



Planning for drought in Utah and the Intermountain West

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Western Water Assessment
University of Colorado-Boulder, CIRES
University of Utah, GCSC

“Scientists and decision-makers collaborating to plan for drought in Utah/Intermountain West”

10/24/18

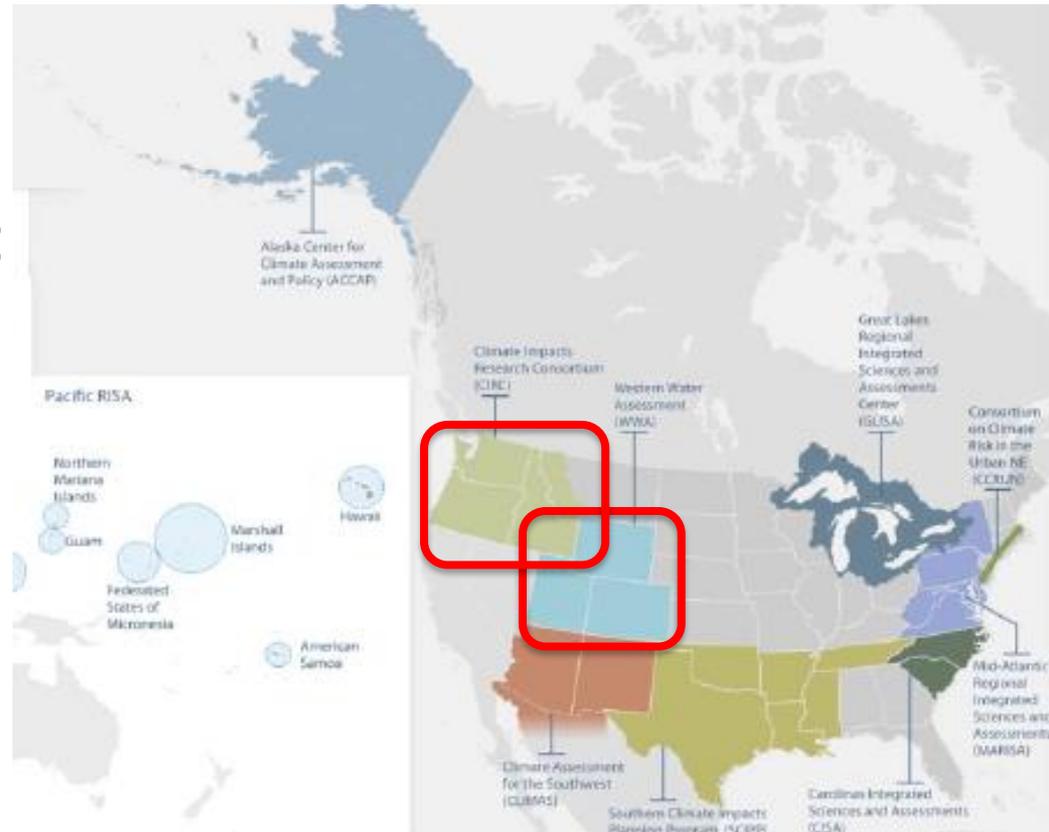
Western Water Assessment (WWA): A NOAA RISA program

- NOAA: Funded by National Oceanic and Atmospheric Administration
- RISA: Regional Integrated Sciences and Assessment Program
- University of Colorado-Boulder
 - CIRES: Cooperative Institute for Research in Environmental Science
- University of Utah
 - Global Change and Sustainability Center

NOAA RISA program

- **Program goal:** to build and expand nation's capacity to prepare for and adapt to climate variability and change
- Focus on working with users of climate information
 - Resource managers (water, range, forest)
 - Decision-makers (state, county, local, agencies)
- Connect climate research to practitioners
- Develop *usable science*
- *Coproduction* of research

- 10 regional programs
- Since late 1990s
- WWA funded in 1999
- WWA works in Utah, Colorado and Wyoming
- Recent focus on **drought**
- CIRC – Climate Impacts Research Consortium



Utah just experienced its driest year since scientists have kept records



Salt Lake City Tribune
Brian Maffly
10/10/18

Current Utah drought

Statewide Precipitation Ranks

October 2017–September 2018

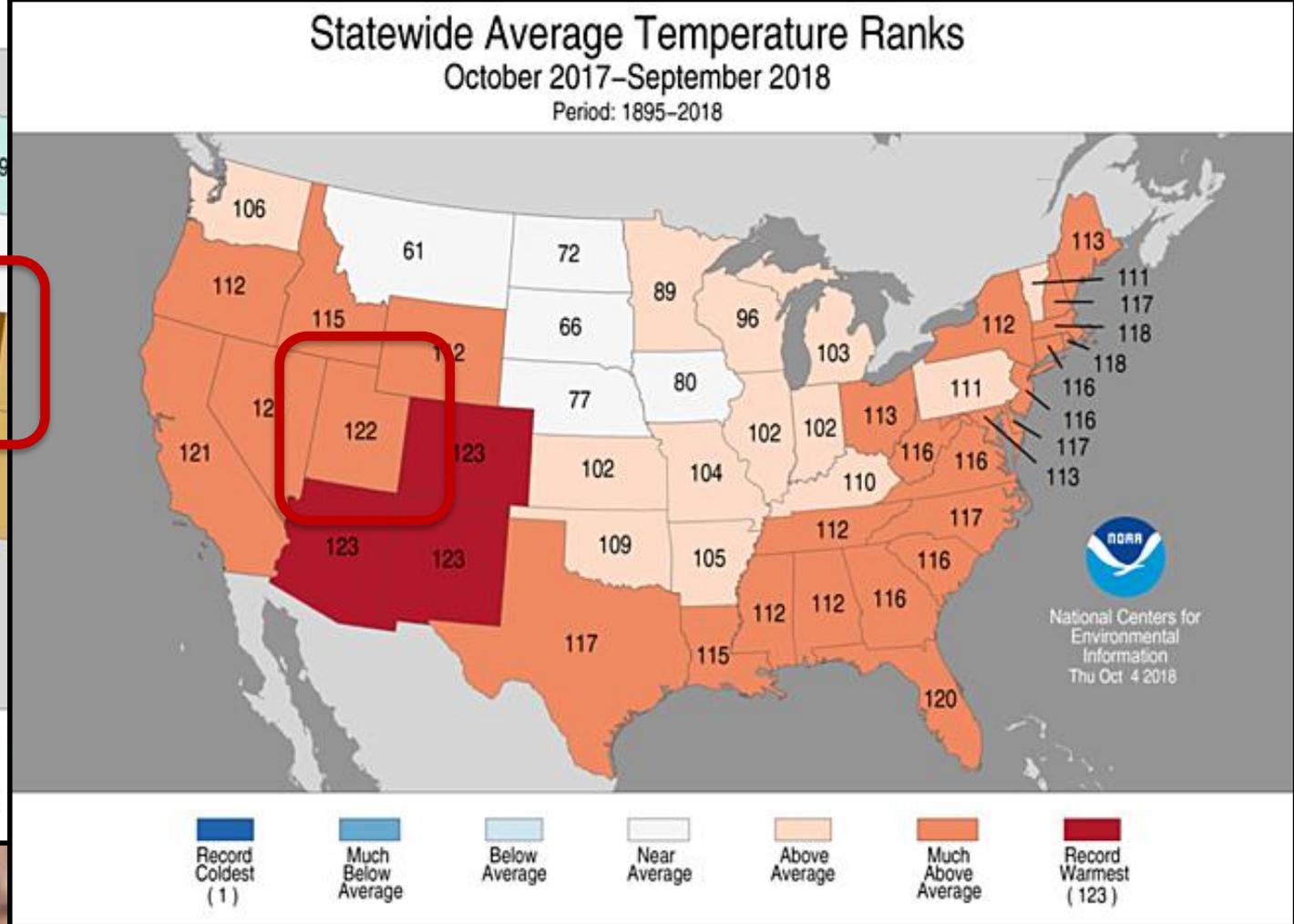


Record Driest (1)
Much Below Average

Statewide Average Temperature Ranks

October 2017–September 2018

Period: 1895–2018



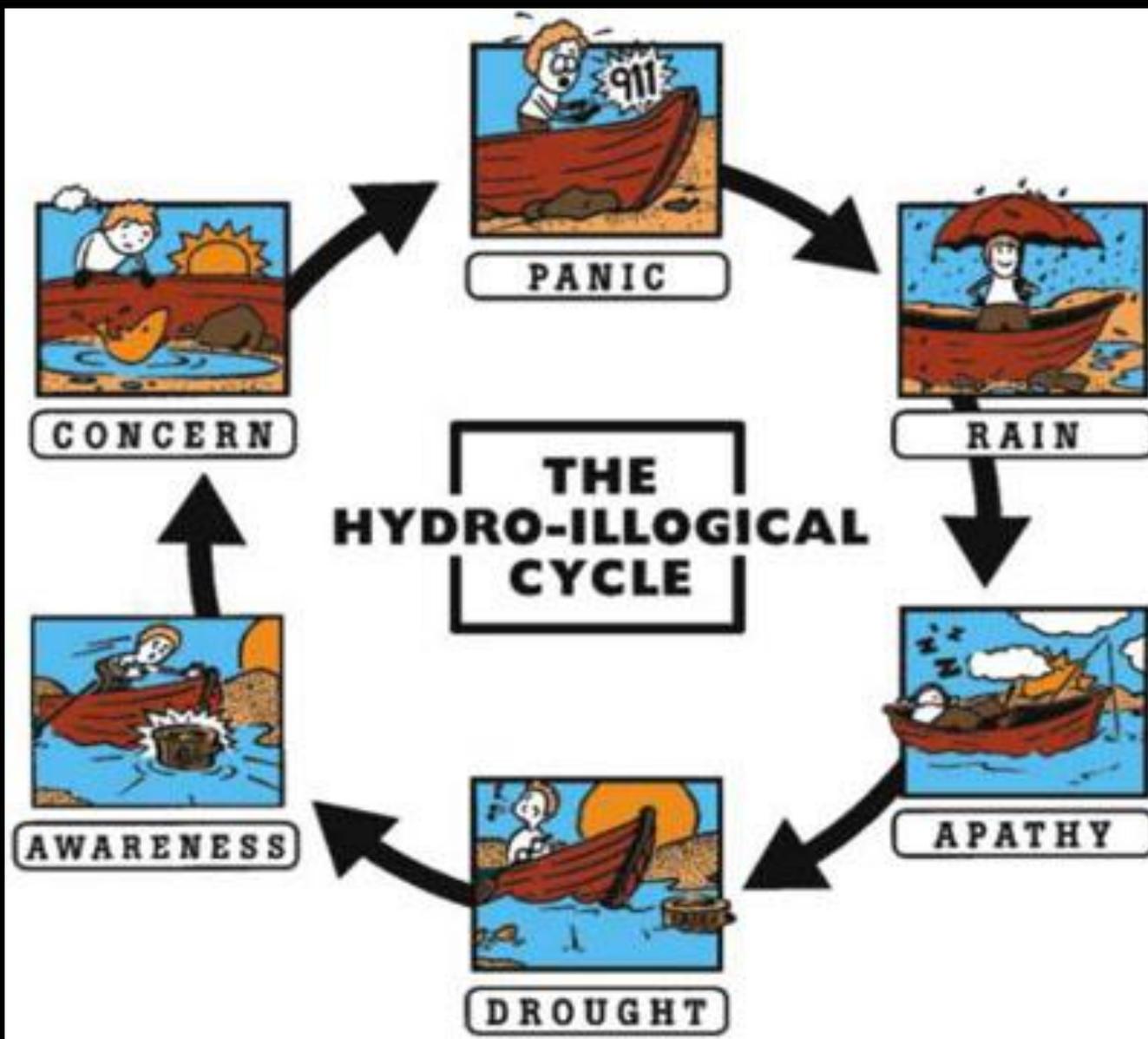
Record Coldest (1)
Much Below Average
Below Average
Near Average
Above Average
Much Above Average
Record Warmest (123)



National Centers for Environmental Information
Thu Oct 4 2018

**And now it's snowing...
The drought is over!**

NO!!!



Partnership with NIDIS

National Integrated Drought Information Systems

<https://www.drought.gov/drought/>

- NIDIS is a division of NOAA
 - Provider of drought information
 - Resource for drought planning
- NIDIS has regional Drought Early Warning Systems (DEWS)
- WWA is funded by NIDIS for drought research, outreach and planning
- Intermountain West DEWS
- Focus on stakeholder outreach in Utah

Drought work in Utah

- Drought contingency planning with water providers
- Utah drought stakeholder meetings
- State of Utah drought response planning
- Drought Decision Ranching Model
- Drought decision analysis

Weber Basin WCD drought planning

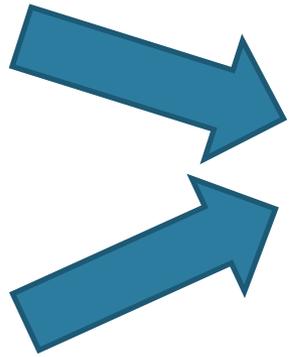
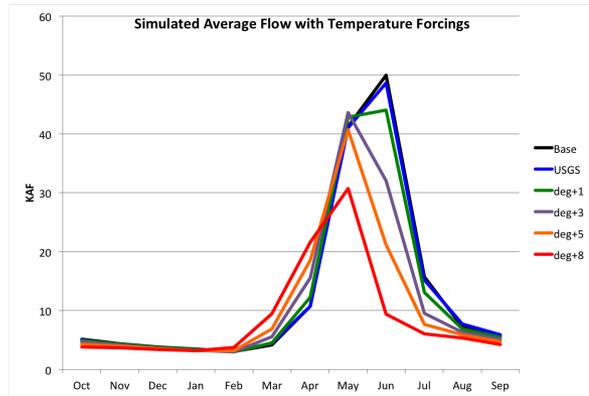
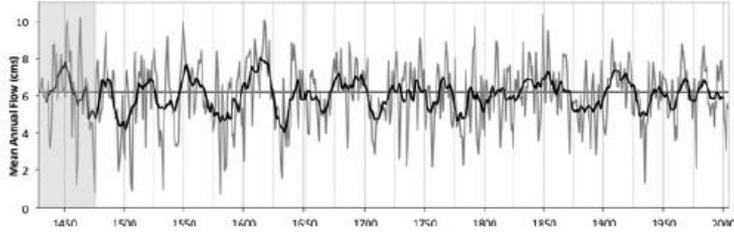
- Bureau of Reclamation funded
- Develop a drought contingency plan
- Collaborative effort
 - Utah DWRe, USU, WWA, consultant
- Information about past and future drought to inform planning



East Canyon Reservoir dam



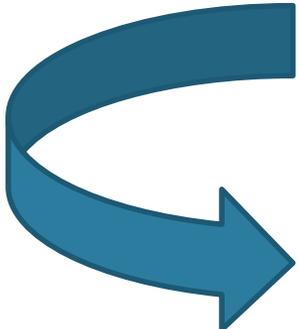
East Canyon Reservoir spilling (2008)



Weber River systems model



Information on drought
-water supply
-reservoir storage



Weber Basin WCD Drought Contingency Plan

Drought stakeholder engagement in Utah

- Utah drought stakeholder meeting – November 2017
 - Water providers, state and federal agencies
- Utah Division of Water Resources
 - Collaboration on drought response planning
- Drought Response Plan workshop – July 2018
 - Drought planning expertise from Colorado, Arizona and New Mexico

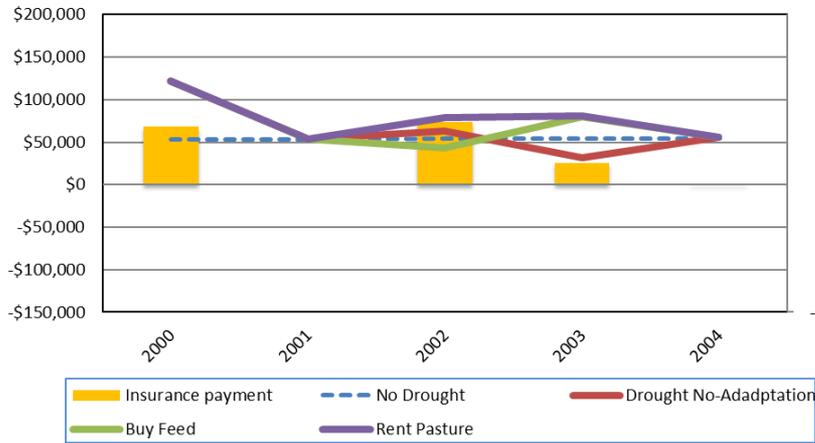
Drought Ranch Insurance Response model

- Model provides annual ranching income
- Based on scenarios
 - Drought/ no drought
 - Ranch management strategies
 - Insurance/no insurance
- Available online: <http://www.ranching.io/>

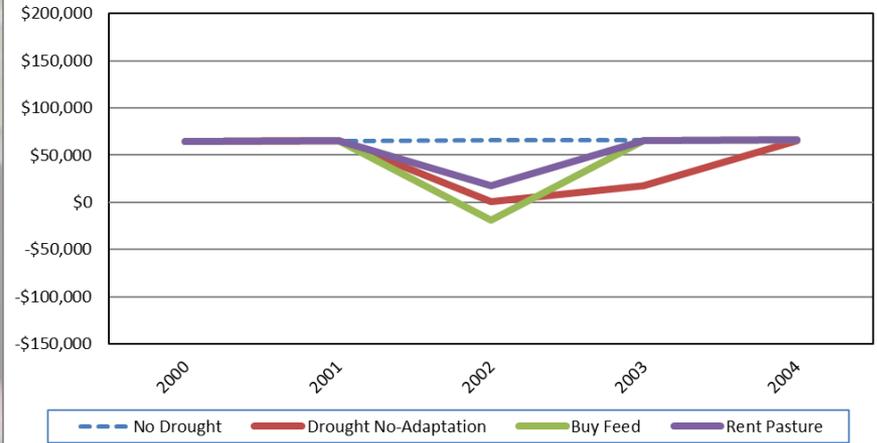
Drought Ranch Insurance Response model

- Research questions:
 - Does insurance affect grazing intensity in larger herds?
 - Does insurance affect drought adaptation?
 - How does drought forecasting affect investment in drought adaptation?
- Available online: <http://www.ranching.io/>

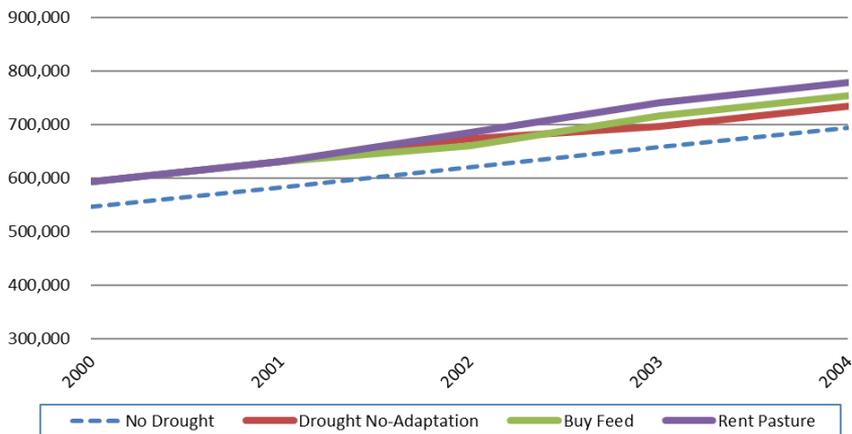
Annual Net from Cattle with insurance



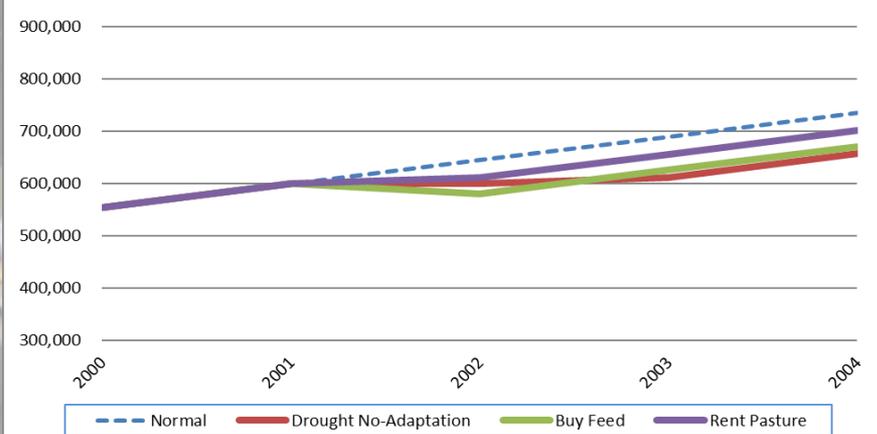
Annual Net from Cattle without insurance



Year-End Net Worth with insurance



Year-End Net Worth without insurance



Five-year runs for a 600-head cow-calf operation accessing 8,000 acres in eastern Colorado with and without PRF insurance

Pasture, Rangeland and Forage (PRF) insurance program

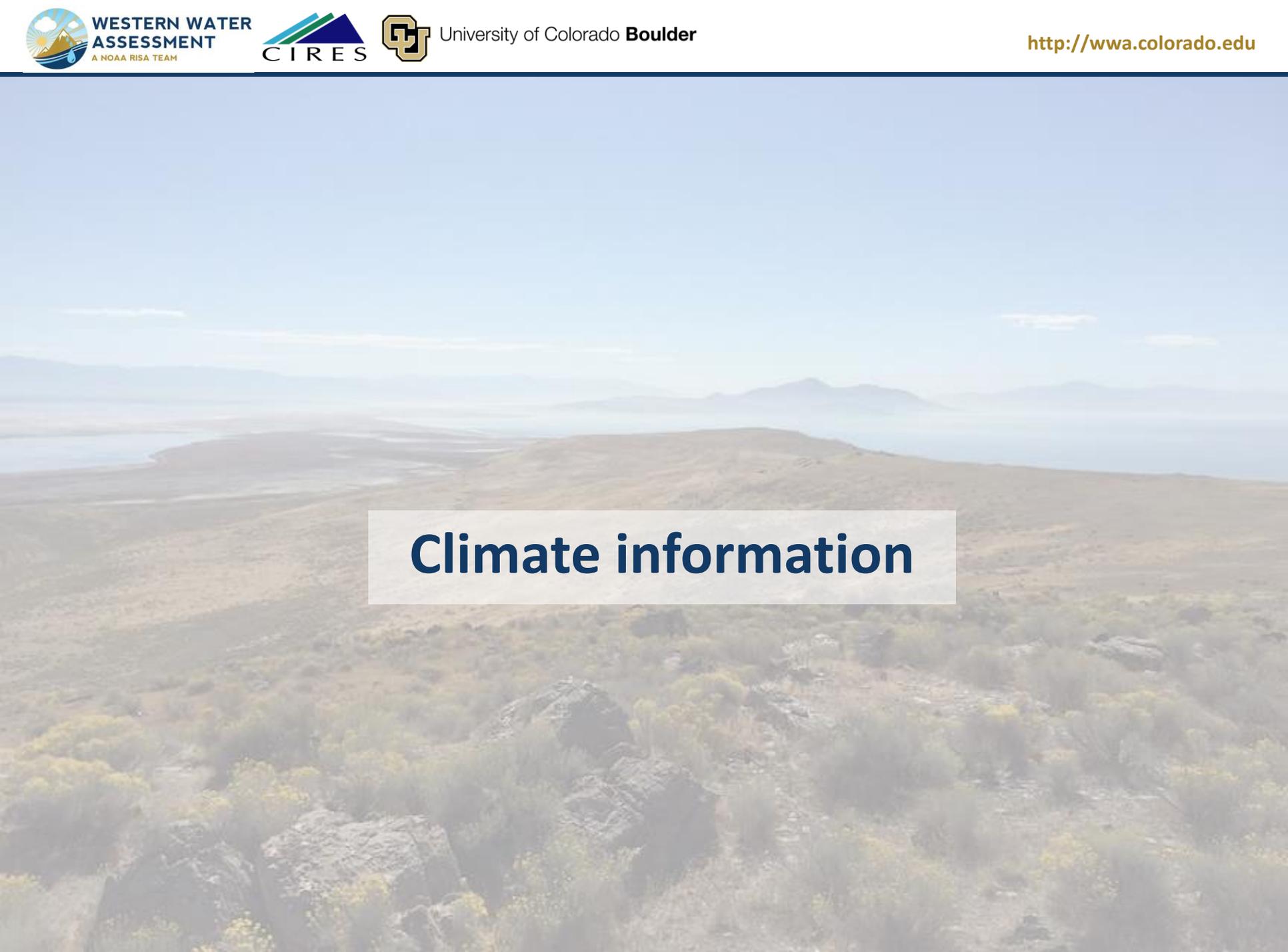
- Insurance payments currently based on precipitation indices
- Comparison of current payment structure to one based on USDM
- What is the risk of non-payment of insurance during drought?
- Experimental comparison tool:
 - <https://www.earthlab-riskappone.org/>

Helping towns/cities plan for climate risks

- Piloting VCAPS facilitation process
 - Vulnerability, Consequences and Adaptation Planning Scenarios (U. of South Carolina, CISA)
- Explores municipal vulnerabilities to changing climate risks
- Can serve as starting point and road map for municipal climate change planning

WWA VCAPS projects

- 5 workshops in summer/fall 2018
- Colorado (focus on drought)
 - Durango, Cortez, Carbondale and Routt County
- Utah
 - Springdale/Rockville/Hurricane
- One day workshops
- Provide climate information specific to community
- Facilitate brainstorming on climate risk/adaptation



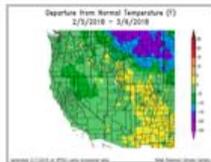
Climate information

Intermountain West Climate Dashboard

<http://wwa.colorado.edu/climate/dashboard.html>

Recent Temperatures and Precipitation, and Current Snowpack

30-day Temp. Anomaly (HPRCC) ?



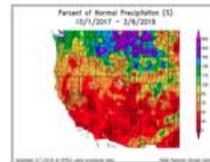
(updated daily)

30-day Precip as % Avg (HPRCC) ?



(updated daily)

Water-Year Precip as % Avg (HPRCC) ?



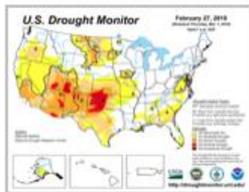
(updated daily)

Current Snowpack as % Median (NRCS) ?



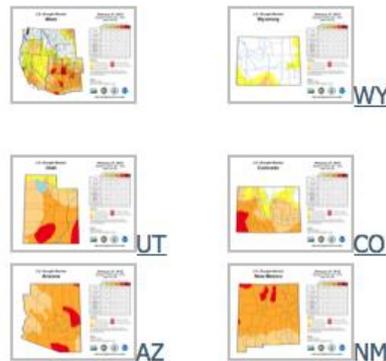
Drought Monitoring

US Drought Monitor (NDMC) ?

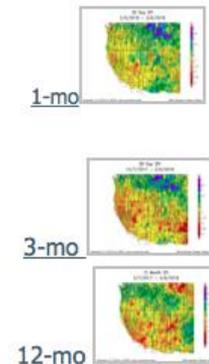


(updated weekly)

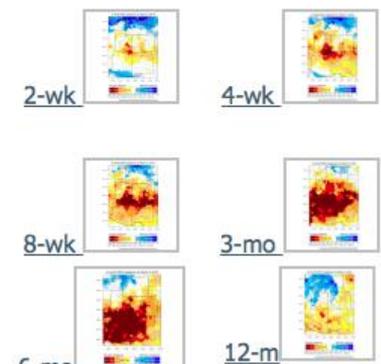
Westwide and State Drought Monitors (NDMC) ? (updated weekly)



Standardized Precip Index (SPI) (HPRCC) ? (updated daily)

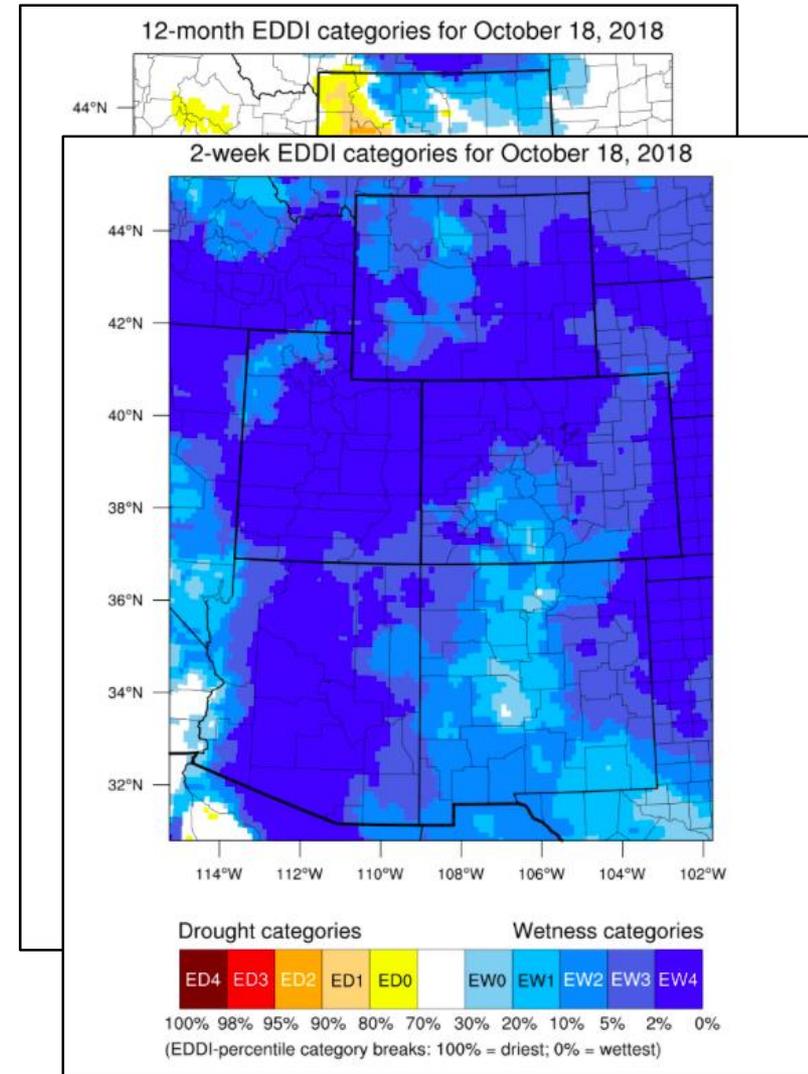


Evaporative Demand Drought Index (EDDI) ? (NOAA PSD, WWA, DRI) (updated daily)



Evaporative Drought Demand Index (EDDI)

- Indicator for drought
 - “Flash” droughts
 - Long-term droughts
- Early warning for drought
- 2 weeks to 12 months
- Compares potential evapotranspiration (ET) to reference ET
- Compares to 30 year average
- Mike Hobbins (NOAA), WWA



Extreme weather event database

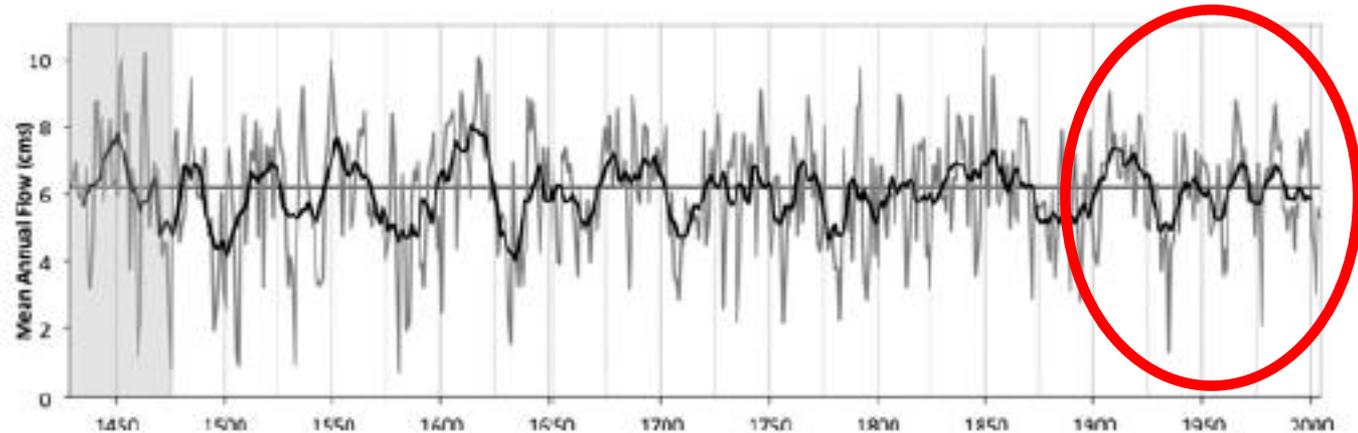
- High impact weather events
- 1862 - present
- Online, searchable database
- 166 total → UT = 46, WY = 62, CO = 58
- Includes: cold wave, drought, flood, hail, high wind, landslide, tornado, wildfire, winter storm
- UT, CO, WY
- <http://wwa.colorado.edu/climate/extremes/database/>

Questions?

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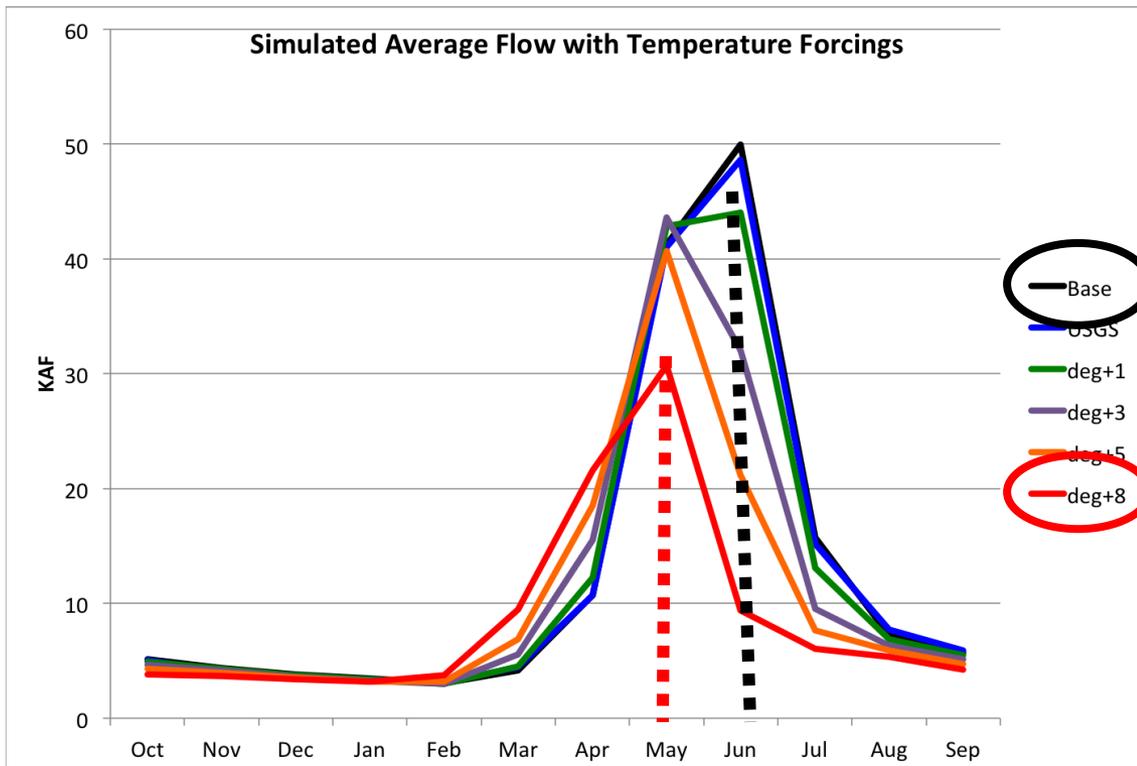
Weber River stream flow reconstruction (Bekker et al. 2014)

PAST



- Paleo-streamflow from tree rings
- 450 years
- Downscaled annual streamflow to monthly streamflow (Jim Stagge, USU)
- More severe and prolonged drought than in historical record
- Used as input for a Riverware model of the Weber River

- Projections of future Weber River flows
- Temperature and precipitation sensitivity analysis of Weber River flow
- Scenario planning approach
- Input for Weber River systems model



FUTURE