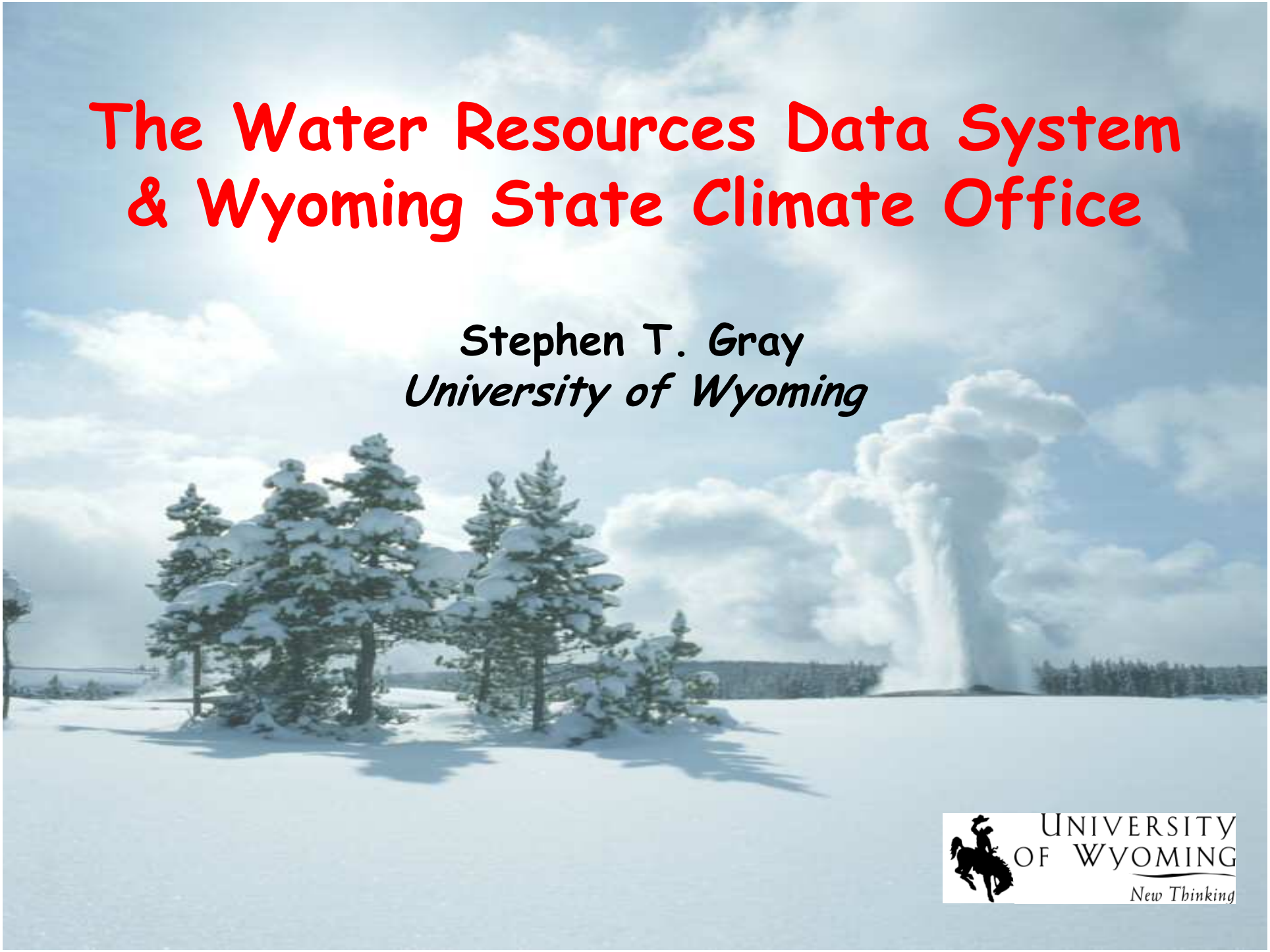
# The Water Resources Data System & Wyoming State Climate Office

**Stephen T. Gray**
*University of Wyoming*



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# Today's Update

- Climate of Water Year 2009
- Water Year 2010 (so far)
- Other Activities
  - Long-term preparations for drought and climate variability/change
  - Research and monitoring projects of interest

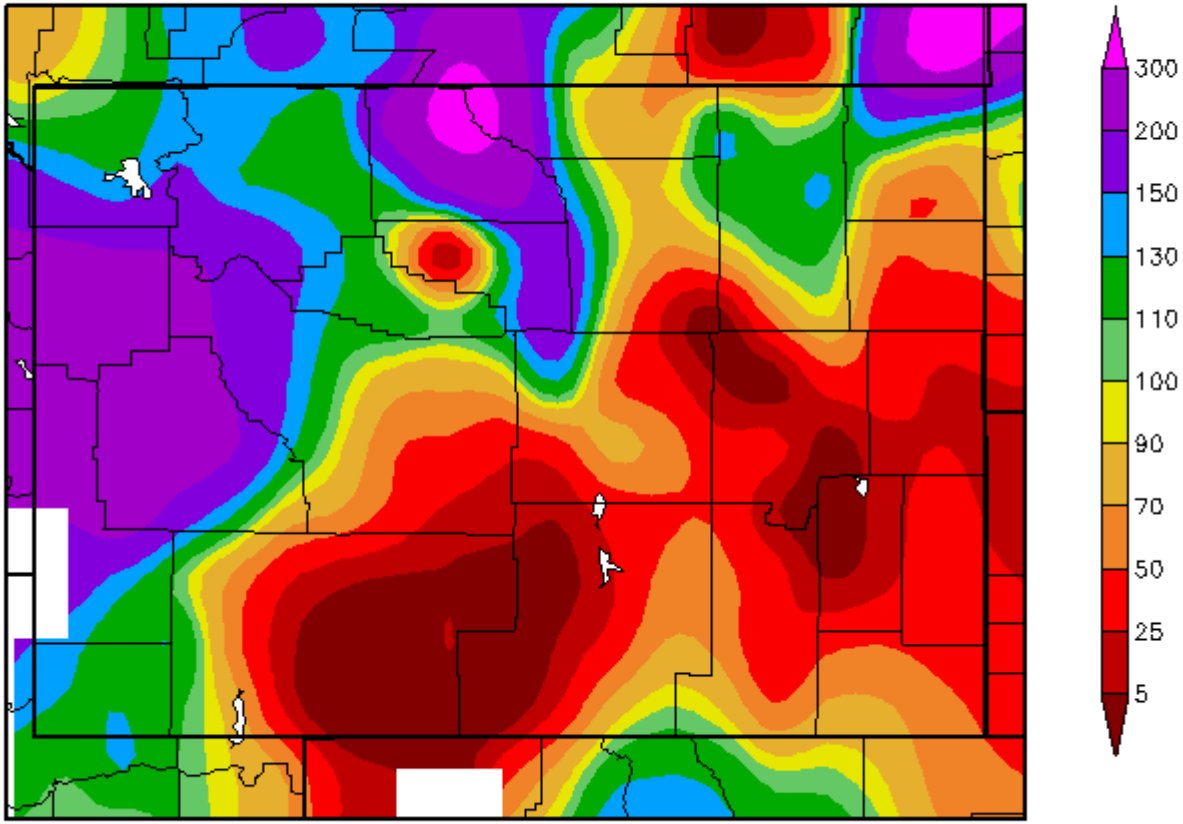
# WRDS/SCO Update:

Climate of Water Years
2009 & 2010

# December 2008

Percent of Normal Precipitation (%)

12/1/2008 – 12/31/2008

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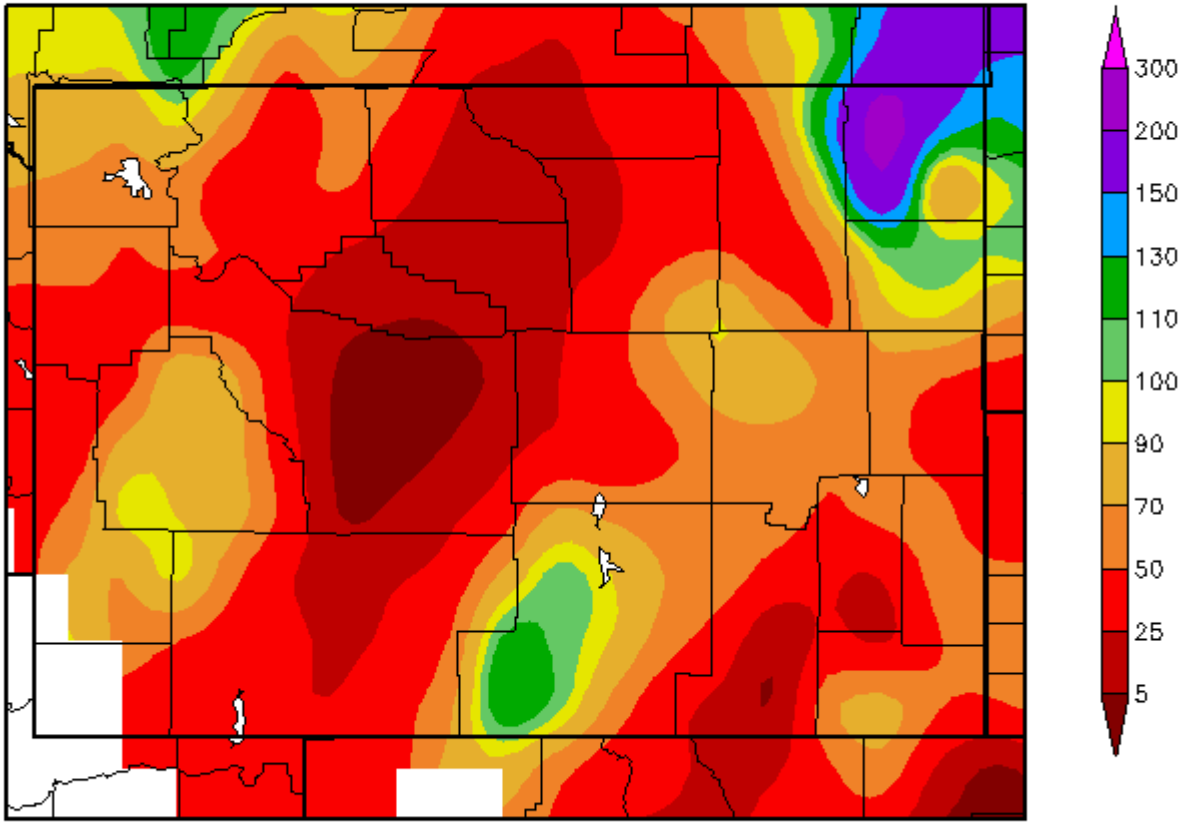
NOAA Regional Climate Centers

# February 2009

Percent of Normal Precipitation (%)

2/1/2009 – 2/28/2009

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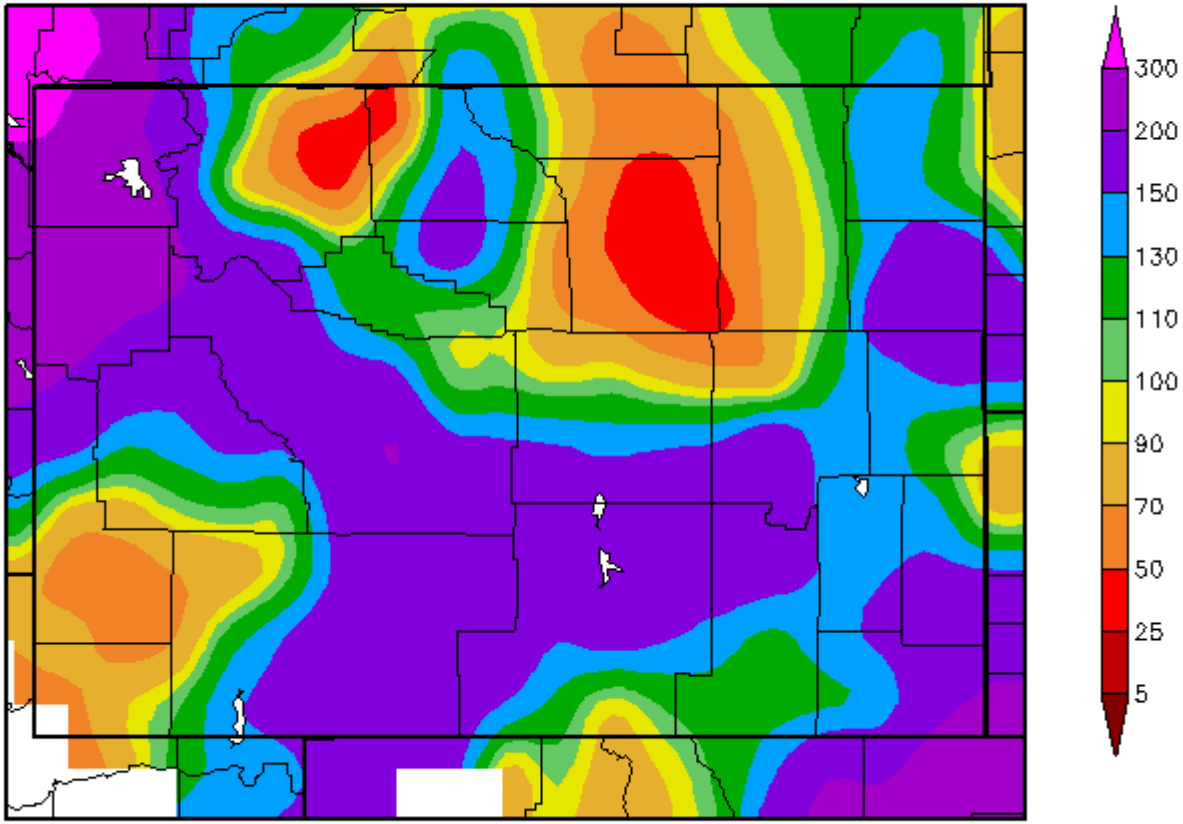
# April 2009

Percent of Normal Precipitation (%)
4/1/2009 – 4/30/2009

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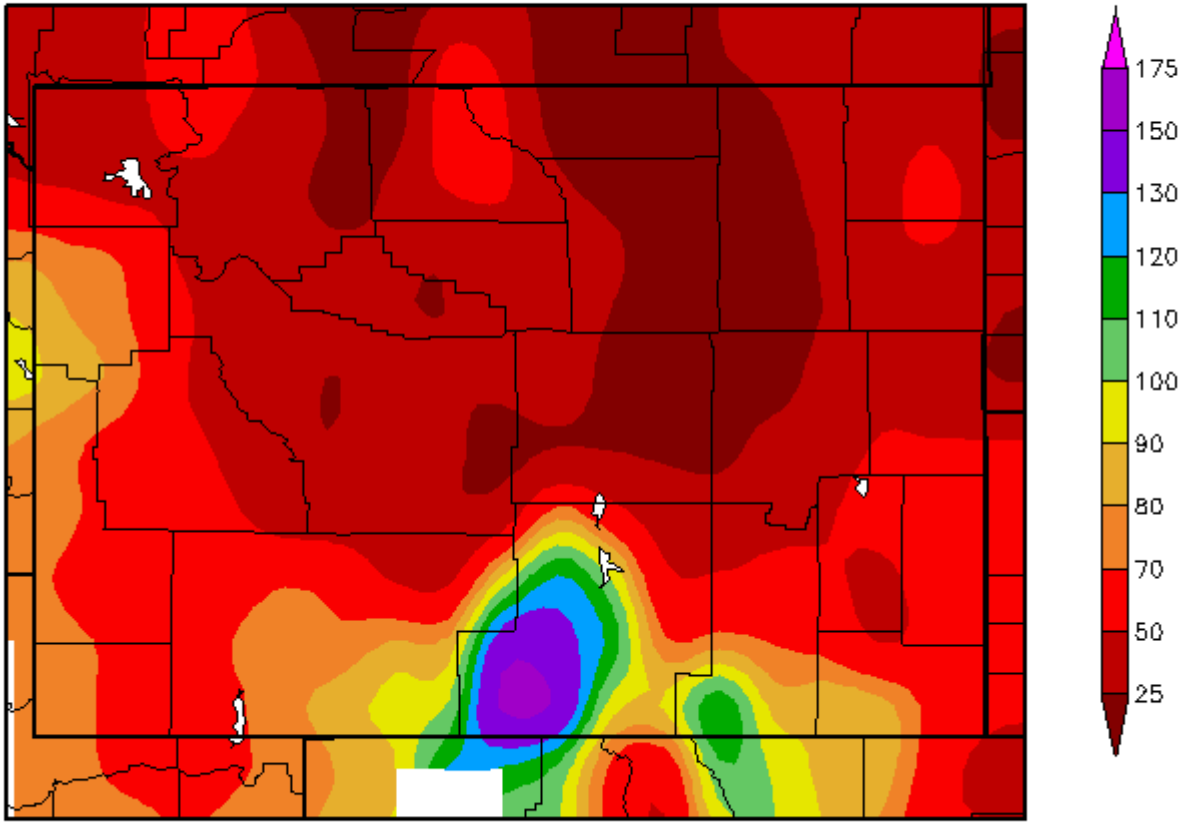
# May 2009

Percent of Normal Precipitation (%)

5/1/2009 – 5/31/2009

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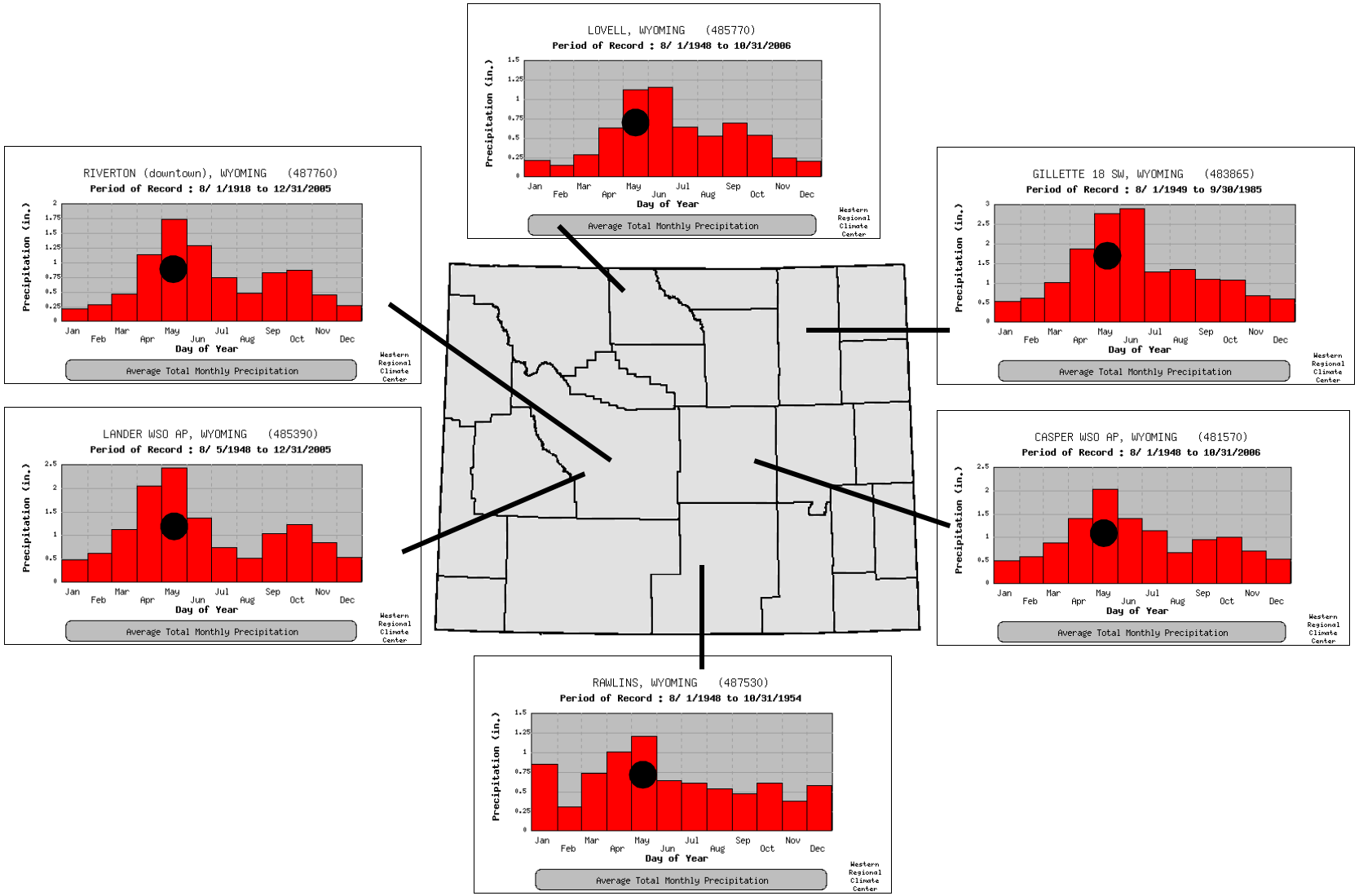
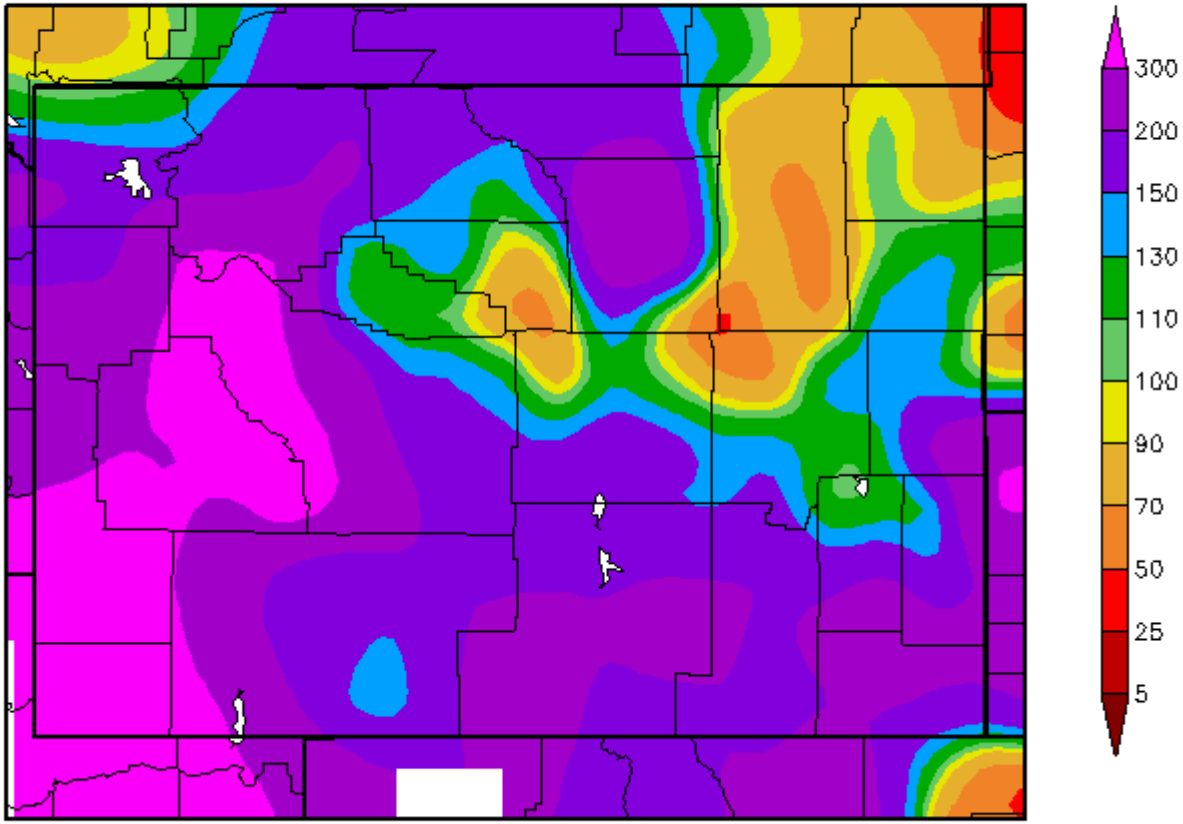
# Peak precipitation occurs in late spring over much of Wyoming



# June 2009

Percent of Normal Precipitation (%)

6/1/2009 – 6/30/2009

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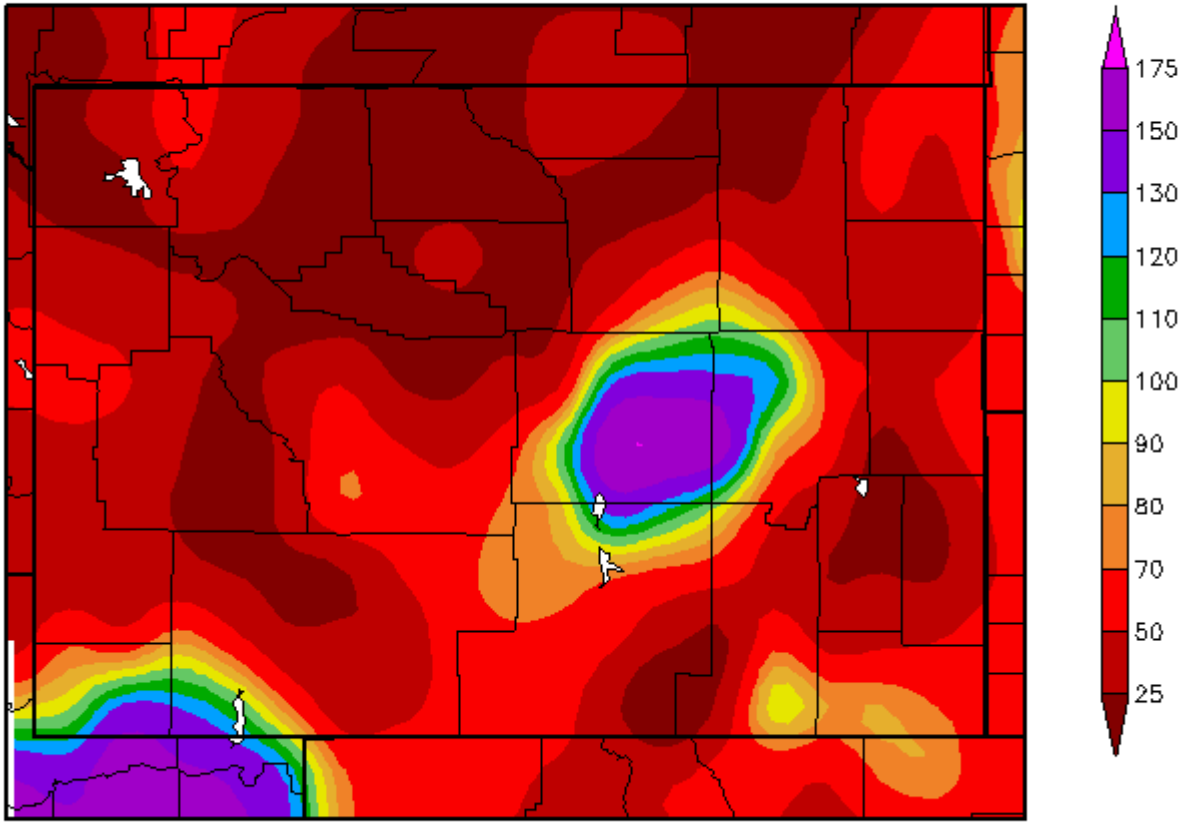
# September 2009

Percent of Normal Precipitation (%)

9/1/2009 – 9/30/2009




Generated 10/11/2009 at HPRCC using provisional data.

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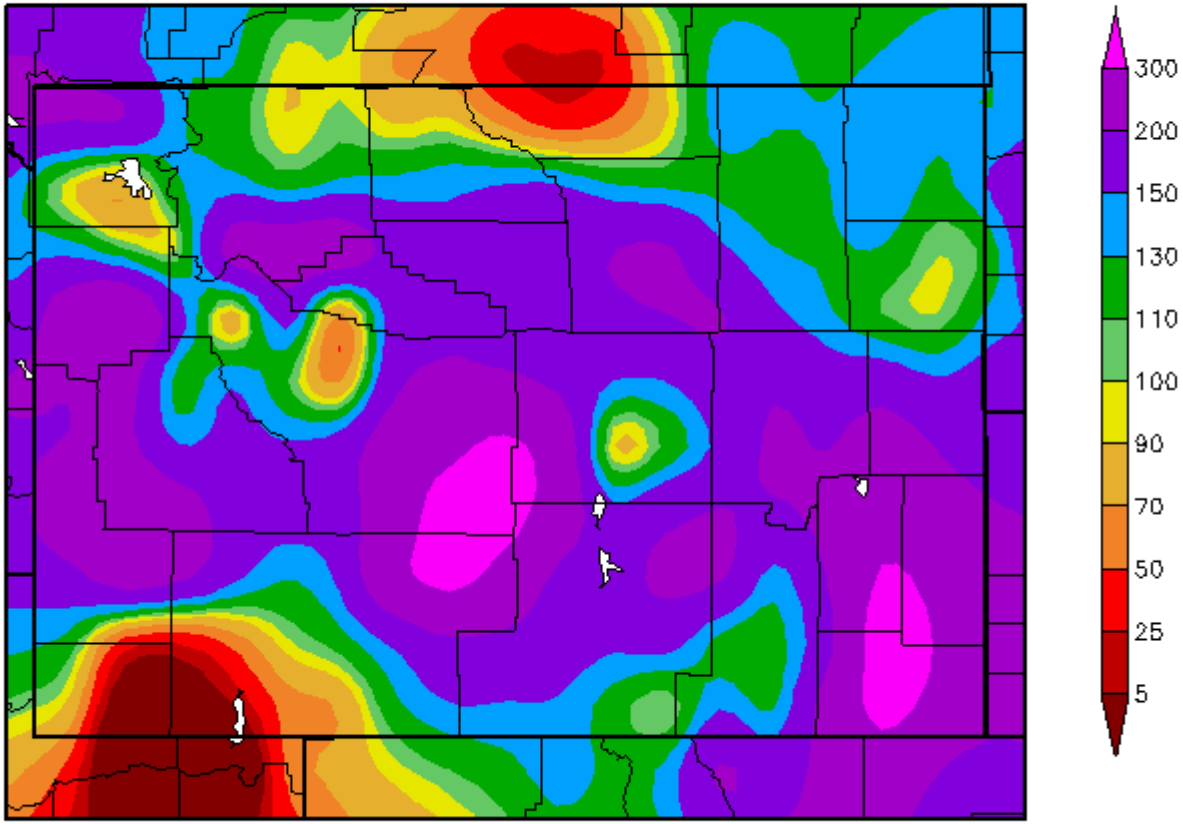
# October 2009

Percent of Normal Precipitation (%)

10/1/2009 – 10/31/2009

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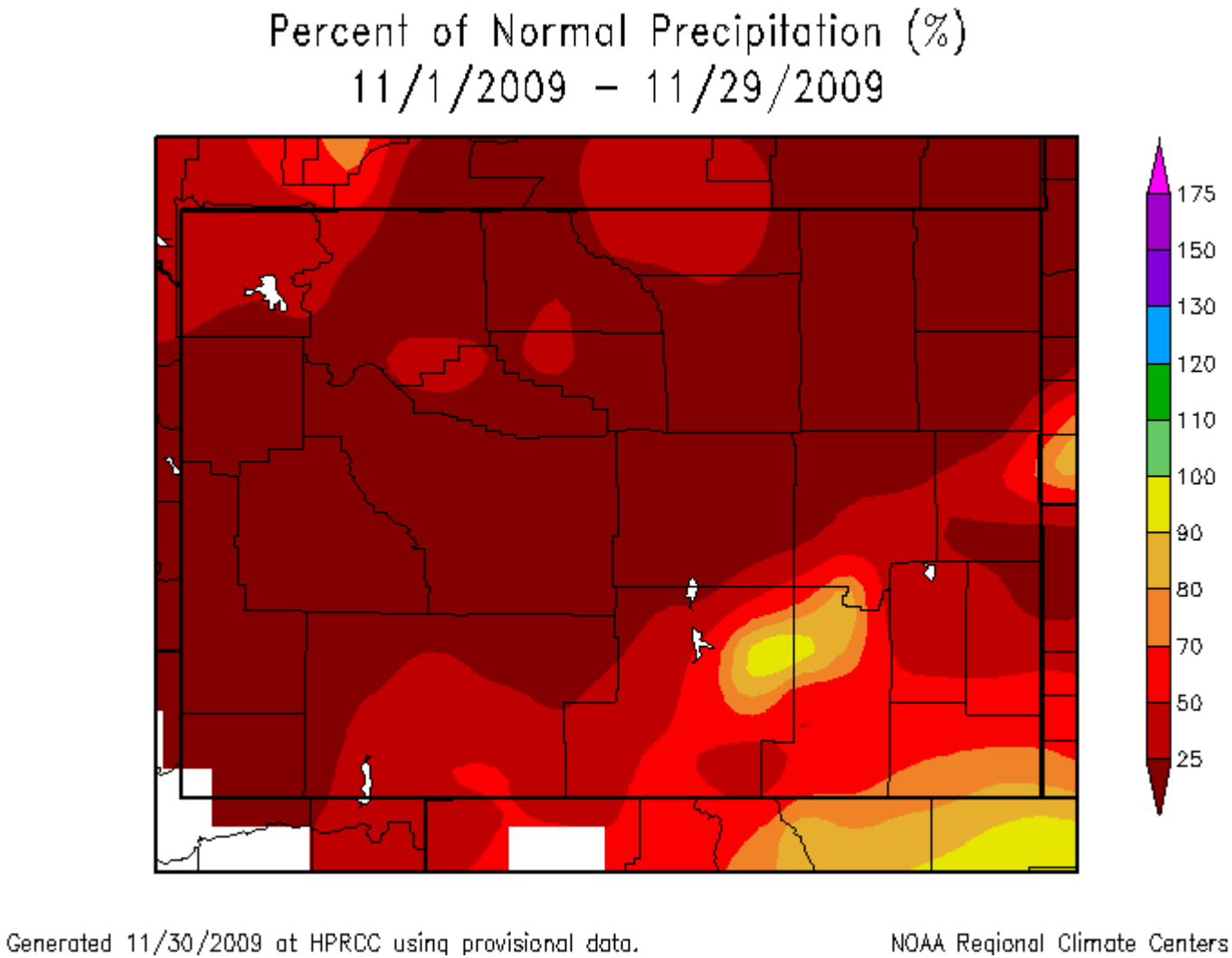
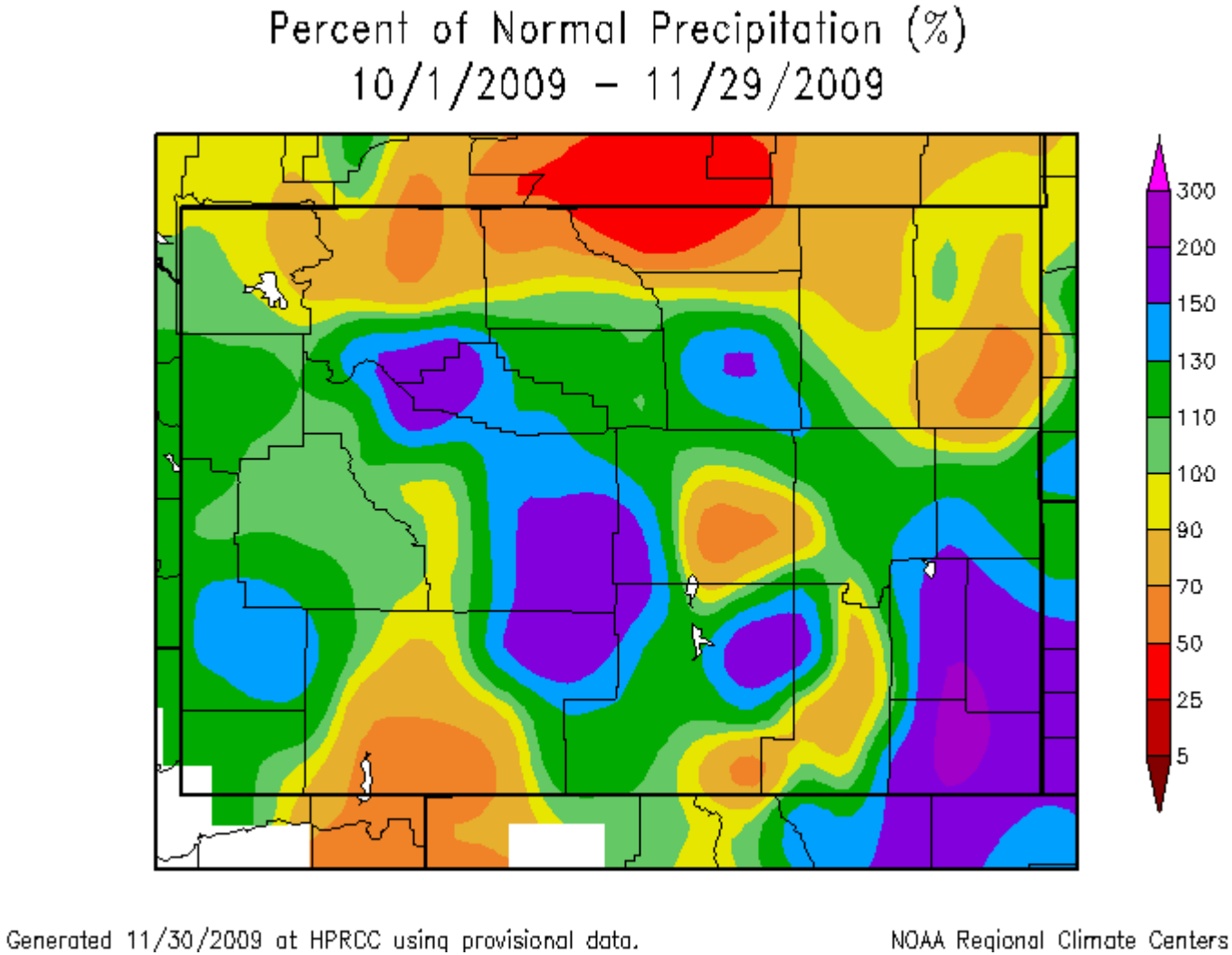
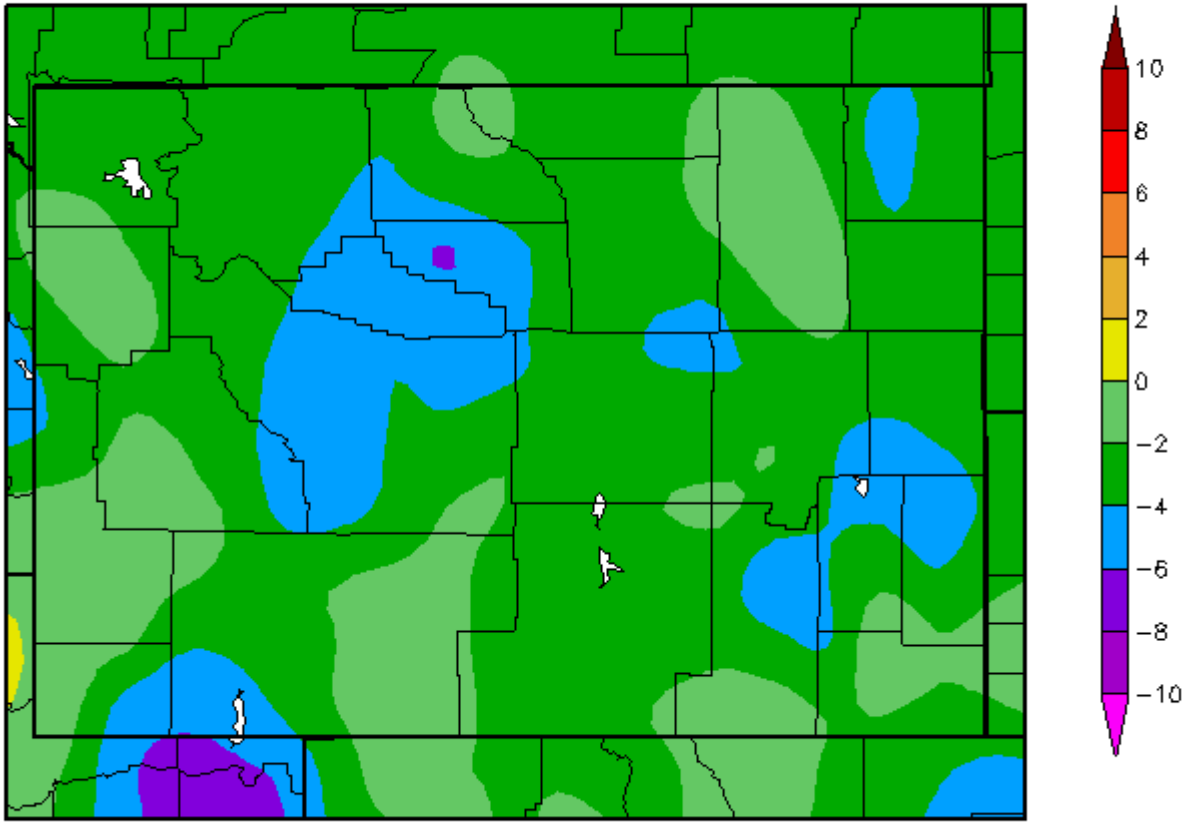
# November 2009



# Water Year 2010 (so far)

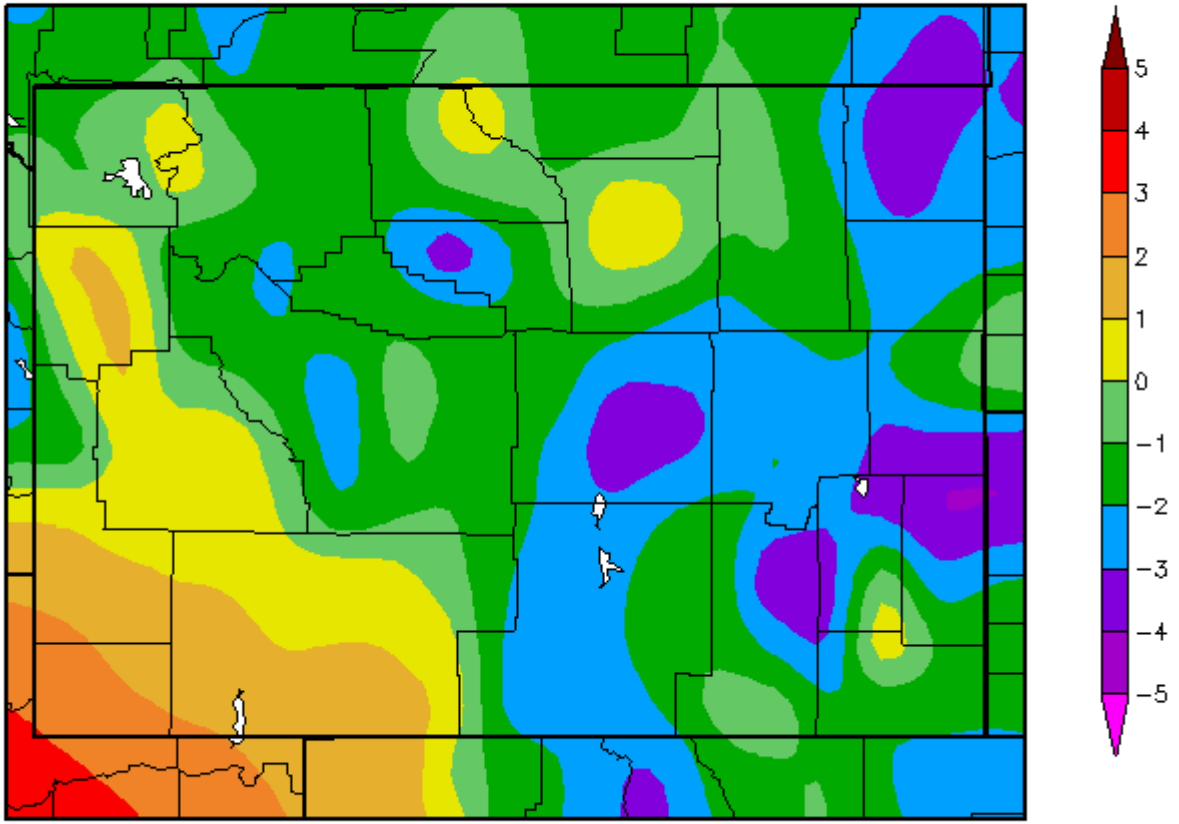


# Temps: June 2009



# Temps: July 2009

Departure from Normal Temperature (F)
7/1/2009 – 7/31/2009




Generated 8/11/2009 at HPRCC using provisional data.

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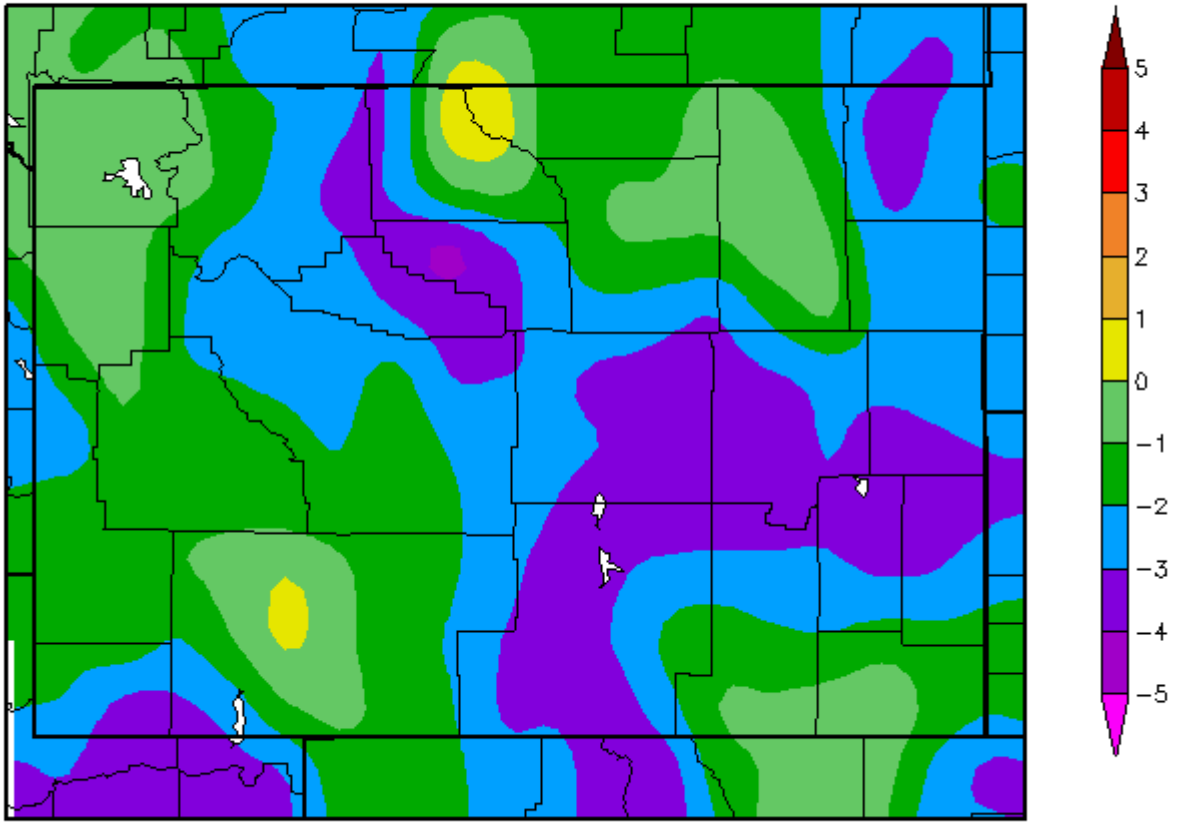
# Temps: August 2009

Departure from Normal Temperature (F)
8/1/2009 – 8/31/2009

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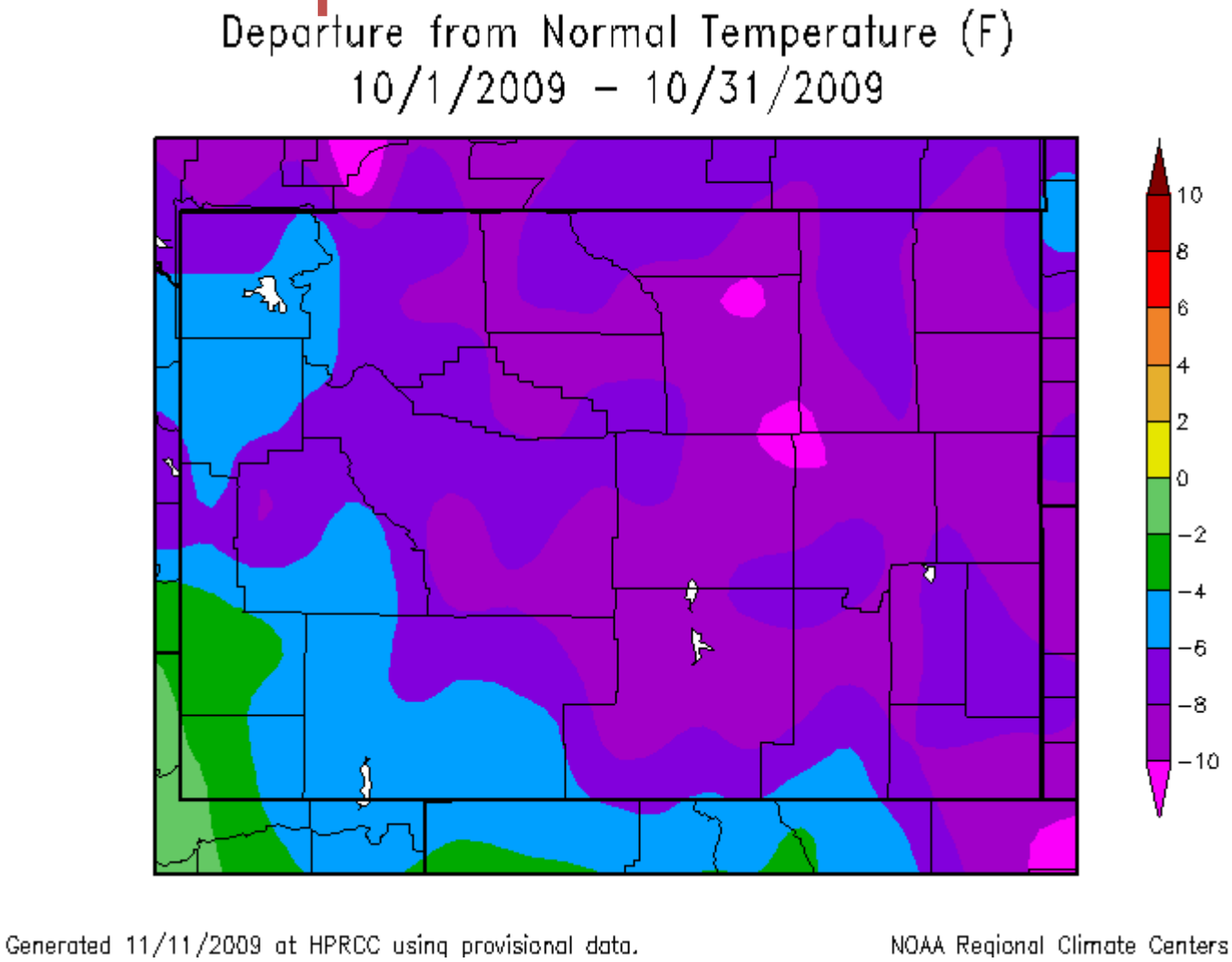
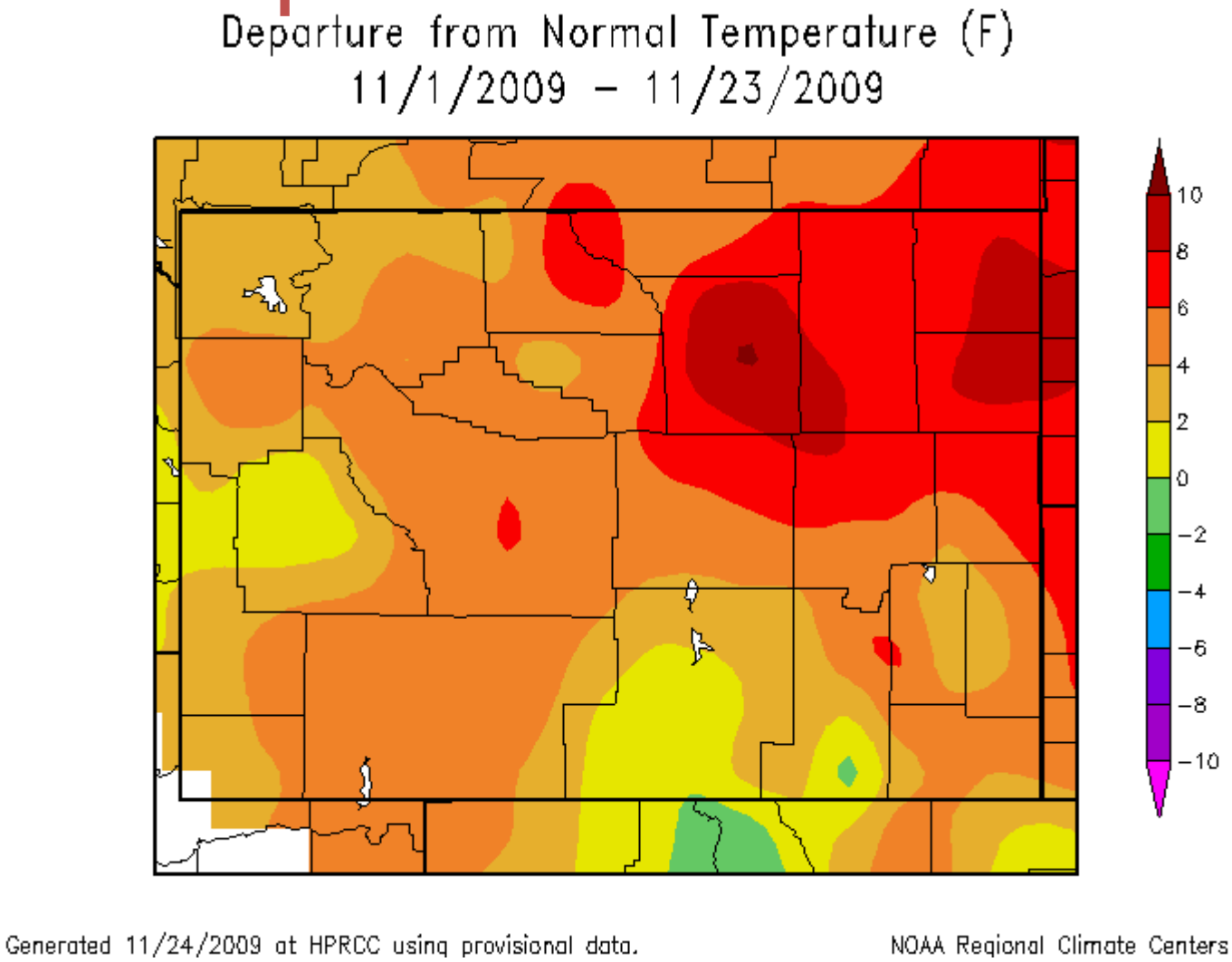
# Temps: October 2009



# Temps: November 2009



# WRDS/SCO Update:

## Online Tool Development

Water Resources Data System - Windows Internet Explorer

http://www.wrds.uwyo.edu/

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Water Resources Data System

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# WRDS

Water Resources Data System

- WRDS Homepage
- Online Data
  - Water
  - Climate
  - Map Server
- Water Library
- State Climate Office
  - Drought
- Cooperative Projects
  - Snowpack
- Research Support
- Other Water Sites

CoCoRaHS


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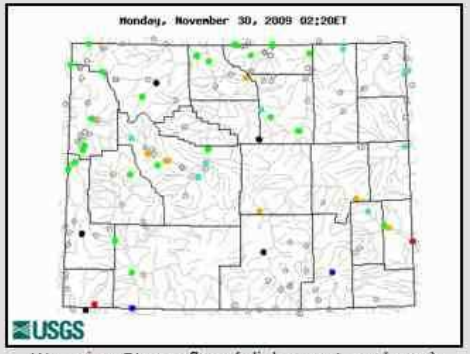
## Water and Climate Data for the State of Wyoming

**Sponsored by the Wyoming Water Development Office**

The Water Resources Data System (WRDS) is a clearinghouse of hydrological and climatological data for the State of Wyoming. WRDS is funded by the Wyoming Water Development Office and housed within the Department of Civil and Architectural Engineering at the University of Wyoming. The Wyoming State Climate Office (SCO) is a branch of WRDS, and together we provide a variety of services ranging from the development of enhanced drought-monitoring products to the online dissemination of water resources publications. WRDS and the SCO also support a variety of stakeholder groups by assisting in the development of the State Water Plan and helping to coordinate long-term monitoring efforts throughout the region.




Wyoming Streamflow (click map to enlarge)
Updated: Monday, 30-Nov-2009 08:01:04 MST

Today's CoCoRaHS Precipitation Reports
Click Map to Enlarge
Become an Observer

Internet 100%

Wyoming State Climate Office - Data - Windows Internet Explorer

http://www.wrds.uwyo.edu/sco/data/data.html

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Wyoming State Climate Office - Data

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- Wyoming Weather
- Climate Change
- Climate Data
- Other Data Sources
- CoCoRaHS
- Drought
- GIS Web Mapping
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- News
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State Climate Homepage

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# Climate Data

The State Climate Office offers several climate data products related to precipitation and temperature for Wyoming.

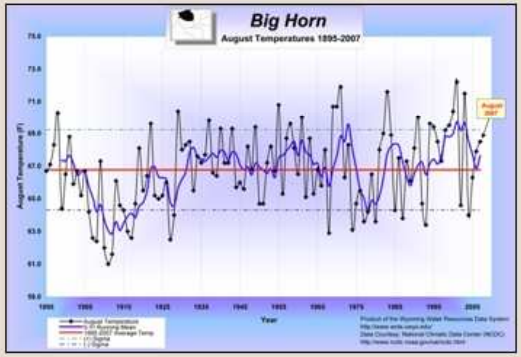
- 1971-2000 Climate Normals
- Comparison of 1971-2000 and 1961-1990 Normals
  - Precipitation
  - Maximum Temperature
  - Minimum Temperature
  - Mean Temperature

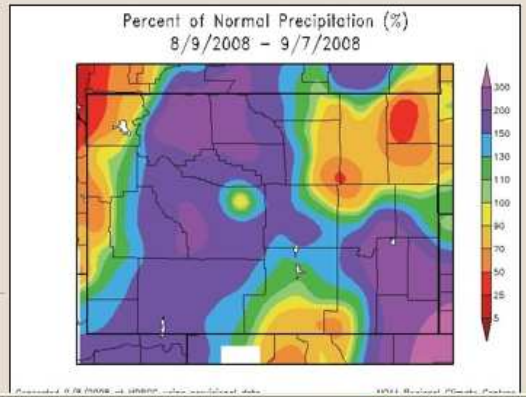
**Temperature Products**

- Climate Division Temperature Charts and Data

**Precipitation Products**

- Water Year Precipitation (NWS COOP) (2003-2009)
- Statewide Precipitation Departures from Normal
- Climate Division Precipitation Charts and Data
- USDA Crop Weather Report



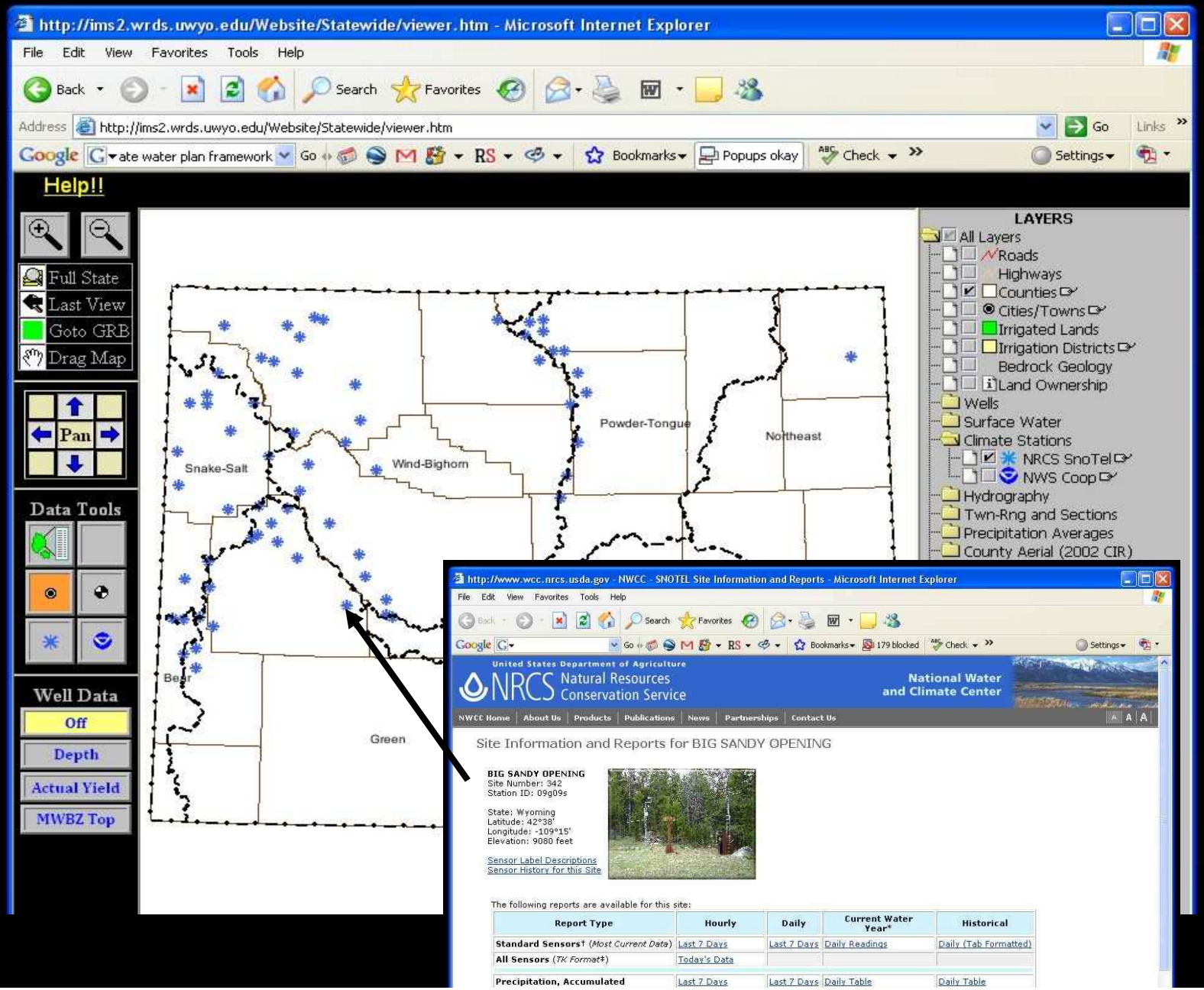

* Water Resources Data System (WRDS)

The Water Resources Data System is a clearinghouse of

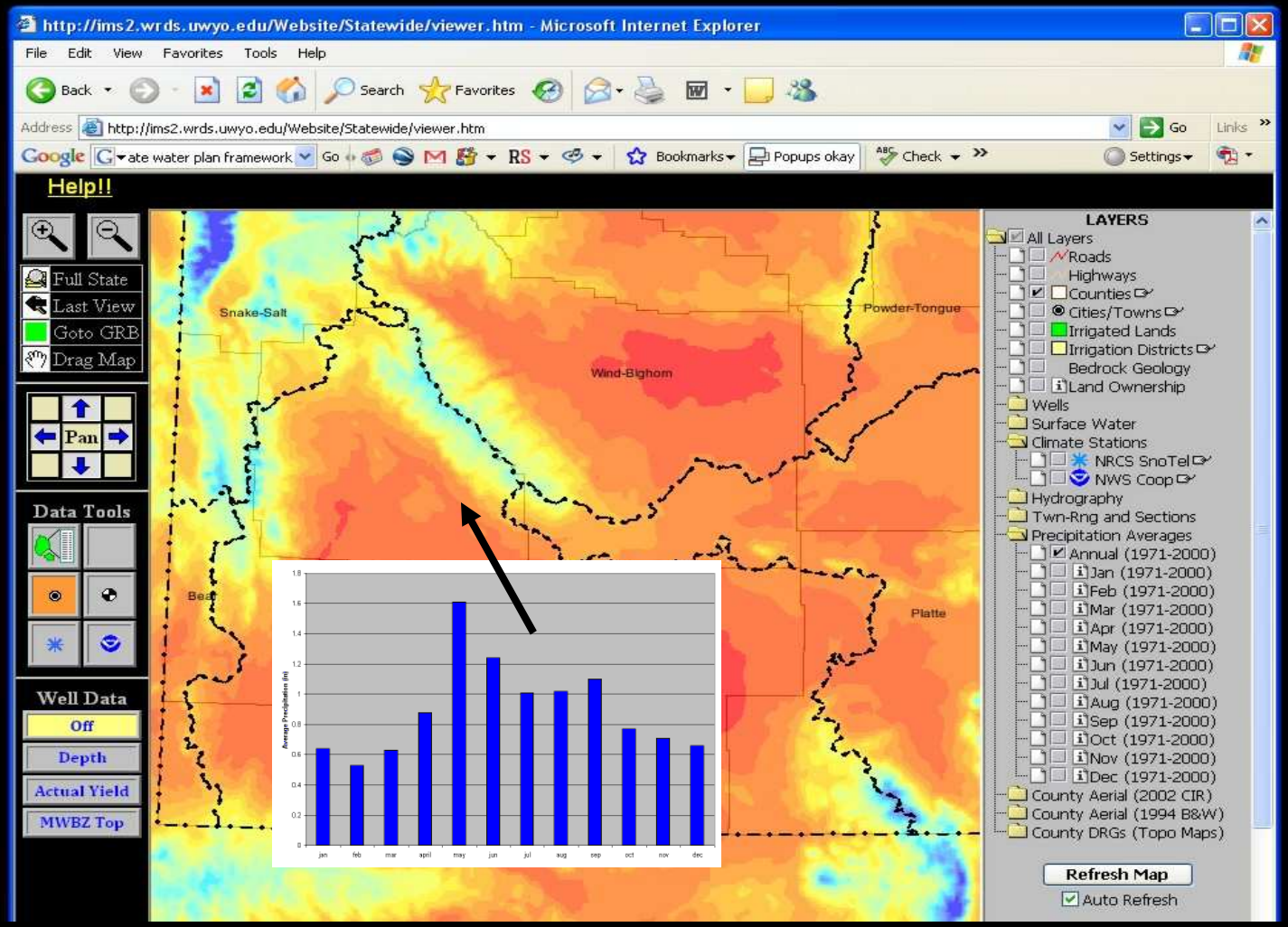
http://www.wrds.uwyo.edu/sco/data/divisional_precip/divisional_precip.html

Internet 100%

# Online Map Resources



# Integrating PRISM and Online Mapping Tools

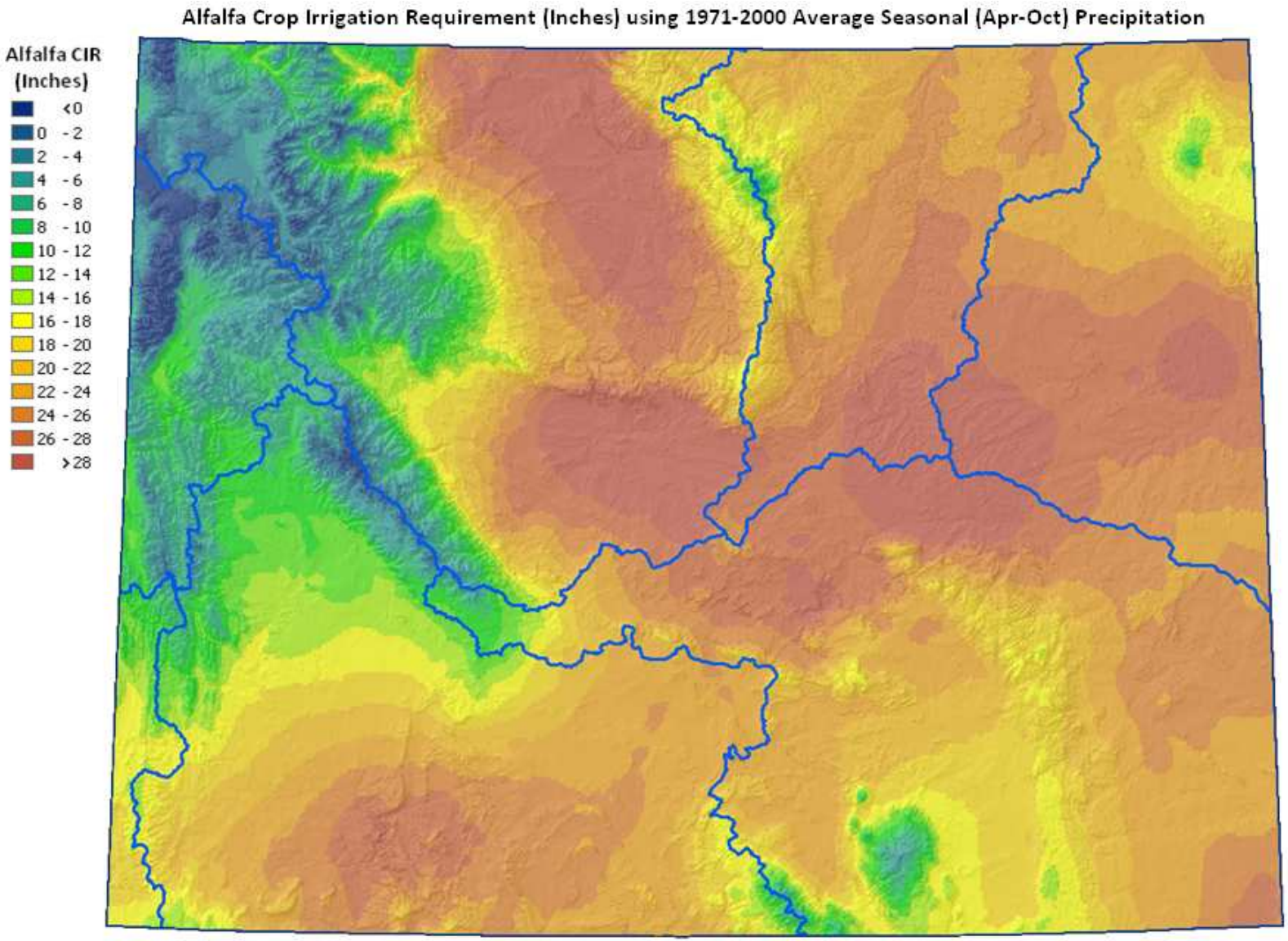



*Google: Wyoming Water Resources*

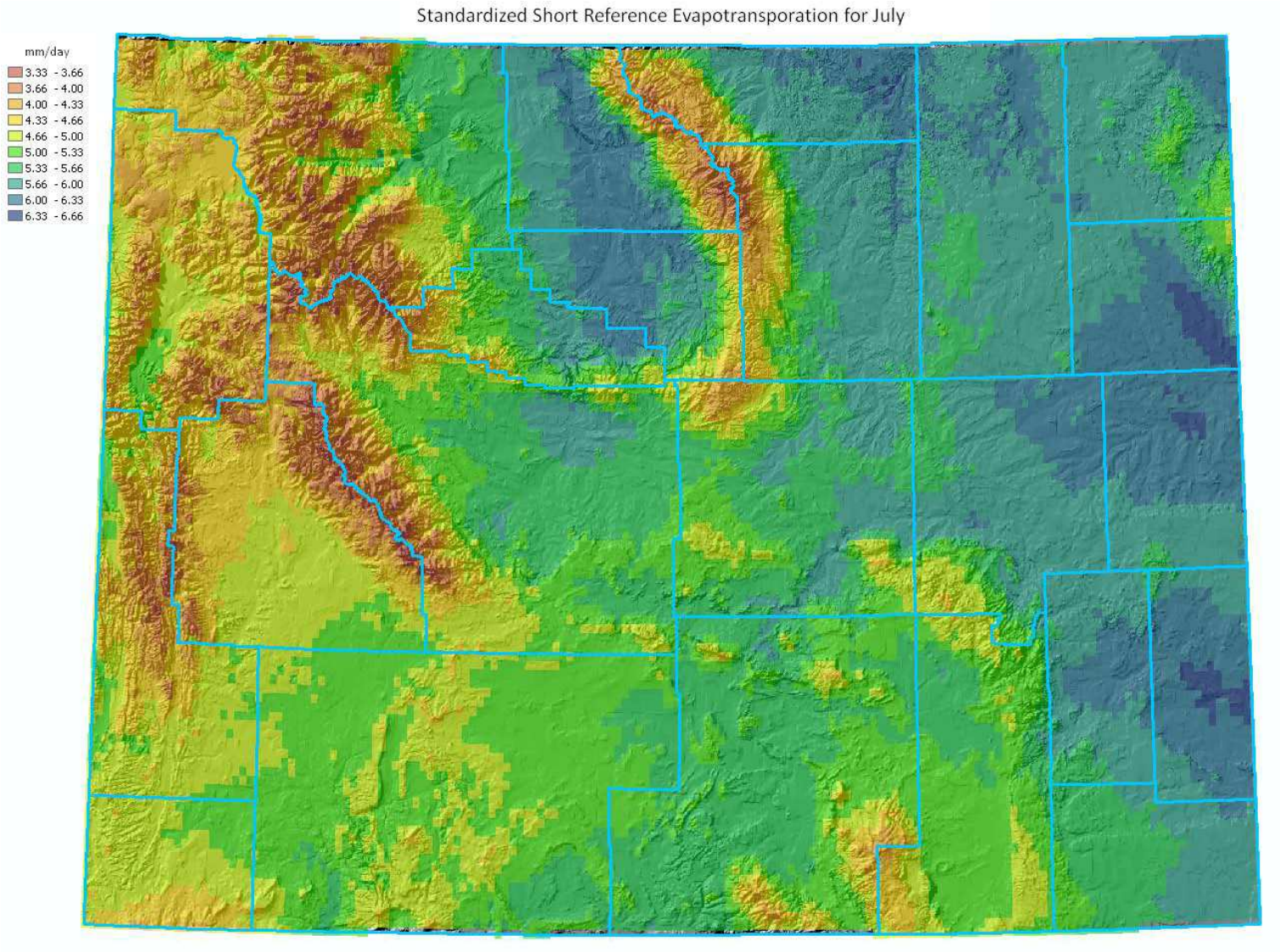
# WRDS/SCO Update:

## Product Development

# In Development: Mapped Crop Irrigation Requirements for Wyoming

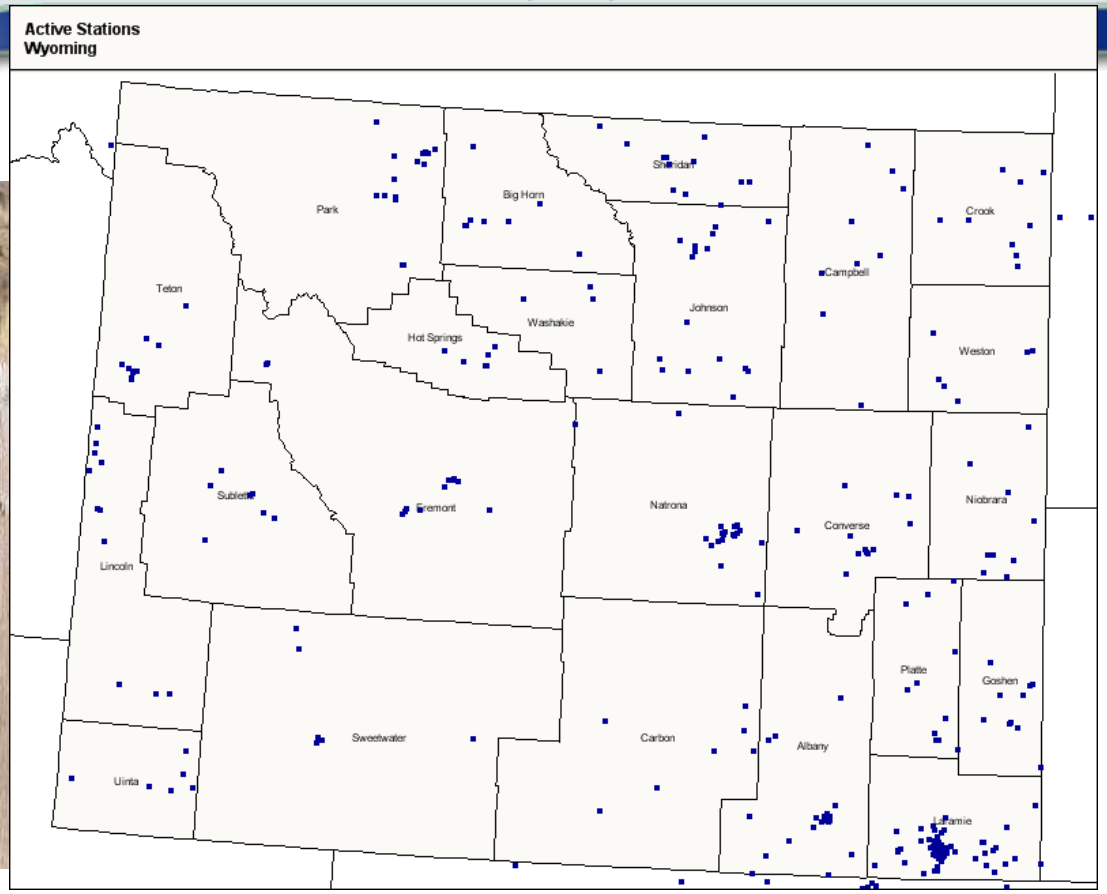


# In Development: Mapped Reference ET for Wyoming



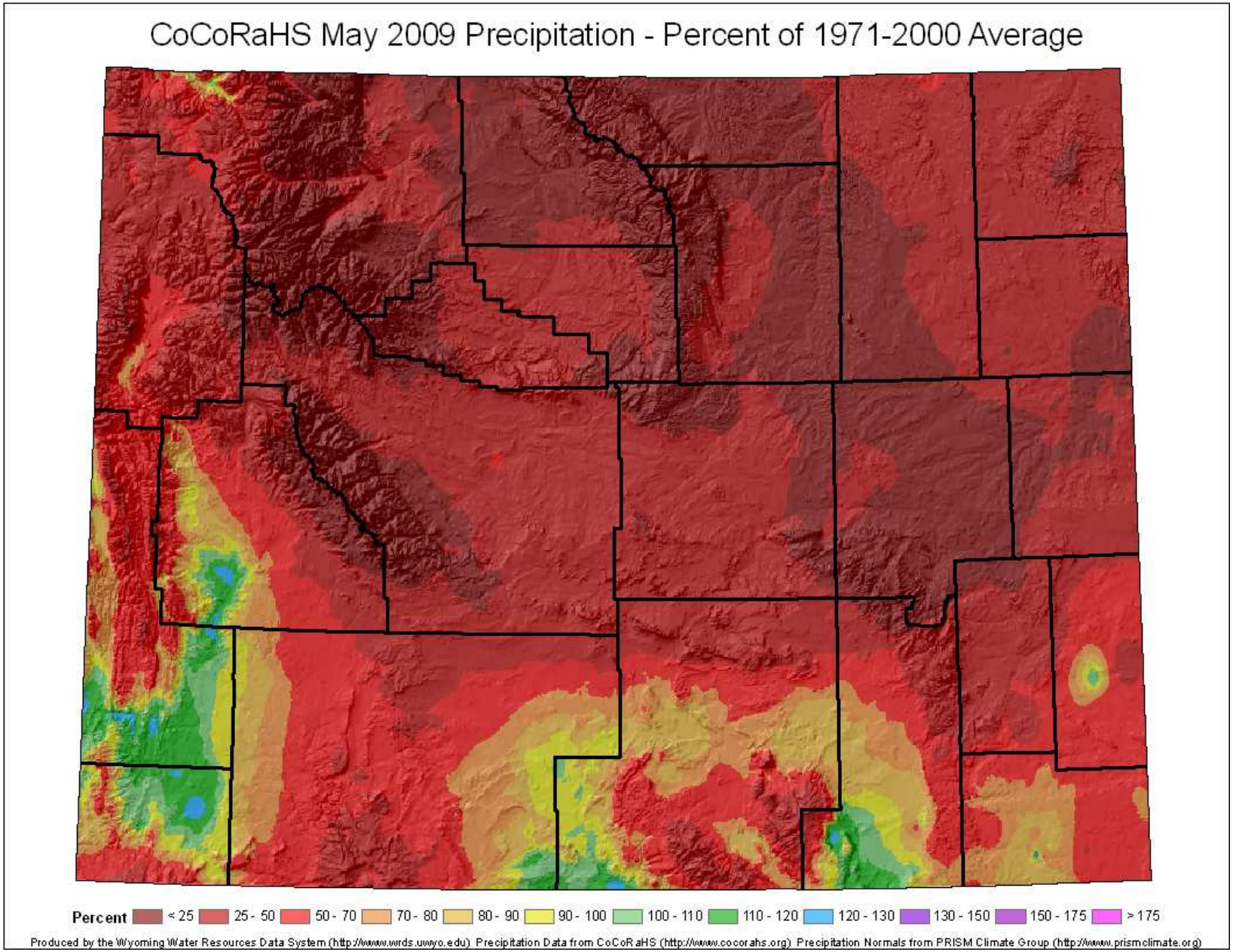
COMMUNITY COLLABORATIVE RAIN, HAIL & SNOW NETWORK

*"Because every drop counts"*

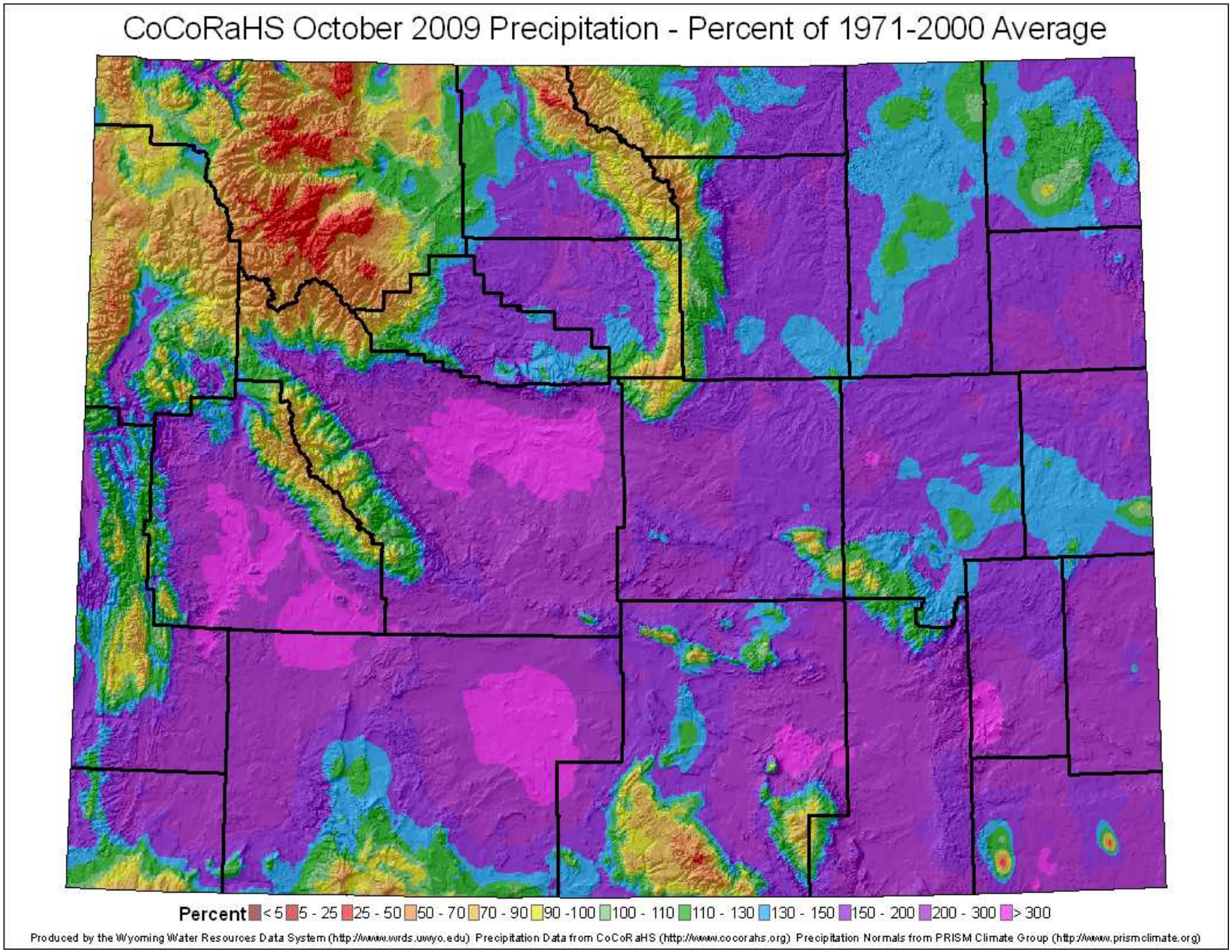



# http://www.cocorahs.org/

# Merging Wyoming CoCoRaHS and PRISM



# Merging Wyoming CoCoRaHS and PRISM



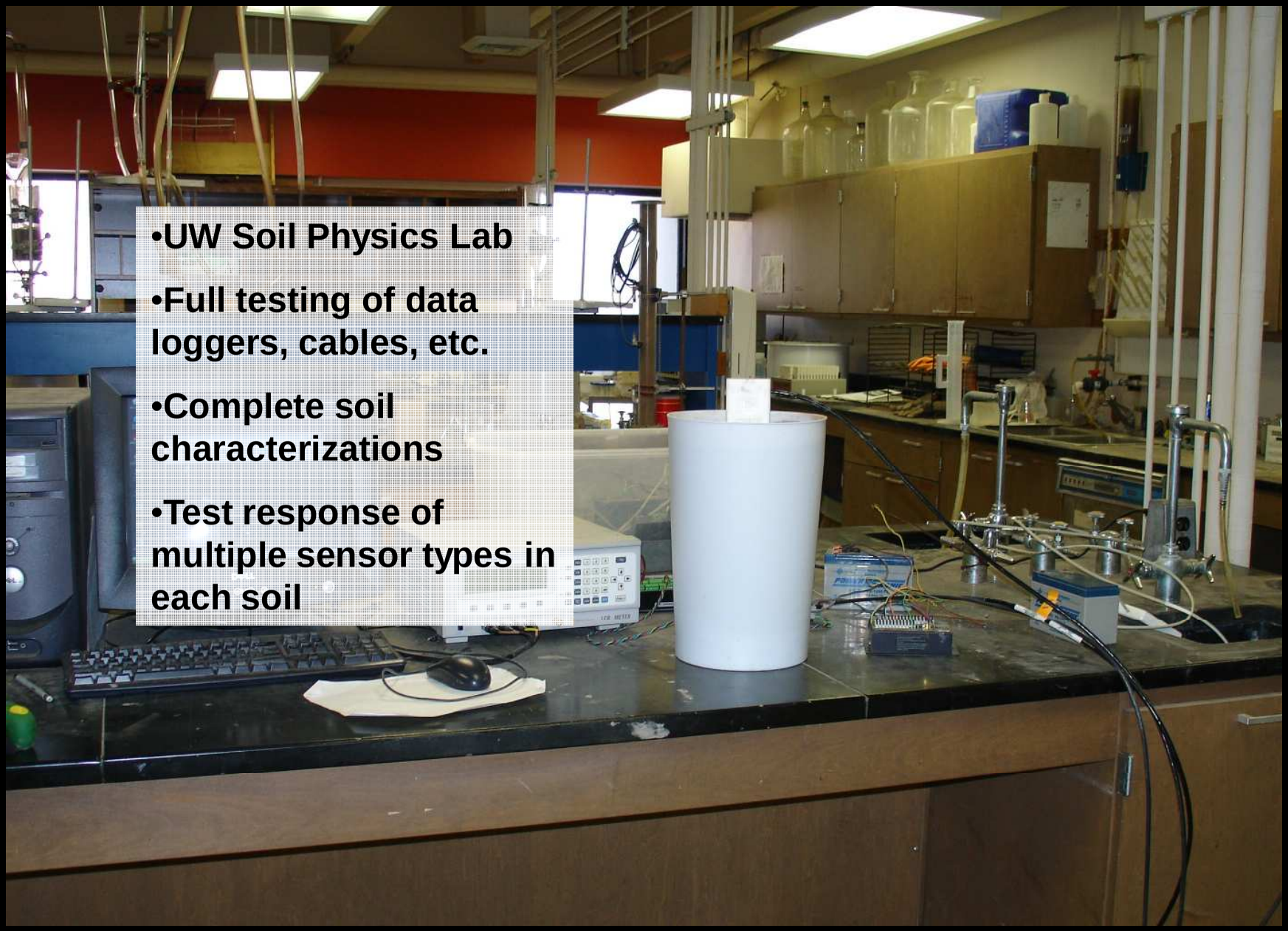
# Items of Interest:

Monitoring

# Updated Wyoming Soil Moisture Network

- Installed or update 25 sites across Wyoming
- Addition of redundant sensors and tipping-bucket gages
- Lab testing and calibration of sensors

# Updated Wyoming Soil Moisture Network



- UW Soil Physics Lab
- Full testing of data loggers, cables, etc.
- Complete soil characterizations
- Test response of multiple sensor types in each soil

# Recent Progress

- Automation of 9 critical NWS-COOP stations
- Six new SNOTEL sites
- Added soil-moisture monitoring to two NWS-COOP sites
- Ongoing work to gage runoff from high-elevation streams

# Items of Interest:

UW Research Initiatives

# FoSTER - Forest-Steppe and Tundra Ecotones Research

Observational network in the Snowy Range (requesting $20 million in NSF-Epscor funding)

Instrumented research sites along elevation transect

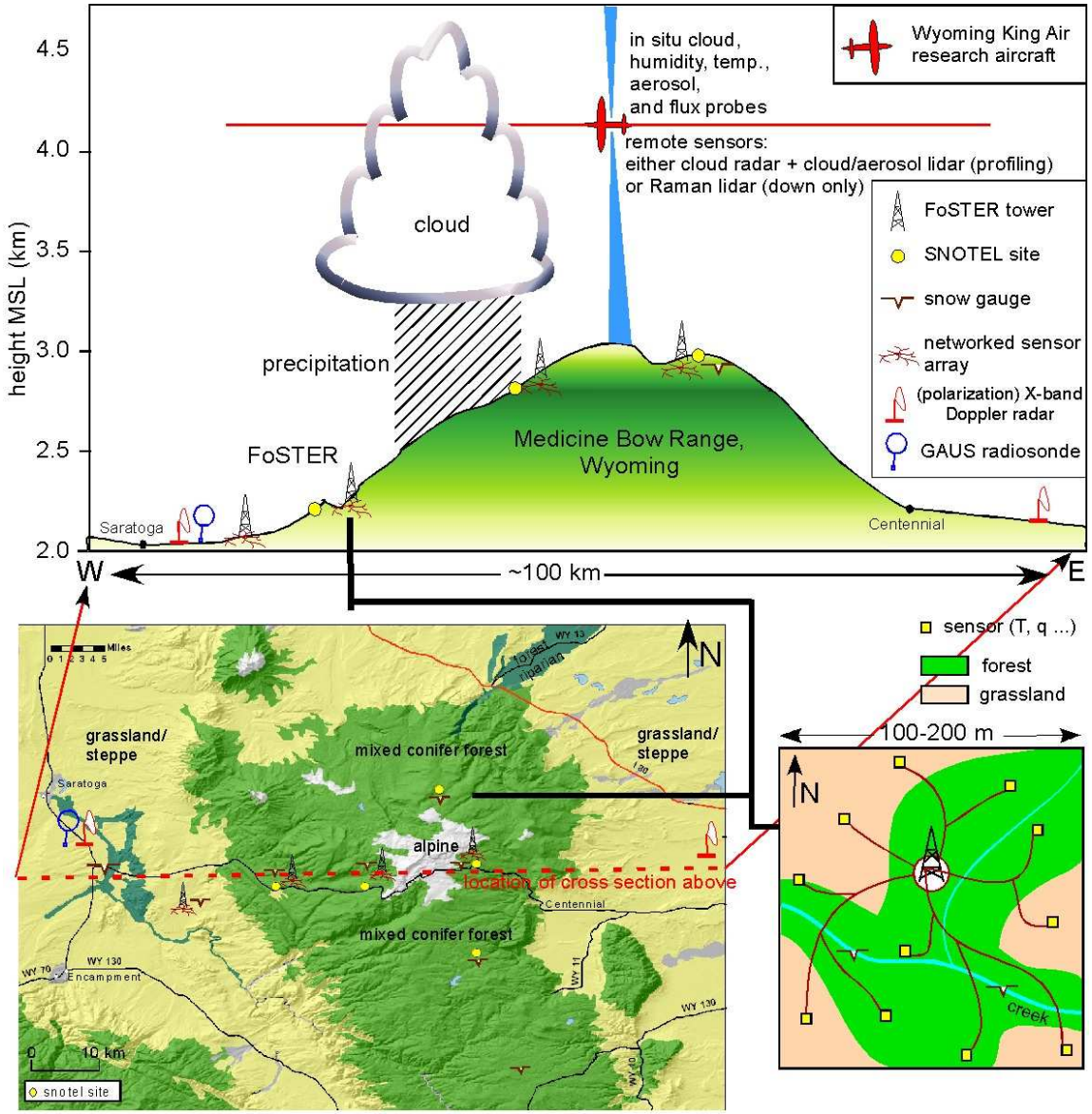
- biosphere-atmosphere exchanges
- ecosystem physiology
- soil and stream biogeochemistry
- hydrology

Supported by cyber-infrastructure for end-to-end data transfer, QA/QC, model assimilation and visualization

# FoSTER Network: Driving Questions

- How sensitive are major ecosystems (across elevational gradients) to alterations in snow depth & distribution?
- What ecohydrological and biogeochemical changes could occur with early snow melt and longer growing seasons in mountain environments?
- How does vegetation control the water budget in complex mountainous terrain?
- ***How will major vegetation disturbances associated with drought and pest outbreaks impact snow accumulation and ablation, soil moisture storage, deep percolation, evapotranspiration, and runoff?***
- How hydrologically connected are major ecosystem types across complex mountain environments?
    - Impact on stream flow dynamics?
    - Snowmelt timing & climate warming?

# FoSTER and SOLPIN Components



# Snowy Range Flux Network

Biosphere-atmosphere exchanges of water, trace gases and energy

- Sagebrush steppe
- Grassland
- Lodgepole pine forest
- Subalpine forest (add capacity to GLEES?)
- Alpine
- Address challenges in complex terrain

Project Leads: Brent Ewers, Elise Pendall, Bob Kelly, Jeff Snider, Dave Williams, Bill Massman (USFS-GLEES), faculty hire in boundary layer meteorology/micrometeorology

# Snowy Range Sub-watershed Network

## Hydrology, stream biogeochemistry

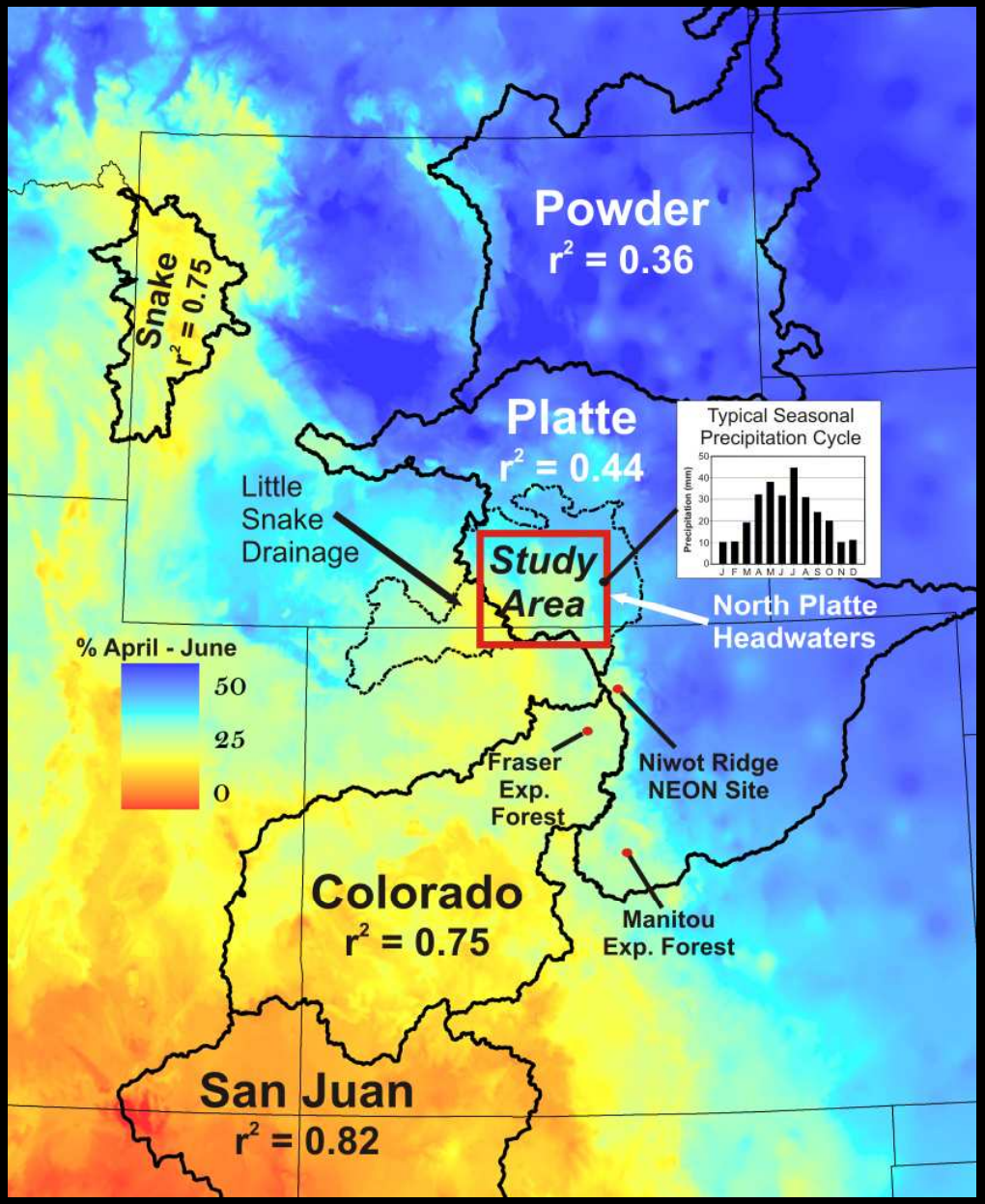
- Sagebrush steppe
- Grassland
- Lodgepole pine forest
- Subalpine forest (Lower Libby Creek)
- Alpine ecotone (Upper Libby Creek)

Project Leads: Ginger Paige, Scott Miller, Bob Hall, Gi-Hyeon Park, Thijs Kelleners, new faculty hire in snow hydrology

## Mountain pine beetle will dramatically alter Western conifer forests

Widespread epidemics driven by warmer temperatures
Tree's natural defenses reduced by drought
Unprecedented (?) in extent, rate of spread and severity

# Runoff Forecast Skill vs. Spring Precipitation



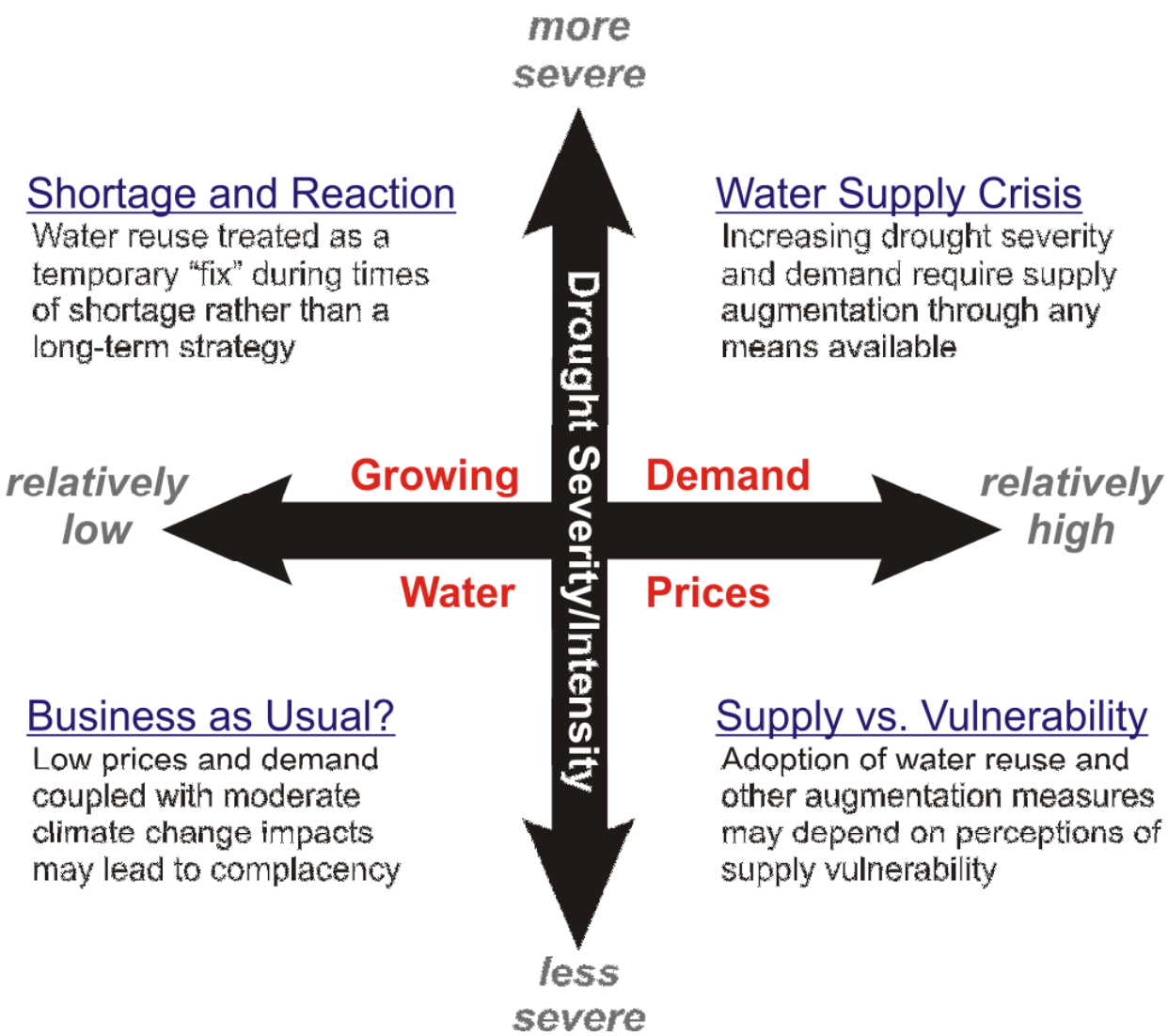
# Items of Interest:

Planning and Decision Support

# Planning in the Face of Significant Uncertainty

- Current efforts lead by National Park Service, US Geological Survey, US Fish and Wildlife, Wildlife Conservation Society
- Focus on developing <u>defensible</u> techniques or strategies for addressing climate change while acknowledging uncertainty

## Use "Scenario Planning" and other techniques to assess vulnerabilities under a wide range of potential futures



# Scenario Planning

- Way to test the "robustness" of a response across a wide range of potential futures
- Means to identify "win-win" strategies
- Tool to explore institutional constraints

Thanks!