently, maintaining appropriate flows to support biological integrity is difficult for larger riverine ecosystems. Climate change, through increased temperature, reduced rainfall, and increased rainfall intensity, is expected to reduce water availability and exacerbate the maintenance of ecological flows in the Arkansas-Red River basin. Understanding the nexus among climate change effects on streamflow, water quality, and stream ecology for watersheds in the Arkansas-Red River Basin can be achieved using currently existing science and technology. This nexus approach will strengthen adaptive-management strategies that focus on shared ecosystem conservation watershed targets. This approach will provide natural-resource managers operating over a variety of spatial scales with measurable relationships between biology and flow while building modeling, monitoring, and statistical capacity to support restoration, conservation, and management goals.

Science Base Link:

https://www.sciencebase.gov/catalog/item/521cf6ace4b01458f7858069

Fiscal Year 2012

Analyzing and Communicating the Ability of Data and Models to Simulate Streamflow and Answer Resource Management Questions

Principal Investigator: Shannon K Brewer (OCF andWRU)
Project Topic: Water Resources, Science Tools for Managers
Geographic Location: South Central Region

Project Summary

To date, hydrological and ecological models have been developed independently from each other, making their application particularly challenging for interdisciplinary studies. The objective of this project was to synthesize and evaluate prevailing hydrological and ecological models in the South-Central U.S., particularly the southern Great Plains region. This analysis aimed to identify the data requirements and suitability of each model to simulate stream flow while addressing associated changes in the ecology of stream systems, and to portray climate variability and uncertainty. The results and deliverables of this project are expected to include a comprehensive, updated, and systematic report on recent developments in ecosystem hydrology with a focus on freshwater resource management. This synthesis report directly addresses existing needs of the Landscape Conservation Cooperatives (LCCs) by providing information that can be readily used to help understand the effect of climate change and land management on hydrology and associated fish communities.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5012e30ae4b05140039e03d3

Assessing the Potential Impact of Sea-Level Rise on Submersed Aquatic Vegetation and Waterfowl in the Northern Gulf of Mexico

Principal Investigator: Megan La Peyre (USGS, Louisiana Fish and CRU)
Project Topic: Water Resources, Wildlife and Plants
Geographic Location: South Central Region (Gulf of Mexico)

Project Summary

Submersed aquatic vegetation (SAV) communities are highly productive ecosystems that provide significant ecological benefits to coastal areas, including essential calories for wintering waterfowl. However, the potential effects of sea-level rise is posing new questions about the future availability of SAV for waterfowl and other coastal wildlife. Of primary concern is the fact that rising seas have the potential to increase salinities in fresh and brackish marshes on the Gulf of Mexico's coast, changing the distribution and composition of SAV communities, and affecting valuable waterfowl habitat and food resources. Not enough is known about the relationship between salinity and SAV to predict how this important food resource will respond to higher salinity levels, creating difficulties for waterfowl conservation planning.

Project Impact

This project identified the relationship between SAV, salinity, and other environmental variables as a first step in understanding how sea-level rise might affect food availability for waterfowl. The study examined coastal marshes of the northern Gulf of Mexico from Mobile Bay, AL, to the Nueces River, TX. Researchers compared SAV distribution and composition across a range of salinity levels, and found that water depth and salinity were the primary factors in determining the amount of SAV resources in a particular marsh. Surprisingly, researchers also found that brackish marsh tended to produce quantities of SAV waterfowl food resources similar to those in fresh marsh environments. The study also found some evidence that saline marshes contain less waterfowl food resources than brackish, intermediate, and fresh marshes.

This work will directly benefit efforts of the Gulf Coast Joint Venture, Gulf Coast Prairies Landscape Conservation Cooperative (LCC), and Gulf Coastal Plains and Ozarks LCC in forecasting the effects of sea-level rise on the distribution, abundance, and diversity of SAV resources and the priority fish and wildlife populations that depend upon them.

This project was co-funded by the South Central Climate Adaptation Science Center and the Gulf Coast Prairie Landscape Conservation Cooperative and Gulf Coastal Plains and Ozarks LCC. An alternate reference to this project can be found here.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5012df8ce4b05140039e03c7

Building Capacity within the CSC Network to Effectively Deliver and Communicate Science to Resource Managers and Planners

Principal Investigator: Dennis Patterson (TTU)
Project Topic: Science Tools for Managers
Geographic Location: South Central Region

Project Summary

A limited amount of valid scientific information about global climate change and its detrimental impacts has reached the public and exerted a positive impact on the public policy process or future planning for adaptation and mitigation. This project was designed to address this limitation by bringing together expertise in the social and communication sciences from targeted academic institutions affiliated with the Department of the Interior's Climate Science Centers (CSCs) through a workshop.

Project Impact

The project team brought together expertise in the social and communication sciences from targeted academic institutions, particularly experts and scholars who are affiliated with the nation's CSCs, by means of an invited workshop. The purpose of this effort was to bring together such a group but also to focus experts in the nation's CSCs on how these Centers' affiliates can more effectively communicate the science of this important but often misunderstood problem and meaningfully inform effective policy in each region.

The workshop involved formal presentations from experts in a variety of disciplines on the problem of climate change and how to more effectively communicate the science of this problem. Specifically, the presentations focused on the scientific, policy, and political aspects of climate change and how to communicate its scientific essentials, as well as, its implications to the general public and policy makers, both bureaucratic and elected. Presenters were scientists and social scientists with expertise in climate change, communication sciences, public opinion analysis, disaster management, public policy, and the politics of climate change. Presenters also included an environmental photographer who offered a visual presentation of the realities of climate change.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5012e061e4b05140039e03c9

Comparing and Evaluating Different Models to Simulate Current and Future Temperature and Precipitation

Principal Investigator(s): Katharine Hayhoe (TTU), Keith Dixon & John Lanzante (NOAA GFDL)
Geographic Location: South Central Region (USA)

Project Summary

Regional assessments of the impacts of climate change on both human systems and the natural environment require high-resolution projections to see the effects of global-scale change on the local environment. This project sought to address a critical and generally overlooked assumption inherent to these projections of regional, multi-decadal climate change: that the statistical relationship between global climate model simulation outputs and real, observed climate data remain constant over time. Utilizing a "perfect---model" experimental design and the output of two high-resolution global climate model simulations, this study evaluated and reported on the ability of three different methods to simulate current and future temperature and precipitation in the U.S., with a focus on the southern Great Plains region. Differences between the methods' abilities during the late 20th versus late 21st century time periods can provide valuable information regarding the level of confidence we should attribute to the climate projections commonly used in impacts analyses and as the basis for decision-support and planning purposes.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5012e146e4b05140039e03cb

Evaluating the Impacts of Climate Extremes on Karst Hydrology and Species Vulnerability

Principal Investigator: Barbara J Mahler (Texas Water Science Center)
Project Topic: Water Resources
Geographic Location: South Central Region

Project Summary

Karst aquifers—formed when the movement of water dissolves bedrock—are critical groundwater resources in North America. Water moving through these aquifers carves out magnificent caves, sinkholes, and other formations. These formations are home to high concentrations of rare and endangered species, but the hydrological conditions that support these species can change rapidly. Managing these ecosystems into the future requires a better understanding of how climate, hydrology, and karst ecosystems interact.

Project Impact

The objective of this project was to determine how species and ecosystems associated with karst might respond to future temperature and precipitation extremes and accompanying changes in groundwater levels and springflow. The research focused on 16 species in the Edwards aquifer in south-central Texas and eight species in the Madison aquifer in western South Dakota. Researchers linked global climate models, regional climate models, and hydrologic models to determine how future springflow might be impacted by changes in temperature and precipitation. By combining information about future hydrology with what we know about species needs, researchers determined the vulnerability of the selected species to climate extremes.

Researchers found that more species in the Edwards aquifer are vulnerable to climate extremes than in the Madison aquifer, due in part to the more severe hydrologic changes that the Edwards aquifer is expected to undergo. This result suggests that including hydrologic factors critical to species health is essential in evaluating the vulnerability of karst ecosystems to climate extremes. Natural resource managers can use this information to understand how the character of karst systems are changing and prioritize conservation activities accordingly.

Science Base Link:

https://www.sciencebase.gov/catalog/item/52d5615ae4b0f19e63da8647

Inter-Tribal Workshops on Climate Change in the Central U.S.

Principal Investigator: Laurel Smith (OU)
Project Topic: Native Communities
Geographic Location: South Central Region

Project Summary

Tribal communities are especially vulnerable to the effects of climate change because of their reliance on the natural environment to sustain traditional activities and their limited resources to respond to climate change impacts. At the same time, tribes have valuable traditional knowledge that can aid regional efforts to address climate change.

There were two overarching goals of this project: The first was to build partnerships between South Central Climate Science Center (SC CSC) researchers and tribal communities, linking tribes with climate change tools and resources and developing a model that could be replicated in other regions. The second goal was to document tribal viewpoints on climate change impacts and adaptation, so that these perspectives could be considered alongside scientific research.

Researchers developed and implemented a series of five workshops – four in Oklahoma and one in New Mexico – that brought together SC CSC researchers and more than 60 tribal members from 33 tribes across the central U.S. The workshops provided an opportunity to educate tribal environmental managers about climate change impacts and conservation strategies, to document the climate-related needs and capabilities of the region's tribal nations, and to build conversation about climate change between researchers and tribal leaders.

In conjunction with the workshops, two indigenous filmmakers on the research team conducted interviews and incorporated these and related footage into a short film titled *Listening for the Rain: Indigenous Perspectives on Climate Change*. The film captures tribal observations and understanding of climate change, as well as the ways in which climate change is currently being addressed in Indian Country. Its circulation on the Internet, at conferences, and by DVD has prompted continued, valuable dialogue among tribal and scientific research communities.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5012e251e4b05140039e03d1

Mapping Fresh, Intermediate, Brackish and Saline Marshes in the North Central Gulf of Mexico Coast to Inform Future Projections

Principal Investigator: Stephen B Hartley (USGS NWRC)
Project Topic: Water Resources
Geographic Location: South Central Region (Gulf of Mexico)

Project Summary

Spatial data depicting marsh types (e.g. fresh, intermediate, brackish and saline) for the north-central Gulf of Mexico coast are inconsistent across the region, limiting the ability of conservation planners to model the current and future capacity of the coast to sustain priority species. The goal of this study was to (1) update the resolution of coastal Texas vegetation data to match that of Louisiana, Mississippi, and Alabama, and (2) update vegetation maps for the Texas through Alabama region using current Landsat Imagery. Creating consistent regional vegetation maps will enable scientists to model vegetation response to and potential impacts of future climate change.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5012de5ce4b05140039e03c4

Terrestrial Connectivity Across the South Central United States: Implications for the Sustainability of Wildlife Populations and Communities

Principal Investigator: Kristen A Baum (OSU)
Project Topic: Landscapes, Wildlife and Plants
Geographic Location: South Central Region

Project Summary

Habitat fragmentation, modification, and loss have been implicated in the decline of many species, including more than 85% of those considered threatened or endangered. Therefore, connectivity, or the ability of organisms to move among habitat patches, is a critical component of landscape health. In addition to influencing the sustainability of wildlife populations and communities, connectivity also contributes to the availability of ecosystem services. The goal of this project was to evaluate terrestrial connectivity across the South Central United States, with a focus on the impact of projected climate and land use changes.

Project Impact

The researchers addressed this goal using a variety of approaches, including evaluating connectivity of major habitat types (grasslands and forests), predicting future changes in landscape connectivity for grassland species, assessing terrestrial vertebrate diversity in relation to habitat loss and fragmentation, and analyzing the combined effects of climate and habitat fragmentation on the distributions of grassland bird species.

They found that connectivity has declined for species with a low to moderate ability to move across the landscape, and that this pattern is expected to continue under future scenarios of land-use change. For grassland birds, the contribution of climate, landscape variables, and their combined effects varied among species, but their combined effects can exceed the independent effects of the two drivers for some species. Thus, the importance of connectivity is expected to increase with the negative implications of climate change for wildlife populations and communities. These results, which are expressed in maps, can be used to inform management decisions and identify future research needs related to terrestrial connectivity within this region.

Science Base Link:

https://www.sciencebase.gov/catalog/item/5012ddb7e4b05140039e03c2