



Hello, My name is Kurt Johnson.

I am the National Climate Change Scientist for the US Fish and Wildlife Service.

I am pleased to be here today to talk about that impacts that current and recent droughts are having on western fish and wildlife resources.



Earlier speakers in this Congress have discussed the key issues of western drought and water availability in detail, so I will not revisit these except for a brief recap.

I will focus the lion's share of my presentation on drought impacts on western fish and wildlife resources and how managers are addressing those impacts...focusing on resources managed by the US Fish and Wildlife Service as an example of broader fish and wildlife issues.

# ***DROUGHT***

**The United States is no stranger to drought**

**Dust Bowl of 1930s**

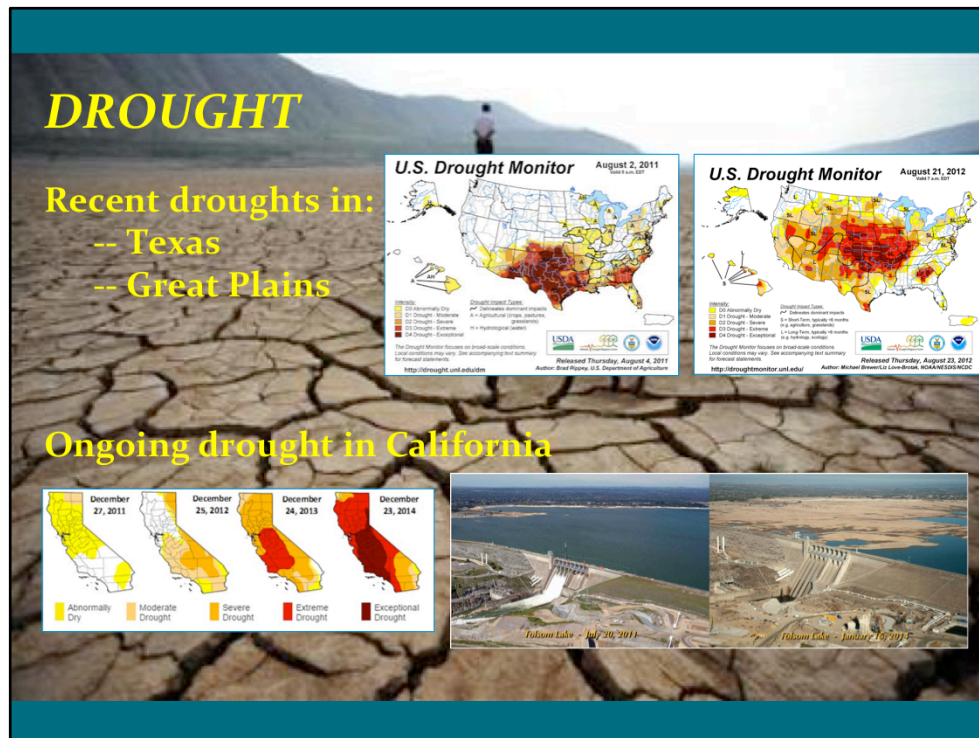
**Devastating droughts also occurred in:**

- 1950s (Great Plains & SW)
- 1960s (NE)
- 1988-89 (widespread)



Drought has always been a part of the American landscape.

Throughout the last century, droughts helped shape the American experience...witness the Dust Bowl of the 1930s



And droughts continue to shape it into the current century...

Recent droughts in Texas, the Great Plains, and an ongoing drought in California having affected millions of lives and having tremendous economic and social impacts.

## ***DROUGHT***

- ❖ Recent trend toward:
  - ✓ Increasing regional drought (Ficklin et al. 2015)
  - ✓ Possibly increasing drought variability (Rayne and Forest, unpubl)
- ❖ Changes largely due to changing potential evapotranspiration -- PET (Ficklin et al. 2015)

Recent trends suggest that regional drought is increasing in some areas – specifically the Upper Midwest, Louisiana, southeastern United States, and western US.

But it is also decreasing in other areas -- New England, Pacific Northwest, upper Great Plains, and Ohio River Valley – demonstrating that trends vary regionally.



## ***DROUGHT – The Future***

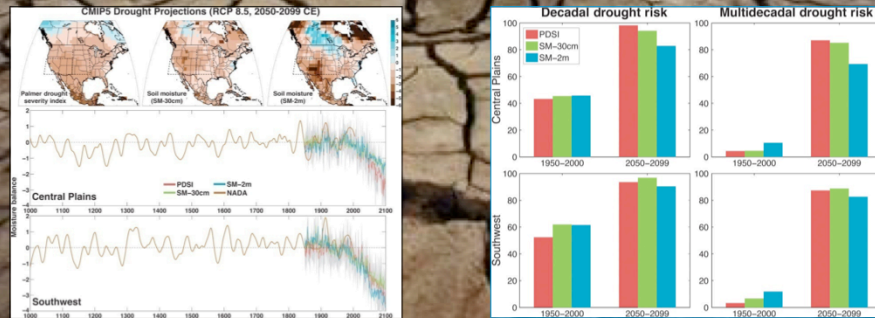
**National Climate Assessment (2014):**

***Short-term (seasonal or shorter) droughts are expected to intensify in most U.S. regions. Longer-term droughts are expected to intensify in large areas of the Southwest, southern Great Plains, and Southeast.***

The 2014 National Climate Assessment concluded that drought trends will likely intensify in certain areas – especially large areas of the Southwest, southern Great Plains, and Southeast

## ***DROUGHT – The Future***

**Cook et al. (2015) modeled potential future drought conditions in Southwest and Central Plains of western N.A.**



More recent modeling efforts support that conclusion.

Researchers modeled potential future drought conditions in Southwest and Central Plains of western N.A.

Their results, and I quote, “point to a remarkably drier future that falls far outside the contemporary experience of natural and human systems in Western North America, conditions that may present a substantial challenge to adaptation”.



Less water....and less predictable water...in the western United States spells more challenges for fish, wildlife, plants and the habitats upon which they depend.

In the remaining time I would like to briefly discuss documented impacts of drought and changing water availability on resources the Service is responsible for managing... we call these our TRUST resources.

I will discuss how the Service has responded to these impacts in the short term and how we are planning for a more long-term adaptive response.



When I use the term “trust resources,” I am referring to resources that the US Fish and Wildlife Service has legal responsibility for managing, which includes:

National Wildlife Refuges

ESA-listed Species

Migratory Birds

certain Migratory Fish (for example, salmon)

certain hatchery-raised fish resources

This past summer, all eight Service regions prepared an initial qualitative assessment of drought impacts to trust resources under their jurisdiction.

The assessment included a description and evaluation of recent impacts of drought on trust resources and the Service response to those impacts.



In the following slides I presenting a summary of results from our western regions:

Pacific Northwest – Region 1

Pacific Southwest – Region 8

Southwest – Region 2

Mountain-Prairie – Region 6



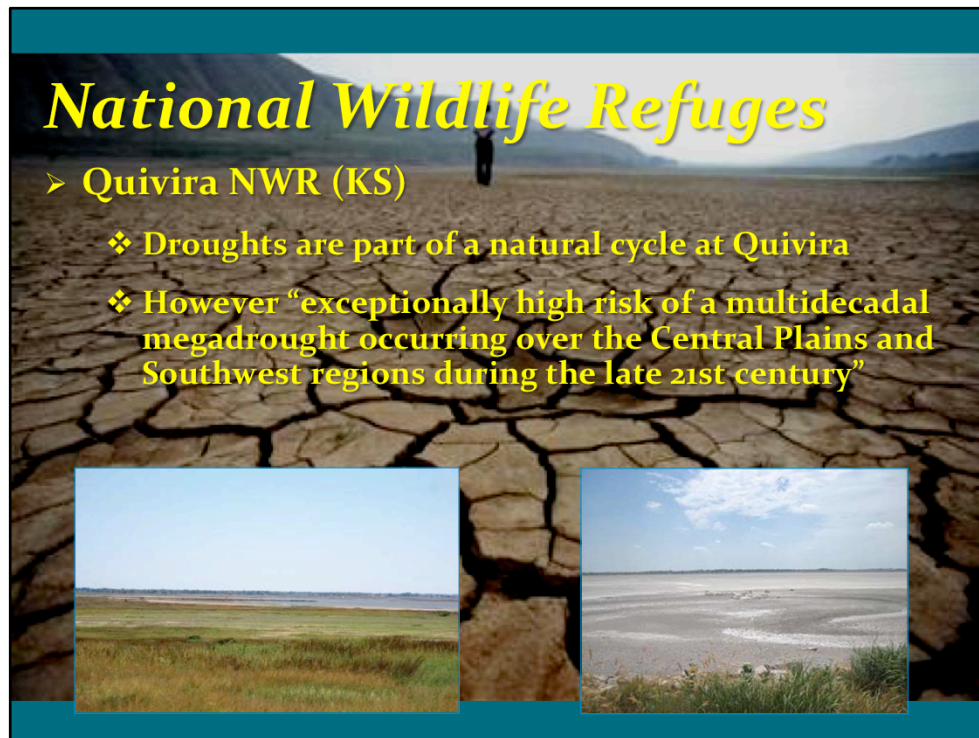
With several notable exceptions, western National Wildlife Refuges are largely water-focused.

Many have managed wetlands that depend on diversion of surface waters...many through water allocations...or groundwater supplies to maintain water levels. Others are associated with reservoirs, rivers, salt marshes, or spring systems.

As such, refuges in the west can be tremendously impacted by drought and changes in water availability.

Survey results from this past July indicate that more than two dozen refuges in the West are currently facing management challenges due to drought impacts on water levels and water availability. The list includes all four of Service regions, with refuges from Kansas to the central Valley of California.

Impacts include wetland drying, reduced river and stream flows, lower reservoir levels...but also increased wildfire at Wichita Mountains



Quivira Refuge in Kansas is a case in point.

The Refuge is centered on Big Salt Marsh, which experienced drought conditions during the 2011-2012 Great Plains drought. The photo on the left shows Big Salt Marsh in September 2010, while the one on the right was taken in August 2011.

Droughts are part of a natural cycle at Quivira, and are sometimes beneficial, allowing the Refuge to aerate the marsh soil and treat invasive plants.

However the future looks challenging indeed, as there “exceptionally high risk of a multidecadal megadrought occurring over the Central Plains and Southwest regions during the late 21st century” posing a grave threat to the marsh system.

## *ESA-listed Species*

- Bay Delta (CA) – Delta smelt
- Santa Ana River system (CA) – Santa Ana sucker, Santa Ana woolly-star, and other species
- Clear Lake (CA) – Lost River and shortnose suckers
- S. California – Peninsular bighorn sheep
- Warner Lakes (OR) – Warner sucker
- Oregon – Oregon spotted frog
- Middle Rio Grande (NM) – Rio Grande Silvery Minnow
- Mojave Desert (NV) – Desert tortoise
- Arizona – Chiricahua leopard frog
- Nevada – Lahontan cutthroat trout

Obviously, many of the federally threatened and endangered species in the West are also aquatic or wetland species..

More than 15 species were identified in the survey as being affected by current and recent drought conditions, including fish, reptiles and amphibians, mammals, and plants...

Even the terrestrial peninsular bighorn sheep has been affected...

## *Migratory Birds*

### ➤ California –

❖ Spring 2015, locally breeding waterfowl reached lowest population level since 1992

### ➤ Nevada –

❖ Stillwater NWR in 4th consecutive year of extreme drought

Migratory birds such as waterfowl, shorebirds, and waders in the arid West are obviously largely dependent on wetlands for all phases of their life history -- breeding, migration and wintering.

Drought impacts to wetland habitats translate to impacts on migratory birds

For example, In California in Spring 2015, locally breeding waterfowl reached lowest population level since 1992 due to the effect of multiple dry years impacting recruitment

In Nevada, Stillwater NWR is in the 4th consecutive year of extreme drought. As a consequence, the refuge is receiving very limited water delivery from local sources and refuge wetlands are dry by early Fall. This is impacting migratory birds as well as public use of the refuge.

## *Certain Migratory Fish*

- California –
  - ❖ Relative abundance of Delta and longfin smelt has decreased
  - ❖ Natural spawning runs of salmon have experienced near failure of entire year classes.
- Oregon and Washington –
  - ❖ Warm water temperatures in mainstem Columbia R. are impeding upstream migration of adult salmon.

Fisheries are feeling the impact.

In California the relative abundance of Delta and longfin smelt has decreased, while natural spawning runs of salmon have experienced near failure of entire year classes.

In Oregon and Washington, warm water temperatures in mainstem Columbia River are impeding upstream migration of adult salmon. Large numbers of fish are seeking refuge and “holding up” in lower reaches of tributary streams that are cooler than Columbia River.

# *National Fish Hatcheries*

➤ NFHs impacted include:

- ❖ Leavenworth
- ❖ Warm Springs
- ❖ Coleman
- ❖ Winthrop
- ❖ Makah
- ❖ Hagerman
- ❖ Kooskia
- ❖ Entiat
- ❖ Lahontan

National Fish Hatcheries in the Pacific Northwest are being impacted by both higher water temperatures and reduced flows

At least nine National Fish Hatcheries have experienced impacts related to higher water temperatures and/or reduced flows. These impacts have included higher disease and parasite incidence, lowered fish return rates, stress, and even mortality.

Some Hatcheries have even been impacted by wildfires!



Drought continues to pose a serious challenge to the resources and ingenuity of Service staff in all regions, but especially the West.

We are faced with the dilemma of addressing significant impacts in the short term – impacts that can threaten some species with extinction – while planning for long-term solutions to the growing issue of drought and climate change.

The Service cannot afford to stay in a reactive mode, but has to become proactive, working with partners to address this critical issue.

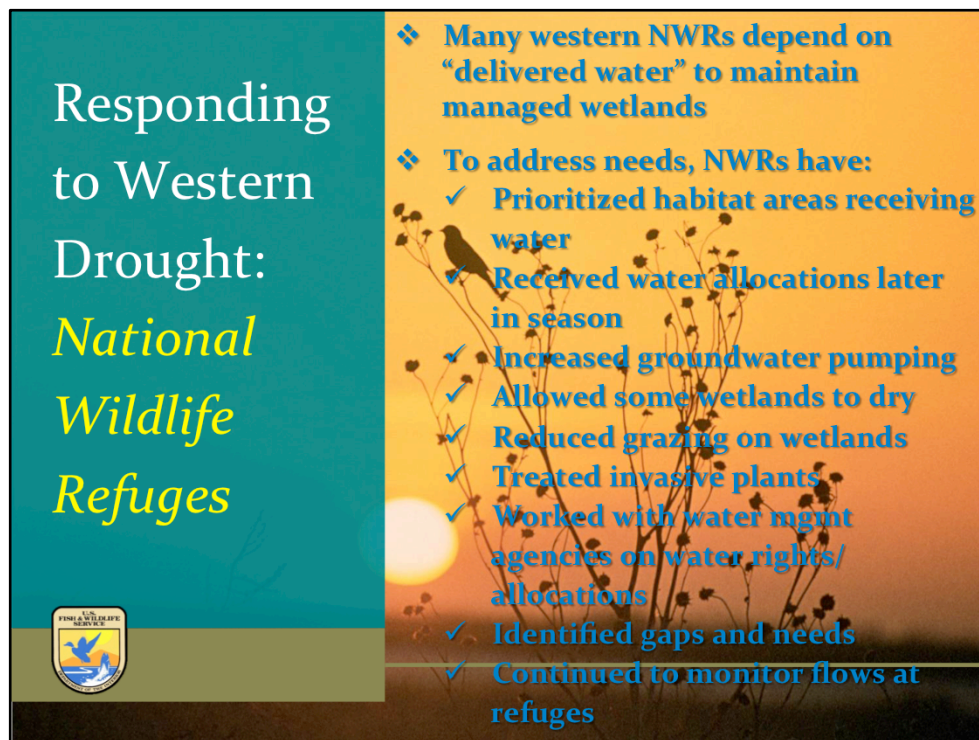
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In the short-term, Service managers and biologists are using every tool in the toolbox to mitigate the impact of drought and water availability on trust resources.

Working to secure water sources is one key tool. Service managers are working with water management agencies to secure water allocations and ensure water rights are protected.

But they are also working to protect hatchery water sources, judiciously use groundwater supplies, and protect watersheds.



In addition, to address impacts and needs, western refuges have:

Prioritized habitat areas within a refuge that receive water allocations

Received water allocations later in season to reduce evaporative losses

Increased groundwater pumping in some cases

Allowed some wetlands to dry

Reduced grazing on some wetlands

Taken advantage of drought to treat invasive plants and aerate soils

Worked with water management agencies on water rights/water allocations

Identified water infrastructure gaps and needs

Continued to monitor flows at many refuges through the Service’s regional Water Resources Branches



For ESA-listed species, drought can present an imminent threat of extinction, and emergency responses may be necessary.

Activities have included:

Capture and translocation or captive maintenance, usually of fish stranded in drying sections of rivers

Creation of new, artificial habitats, e.g. pond habitats have been created for Chiricahua leopard frog in areas where natural ponds have dried up

Grazing and vegetation management in riparian areas

Woody fuels thinning to reduce wildfire risk

Emergency Section 7 consultations directed at drought response and wildfires

Increased interaction with water management and other agencies to address water needs

## Responding to Western Drought: *Migratory Birds*

- ❖ Response has primarily involved providing habitat on refuges and private lands
- ❖ Activities have included:
  - ✓ Using groundwater to offset lack of surface water
  - ✓ JVs using incentives to get farmers to flood ag areas, esp. rice fields
  - ✓ Prioritizing wetlands to receive water
  - ✓ Translocation of some birds
  - ✓ Using drought conditions for good—invasives removal

Migratory birds are directly affected by availability of wetland habitats.

Activities to mitigate drought impacts on migratory birds have included:

Some managers are using groundwater to offset the lack of surface water

JVs using incentives to get farmers to flood ag areas, esp. rice fields

Prioritizing wetlands to receive water

Translocation of some birds

And , as previously mentioned, some managers are using drought conditions for good—lower water conditions may allow for the removal of invasive plants



# Responding to Western Drought: *Fisheries*

- ❖ Fisheries in the west are challenged by changing flow and temperature regimes
- ❖ Activities have included:
  - ✓ Fish translocations
  - ✓ Disease monitoring
  - ✓ Increased monitoring of populations
  - ✓ Collaboration with partners to develop measures to increase resiliency of streamflows
- ❖ See activities of National Fish Hatcheries (next slide)



Fisheries in the west are challenged by changing flow and temperature regimes

Management actions to address drought have included:

Fish translocations

Disease monitoring in fish populations

Increased monitoring of populations

Collaboration with partners to develop measures to increase resiliency of streamflows

Additional actions have been implemented for hatchery raised fish, as discussed in the next slide



Pacific Northwest hatcheries have been especially challenged by the current drought.

Hatcheries have:

Removed unhealthy fish from facilities

Moved healthy fish to other facilities

Released fish earlier than normal

Monitored and controlled disease outbreaks

Monitored water flows and temperatures

Made infrastructure and operational changes

Conducted vulnerability assessment: Winthrop NFH – Climate Change Vulnerability Assessment -- 2013



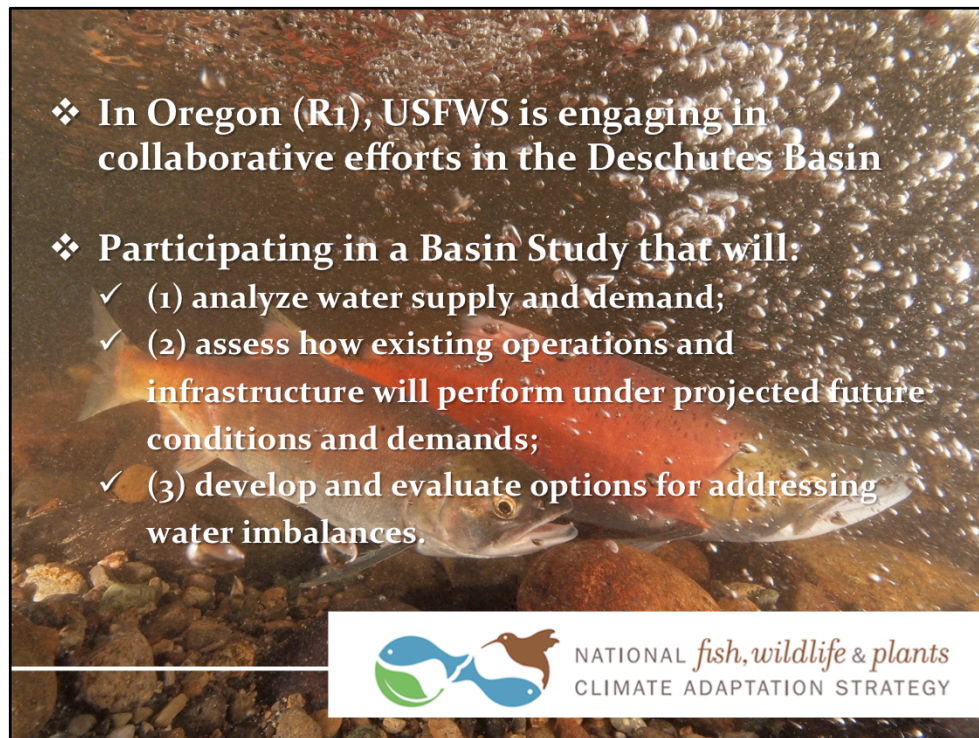
At the same time it is responding to crises in the short-term, the Service is moving toward development of long-term collaborative solutions to the impacts of changing water availability on trust resources.

Securing water rights and water allocations are a key element, but we must move beyond this to ensure “water security” in an era of changing climate and increasing drought



The Service was actively involved with the Association of Fish & Wildlife Agencies and NOAA in creating the **National Fish, Wildlife, and Plants Climate Adaptation Strategy** and is now actively implementing this plan in collaboration with a wide variety of partners.

I highlight three efforts...one in each of three regions.



In Oregon (R1), USFWS is engaging in collaborative efforts in the Deschutes Basin by participating in a Basin Study that will:

- (1) analyze water supply and demand, including integrating climate change modeling;
- (2) assess how existing operations and infrastructure (i.e., reservoirs, canals, etc.) will perform under the projected future water supply conditions and demands;
- (3) develop and evaluate options for addressing identified water imbalances.



In California (R8), USFWS is working with many partners:

Water allocation optimization model development with UC Davis

Partnering with state and conservation organizations on a project to better estimate water requirements for wetlands in the Sacramento Valley

Sharing resources and information regarding drought response and planning as part of the Central Valley drought coordination team

Developing a data portal with partners to share near real-time water availability conditions across the Central Valley.



- ❖ In 2015, the Southwest Region's (R2) Science Applications Program initiated a project that focuses on holding basin-specific forums:
  - ✓ To review land and water management practices
  - ✓ To improve the capacity of resource managers to more reliably meet the needs of all water users



NATIONAL *fish, wildlife & plants*  
CLIMATE ADAPTATION STRATEGY

In 2015, the Southwest Region's (R2) Science Applications Program initiated a project that focuses on holding basin-specific forums:

To review land and water management practices, including recent innovations in water conservation

To improve the capacity of resource managers to more reliably meet the needs of all water users, including recreationists and ecosystems, during periods of drought.



### Landscape Conservation Cooperatives

Part of the Service's Science Applications' portfolio includes the FWS budget allocation for Landscape Conservation Cooperatives.

The vision for the LCC Network is landscapes capable of sustaining natural and cultural resources.

Key aspects of LCCs are:

- Bringing partners together.
- Setting shared priorities and vision.
- Identifying data gaps and how to address them.

These characteristics make the 22 self-directed LCCs ideal for bringing states together to identify priorities and needs for managing drought.



### Tools for Managing Drought & Other Climate Stressors

Today, many--if not most--of the LCCs in the West and across the country are actively working on drought- and climate-related issues and producing tools designed for wildlife and habitat managers to help agencies and partners develop and access the best scientific data available and increase their confidence in successful conservation investments on the ground.

Drought-related work that these LCCs support focuses on:

- Increasing the predictability for decision making about water supplies.
- Conducting vulnerability assessments and scenario planning that allow better decision making.
- Predicting habitat changes related to drought and how that could impact species migrations and survival.
- Fostering collaboration to design desired future landscapes.
- Hosting workshops and conducting training for states and others on drought and being climate smart.

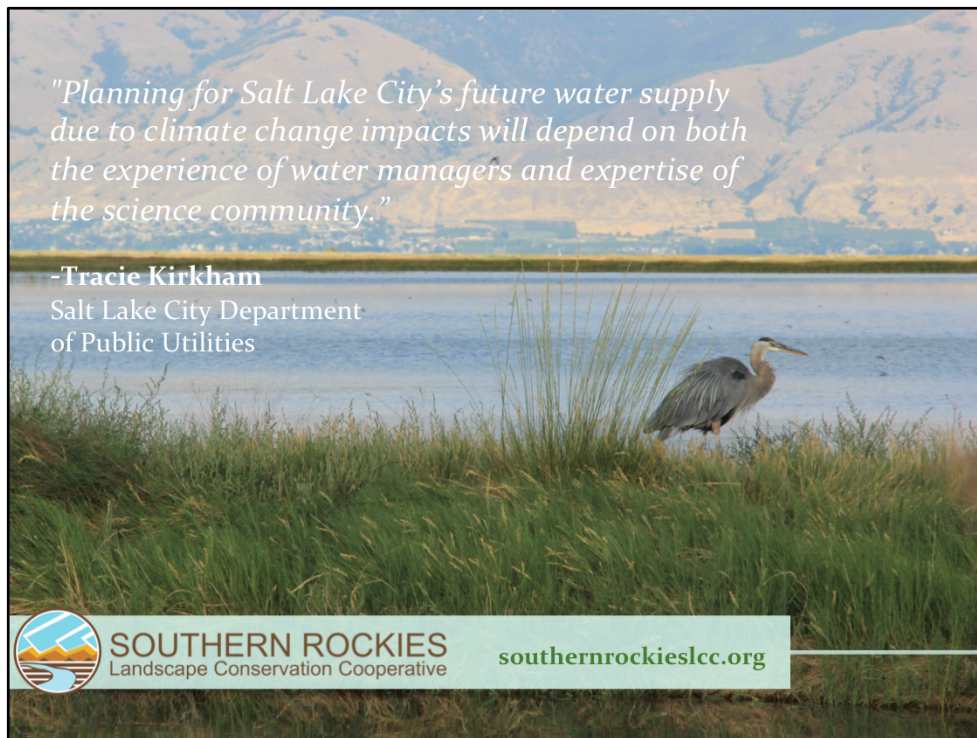
I'd like to tell you about three LCC projects that are underway.



### WaterSMART in Utah

The Bear River is the largest contributor to the Great Basin and the only significant new source of future water supply for the burgeoning Wasatch Front that includes Salt Lake City.

The Southern Rockies LCC, as part of its work in the Intermountain West, is funding a project by Utah State University to improve water managers' understanding of stream flow variability and impact from climate extremes; the **WaterSMART** project.



### WaterSMART in Utah

#### Prediction Tools:

The **WaterSMART** project developed predictions tools to assess risk of extreme wet/dry climate conditions for the next 10 to 15 years. Project results increased the predictability in decision-making for managing future water supply such as for the Bear River.

The project reconstructed 1,200 years of Bear River streamflow to create Utah's first operational prediction for Great Salt Lake water levels for the next five years. The project also reduced uncertainty for climate model projections of future water availability in the basin.



### Central Valley Landscape Conservation Project

California's Central Valley is the resting and nesting grounds for tens of millions of migrating birds amidst agricultural development.

Typically, we would see about 300,000 acres of agricultural land flooded for migratory birds to feed on – this year, wildlife refuge managers expect 75,000-100,000 acres. But drought is just one symptom of a landscape that is highly vulnerable to numerous stressors including land use changes, increasing temperatures, habitat loss.

The California LCC recently initiated the **Central Valley Landscape Conservation Project** with natural resource managers, scientists, and decision makers in the region to cooperatively agree on strategic, climate-smart conservation actions to maximize the adaptive capacity of priority species, habitats, and ecosystems to support an ecologically connected landscape.



### Central Valley Landscape Conservation Project

#### Assessment, Planning & Implementation Process and Tools:

- Priority resources identified by a broad set of partners
- Vulnerability assessments and/or scenario planning for priority resources developed based on existing data and climate information
- Climate-smart adaptation strategies developed for priority resources based on vulnerability assessments and/or scenario plans
- Spatially explicit conservation options built from the adaptation strategies to support resilience and adaptation of priority resources
- Online toolbox and outreach plan to help partners use and apply the conservation options for their organization
- "Lessons Learned" document to inform similar efforts.



### Southwest Climate Summit

We can all agree about the value and importance of sharing knowledge, experiences, actions.

An extraordinary list of partners including five LCCs, the Southwest Climate Science Centers, federal natural resource agencies, and others sponsored the recent 2015 Southwest Climate Summit on November 2-3 in Sacramento.



## Southwest Climate Summit

Goals of the summit were to:

Discover emerging climate science

Explore adaptive management

Share Climate-Smart Conservation results

Discuss management and policy responses

Results will be posted on the Summit website



#### Concluding Thought

The LCCs and the Fish and Wildlife Service overall are thinking about and developing tools collaboratively to aid managers in addressing drought.

These challenges are too big for us to tackle alone. We need to work together to identify the goals and priorities and then set about tackling them collectively.