

# RECLAMATION

*Managing Water in the West*

## SECURE Water Act Report to Congress and Data Visualization Tool

Sustainable Water Resources  
Roundtable

June 19, 2016



U.S. Department of the Interior  
Bureau of Reclamation

# Bureau of Reclamation – Quick Overview

Manages, develops, and protects water and related resources in an environmentally and economically sound manner in the interest of the American public.

- Nation's largest wholesale water supplier, operating 337 reservoirs
- Second largest producer of hydropower in the United States
- Delivers 10 trillion gallons of water to more than 31 million people each year.
- Manages, with partners, 289 recreation sites that have 90 million visits annually.



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# Public Law 111-11 Subtitle F SECURE Water Act – Section 9503

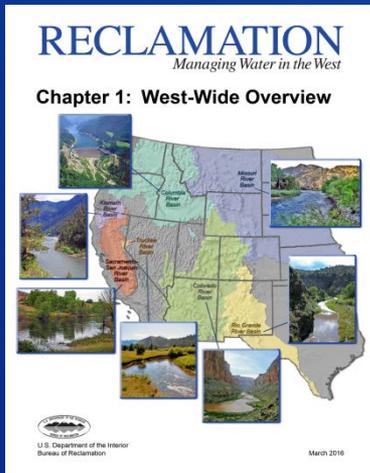
(c) **REPORTING.** Not later than 2 years after the date of enactment of this Act, and **every 5 years thereafter**, the Secretary shall submit to the appropriate committees of Congress a report that describes—

- (1) **Effects and risks resulting from**, global climate change with respect to the quantity of water resources
- (2) **Impacts** of global climate change **with respect to operations**
- (3) **Mitigation and adaptation strategies** considered and implemented
- (4) **Coordination activities** conducted by the Secretary
- (5) the implementation of a west-wide risk assessment **monitoring plan**

First Report to Congress published 2011, Second Report Published 2016, Third Report due 2021

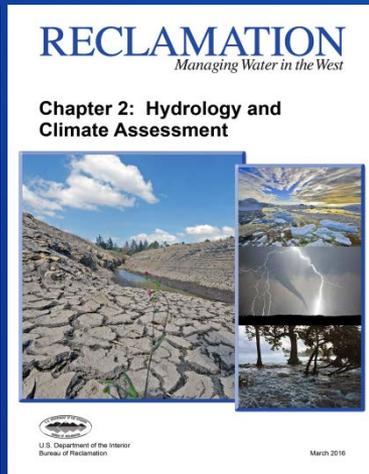
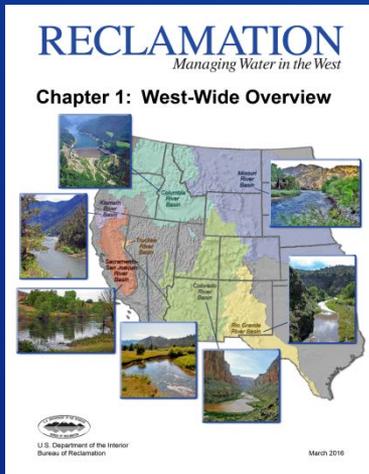


# SECURE Water Act Report Organization



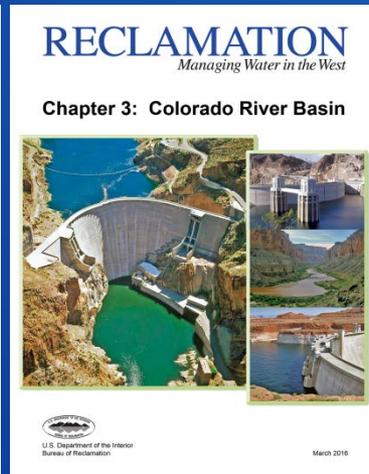
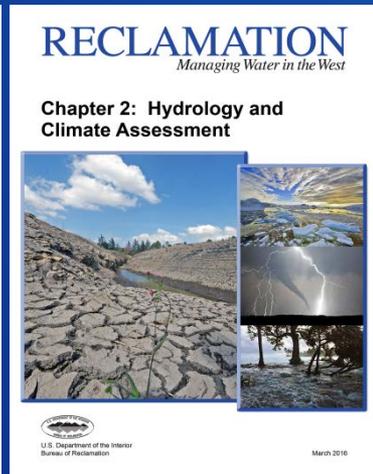
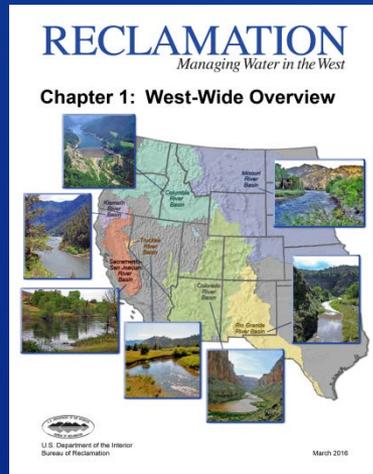
- Section 1: Background on the SECURE Water Act
- Section 2: Projected **effects of climate change on hydrology**
- Section 3: Anticipated **impacts on water supplies and water operations**
- Section 4: Mitigation and **adaptation strategies** considered by Reclamation and its Western partners
- Section 5: Federal agencies, State water resource agencies, and other Western **stakeholder coordination**

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- Section 1: Introduction to Reclamation's hydrology and climate assessments
- Section 2: Assessment of the effects of climate change on water supply
- Section 3: Assessment of water demand
- Section 4: Coordination with the U.S. Geological Survey to analyze groundwater supply
- Section 5: Coordination activities and research

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- Section 1: Colorado river basin setting and description of the **Colorado River Basin Water Supply and Demand Study**
- Section 2: **Key impacts** to water and environmental resources
- Section 3: **Potential adaptation strategies** to address water deficits
- Section 4: **Coordination** activities within the basin to **implement adaptation actions**

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# SECURE Water Act Report Organization

## RECLAMATION *Managing Water in the West*

### Chapter 1: West-Wide Overview



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## RECLAMATION *Managing Water in the West*

### Chapter 2: Hydrology and Climate Assessment

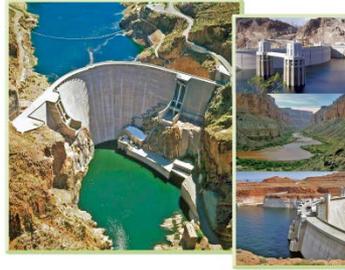


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### Chapter 3: Colorado River Basin

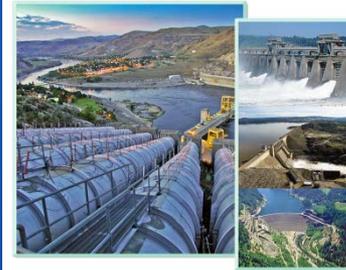


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### Chapter 4: Columbia River Basin



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### Chapter 5: Klamath River Basin

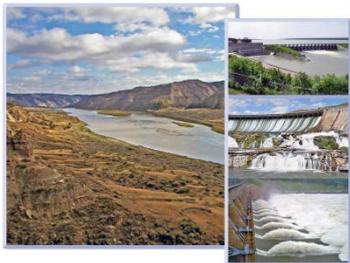


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### Chapter 6: Missouri River Basin



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### Chapter 7: Rio Grande Basin

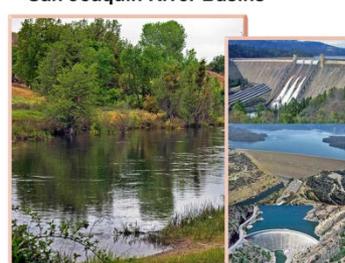


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### Chapter 8: Sacramento and San Joaquin River Basins



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### Chapter 9: Truckee River Basin

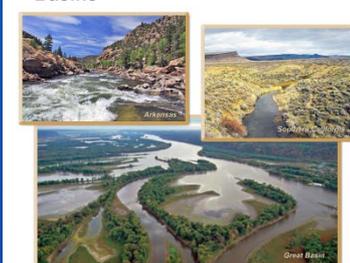


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### Chapter 10: Other Western River Basins



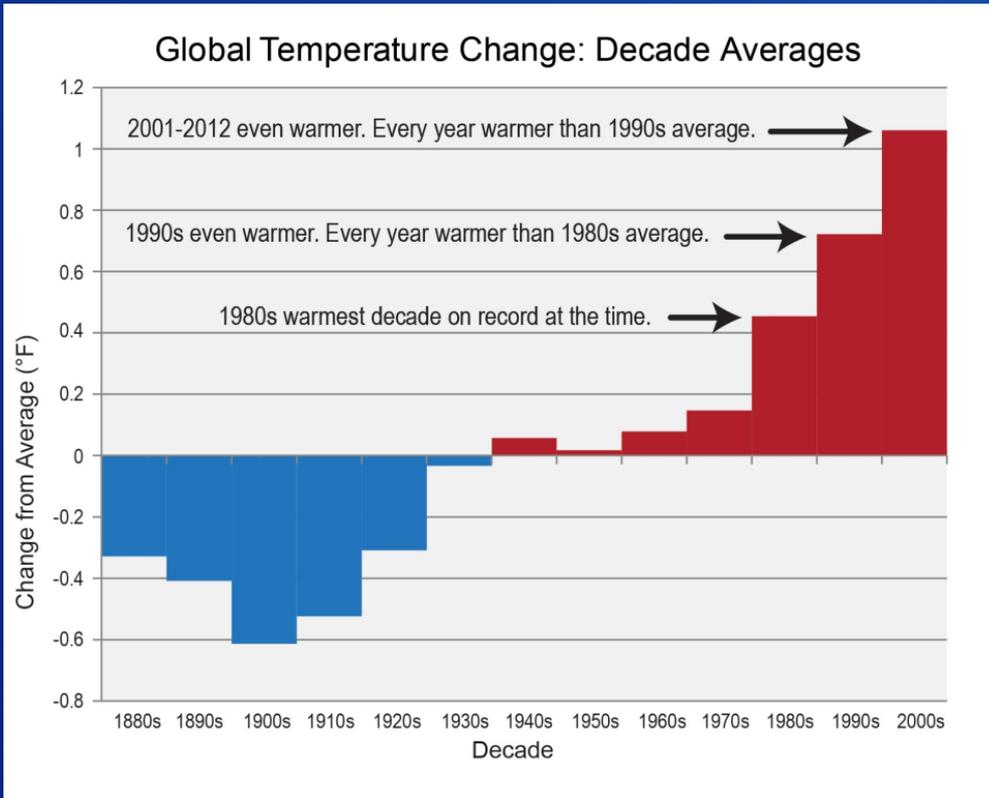
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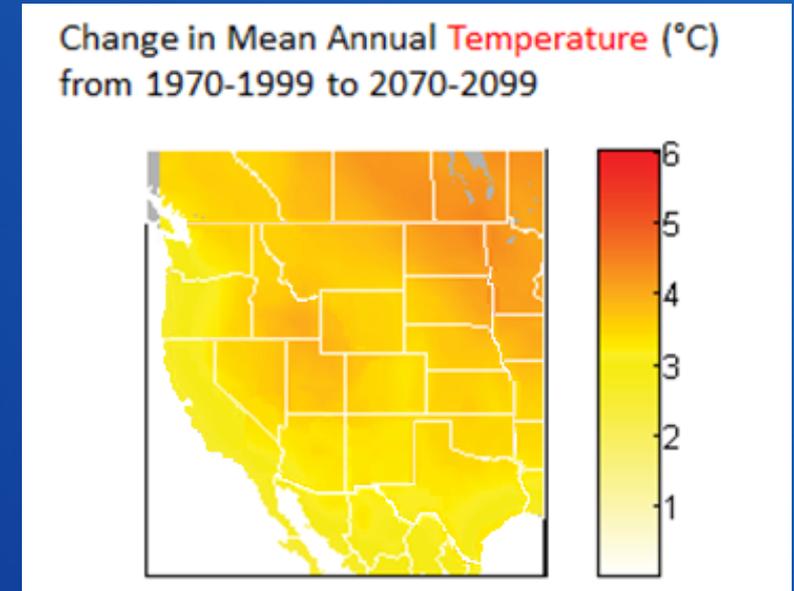
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# Effects and Risks of Climate Change

- Observed increases in mean annual temperature have been approximately 2 °F since 1900
- Continued warming of 5 - 7 °F is projected over the course of the 21st century.



Source: NOAA

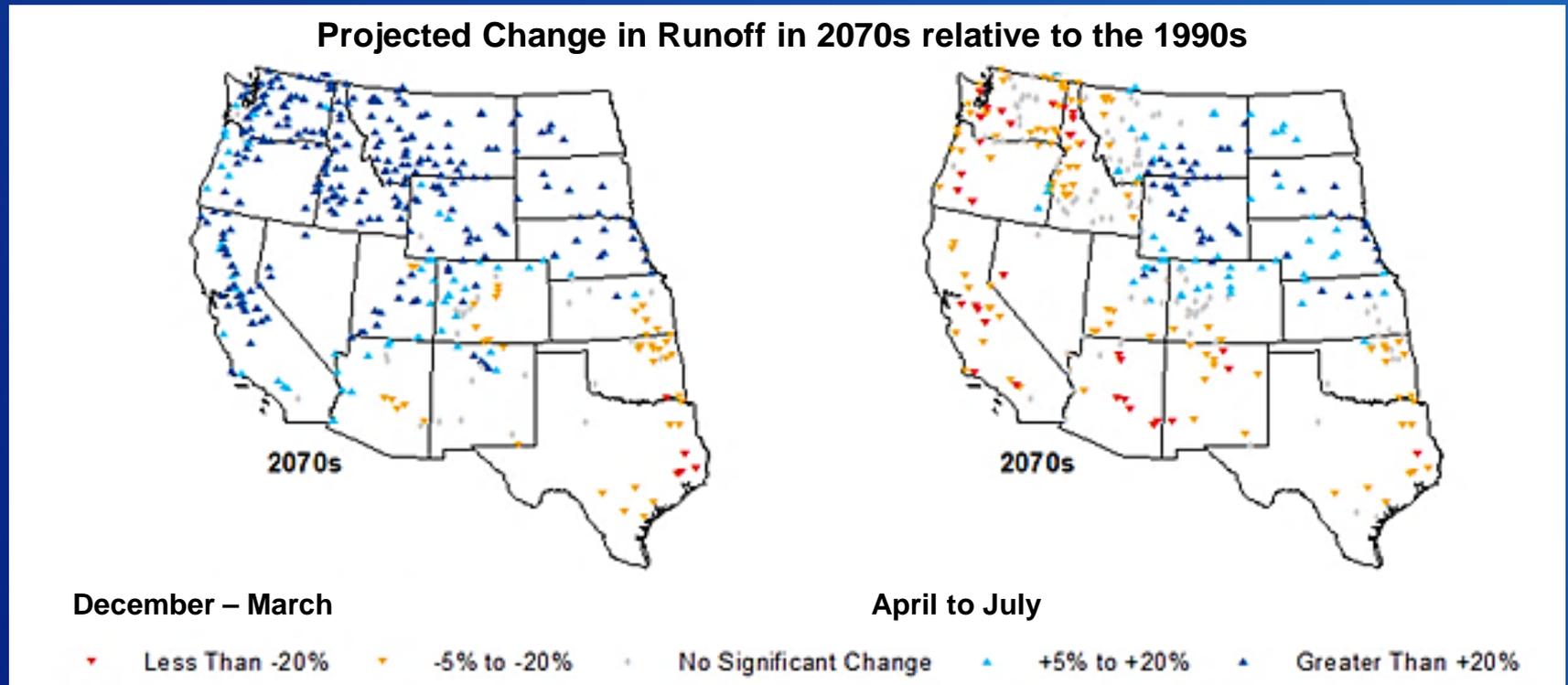


Source: Bureau of Reclamation

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# Effects and Risks of Climate Change

- **Timing and quantity of runoff** are expected to continue to be impacted
  - Increased rainfall-runoff during the cool season rather than snowpack accumulation
  - Increases in December-March runoff and decreases in April-July runoff



# Climate Change Impacts to Water Resources

Anticipated **impacts on water supplies** and water **operations**:

- Water deliveries



## **Changes in Water Supply and Demand**

Climate assessments project that the manageable water supply, in general, will decline in much of the West. A decrease of up to 8 percent in average annual stream flow is projected in several river basins, including the Colorado, the Rio Grande, and the San Joaquin river basins.

## **Changes in Timing of Runoff and Water Availability**

West-wide, runoff is expected to shift to earlier times of the year (less in summer, more in winter and spring), making it more difficult to manage water deliveries as they have been managed in the past. Reservoirs are anticipated to fill earlier in the year, with a corresponding reduction in the water supply available through the summer season.



# Climate Change Impacts to Water Resources

## Anticipated impacts on water supplies and water operations:

- Water deliveries
- Hydropower
- Recreation
- Flood management
- Fish, wildlife, and ecological resources
- Water quality
- Groundwater management
- Watershed integrity



### Changes in Water Supply and Demand

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### Changes in Timing of Runoff and Water Availability

West-wide, runoff is expected to shift to earlier times of the year (less in summer, more in winter and spring), making it more difficult to manage water deliveries as they have been managed in the past. Reservoirs are anticipated to fill earlier in the year, with a corresponding reduction in the water supply available through the summer season.



### Change in Snowpack versus Rainfall

Across the West, snowpack generally is projected to decrease as more precipitation falls as rain and warming temperatures cause earlier snowmelt. Water deficits are expected to worsen throughout the Columbia River Basin due to more precipitation falling as rain, shifts in runoff timing, lengthening of the growing season, and greater reliance on stored water.



### More Extreme Weather Events

A likelihood for more frequent extreme weather events is projected in many areas of the West. In the Rio Grande Basin, an increased potential for strengthening of the summer monsoons is projected, with corresponding increases in the portion of the basin's precipitation falling downstream of current water storage infrastructure.



### Changes in Supply and Runoff Timing

West-wide, runoff is anticipated to shift to earlier periods of the year (less in summer, more in the winter and spring). Where peak demand for hydropower occurs during the hottest weeks of summer, shift in runoff timing is expected to impact summer hydropower revenues due to a reduction in peak-season hydropower generation.



### Changes in Hydropower Demand

The warming projected across the West is generally expected to decrease energy demand during winter (for heating) and increase demand during summer (for cooling). These changes might necessitate adjustments in reservoir operations to better align with demand, although the reduced summer inflow may present its own challenges.



### Flatwater Recreation

Increased summer and winter temperatures may increase visitation at reservoirs for camping, boating, swimming, fishing, and other activities. Lower reservoir levels will mean a decrease in the area available for those activities. In some cases, reduced reservoir storage could make it more difficult for water-dependent recreational opportunities.



### River Recreation

Increased summer and winter temperatures may increase the popularity of recreational opportunities in and along Western rivers, while decreased snowpack resulting in reduced flows in key river tributaries has negative implications for flow-dependent recreation such as boating and fishing.



### At Reservoirs with Multiple Year Storage

Where reservoirs are designed to store several years of runoff, the additional flood risks associated with climate change are generally considered minimal, due to the considerable capacity of those facilities to deal with shorter-duration high flow events.



### At Reservoirs Managed for Annual Refill

Where reservoirs require year-round balancing of flood control functions with other purposes, changes in the magnitude, intensity, and severity of extreme runoff events may prompt reconsideration of operating rules to better manage flood risks while maximizing storage opportunities.



### Reservoir Sedimentation

At many reservoirs, the increased frequency of intense storms and flood events coupled with frequent, higher-intensity wildfires will lead to accelerated reservoir sedimentation due to increased sediment runoff during storm events.



### Water and Air Temperature Impacts

Fisheries sensitive to a warming aquatic habitat will be more frequently stressed, and suitable habitat for cold-water dependent species such as trout will be reduced. Shifts in the geographic range of various species are anticipated. The incidence of pathogens in warming waters also may increase.



### Aquatic Migration

Changes in the timing of species migration will become more likely with increased water and air temperatures. In the Columbia River Basin, elevating temperatures would increase the number and severity of thermal barriers to migration for certain fish, including several federally listed species.



### Invasive Species

Warmer water temperatures and other climate-related stresses on native species can confer competitive advantages to various non-native and invasive species. Studies indicate that quagga mussels could expand their range under projected climate scenarios, further complicating facility maintenance.



### Sea Level Rise

Sea level rise increases the salinity of vulnerable coastal waterways. Sea level rise is a significant concern in the Sacramento-San Joaquin Delta, affecting not only its suitability as a water source for agricultural, municipal, and environmental uses, but also the ability to move freshwater through the estuary to water users.



### Riverine Habitat

In Western river basins, it is anticipated that changes to hydrology and climate may make it more difficult to achieve environmental flows to support endangered species. In the Columbia River Basin, projected increases in winter flooding and decreases in summer flows will affect Coho and Chinook salmon as well as steelhead.



### Changes in Groundwater Recharge

Studies project that warmer climate conditions could reduce groundwater recharge. In the Missouri River Basin (northern Great Plains) and in the Santa Ana watershed of southern California, groundwater recharge could be reduced as rising temperatures increase water demands and as decreased precipitation reduces recharge.



### Changes in Groundwater Demands

With increased variability and uncertainty of precipitation and surface water supplies, many Western communities are expected to increase reliance on groundwater as a source for both agricultural and municipal purposes. In California's Central Valley, increased groundwater dependency may result in additional land subsidence and a reduction in aquifer storage capacity.



### Coastal Saltwater Intrusion

In coastal communities, sea level rise and an increased reliance on aquifer withdrawals has the potential to increase the risk of saltwater intrusion into freshwater coastal aquifers.



### Changes in Land Cover and Vegetation Mix and Density

Changes in precipitation, temperature, humidity, CO<sub>2</sub>, and other climate conditions are expected to affect the composition, distribution, and productivity of vegetative communities, in turn affecting watershed hydrology. For example, in southern California, warmer temperatures are expected to cause forested landscapes to migrate over time northward and to higher elevations.



### Forest Insects and Disease

Increased tree mortality from insects already has been observed throughout the West, raising concerns about the future distribution of forest vegetation. In the forests of some parts of New Mexico, moisture stress has led to bark beetle infestations, in turn leading to a potential transition of the affected forests to a new mix of species, forest structure, and ecological processes.



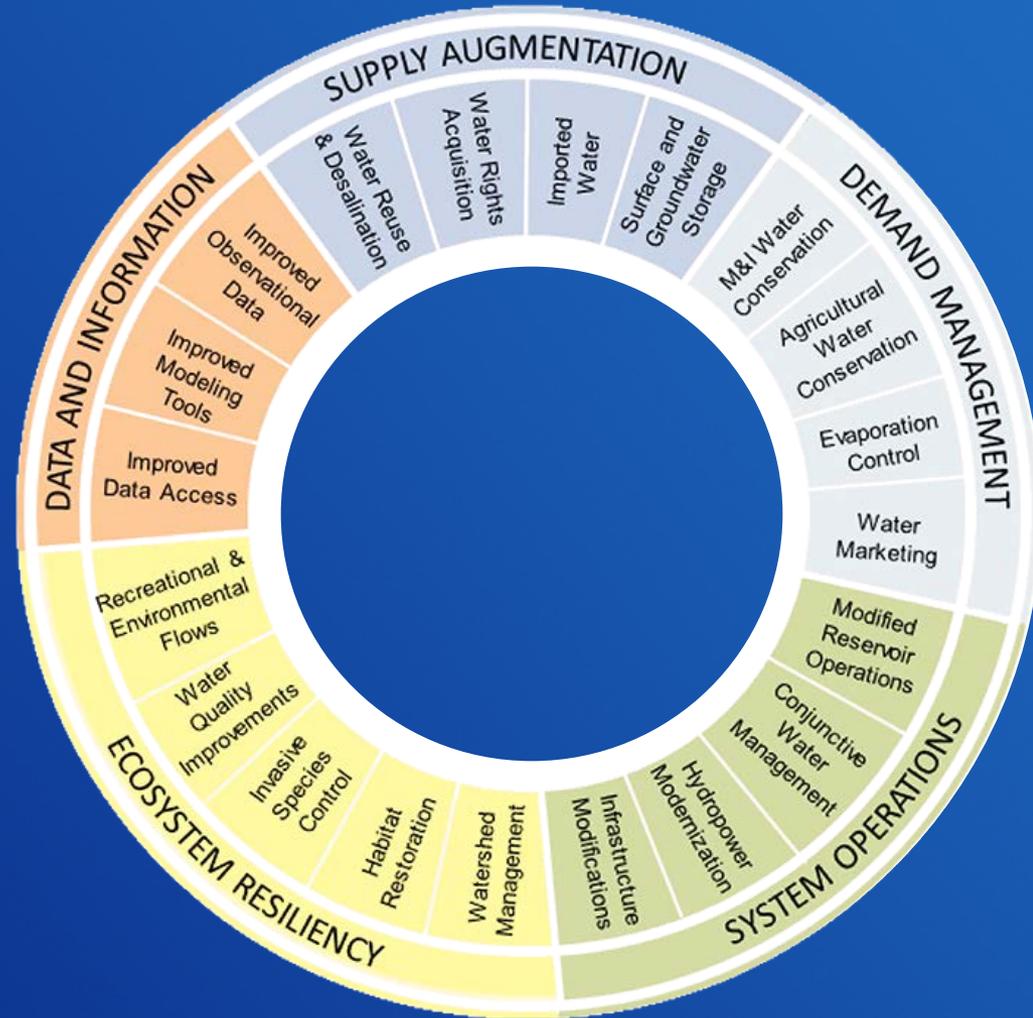
### Forest Fires

In the Missouri River Basin, an increased risk of wildfires is projected due to the expectation that more intense droughts, higher temperatures, and disease will stress forest vegetation.

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# Climate Change Mitigation and Adaptation Strategies

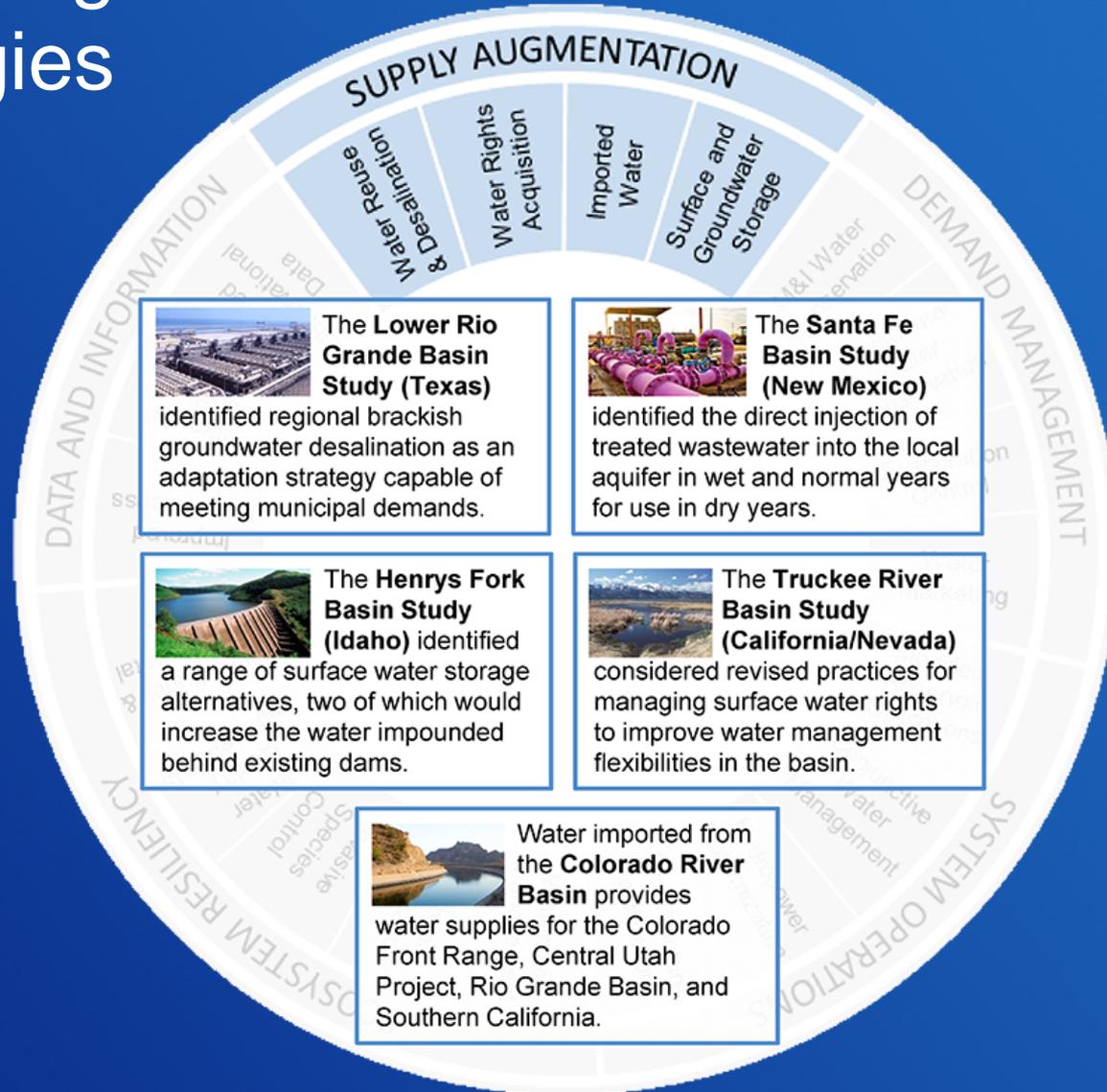
- WaterSMART Basin Studies evaluate *portfolios of adaptation actions*
- Accomplishments and current/on-going actions implementing the *Climate Change Adaptation Strategy*
- Information from the *WaterSMART Program on current actions*



# Climate Change Mitigation and Adaptation Strategies

## Water Supply Augmentation

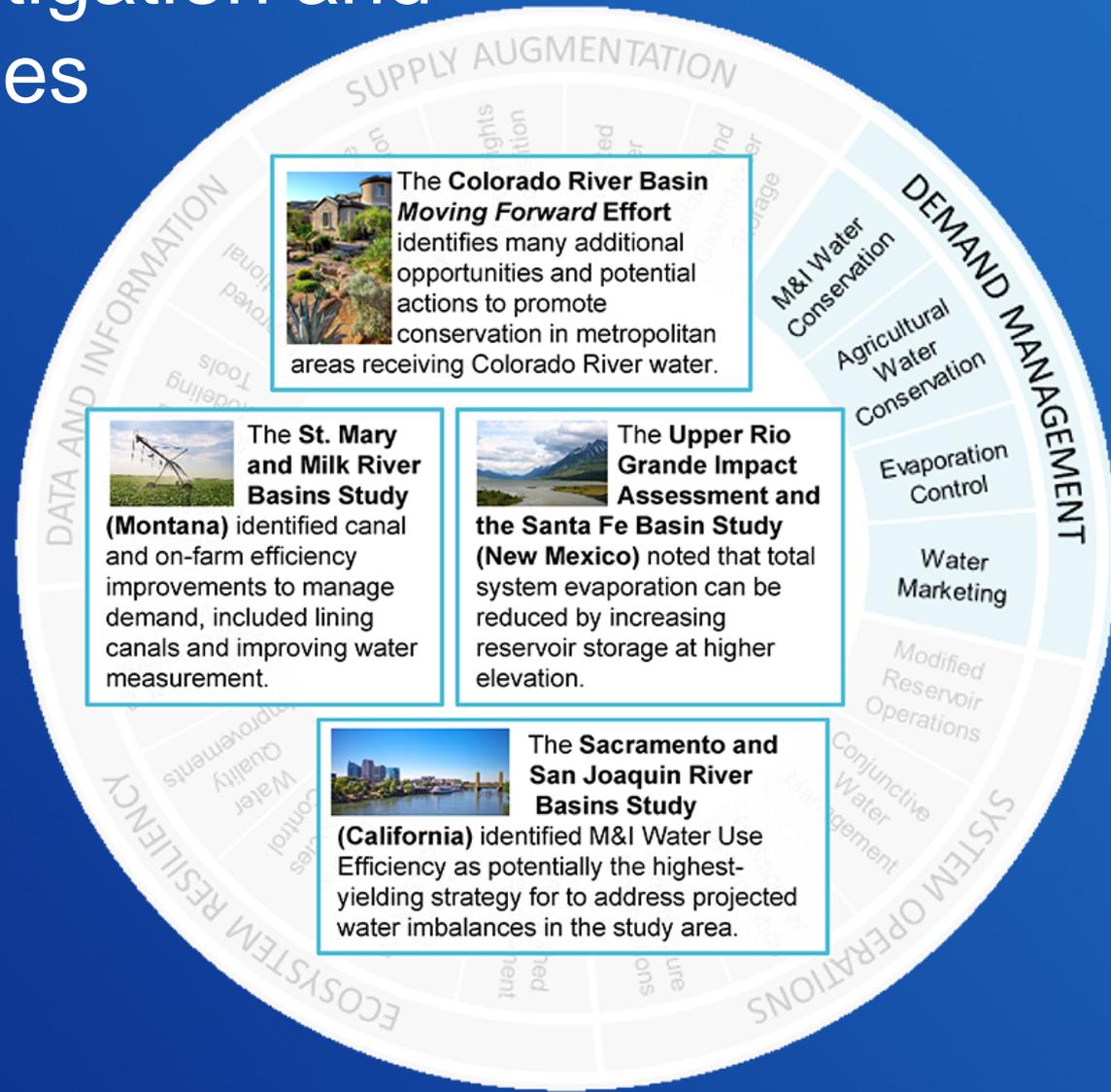
- Water Reuse and Desalination
- Water Exchanges
- Optimizing Water Storage (surface and groundwater)



# Climate Change Mitigation and Adaptation Strategies

## Demand Management

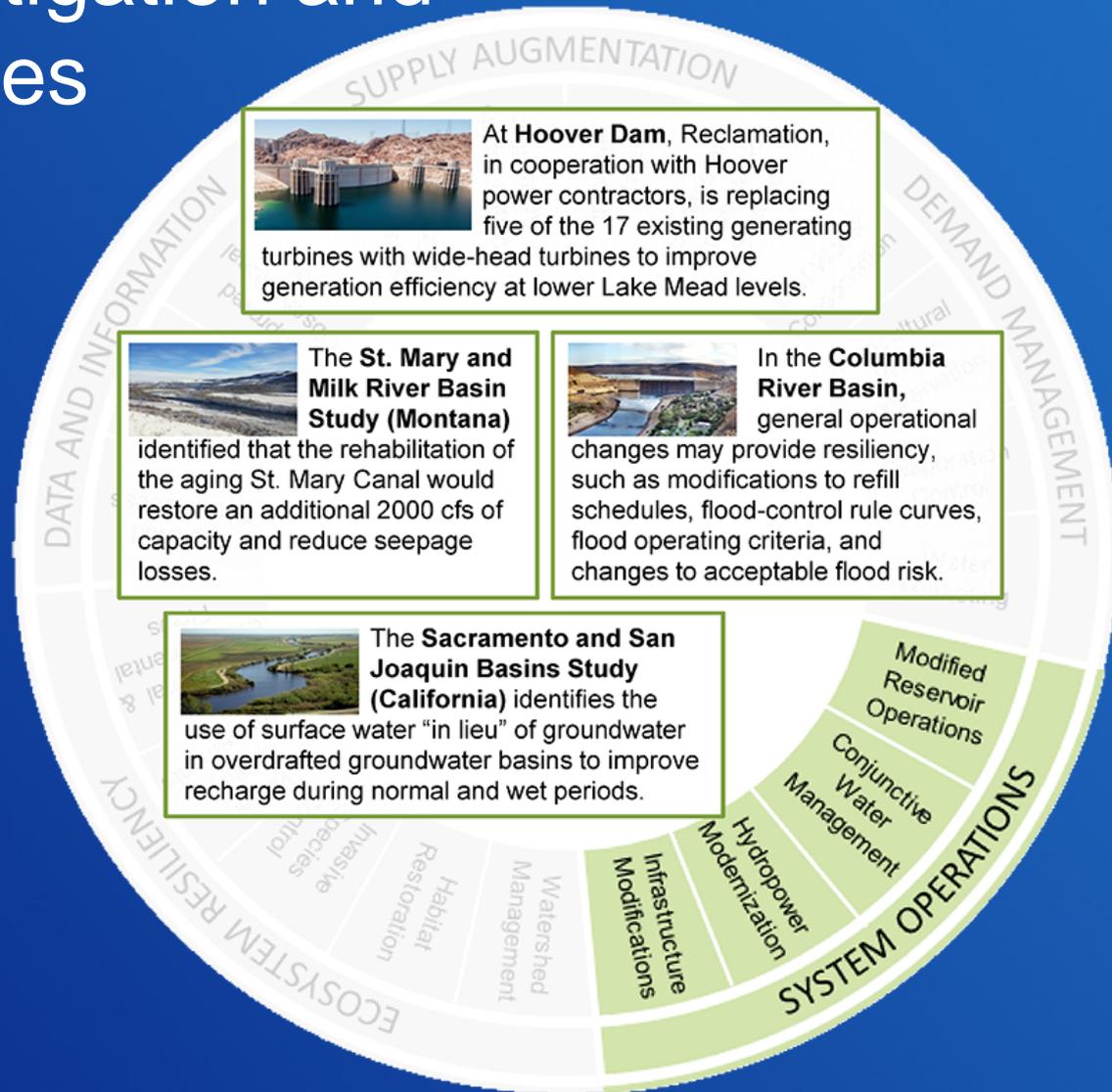
- Water Conservation
- Evaporation Control
- Water Markets



# Climate Change Mitigation and Adaptation Strategies

## System Operations

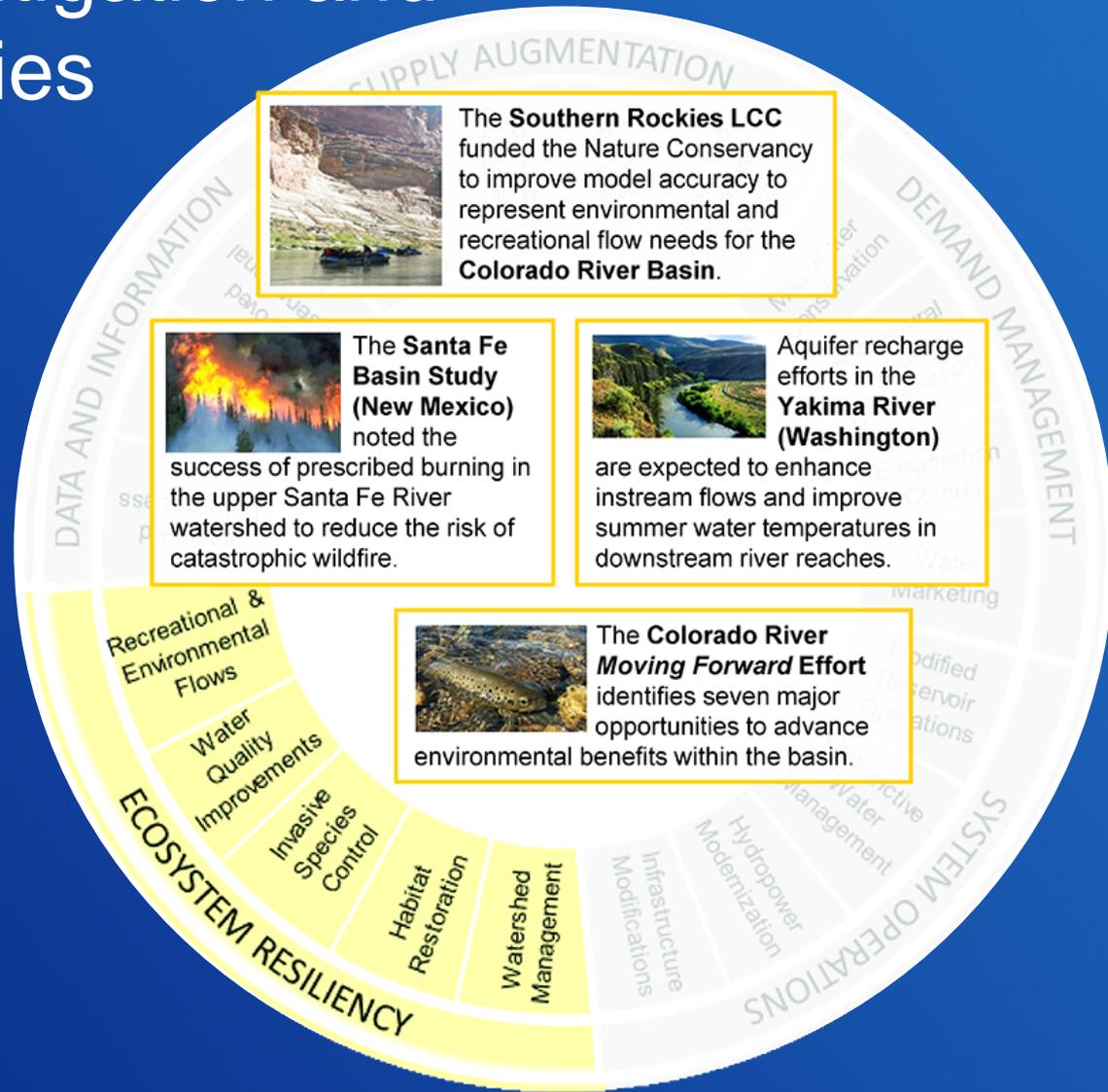
- Modified Reservoir Operations
- Conjunctive Water Management
- Hydropower Modernization
- Infrastructure Investment



# Climate Change Mitigation and Adaptation Strategies

## Ecosystem Resiliency

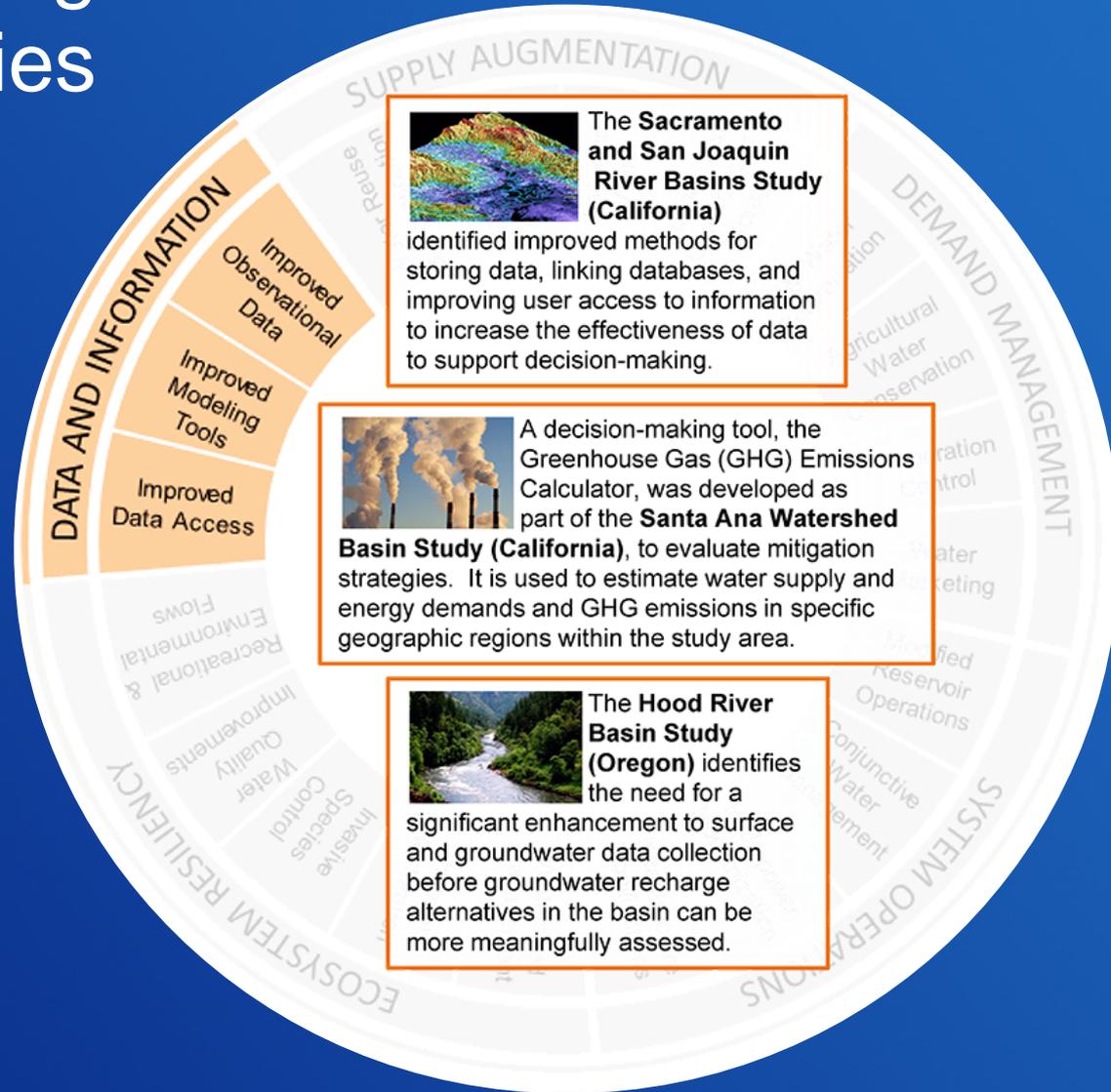
- Recreation and Environmental Flows
- Water Quality
- Habitat Restoration
- Watershed Management



# Climate Change Mitigation and Adaptation Strategies

## Data and Information

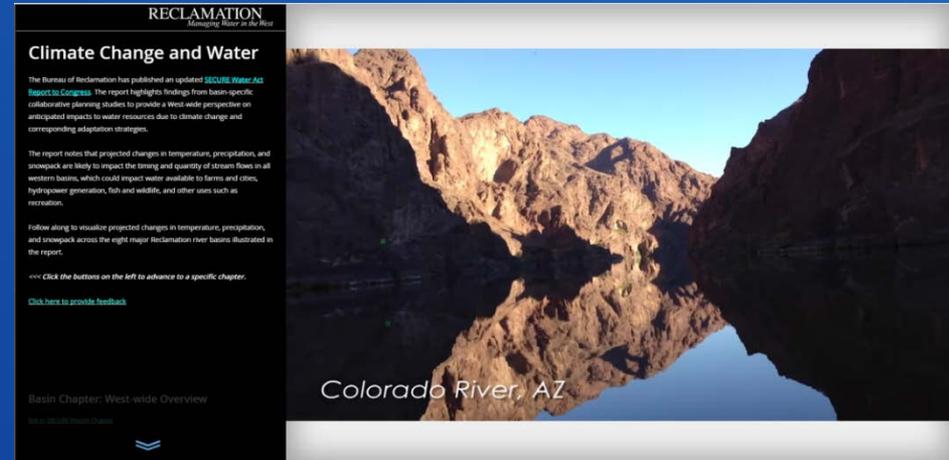
- Observational Data
- Modeling Tools
- Data Accessibility



# SECURE Water Act Report Data Visualization Tool

SECURE Report Companion Tool

- **Web-based visualization** of climate data that reproduces the narrative of the 2016 SECURE Water Act Report to Congress
  - Highlights report findings
  - Links to reference documents
- **Companion product** that allows the public to access and **interact with climate data**
  - Interactive website of **geospatial data**
  - Presents hydrology and climate data by river basin
  - **Downloadable** datasets



Interactive Data and Key Highlights



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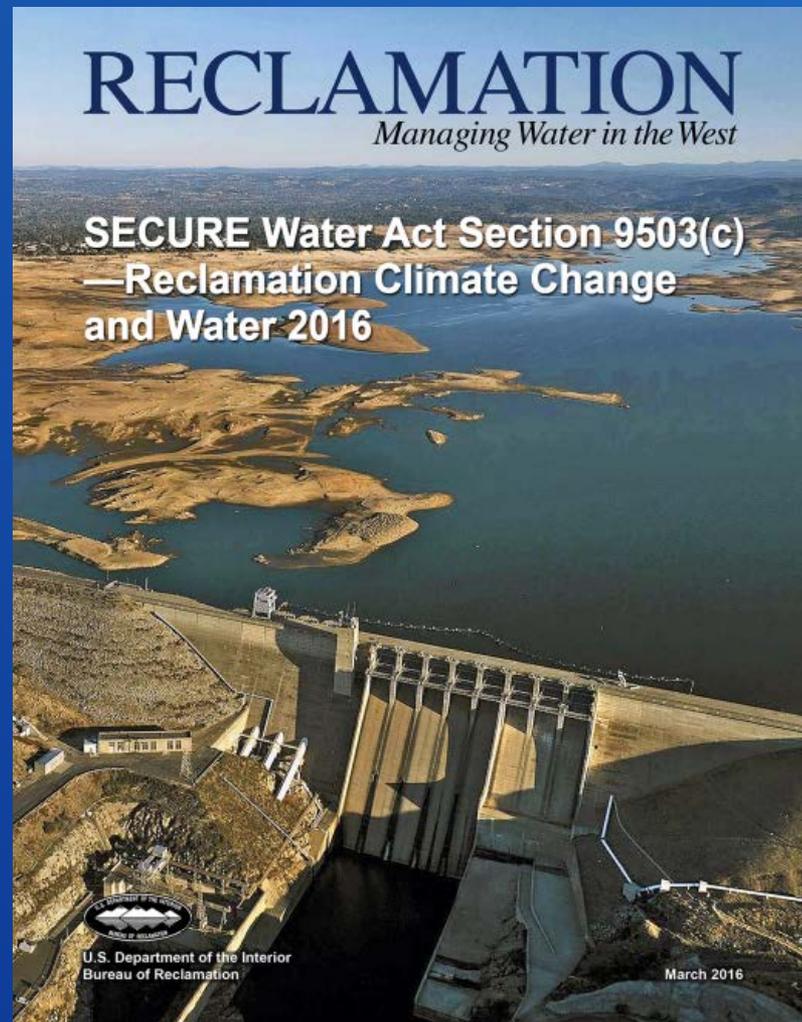
# SECURE Water Act Report Highlights

*Projected increases in temperature* will increase rainfall-runoff during the cool season rather than snowpack accumulation

*Changes in the magnitude and timing of water* will impact the ability of existing water infrastructure and water management practices to satisfy competing water demands

*Portfolios of adaptation actions* will be necessary to mitigate the impacts of climate change

*Collaborative planning activities* in each watershed and west-wide are needed to build climate resiliency



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# Questions?

## Useful Links:

- SECURE Water Act Report and [Tool](http://www.usbr.gov/climate/SECURE)  
[www.usbr.gov/climate/SECURE](http://www.usbr.gov/climate/SECURE)

- Reclamation ARCGIS Online Homepage  
<http://usbr.maps.arcgis.com/home/index.html>

- ESRI Story Map Gallery  
<https://storymaps.arcgis.com/en/gallery/>

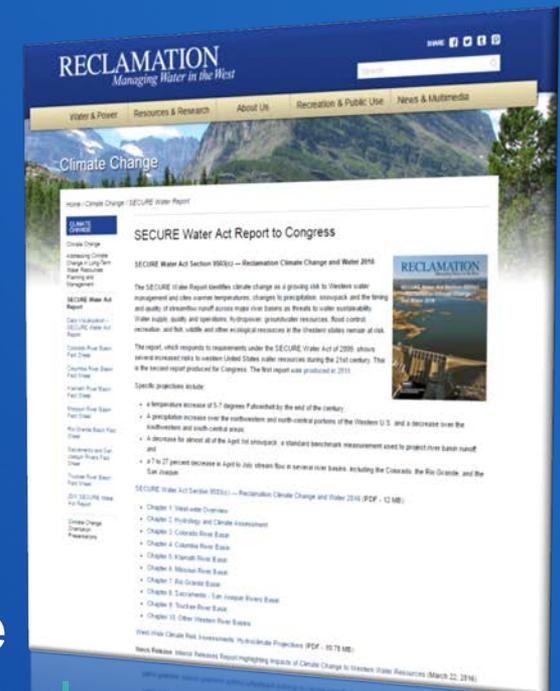
## Contact:

Katharine Dahm, Ph.D., P.E.

Bureau of Reclamation, Policy and Administration

Water Resources and Planning Division

[kdahm@usbr.gov](mailto:kdahm@usbr.gov), 303-445-2495



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