



Changing Weather in the SW New Mexico Mountain Range: Heat, Drought, Precipitation and Extreme Weather

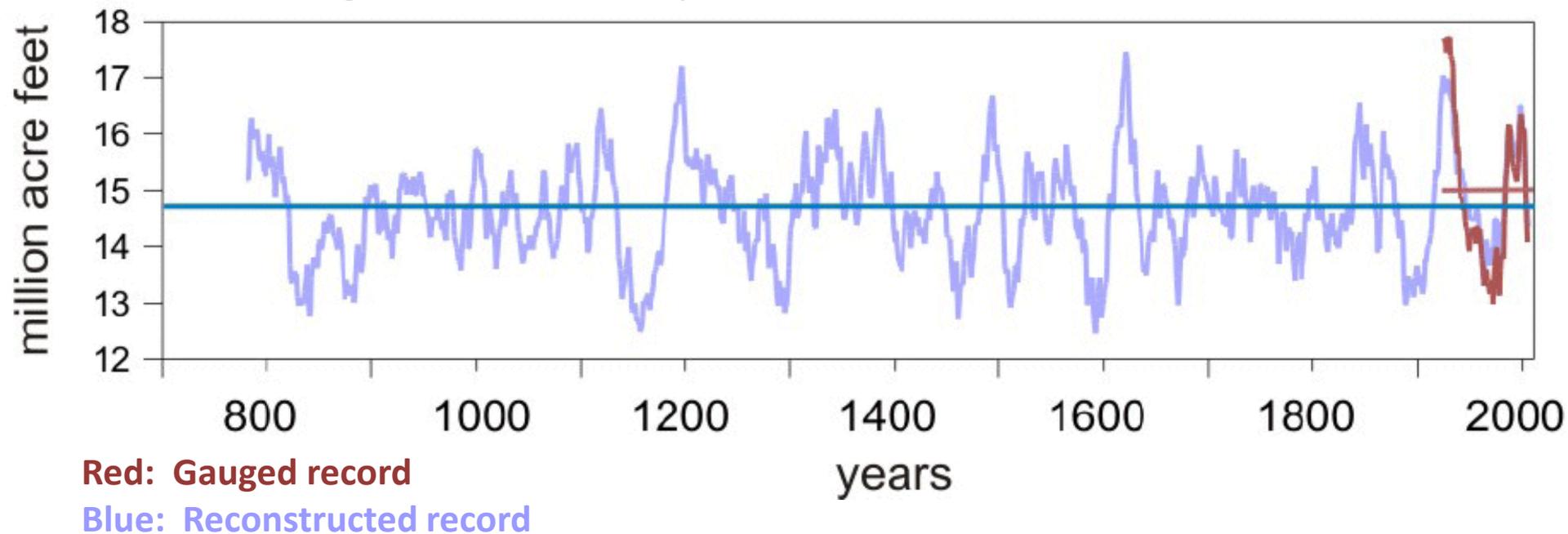
Dr. Dave DuBois

New Mexico State Climatologist

**Presented at the community meeting on a Sustainable Silver City
February 19, 2013**

Lessons from History

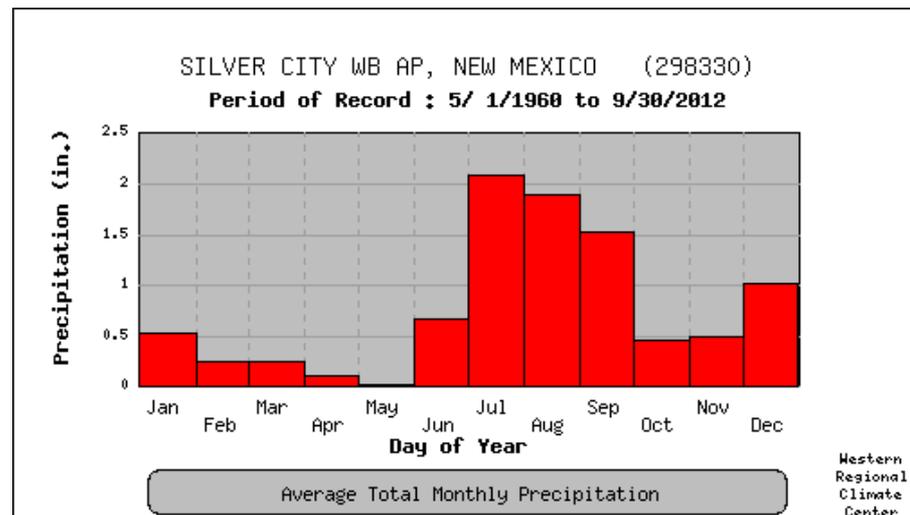
- Past droughts in the Southwest have been more severe than the present - “Megadroughts” – lasting decades
 - Colorado River flow study showed 12th century drought lasting more than 30 years



From: Meko, D.M., C.A. Woodhouse, C.H. Baisan, T. Knight, J.J. Lukas, M.K. Hughes, and M.W. Salzer, 2007. Medieval drought in the upper Colorado River basin. *Geophysical Research Letters* 34m L10705, doi: 10.1029/2007GL029988

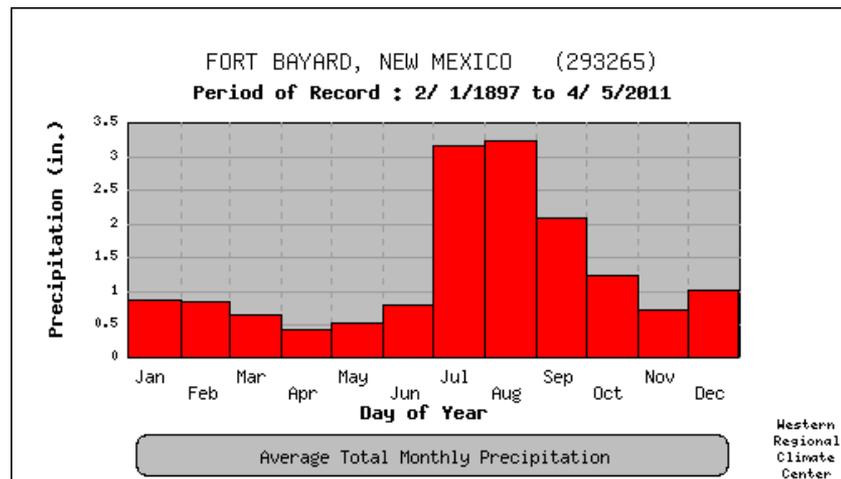
Silver City Climatology

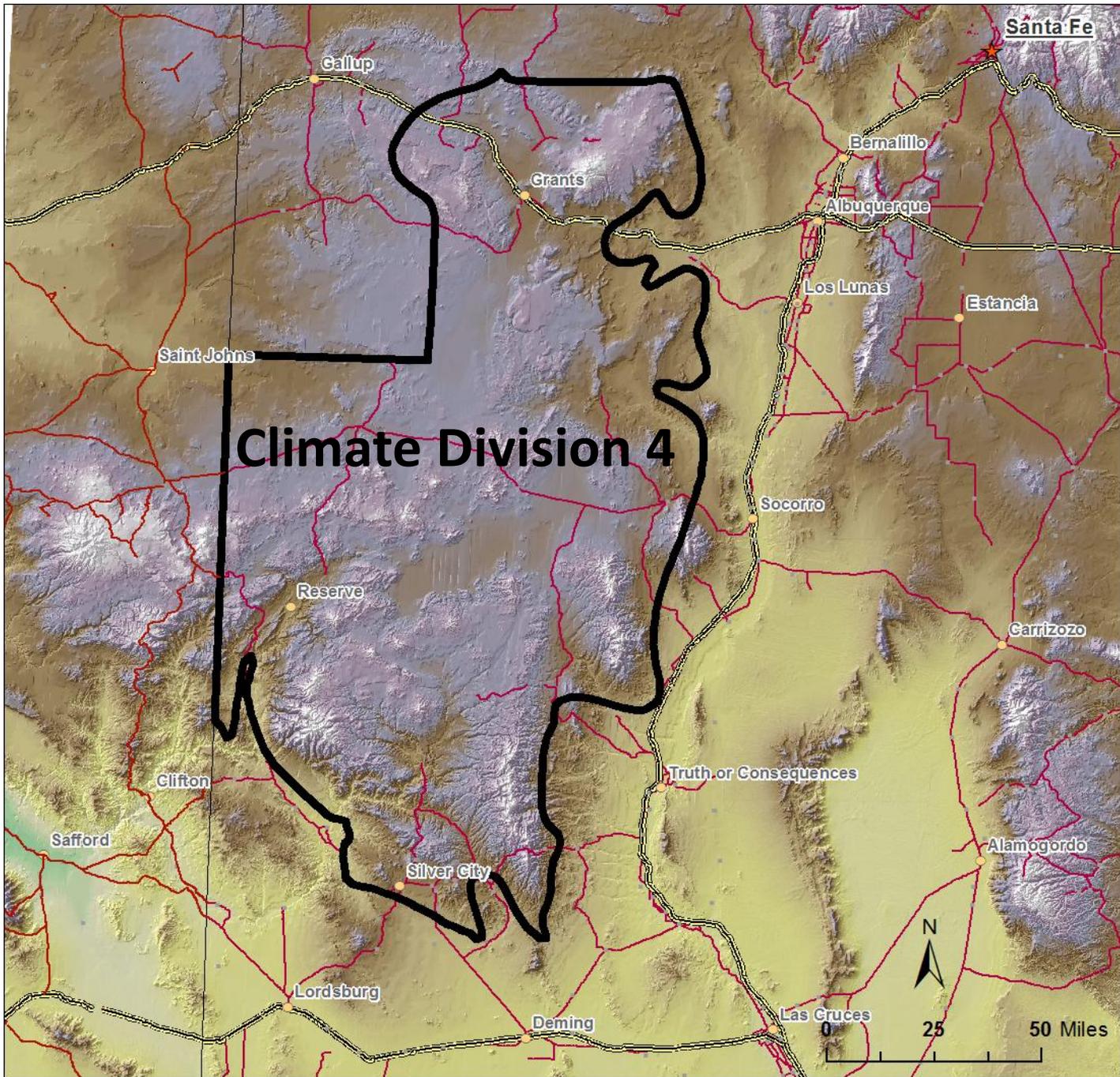
- Period of record 1960-2012
- Extreme cold -9F (1/11/1962, 2/3/2011)
- Extreme hot 102F (6/19/1960, 7/1/1960)
- Most precipitation 2.08" (8/3/1963)
- Snowiest year 13" 1967



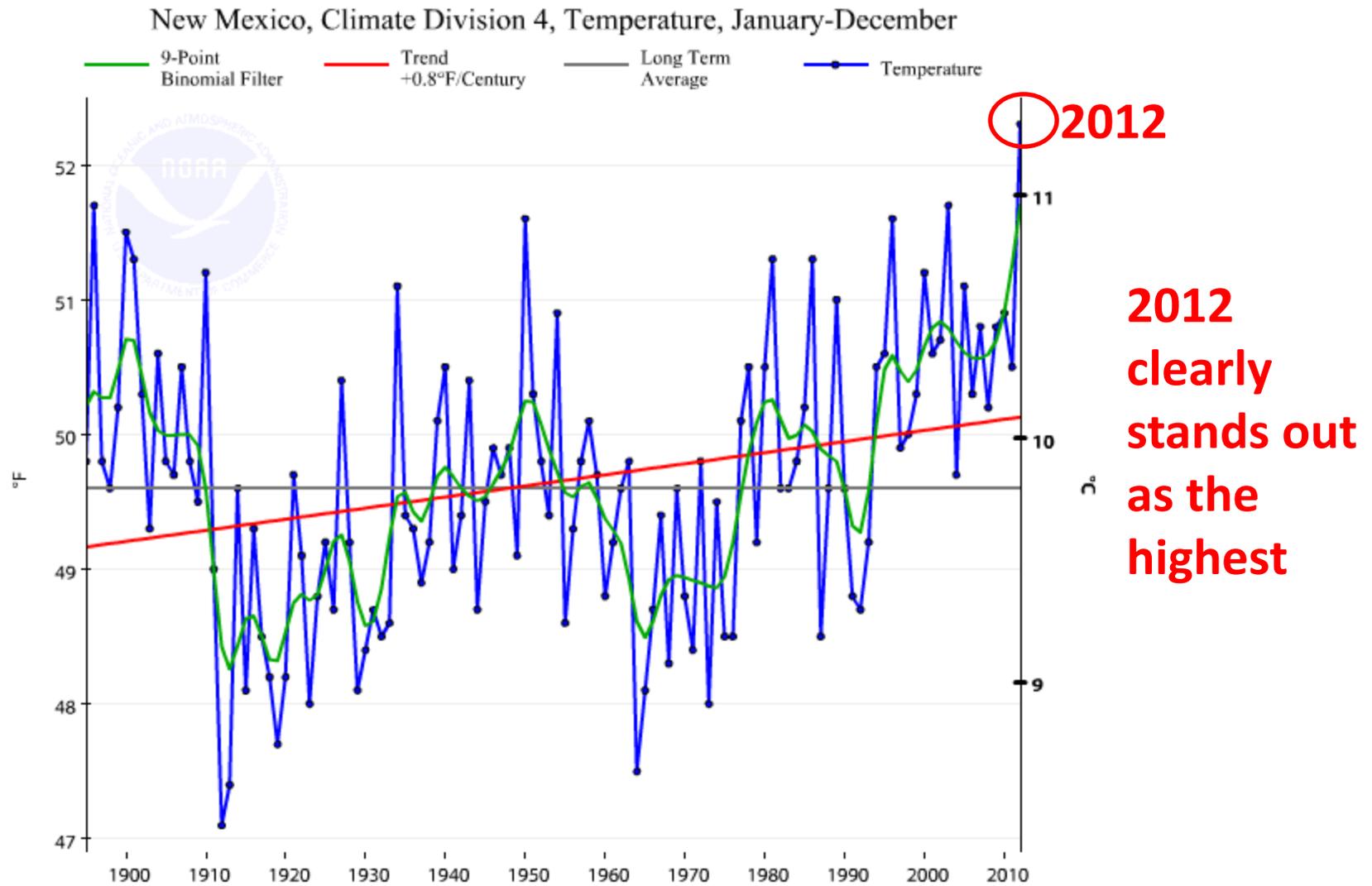
Ft. Bayard Climatology

- Period of record 1877-2011
- Extreme cold -12F (1/1/1911, 1/2/1911, 1/3/1911)
- Extreme hot 106F (6/26/1994, 8/2/1911)
- Most precipitation 3.55" (8/31/1925)
- Snowiest year 29.1" 1939

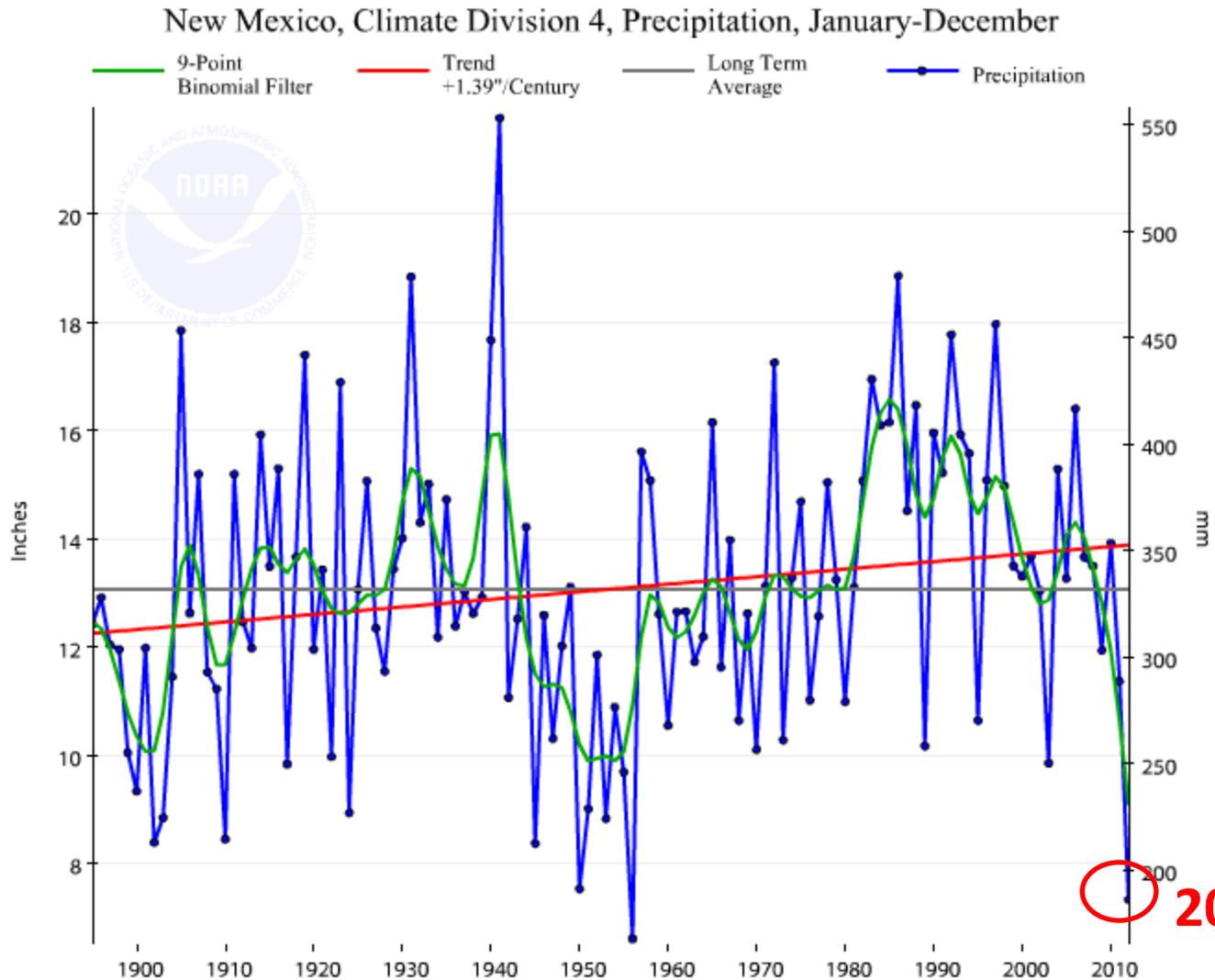




Annual Climate Division 4 Temperatures since 1895



Annual Climate Division 4 Precipitation since 1895

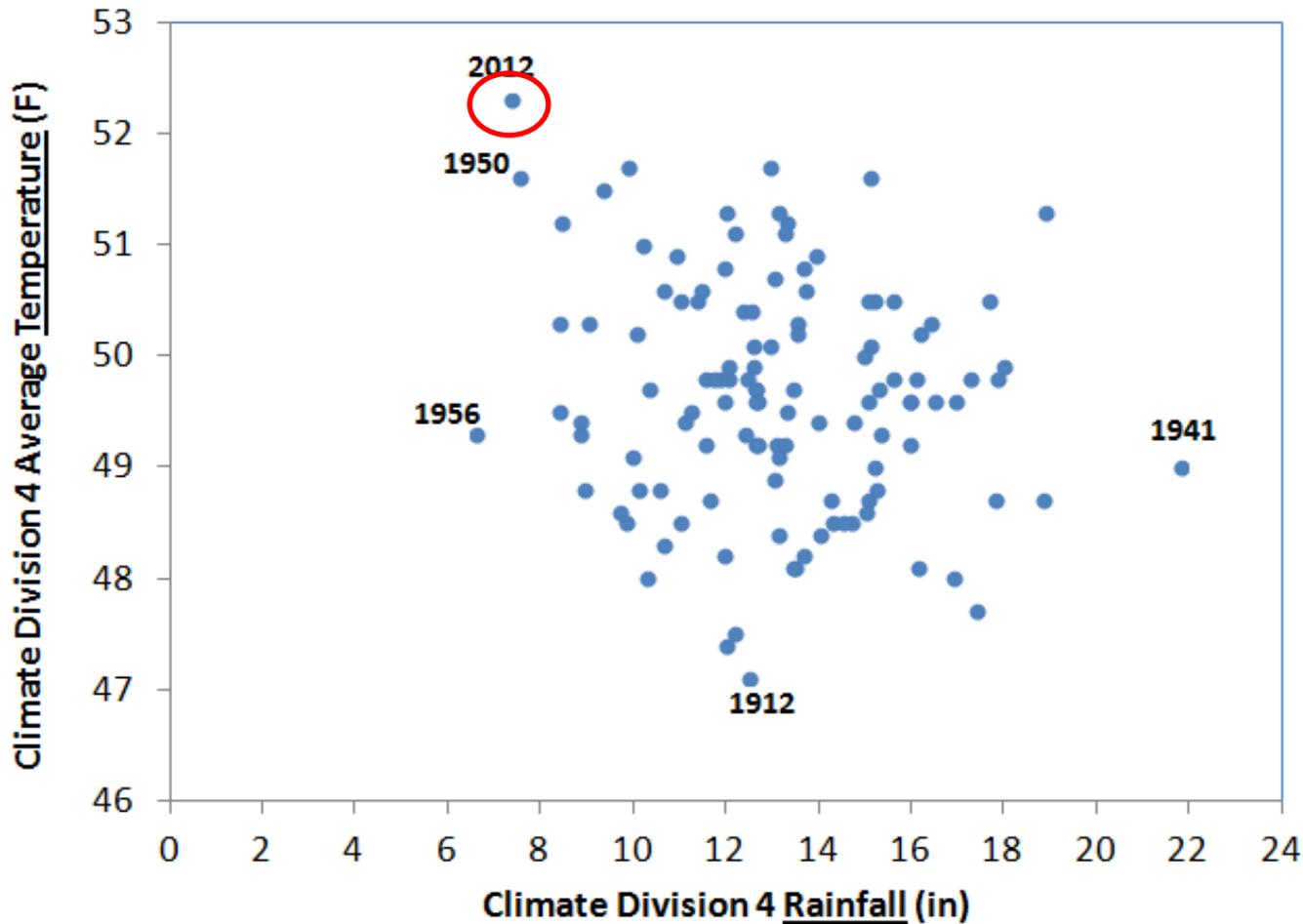


**Again,
2012
clearly
stands out
as an
extreme
(2nd driest)**

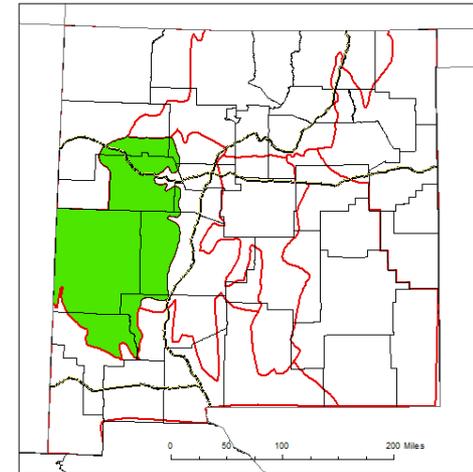
**Only 1956
was drier**

2012

Climate Division 4 Rain & Temperatures: 1895-2012



Climate division 4



2012 stands out as the warmest on record

New Mexico Precipitation Rankings

(through December 2012)

- Calendar Year 2012 was the **2nd Driest** year on record for New Mexico. (Statewide precipitation was just 60% of normal...only 1956 was drier!)
- 2011 + 2012 were both the **Driest & Warmest** consecutive 2 year period on record for New Mexico.

Period	Amount	20 th Century Average	Departure	Rank	Wettest/Driest Since	Record Year
Jul - Dec 2012 6-month period	5.69" (144.53 mm)	8.84" (224.54 mm)	-3.15" (-80.01 mm)	6 th Driest 113 th Wettest	Driest since: 2003 Wettest since: 2011	Driest: 1956 Wettest: 1941
Jan - Dec 2012 12-month period	8.17" (207.52 mm)	13.52" (343.41 mm)	-5.35" (-135.89 mm)	2 nd Driest 117 th Wettest	Driest since: 1956 Wettest since: 2011	Driest: 1956 Wettest: 1941
Jan 2011 - Dec 2012 24-month period	17.46" (443.48 mm)	27.03" (686.56 mm)	-9.57" (-243.08 mm)	1 st Driest 117 th Wettest	Driest to Date Wettest since: 2011	Driest: 2012 Wettest: 1942

US Drought Monitor

Drought classification puts drought in historical perspective

<u>DM Level</u>		<u>Name</u>	<u>Frequency</u>
D0		Abnormally dry	3-5 years
D1		Moderate drought	5-10 yrs
D2		Severe drought	10-20 yrs
D3		Extreme drought	20-50 yrs
D4		Exceptional drought	50-100 yrs

Current Drought Status

U.S. Drought Monitor

February 12, 2013
Valid 7 a.m. EST

New Mexico

Over 98%
of state is
in drought

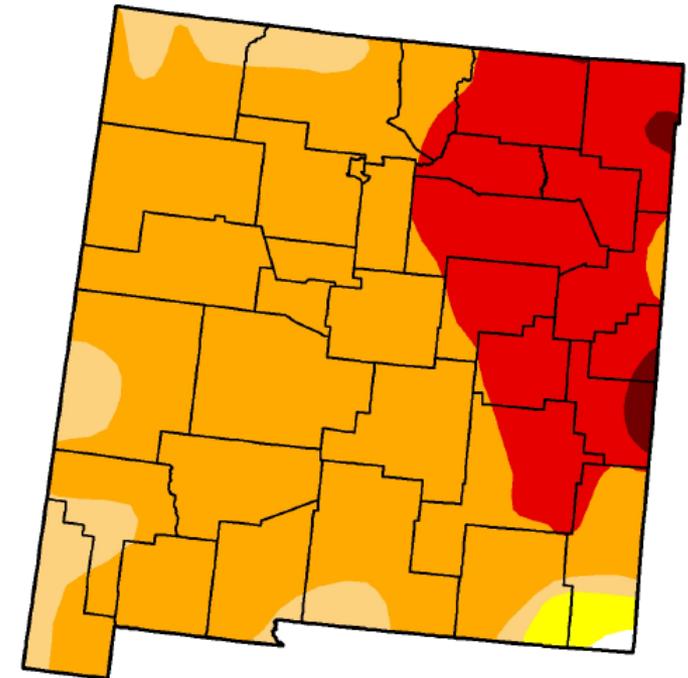
Last year at
this time
88%

However,
<1% in D4
compared
to 8% in
2012

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.20	99.80	98.45	89.85	25.36	0.97
Last Week (02/05/2013 map)	0.20	99.80	98.45	92.60	25.36	0.97
3 Months Ago (11/13/2012 map)	0.07	99.93	98.80	74.51	16.30	0.68
Start of Calendar Year (01/01/2013 map)	0.00	100.00	98.83	94.05	31.88	0.97
Start of Water Year (09/25/2012 map)	0.00	100.00	100.00	62.56	12.25	0.66
One Year Ago (02/07/2012 map)	8.10	91.90	87.63	63.73	24.79	8.13

Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu>

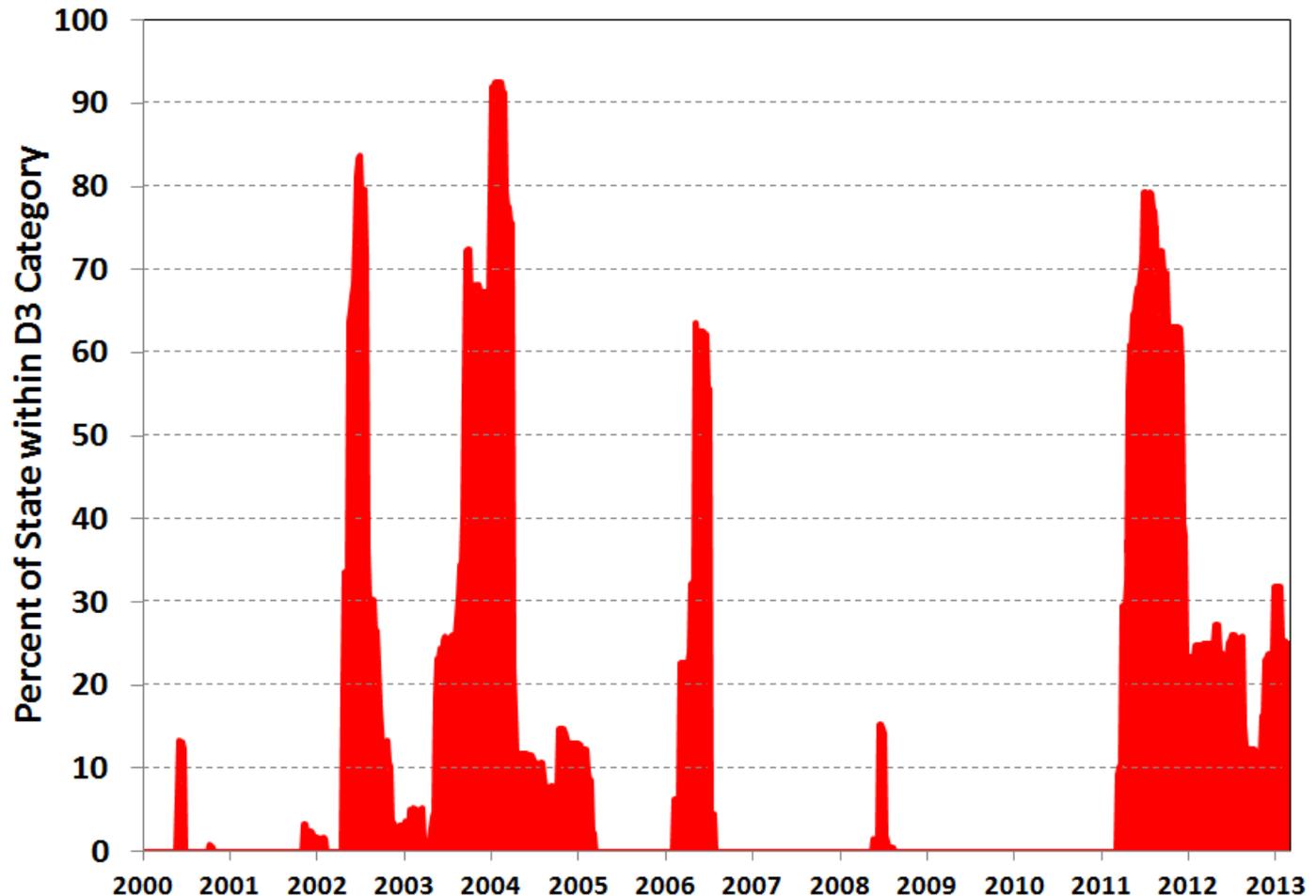


Released Thursday, February 14, 2013
Michael Brewer, National Climatic Data Center, NOAA

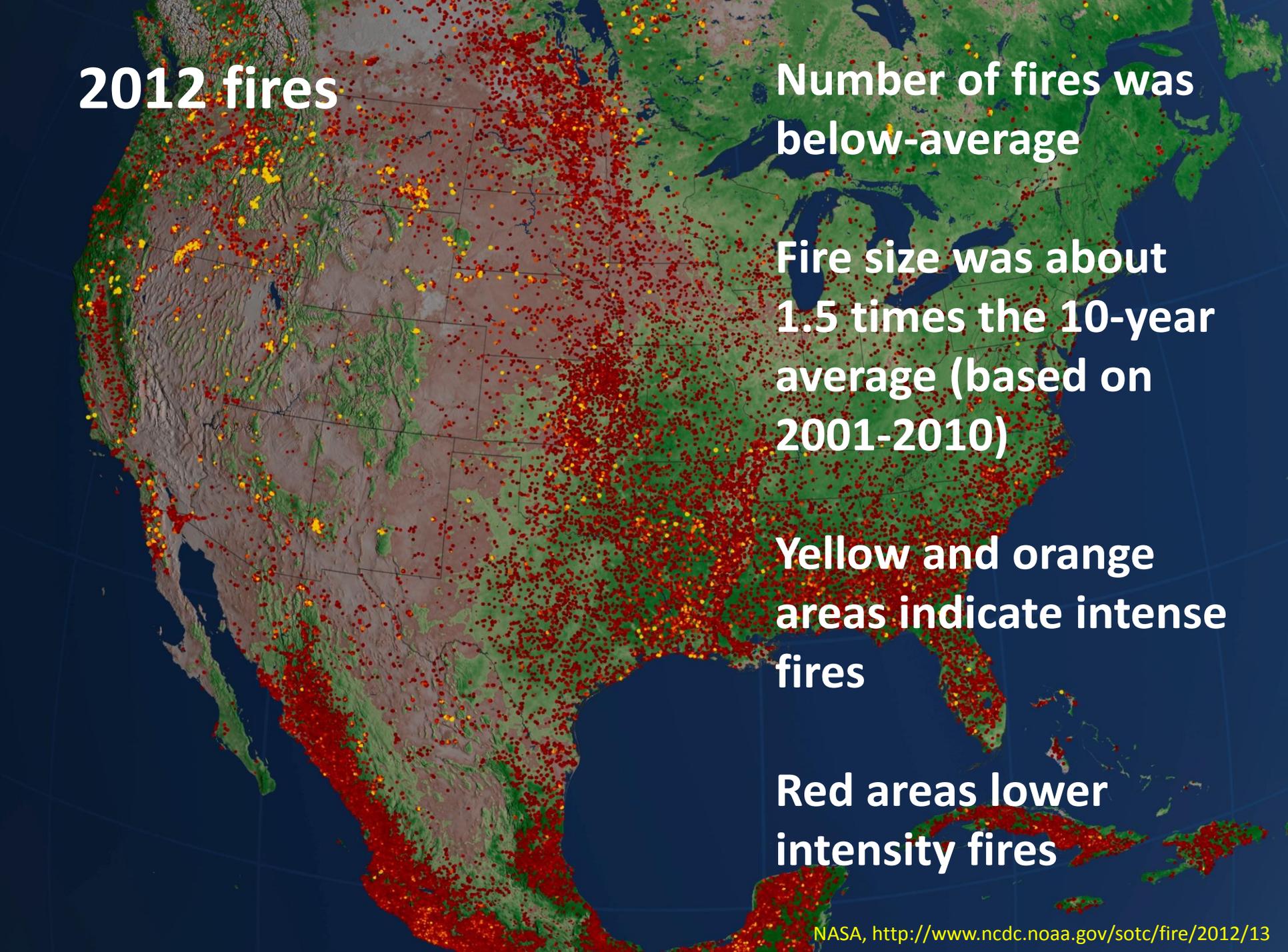
How unusual is this drought?

- Look at Drought Monitor in NM over past 12 yrs

**%
D3
Extreme
Drought**



2012 fires



Number of fires was below-average

Fire size was about 1.5 times the 10-year average (based on 2001-2010)

Yellow and orange areas indicate intense fires

Red areas lower intensity fires

Short-term Forecast

- Rio Grande Basin storage at 29% of long term average
 - Elephant Butte at 15% of average (9% of capacity)
 - Heron at 51% of average (38% of capacity)
- Slow start to the 2012-2013 snow accumulation season
- Storm tracks have not favored NM mountains
- Runoff forecasts so far are disappointing

Elephant Butte Reservoir

Current Storage 198,811 acre-ft

Capacity 2,195,000 acre-ft

Current inflow 455 cfs

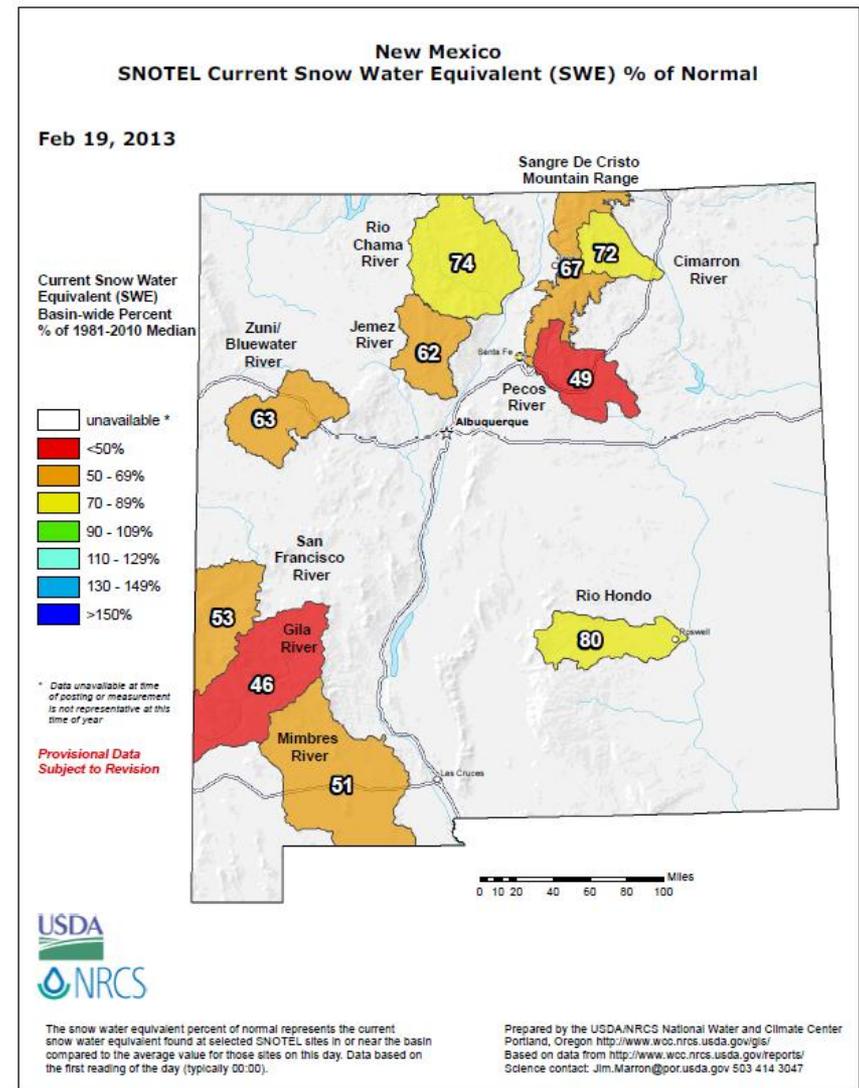
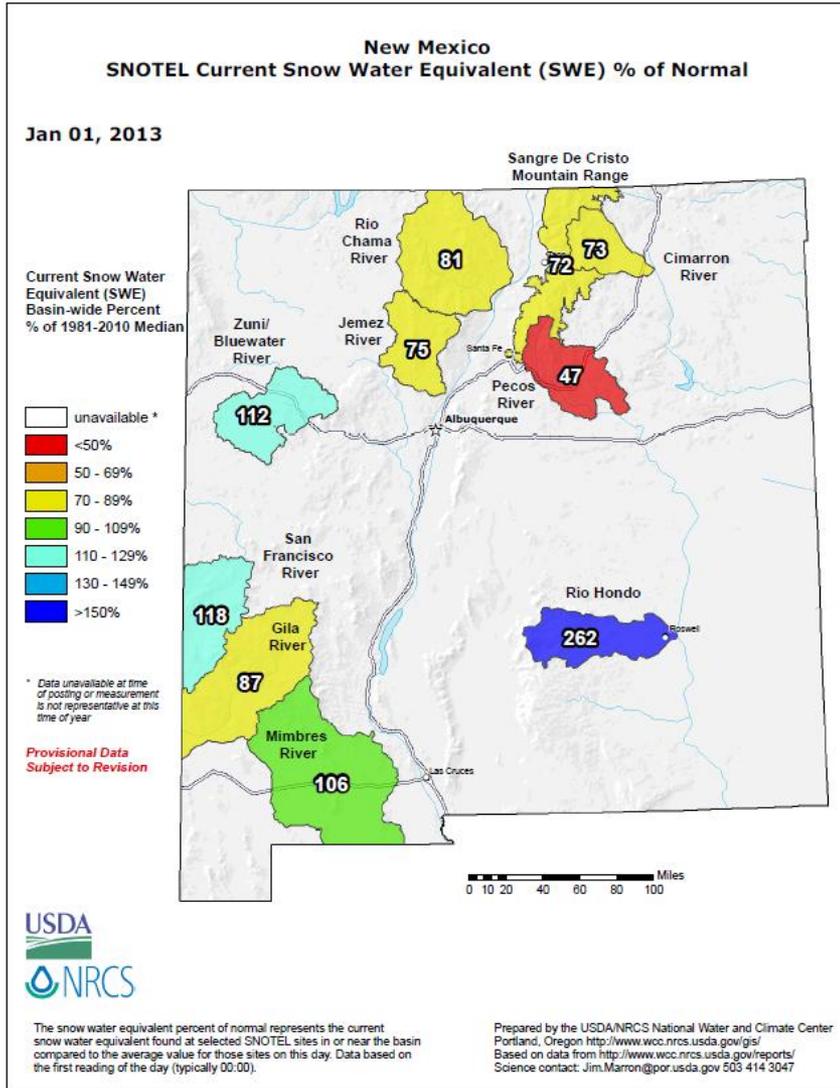


Photo from Feb. 16, 2013

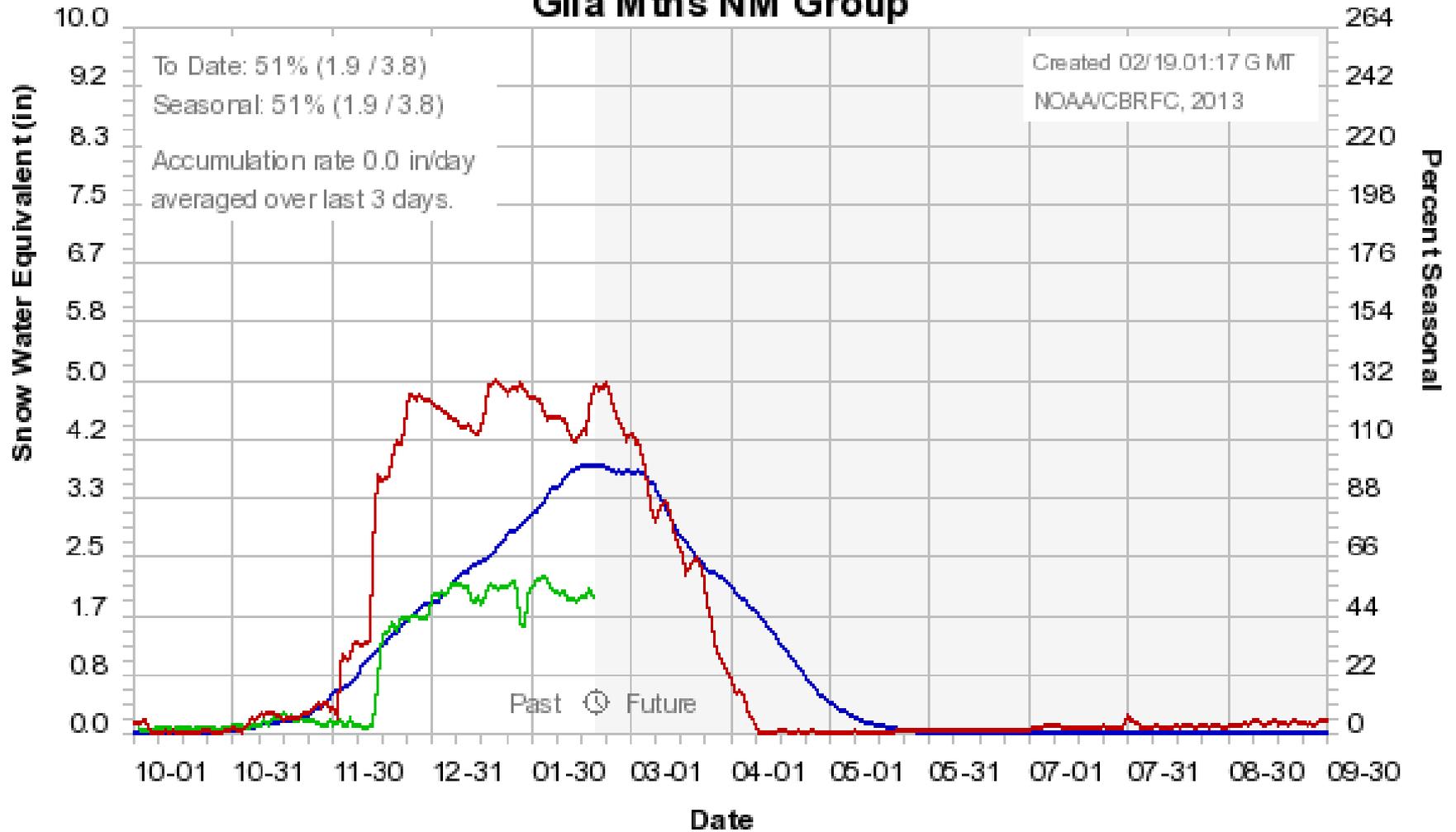
Current Snow Water Equivalent

SWE beginning of year

Current SWE % of normal 2013



Colorado Basin River Forecast Center Gila Mtns NM Group



Average 1981-2010 **2013** **2012** **2013**

Includes Snotel stations: Frisco Divide (FRDN5), Silver Creek Divide (SCDN5), Lookout Mtn (LKTN5), Mcknight Cabin (MCKN5), Signal Peak (SGNN5)

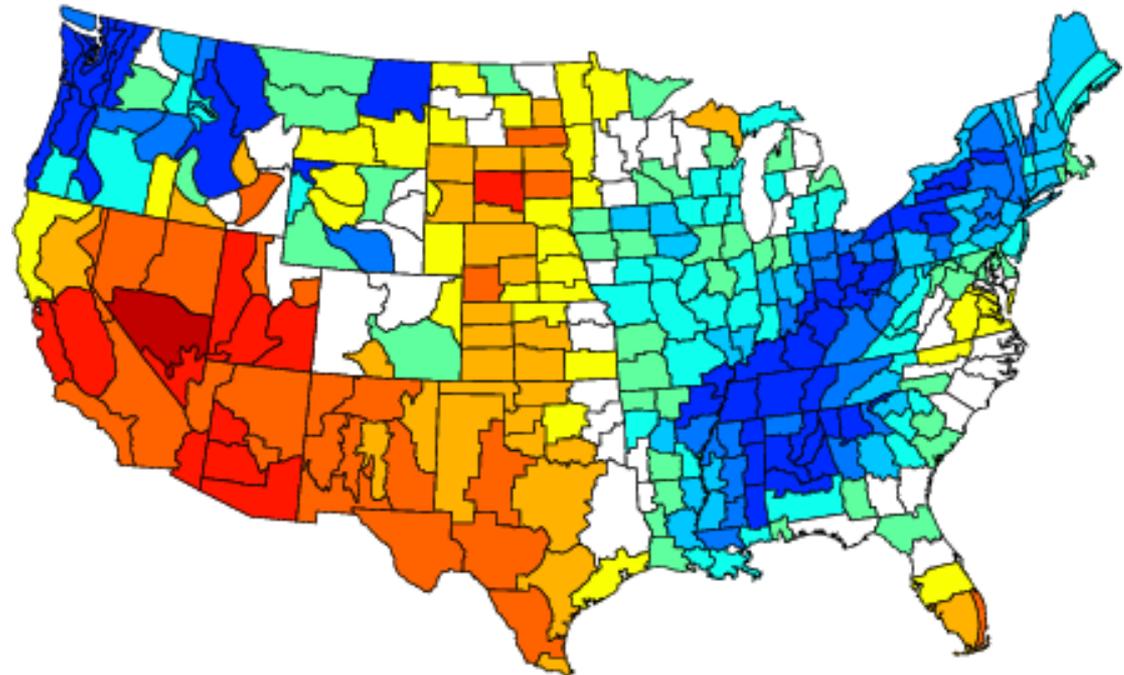
Seasonal Predictions

- La Nina is in the past
- In the neutral phase of the El Nino/La Nina cycle (ENSO)
- Pacific Decadal Oscillation (PDO) is negative
- Need to look at analog years when PDO- and ENSO is neutral
- Found 10 years that fit that recipe
 - 1948, '51, '53, '56, '61, '64, '72, '90, 2008, 2011

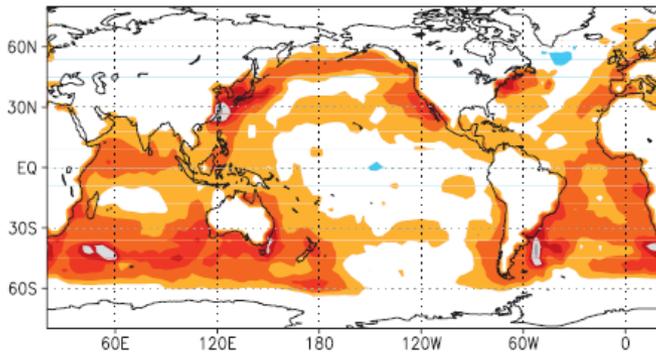
This is what the pattern looked like in the past analog years

Composite Standardized Precipitation Anomalies
Jan to Mar 1948,1951,1953,1956,1961,1964,1972,1990,2008,2011
Versus 1981–2010 Longterm Average

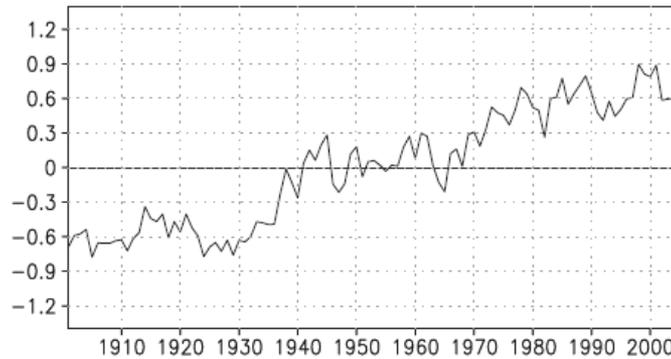
Drier than the 30-year normal precipitation across much of the southwest US and southern Great Plains



REOF1 27.2%

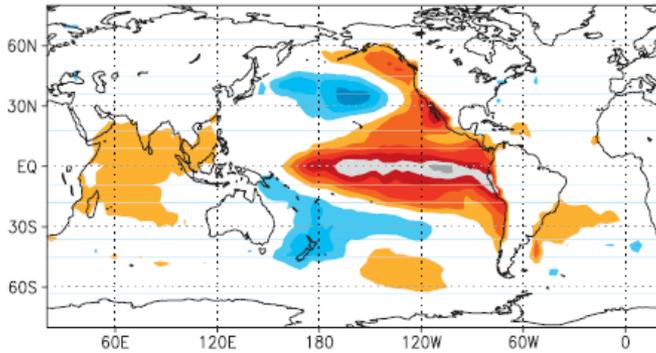


PC1

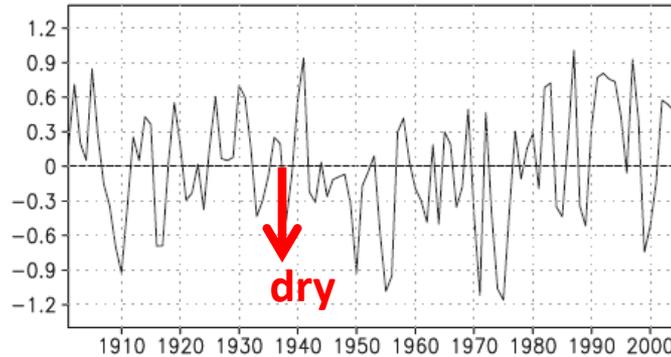


Long term trend

REOF2 20.5%



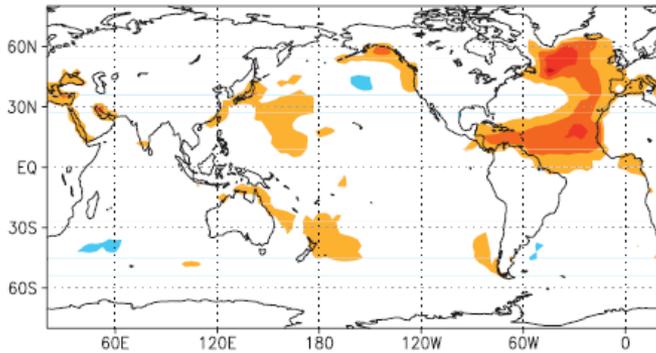
PC2



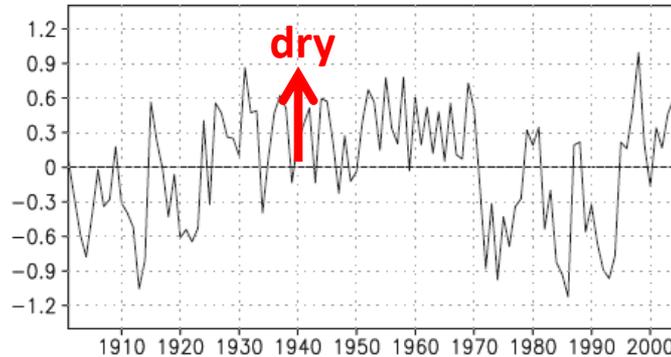
Pacific Decadal Oscillation (PDO)

PDO- dry
Like La Nina

REOF3 5.8%



PC3



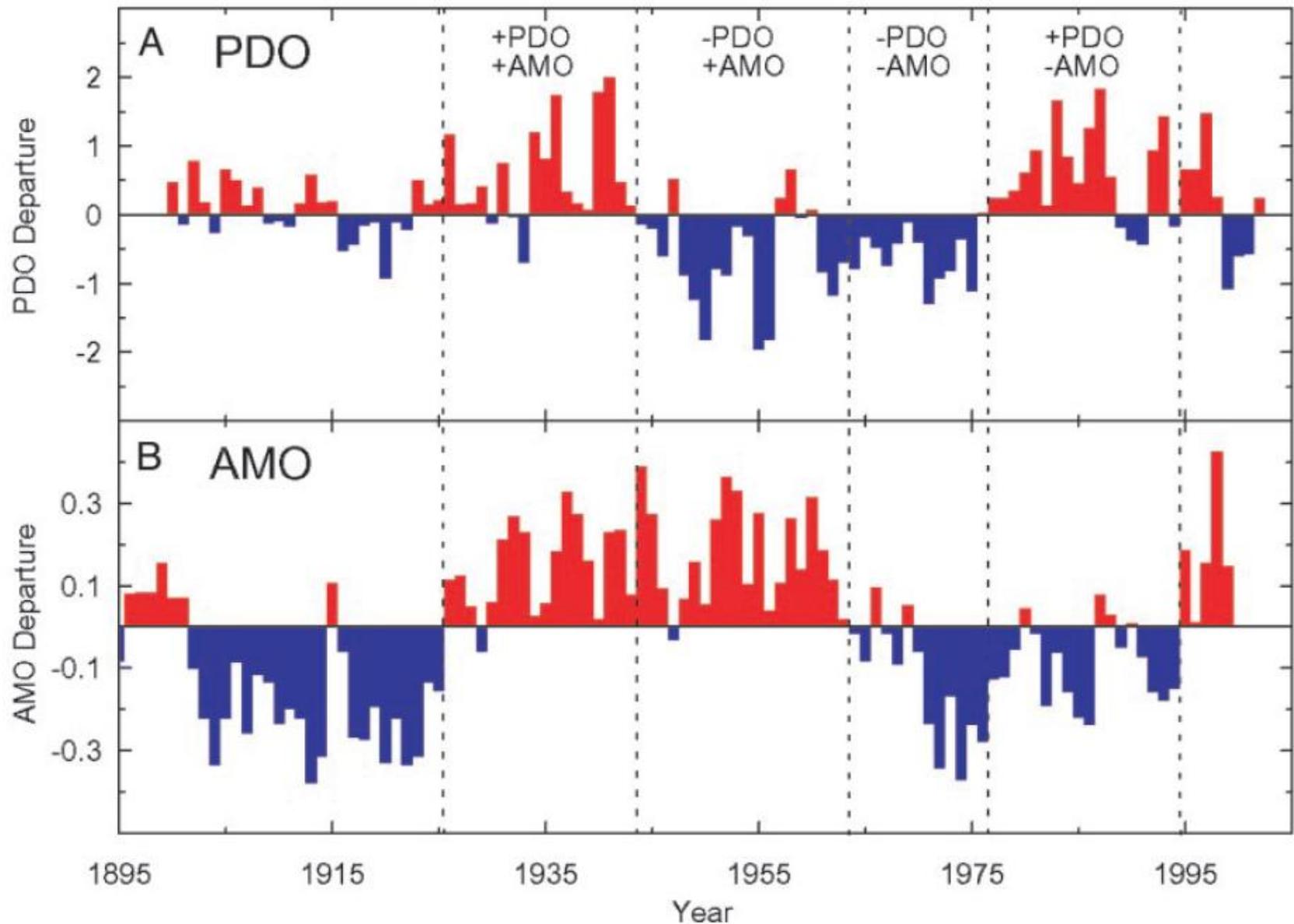
Atlantic Multidecadal Oscillation (AMO)

AMO+ dry



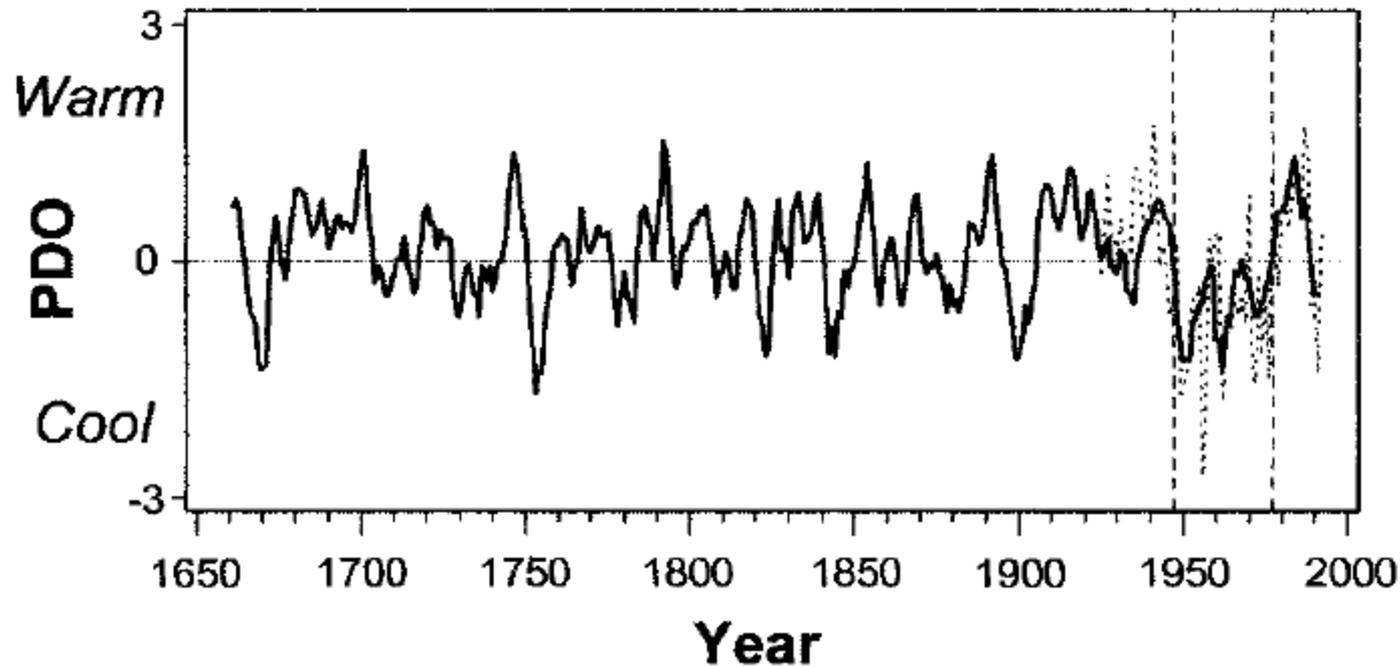
Principal components of annual mean SST from 1901-2004

More susceptible to drought during periods of $-PDO$, $+AMO$

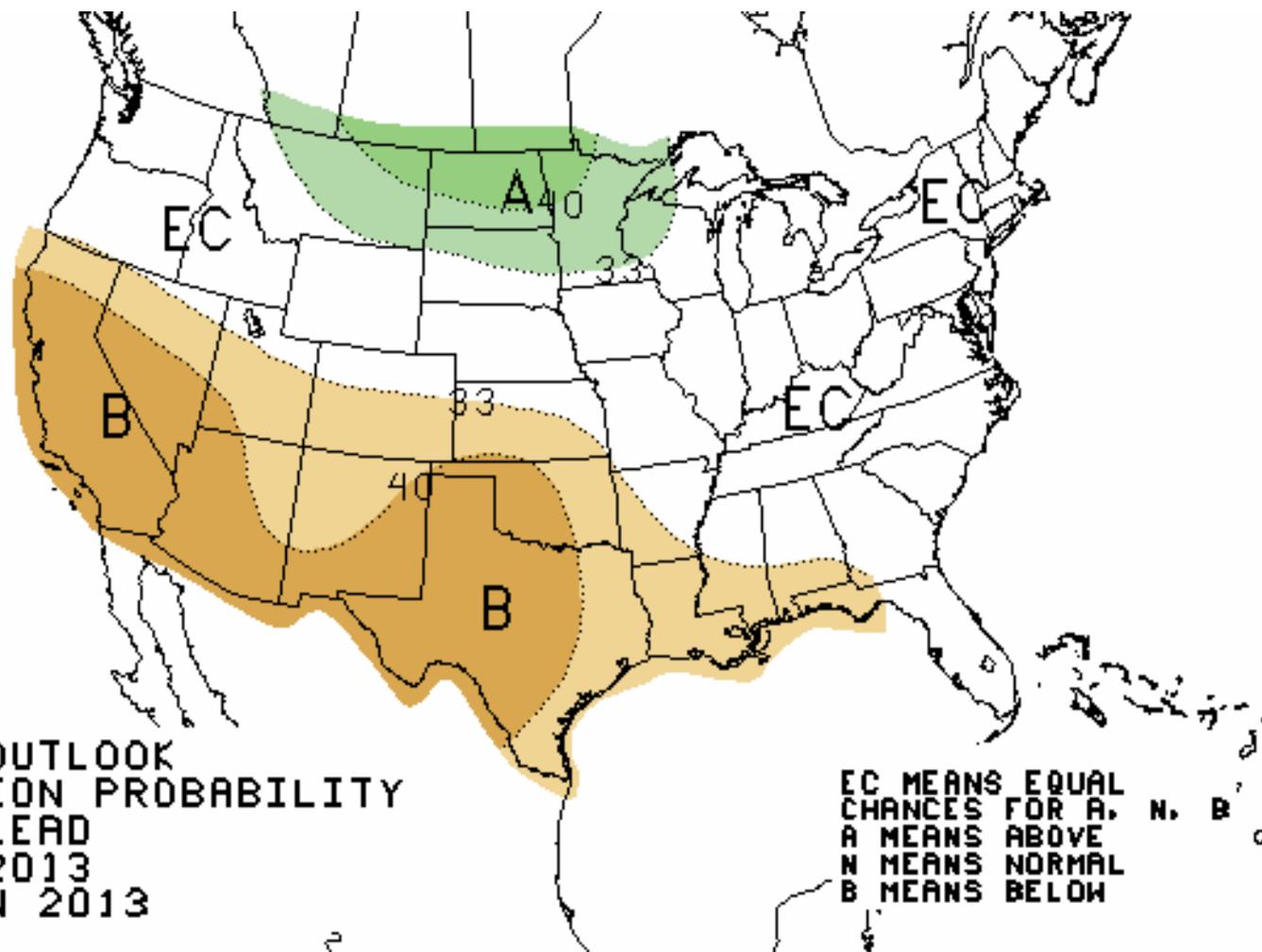


Going back further using tree rings

Here the authors used tree ring records from Jeffrey pine and big-coned Douglas fir in Southern California and Baja, Mexico

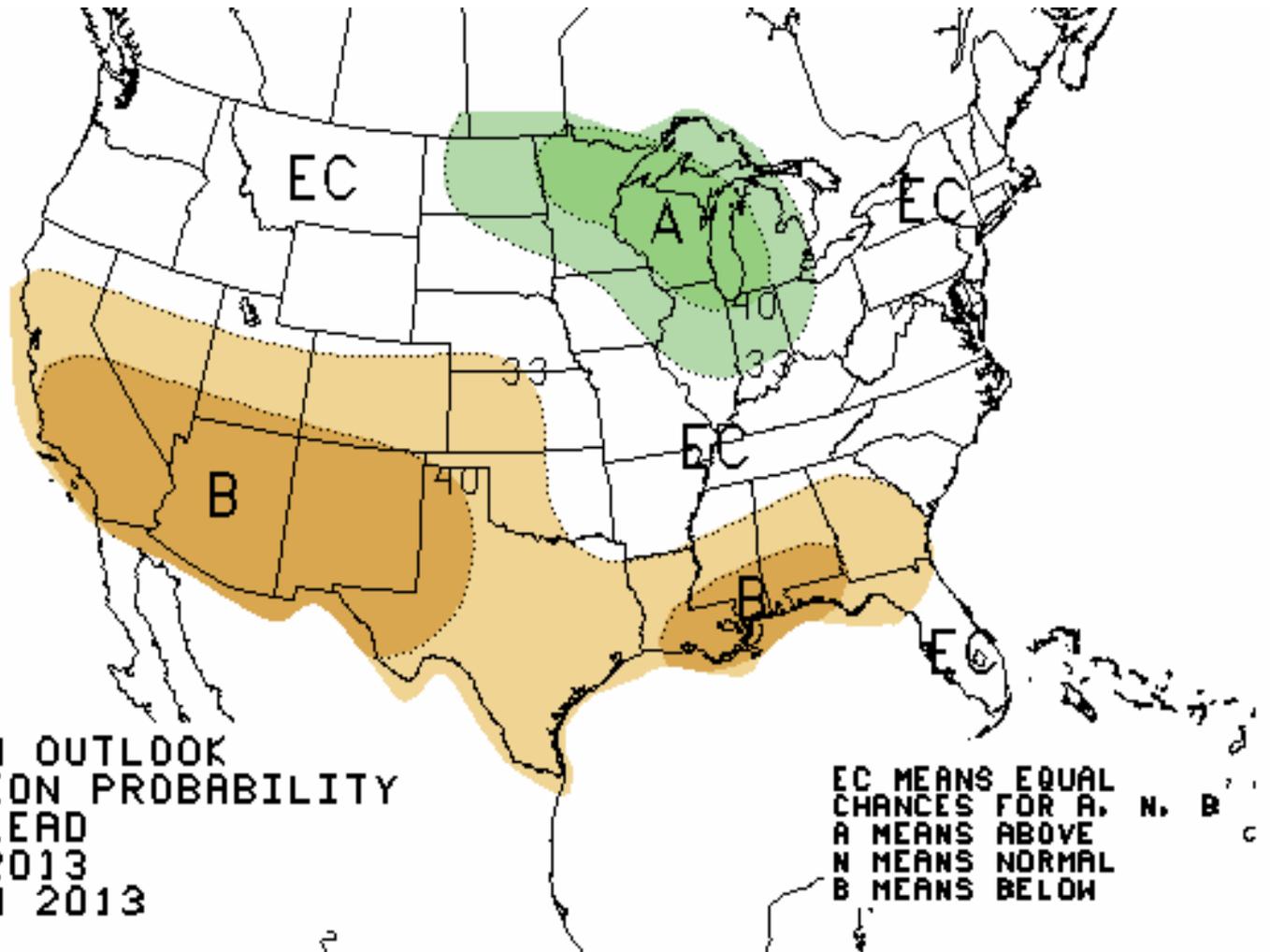


February 2013 Precipitation Outlook



ONE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
0.5 MONTH LEAD
VALID FEB 2013
MADE 17 JAN 2013

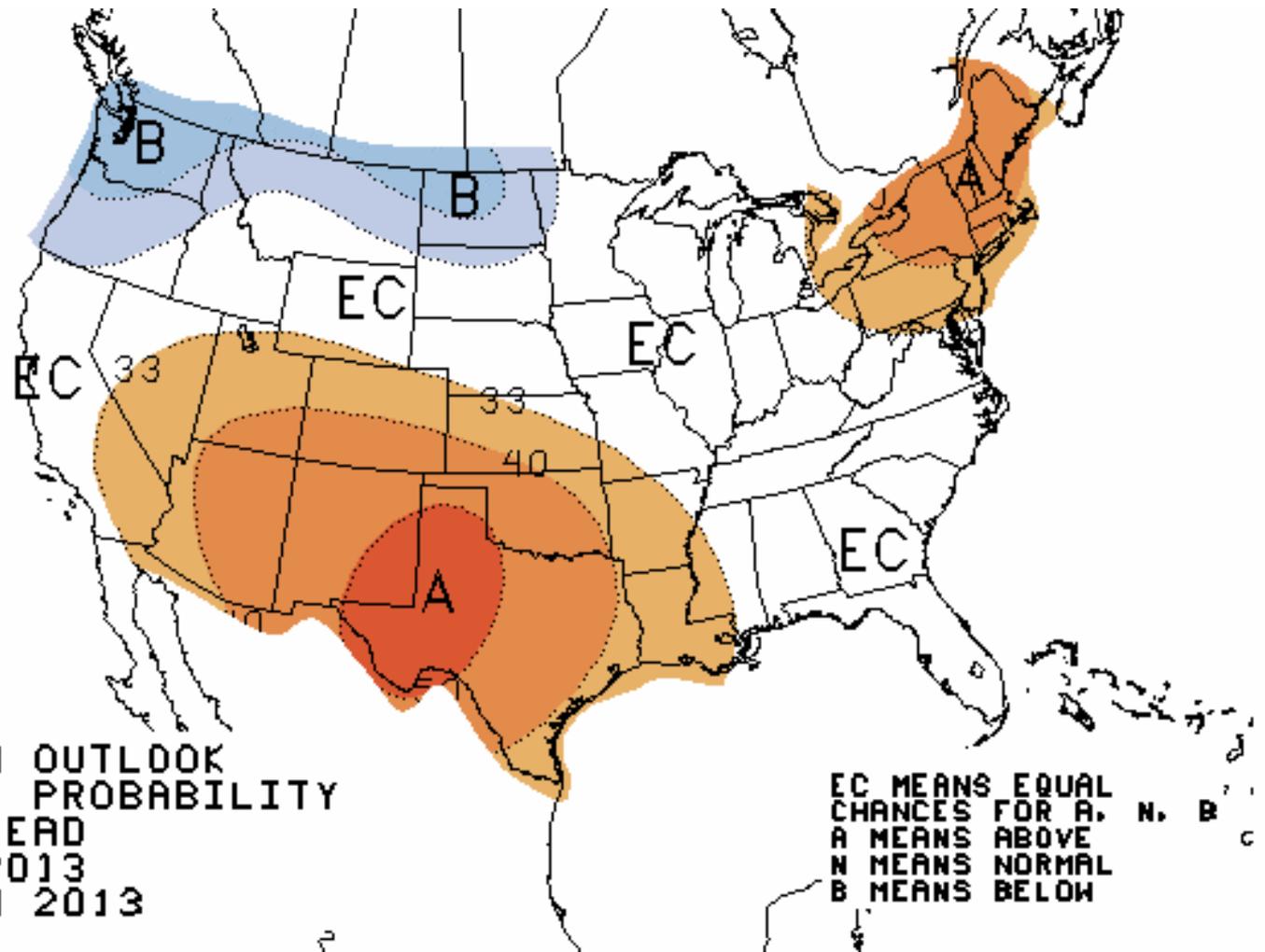
February – April Precipitation Outlook



THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
0.5 MONTH LEAD
VALID FMA 2013
MADE 17 JAN 2013

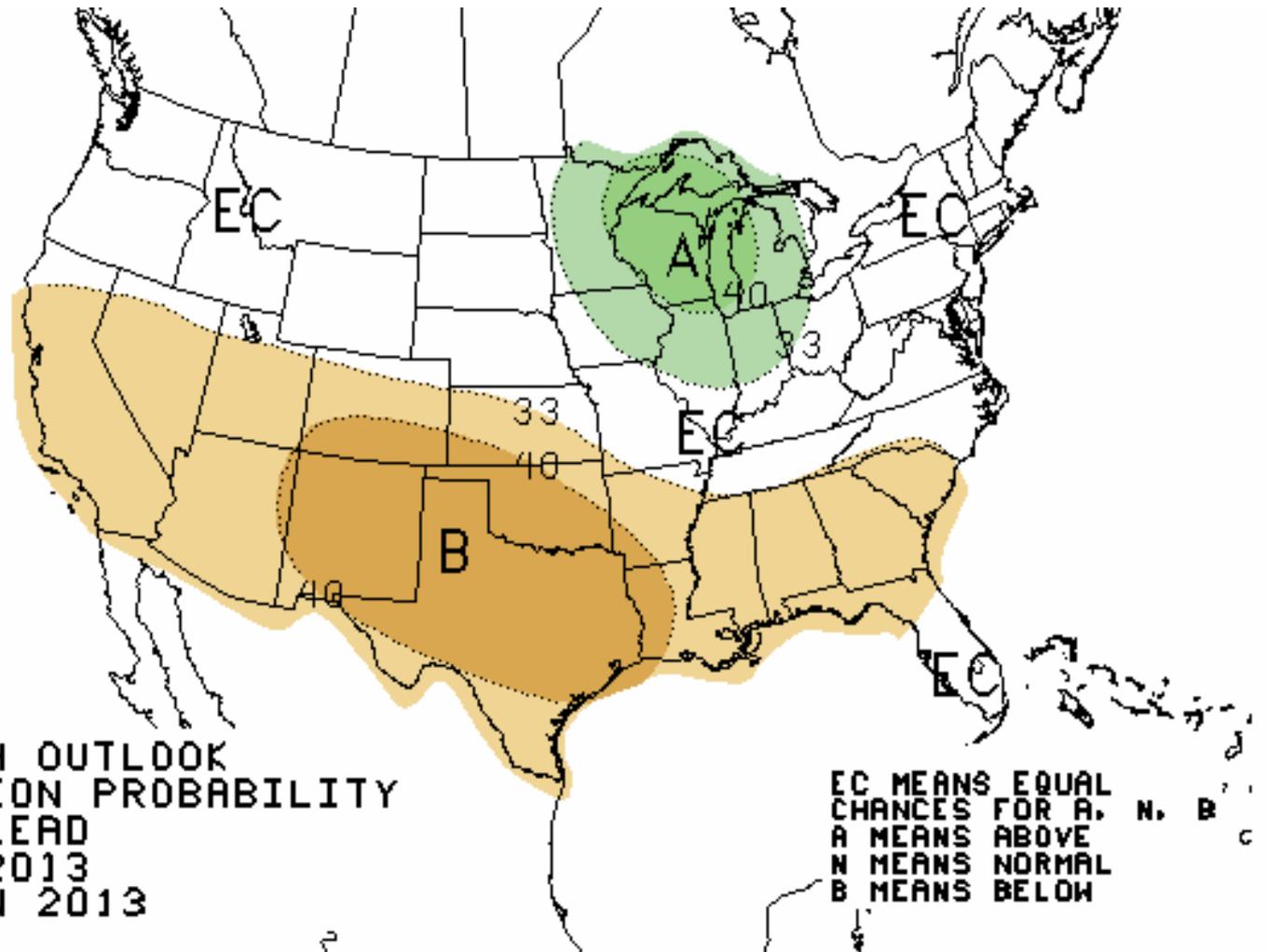
EC MEANS EQUAL
CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW

February – April Temperature Outlook



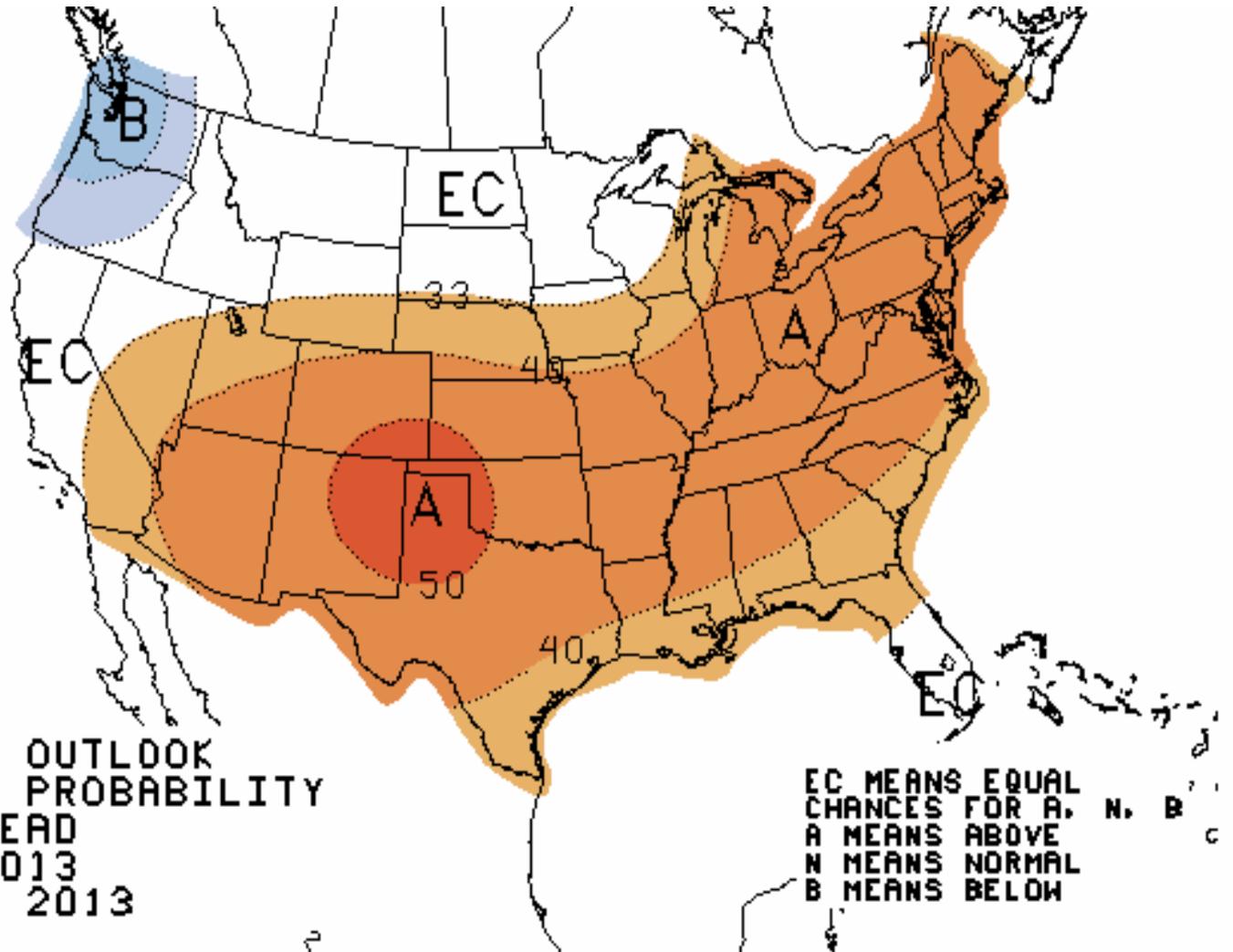
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID FMA 2013
MADE 17 JAN 2013

March – May Precipitation Outlook (Spring Season)



THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
1.5 MONTH LEAD
VALID MAM 2013
MADE 17 JAN 2013

March – May Temperature Outlook (Spring Season)



THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
1.5 MONTH LEAD
VALID MAM 2013
MADE 17 JAN 2013

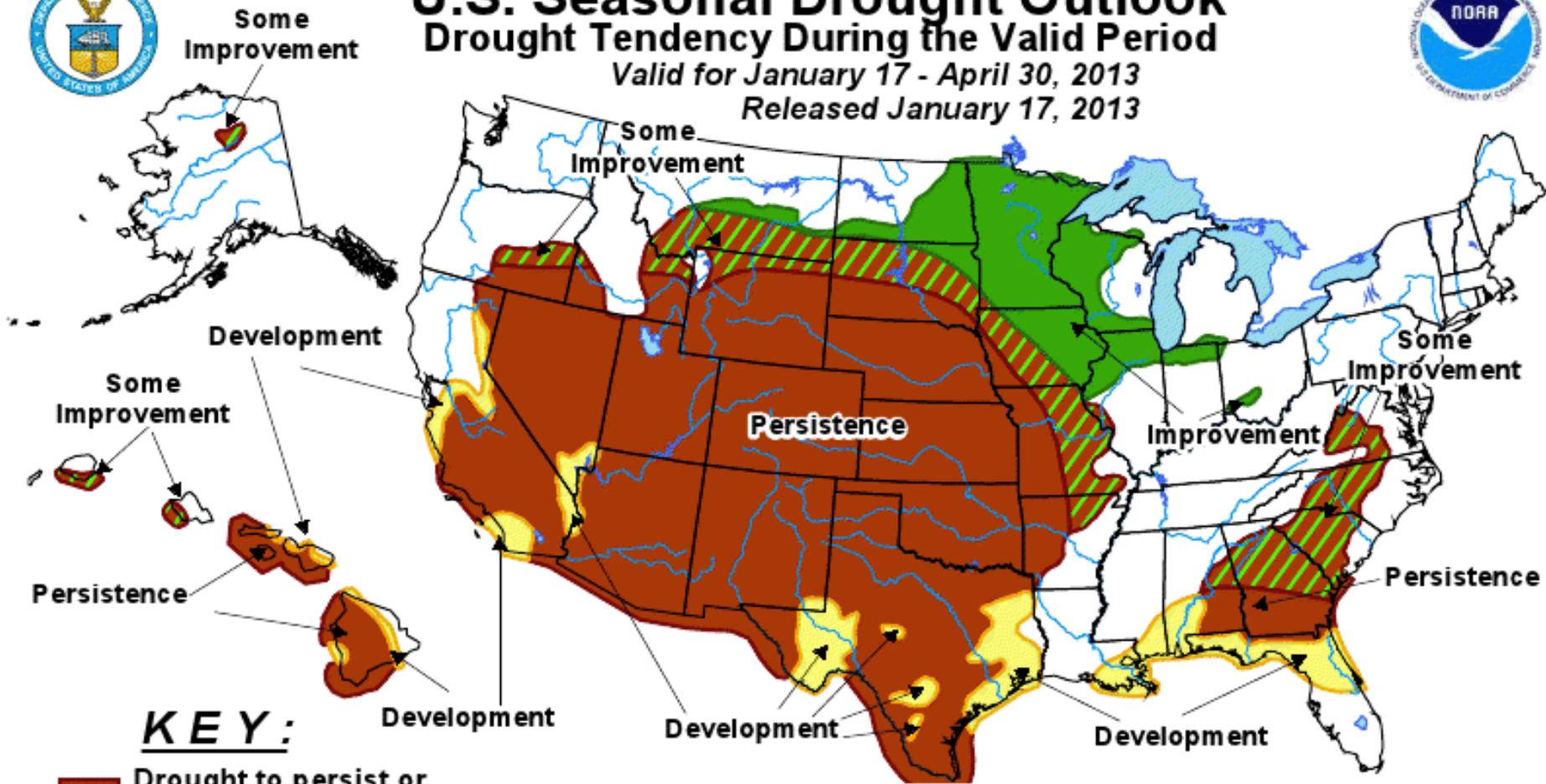


U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for January 17 - April 30, 2013

Released January 17, 2013



KEY:

-  Drought to persist or intensify
-  Drought ongoing, some improvement
-  Drought likely to improve, impacts ease
-  Drought development likely

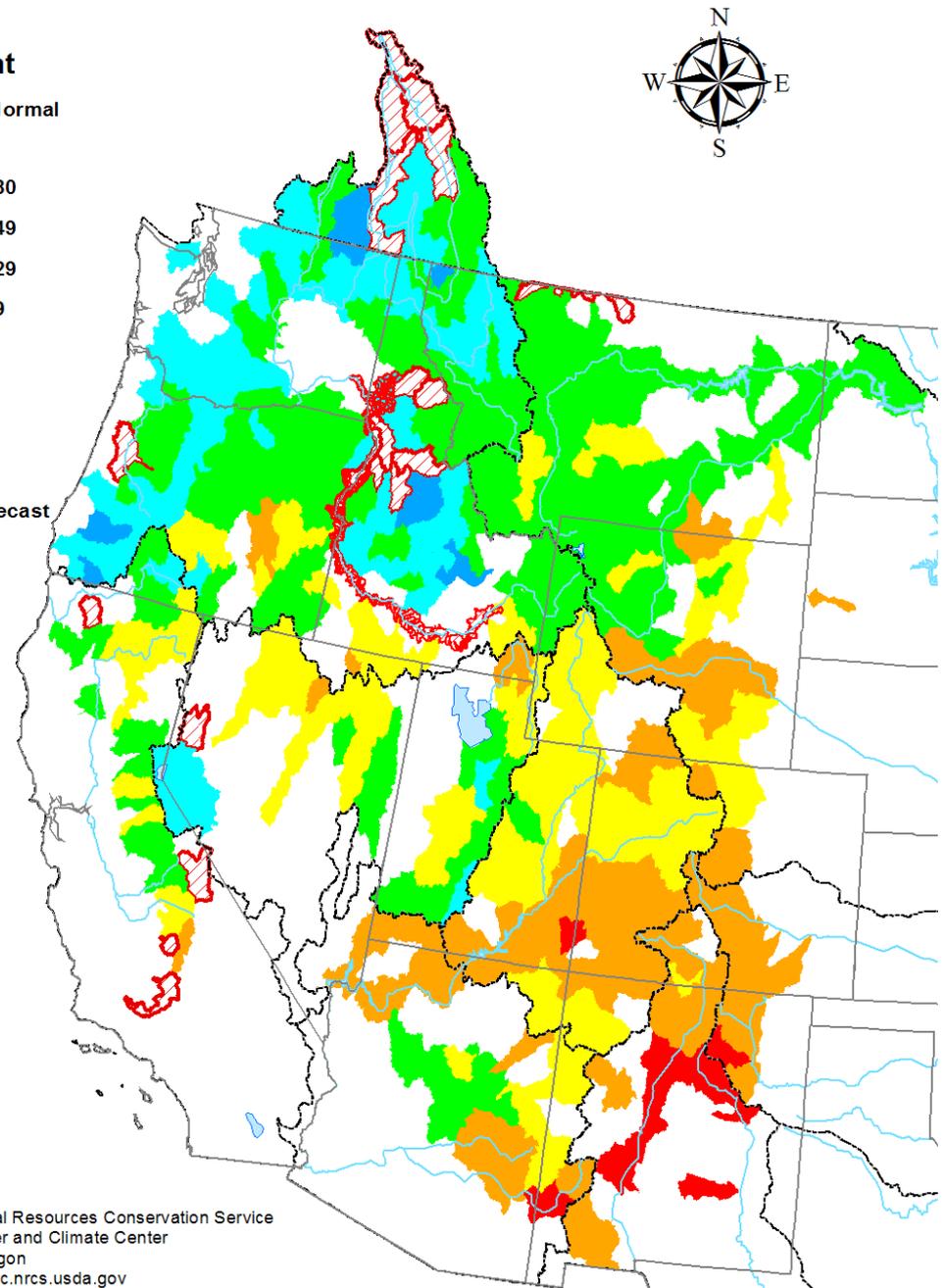
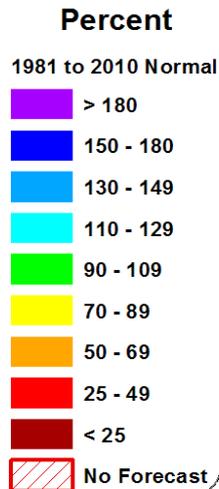
No Drought Posted/Predicted 

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

Disappointing Streamflow Forecast

NRCS forecast for
Spring and
Summer as of
January 1, 2013

<u>Forecast point</u>	<u>% of ave</u>
Inflow into El Vado lake	64
Rio Grande at Otowi	47
Rio Grande at San Marcial	38
Pecos at Santa Rosa Lake	39

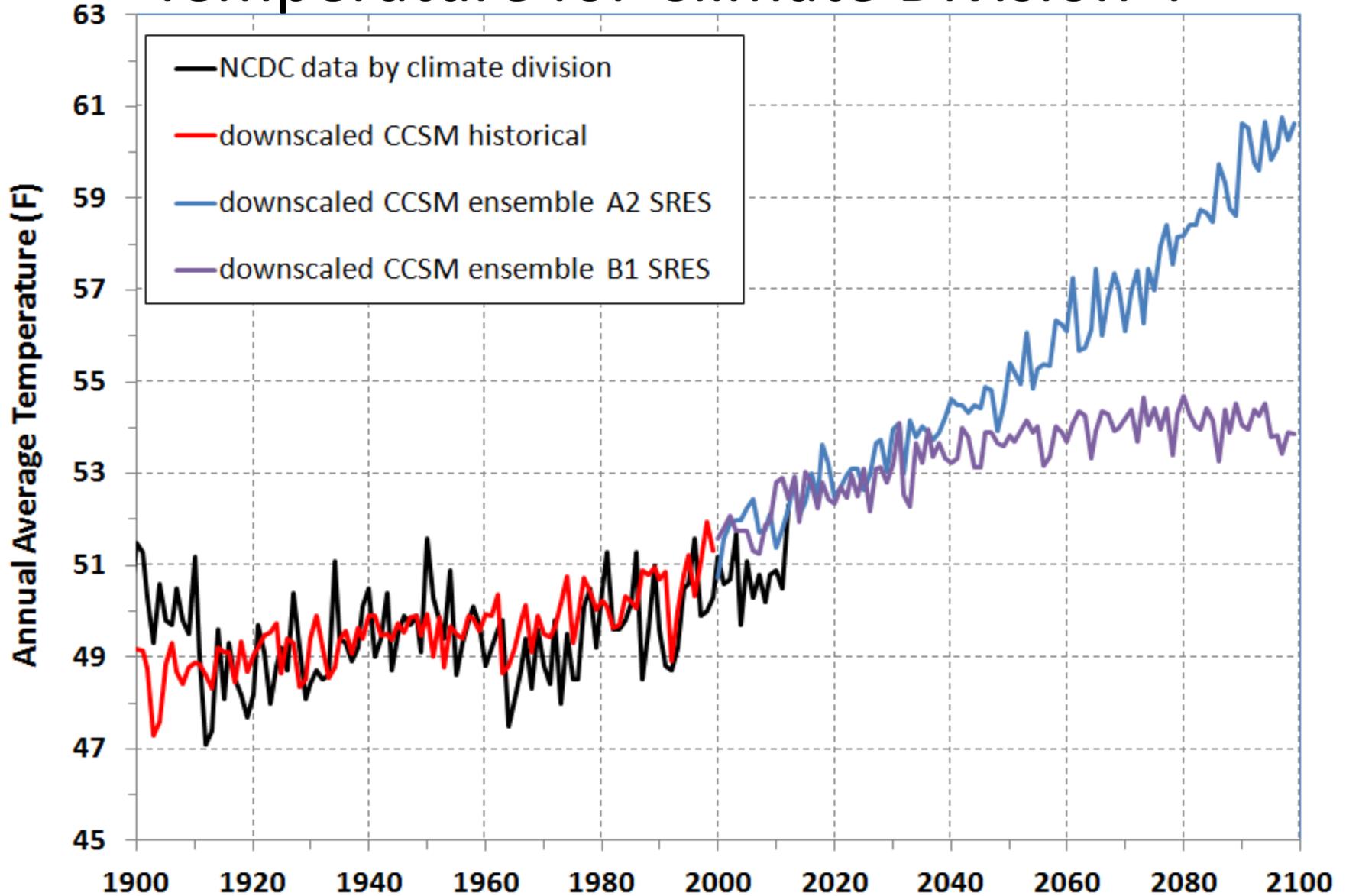


Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
<http://www.wcc.nrcs.usda.gov>

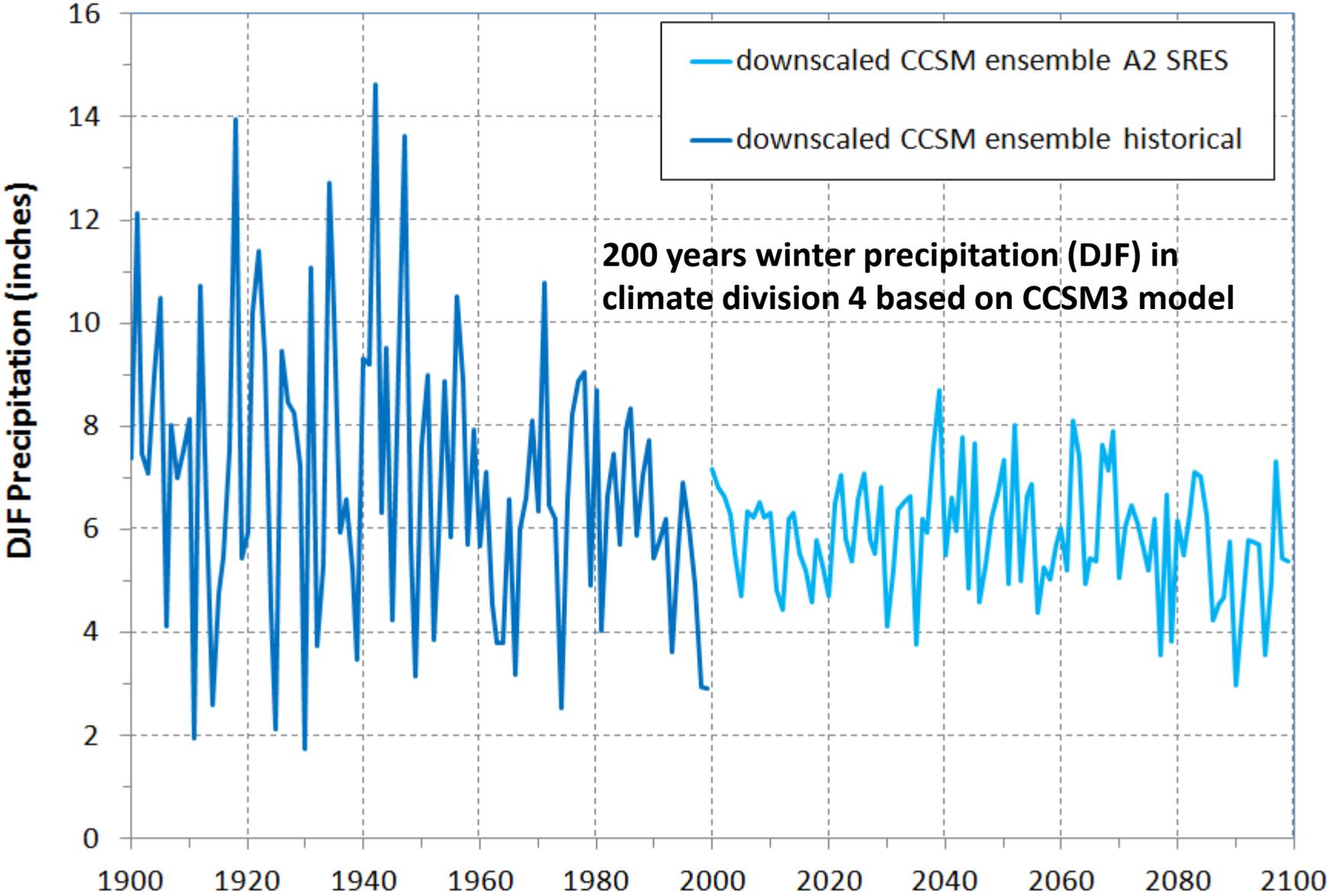
Climate Predictions

- Intergovernmental Panel on Climate Change (IPCC)
- Assessment Report 4 (AR4) completed in 2007
 - Assessment Report 5 (AR5) in the works
 - Multiple models used
 - Numerous emission scenarios (40)
 - Consider here high emissions scenario A2 and low emissions B1
 - One such model is the NCAR Community Climate System Model (CCSM3)

Temperature for Climate Division 4



More uncertainty in precipitation



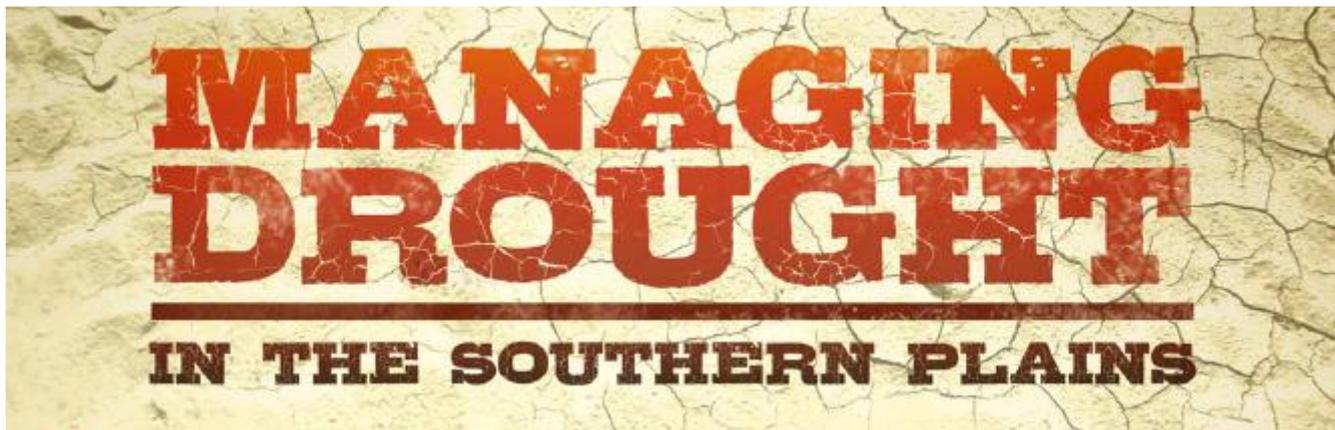
200 years winter precipitation (DJF) in climate division 4 based on CCSM3 model

Data: NCAR, <https://gisclimatechange.ucar.edu/>

Impacts through end of century

- Mid-latitude storm tracks migrate northward
- Reduced snowpack, earlier snowmelt
- Reduction in late spring and summer runoff
- Increases in evaporation, reduction in soil moisture
- Drought to be more frequent
- Frost free season increases between 17 and 24 days over the 2041-2070
- Effects on monsoon are not clear, but possible delay of monsoon season but overall precipitation amount unchanged
- Pests – bark beetle infestations during drought
- Wildfires and resulting land cover and ecological changes

Drought Webinar 2nd Thursday each month



Register at: www.southernclimate.org

To register or for more information, contact:

Southern Climate Impacts Planning Program

<http://www.southernclimate.org>

405-325-2541 or scipp@mesonet.org

Webinar Topics:

- La Niña
- Cattle & Livestock
- U.S. Drought Monitor
- Ecological Impacts
- Assistance Programs
- Water Supply
- Ranch Drought Planning
- Wildfire
- Drought Ready Communities
- Agricultural Impacts

Archives on  YouTube

<http://www.youtube.com/user/SCIPP01>

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Enter Keywords

The January 2013 climate summary for Arizona and New Mexico

 02:43

Products, Tools and Publications

 **Southwest Climate Podcast - Jan 2013**
In the January podcast, CLIMAS scientists discuss the recent Arctic blast and the climate word du jour "sudden stratosphere warming."

 **Southwest Climate Outlook - Jan 2013**
The January 2013 Southwest Climate outlook is published and contains a summary of current conditions and highlights.

 **Summary for Decision Makers - Apr 2011**
The Summary for Decision Makers is the first chapter of the Assessment of Climate Change in the Southwest United States

 **Southwest Climate Outlook - Dec 2012**
The December 2012 Southwest Climate outlook is published and contains a summary of current conditions and highlights.

Spring 2013 Colloquium

- Friday, March 1st at 10:30 **Drought Impacts on Dush and Health in New Mexico** presented by Dave DuBois
- Friday, March 15th at 10:30 **Field of Dreams, or Dream Team? Assessing Two Models for Drought Impact Reporting in the Semiarid Southwest** presented by Alison Meadow
- Friday, April 19th at 10:30 **Recent Variations in Low-Temperature and Moisture Constraints on**

News Flash: Adapting to Expected Colorado River Shortfalls

A new, two-year study by the U.S. Bureau of Reclamation quantifies expected shortfalls caused by over-allocated Colorado River water and assesses how to mitigate and adapt to these deficits.

Results of the study include a 9 percent decrease in streamflow measured at Lees Ferry over the next 50 years, taking into account climate changes. This decline is accompanied by increases in water demand, which is projected to range between 18.1 and 20.4 million acre-feet (maf) by 2060; consumptive use in the last 10 years has averaged 15.3 maf. The net result is that the Colorado River may experience an annual deficit of about 3.2 maf by 2060.

The ways in which the region adapts to and minimizes the deficit will be critical, and the study assessed more than 150 proposals to resolve the imbalance. These strategies included increasing water supply with reuse and desalination and reducing demand

NM Climate Center

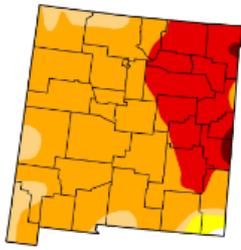
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NM Drought Map

U.S. Drought Monitor February 12, 2013
Web 7 a.m. EST

Drought Conditions (Percent Area)

	D1	D2	D3	D4	D5	D6
Current	0.00	98.820	98.45	99.85	25.36	0.07
Last Week (20130205 est.)	0.00	98.820	98.45	99.85	25.36	0.07
3 Weeks Ago (11/13/2012 est.)	0.07	98.83	98.35	74.51	18.20	0.08
Start of Calendar Year (20130101 est.)	0.00	100.00	98.33	94.35	31.00	0.07
Start of Water Year (20121001 est.)	0.00	100.00	100.00	92.00	12.25	0.06
One Year Ago (20120205 est.)	0.10	91.50	67.00	52.72	24.70	6.73



Legend:
■ D3 Abnormally Dry
■ D4 Drought - Moderate
■ D5 Drought - Severe
■ D6 Drought - Extreme
■ D7 Drought - Exceptional

The Drought Monitor focuses on local-scale conditions. Local conditions may vary. See accompanying text summary for Kansas statements.
<http://droughtmonitor.unl.edu>

Released Thursday, February 14, 2013
 Michael Brewer, National Climatic Data Center, NOAA

Latest Tweets

Dave DuBois
nmclimate

nmclimate MT @NMSUinsider "Estim. time-delayed factors in separating land cover temperatures using bi-angular mixed pixels" 3:30pm FRIDAY NMSU GT200
 yesterday · reply · retweet · favorite

nmclimate MT @AlbaSoular Some slightly positive news: #DonaAnaCounty farmers may get up to 6 acre-in of water this summer, as opposed to none. #drought
 2 days ago · reply · retweet · favorite

Join the conversation

<http://weather.nmsu.edu>

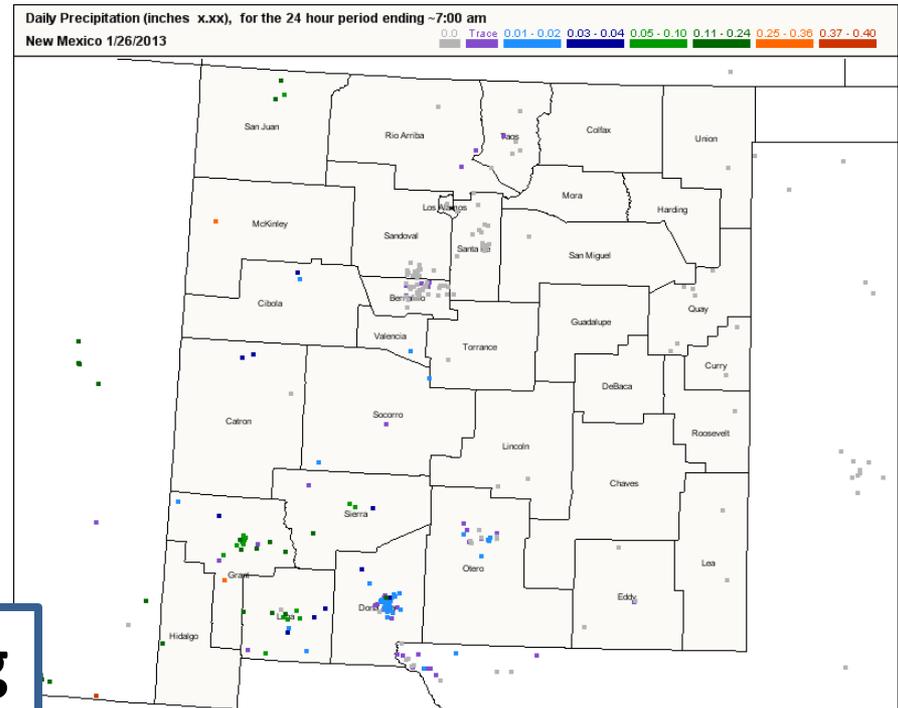
Latest Blog Posts

- 2013-1-16** If you are interested in collecting rain and snow observations for us read on! We are going to hold a training workshop for the volunteer ...[Read More](#)
- 2013-1-4** Decent snow amounts across the southern NM desert were observed from this past storm. This time focus was on the lower elevations and over the ...[Read More](#)
- 2013-1-3** Let it snow, let it snow! It was nice to wake up to a dusting of snow this morning in Las Cruces. We started out ...[Read More](#)



CoCoRaHS

- Community Collaborative Rain Hail and Snow network
- Let's work together to measure precipitation across the nation. . . Be a volunteer!



Sign up: www.cocorahs.org

How Can you become part of the network?



Five easy steps

1. Sign-up on the CoCoRaHS Web page
www.cocorahs.org
2. Obtain a 4" diameter plastic rain gauge (info available on web site)
We have some available if you not able to buy one
3. View the “online training slide show” or
attend a training session
4. Set-up the gauge in a “good” location in your yard
5. Start observing precipitation and report on-line daily

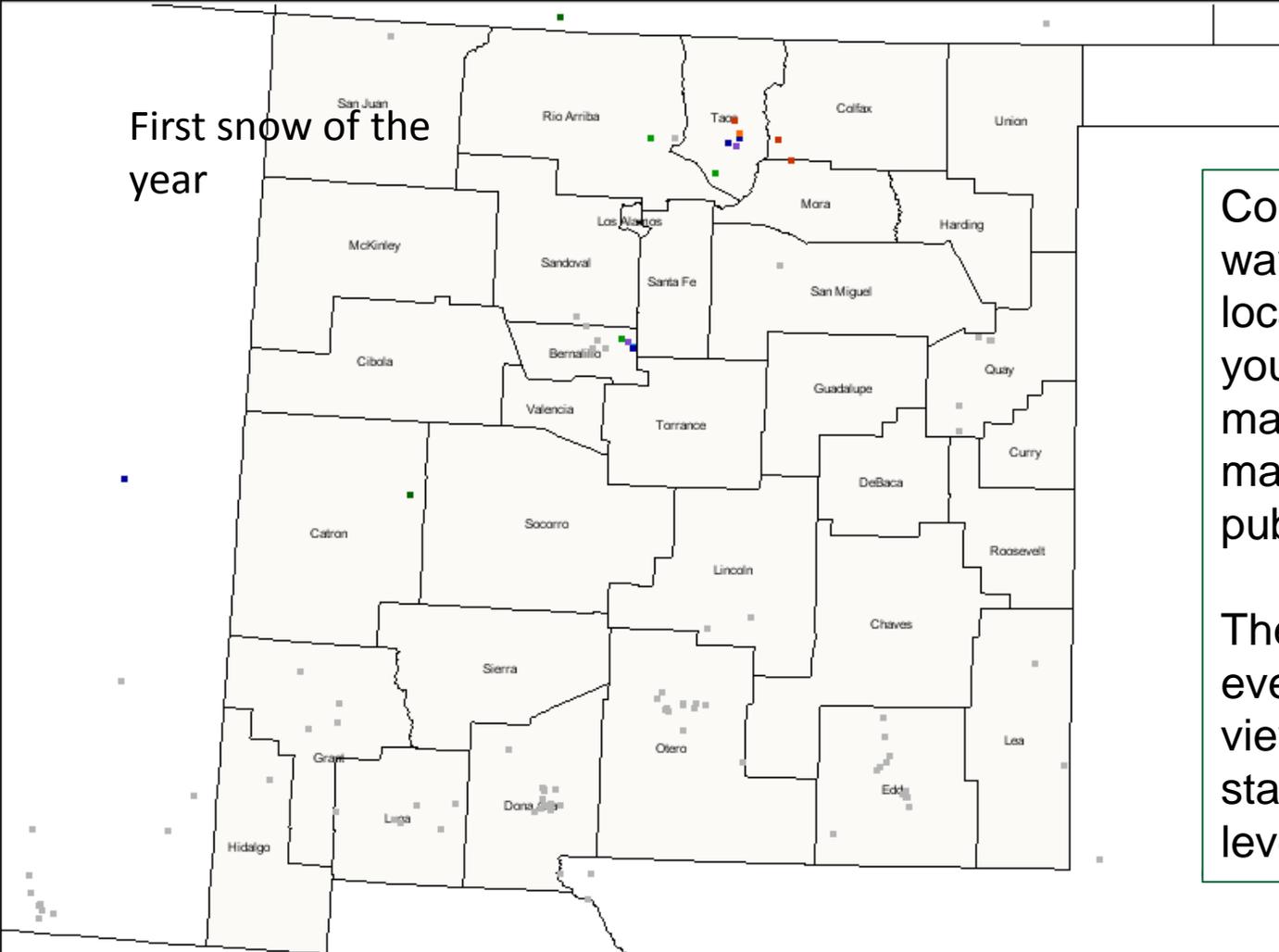
Even if you don't participate

Daily Snow (inches x.x), for the 24 hour period ending ~7:00 am

New Mexico 10/8/2011



First snow of the year



CoCoRaHS is a great way to find out about local precipitation even if you don't participate. All maps and education materials are free to the public.

The maps are updated everyday and are viewable on a national, statewide and county level.



Contact

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