Climatological Context and Evolution of the 2010-2012 Drought in the Southern Plains and Southern Rockies

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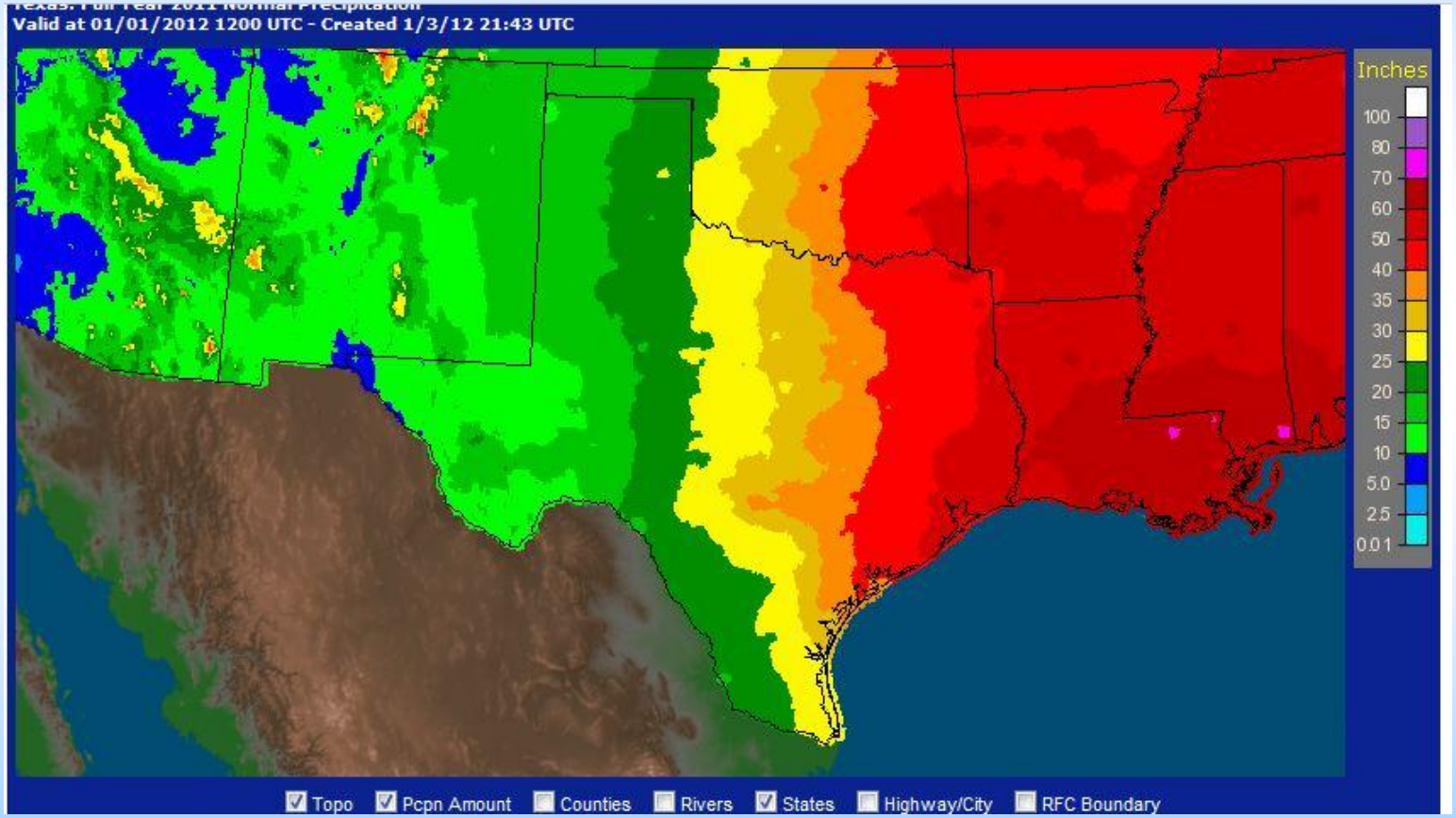
Climate Variability and Drought are Common in OK, TX, and NM.



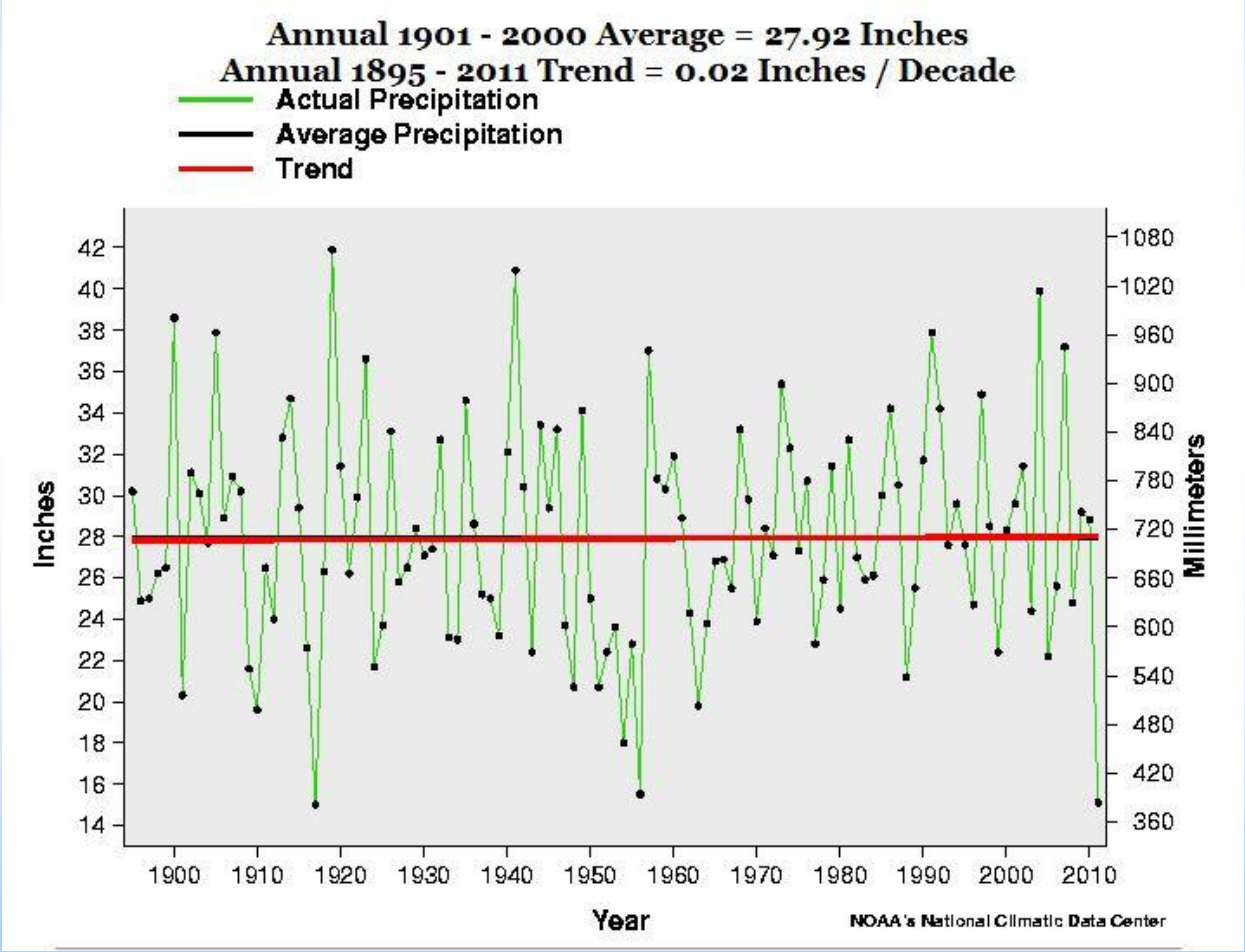
Climate Variability and Drought are Common in OK, TX, and NM

- Climate variability is a naturally occurring phenomenon across OK, TX, NM.
- Despite the average yearly state precipitation of about 28” in TX there have been individual years with as low as 14+” and as much as 42+”.
- The multiyear drought of 1950-1956 is still the long term drought of record for Texas.
- However, 2011 has now eclipsed 1917 and 1956 as the most intense 1 year drought in Texas since modern recordkeeping began in 1895, based on lack of observed precipitation and the Palmer Drought Severity Index (PDSI).

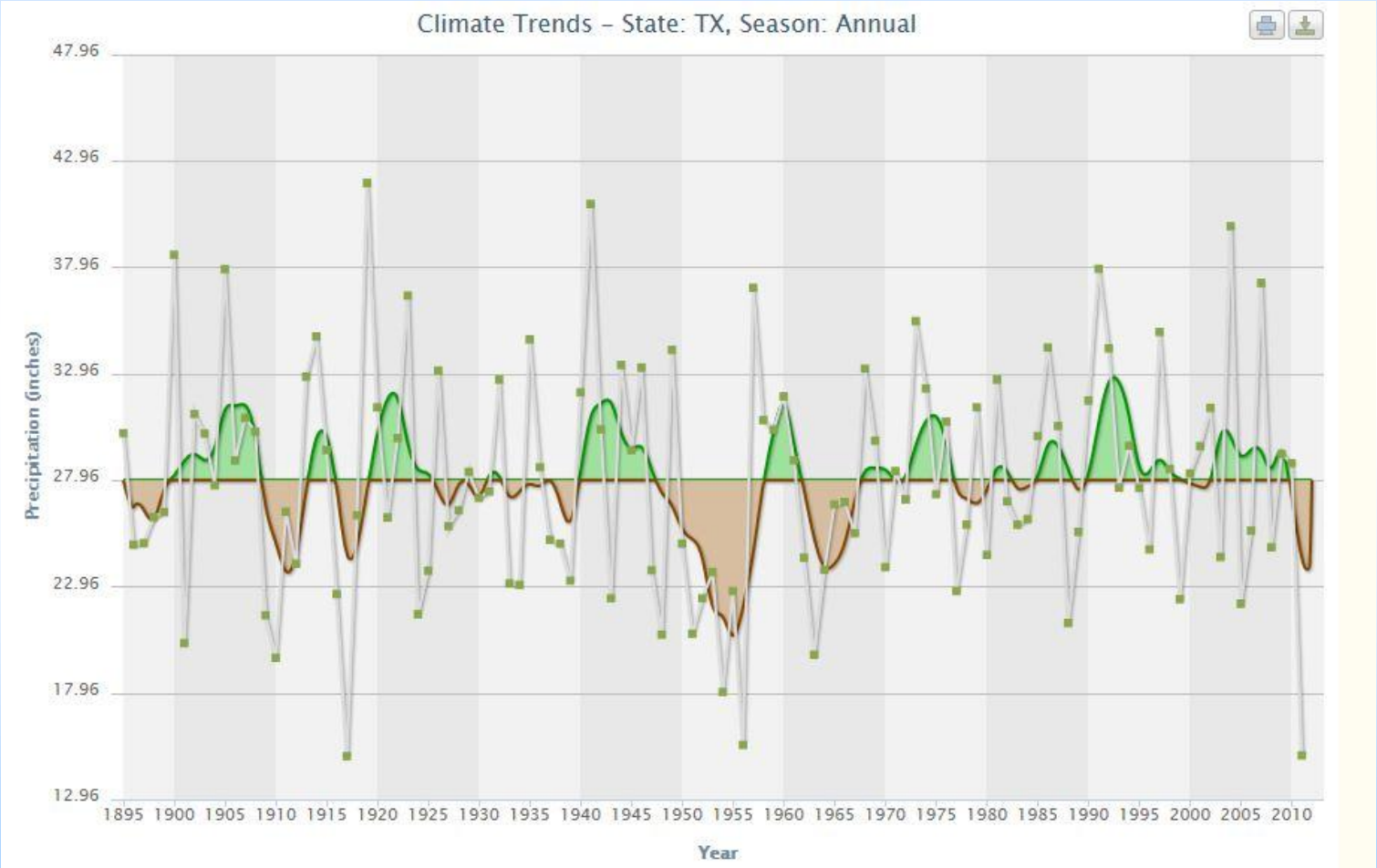
Climate Variability and Drought are Common in OK, TX, and NM

- Despite the average yearly precipitation of 34” in OK, yearly variability can range from 19” to over 48”. October 2010-September 2011 saw most intense 1 year drought on record since the mid 1950s.
- In NM, statewide average yearly precipitation is 13.5”, but extremes range 100% on both tails from 6.55” to 27”. October 2010-September 2011 saw most intense 1 year drought on record since 1895.

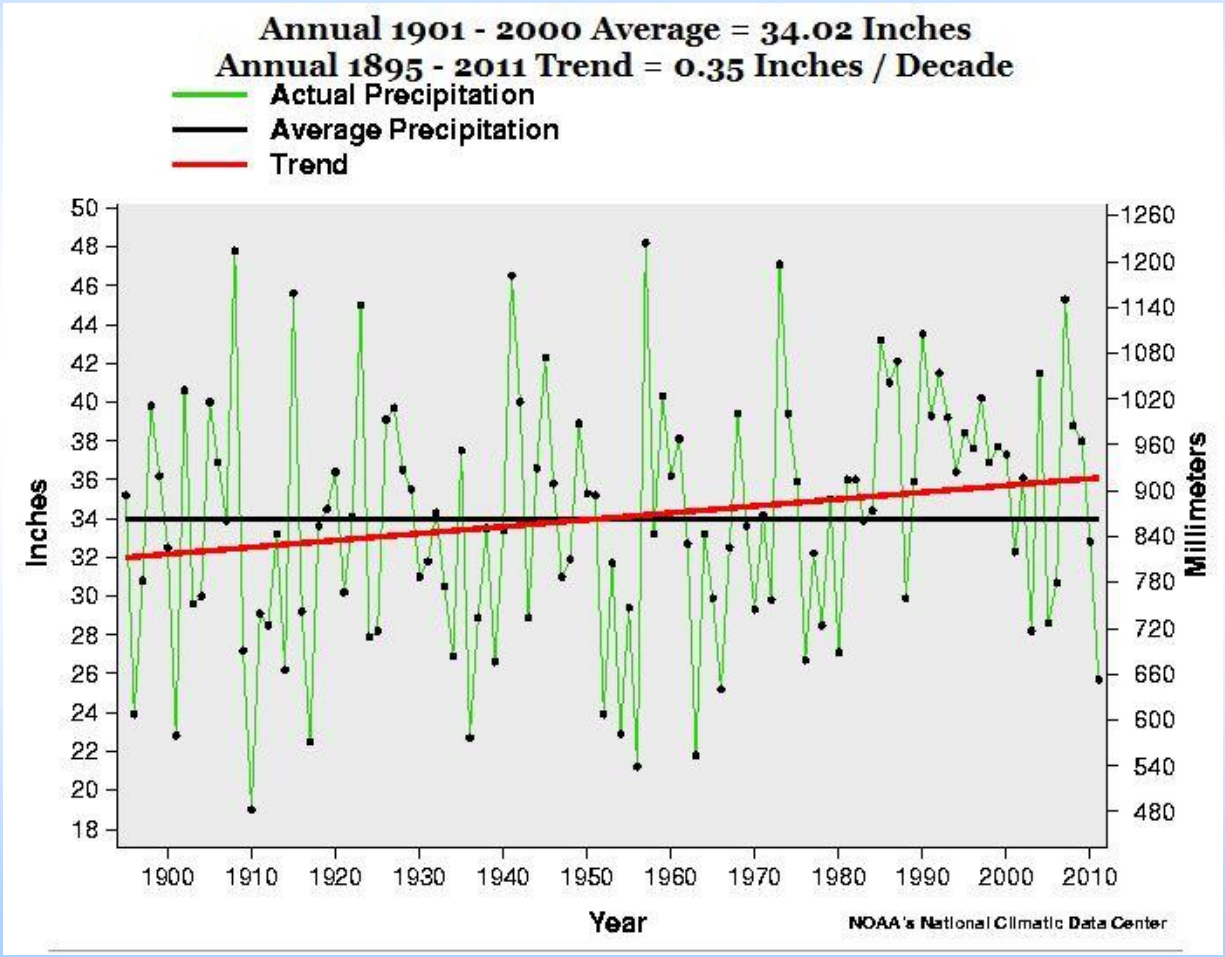
Texas Observed Annual Precipitation



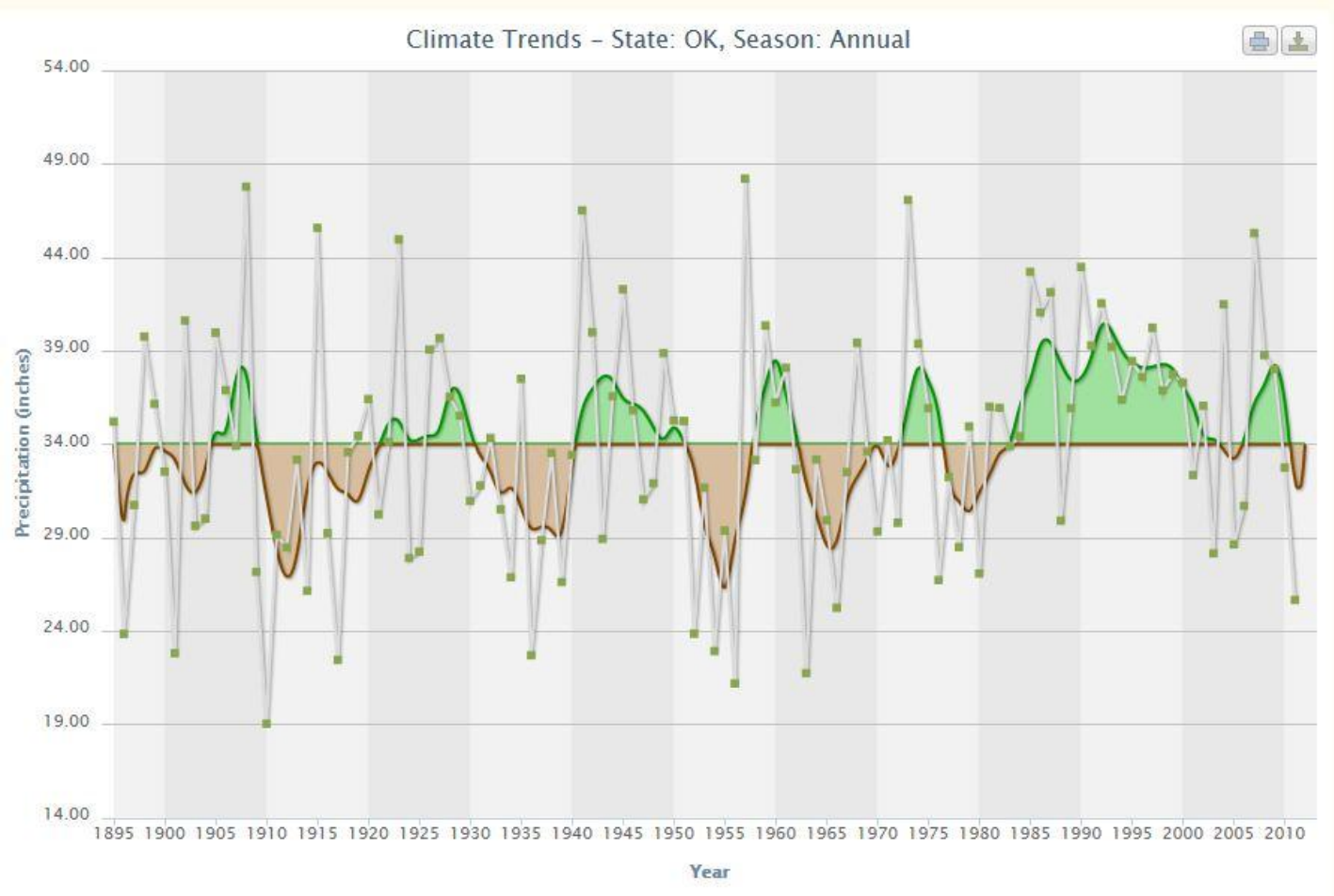
Texas Observed Annual Precipitation with 5 Year Rolling Averages.



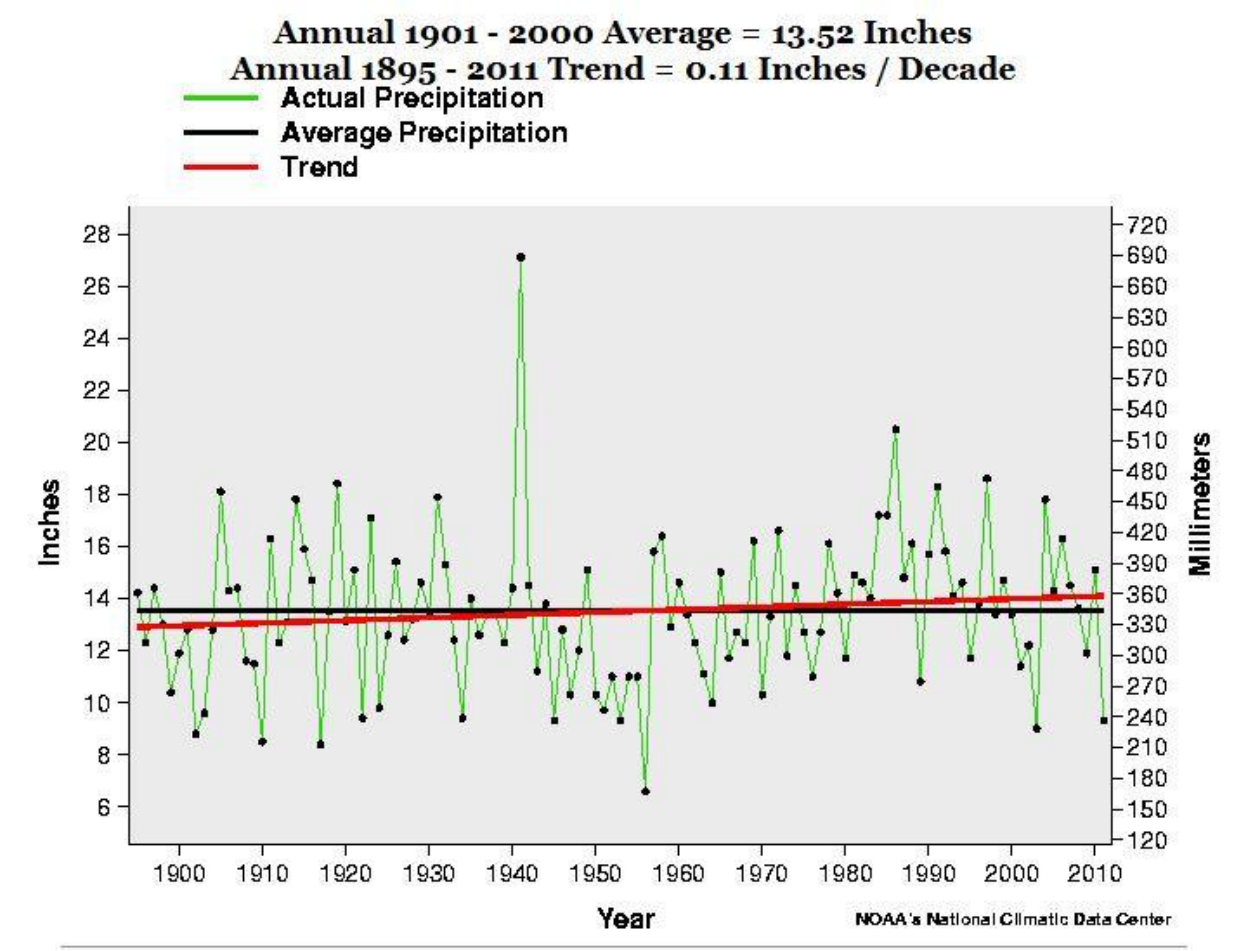
Oklahoma Observed Annual Precipitation



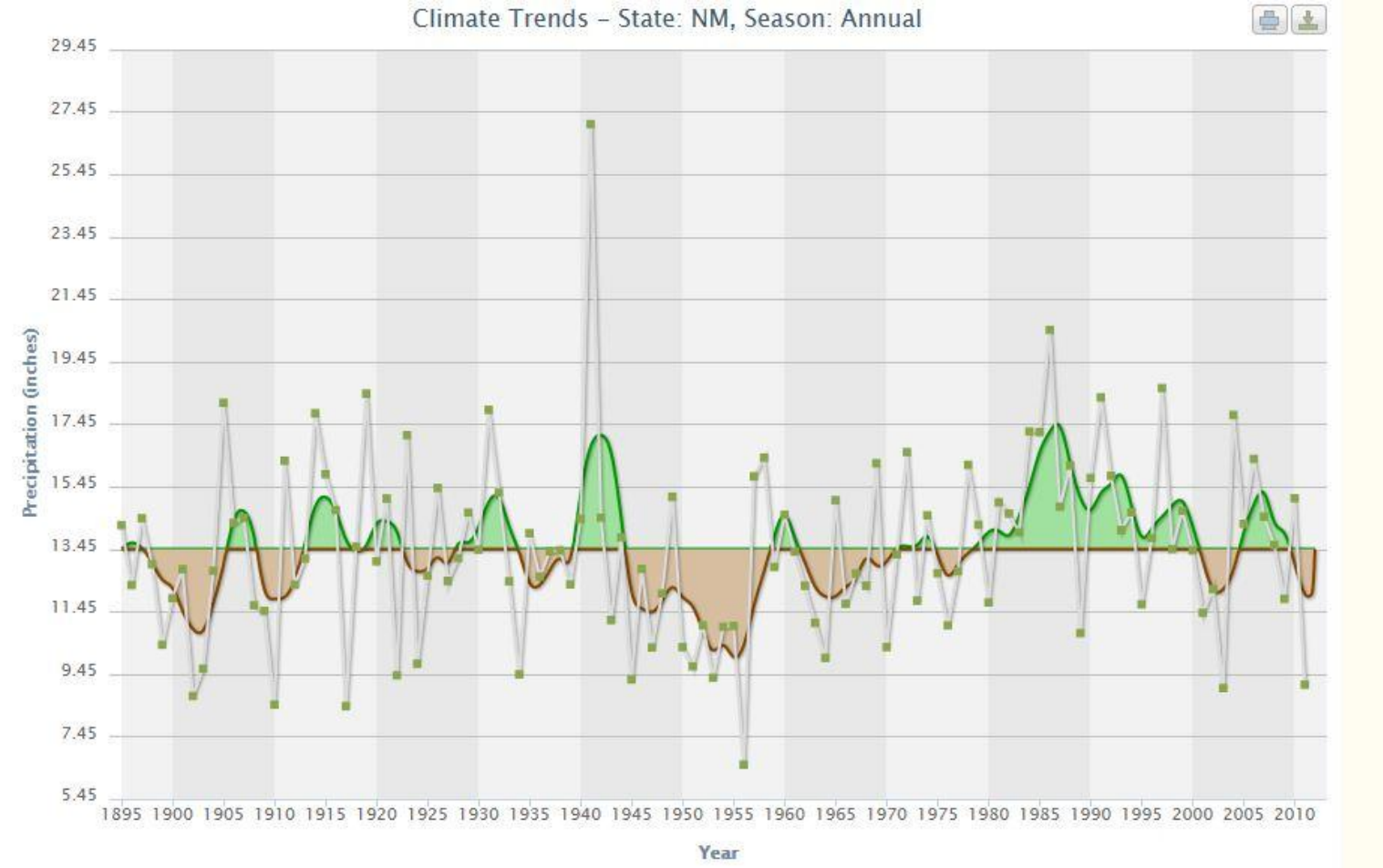
Oklahoma Observed Annual Precipitation with 5 Year Rolling Averages



New Mexico Observed Annual Precipitation



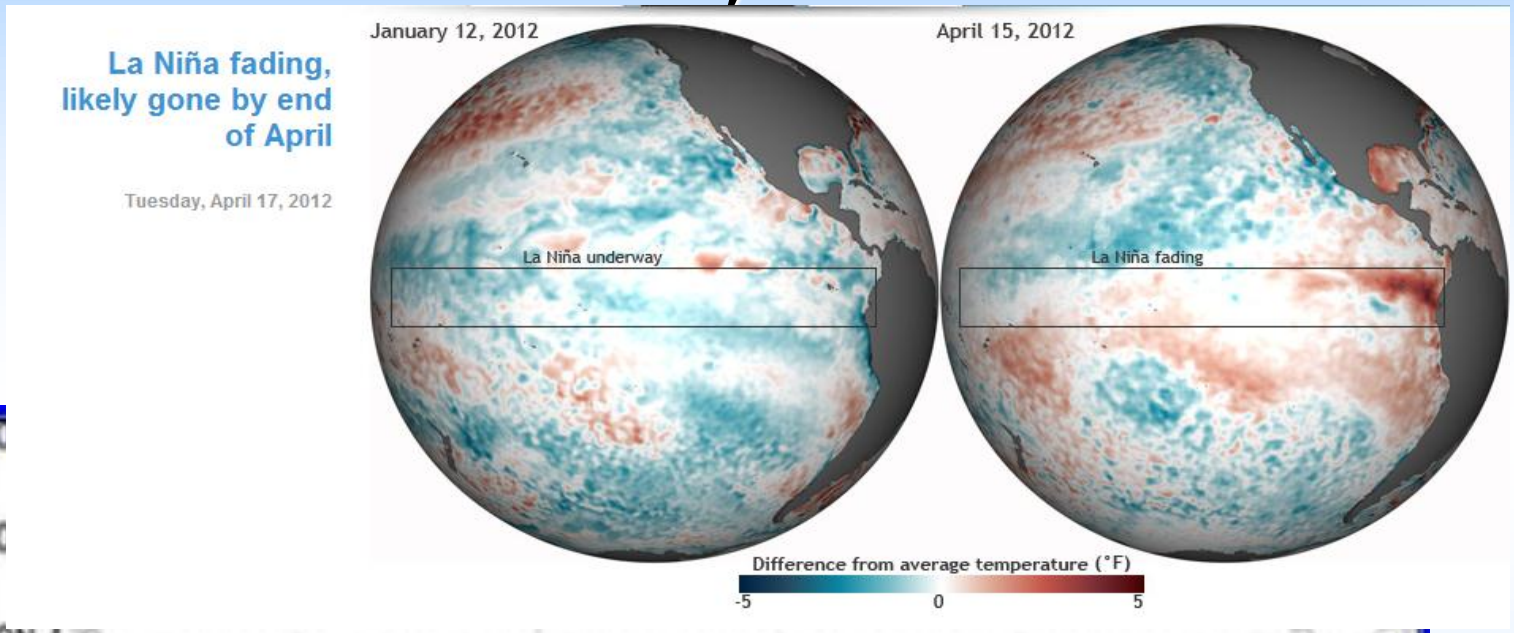
New Mexico Observed Annual Precipitation with 5 Year Rolling Averages

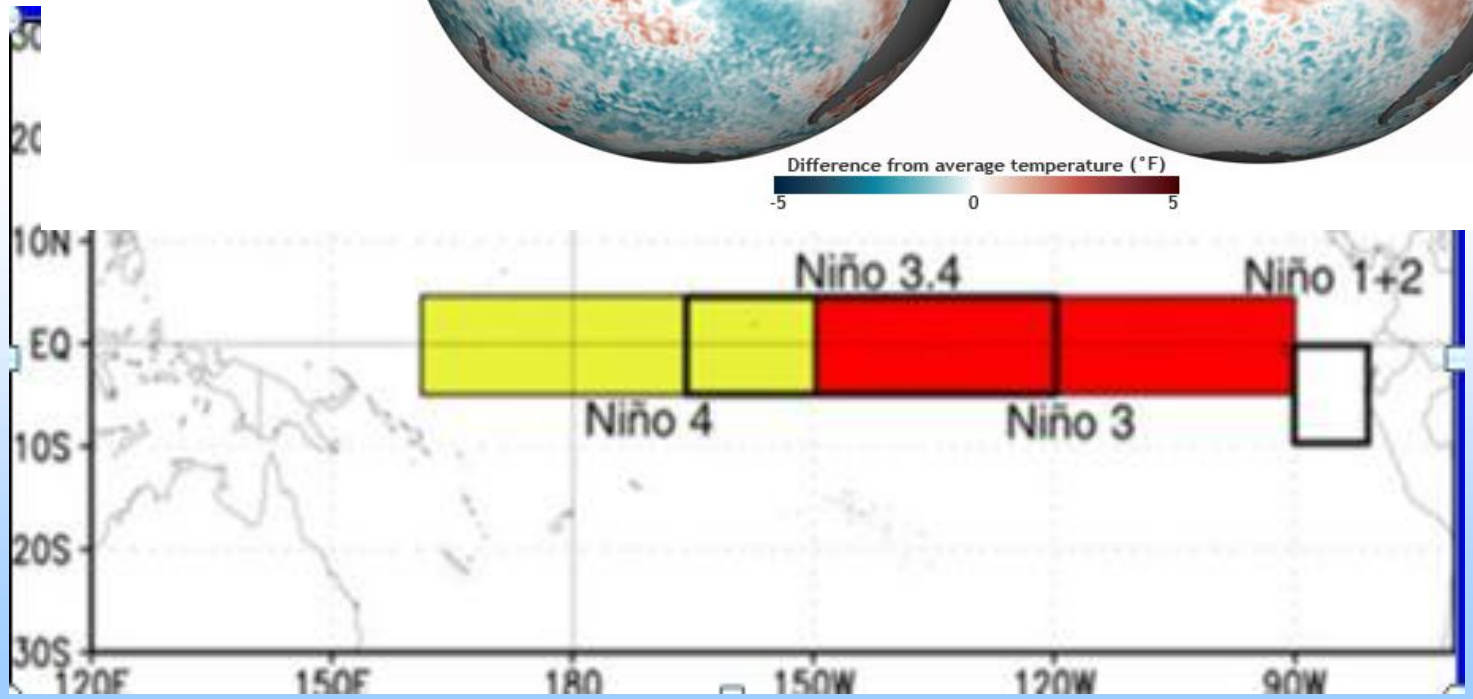


Unique Features of the Drought.

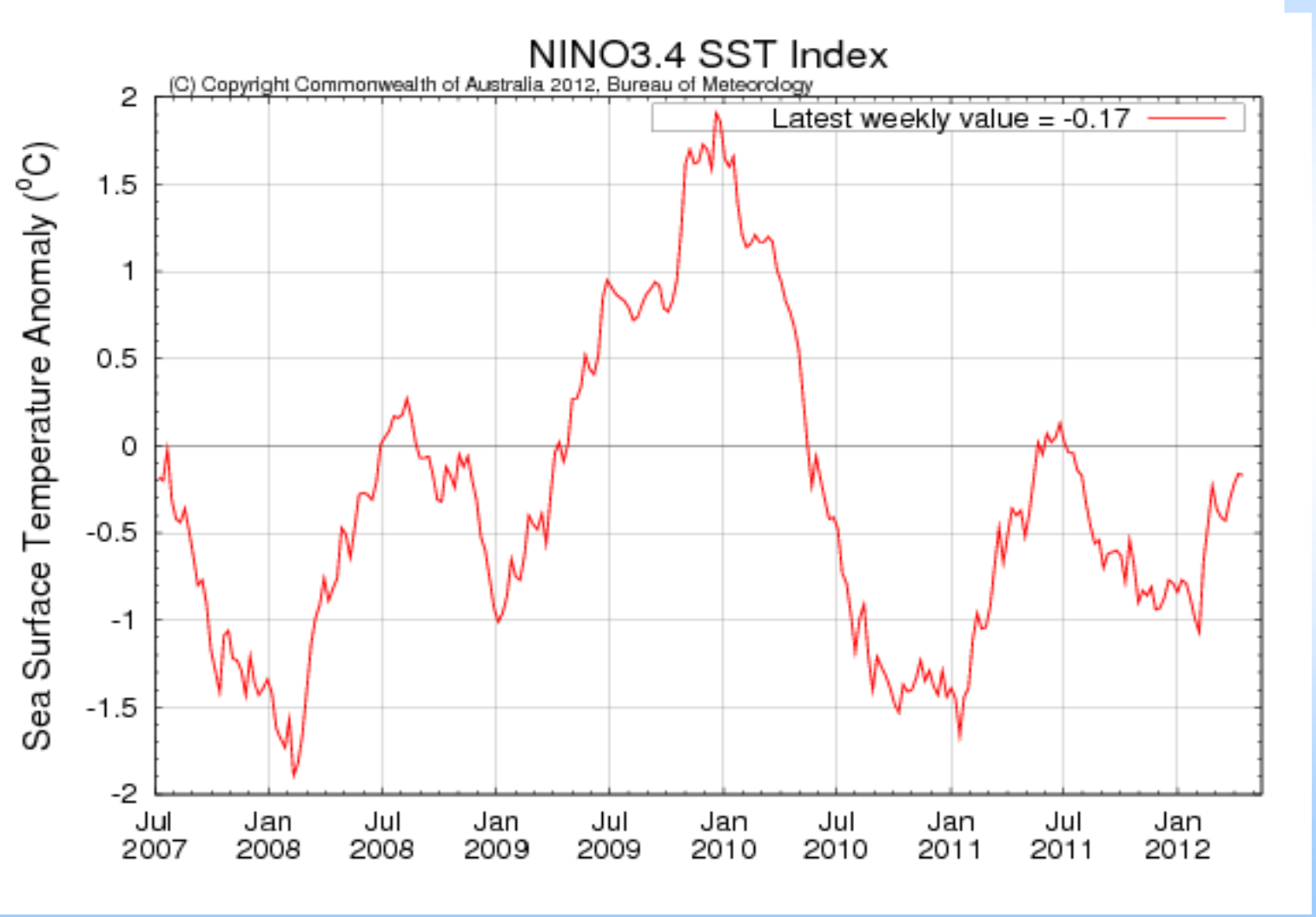
- Almost uniform onset across the entire region on October/November 2010.
- Spatial coverage of the drought enveloped the NM/TX/OK region.

A Strong Correlation Exists Between Sea Surface Temperatures in the Equatorial Central Pacific Ocean and Precipitation in NM, OK, TX

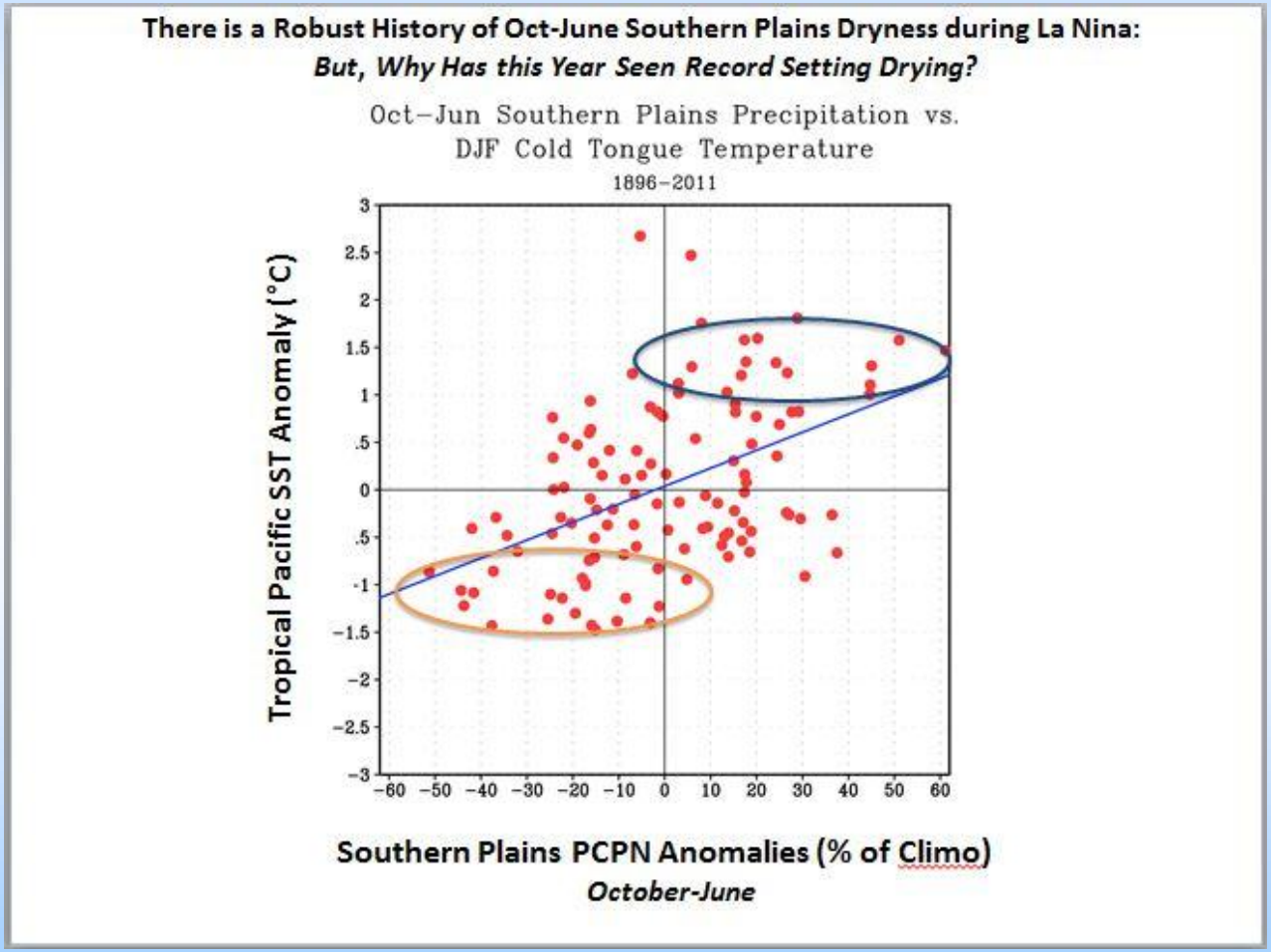




Sea Surface Temperature Anomalies in the Nino 3.4 Region over the past 5 years

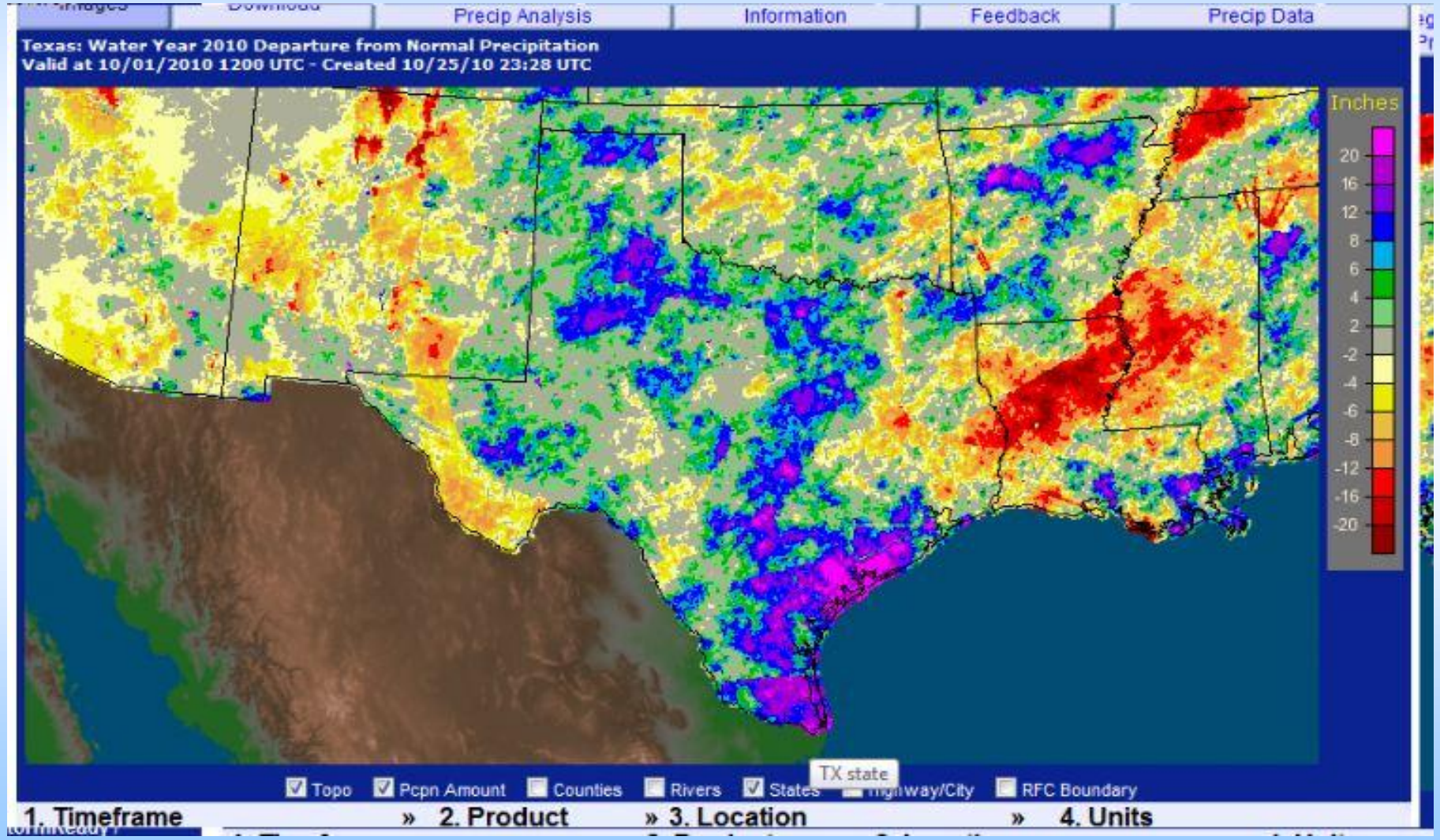


Scatter Plots Show Strong ENSO Correlation for Southern Plains

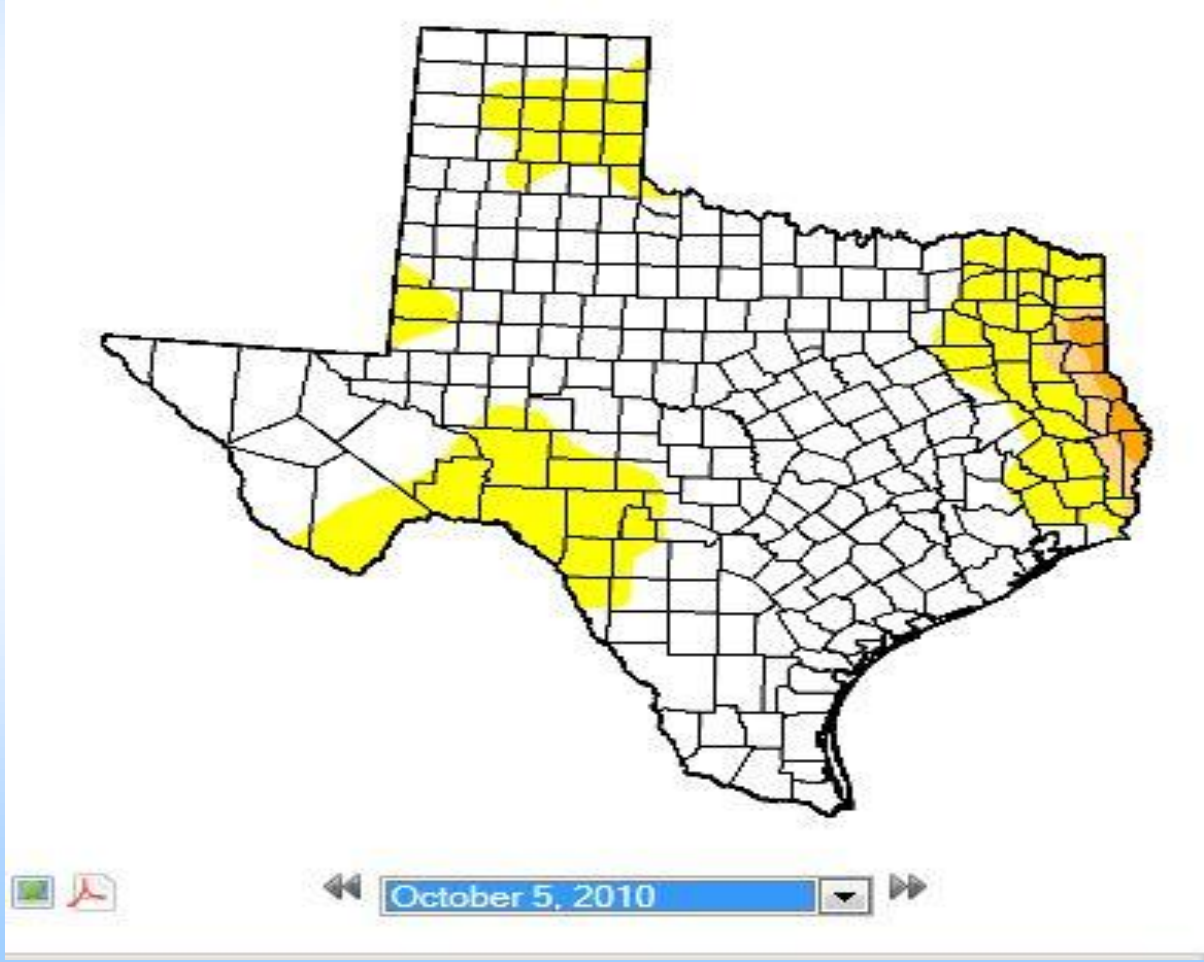


Data Courtesy of Marty Hoerling, NOAA ESRL

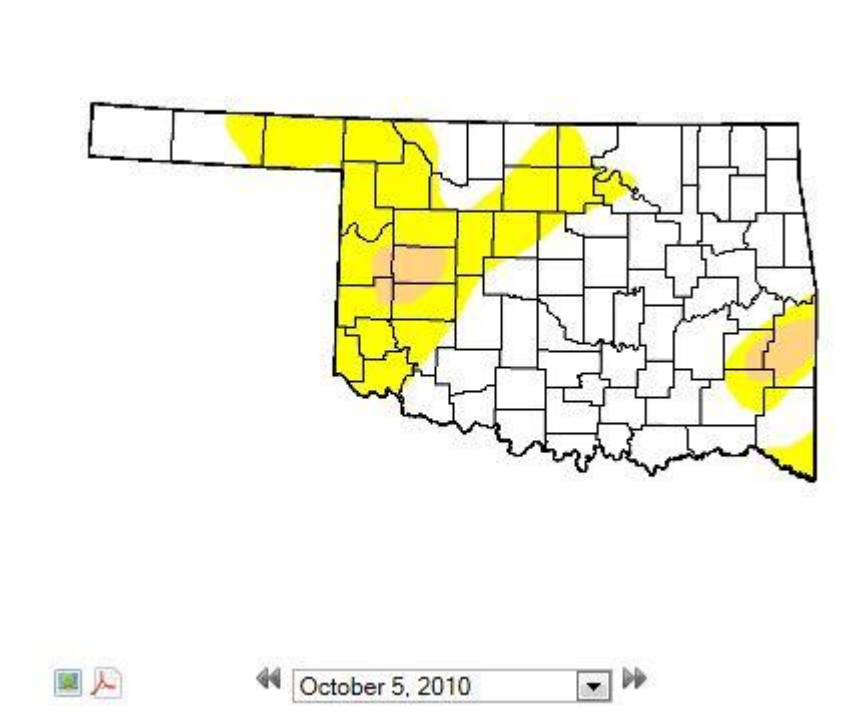
Precipitation Departure from Normal. 1/1/10-10/25/10.



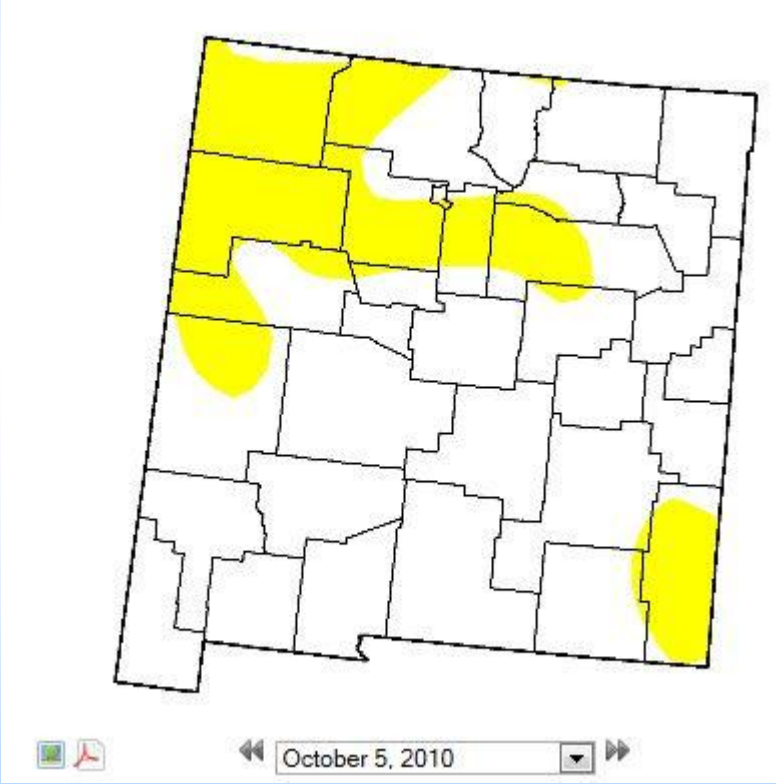
Only 2% of TX in Drought on October 5, 2010.



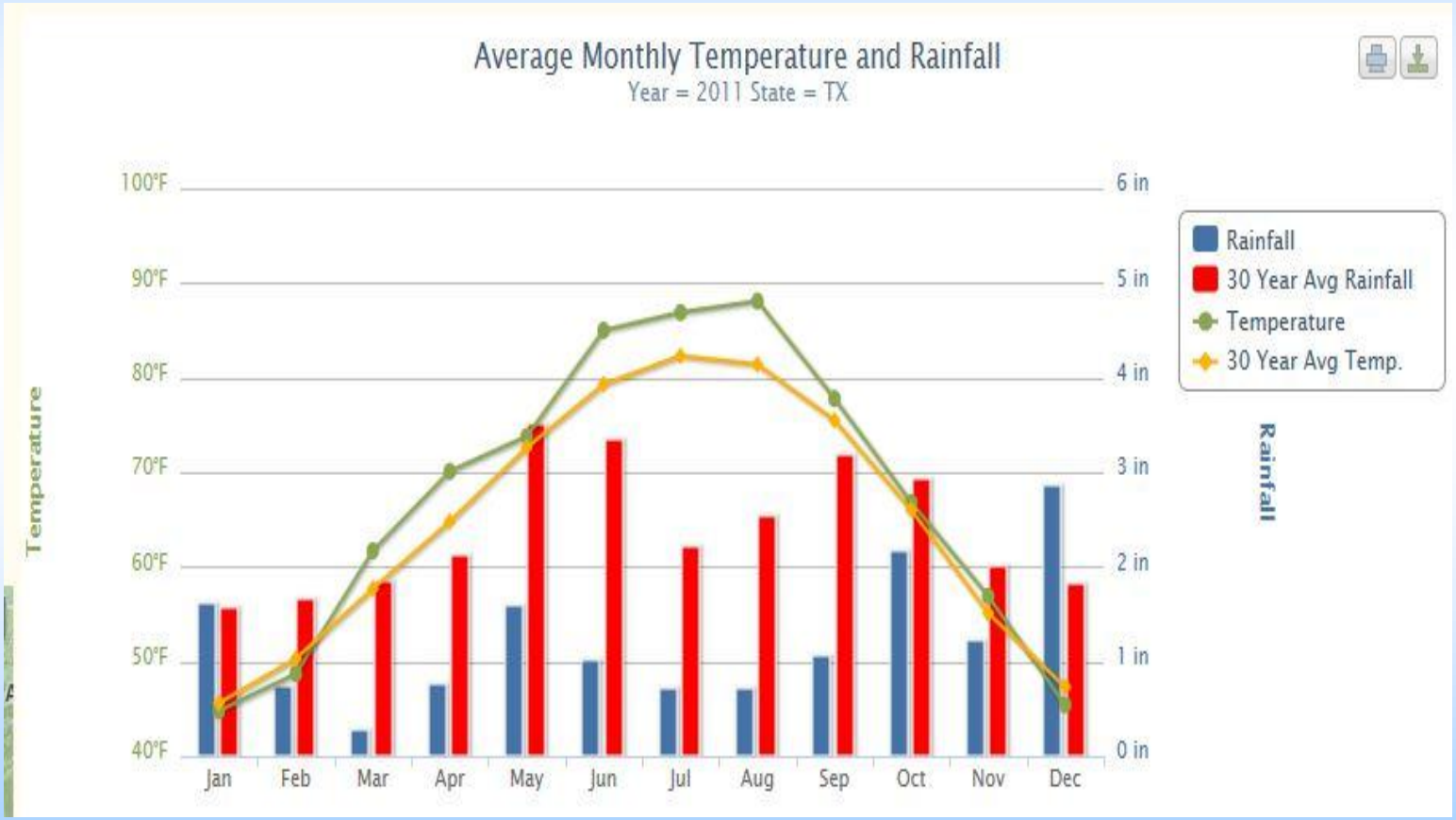
Only 4% of OK in Drought on 10/5/10



0% of NM in Drought on 10/5/10



7 Consecutive Months (Mar-Sept) in TX with each month having the Bottom 10 Driest Precip

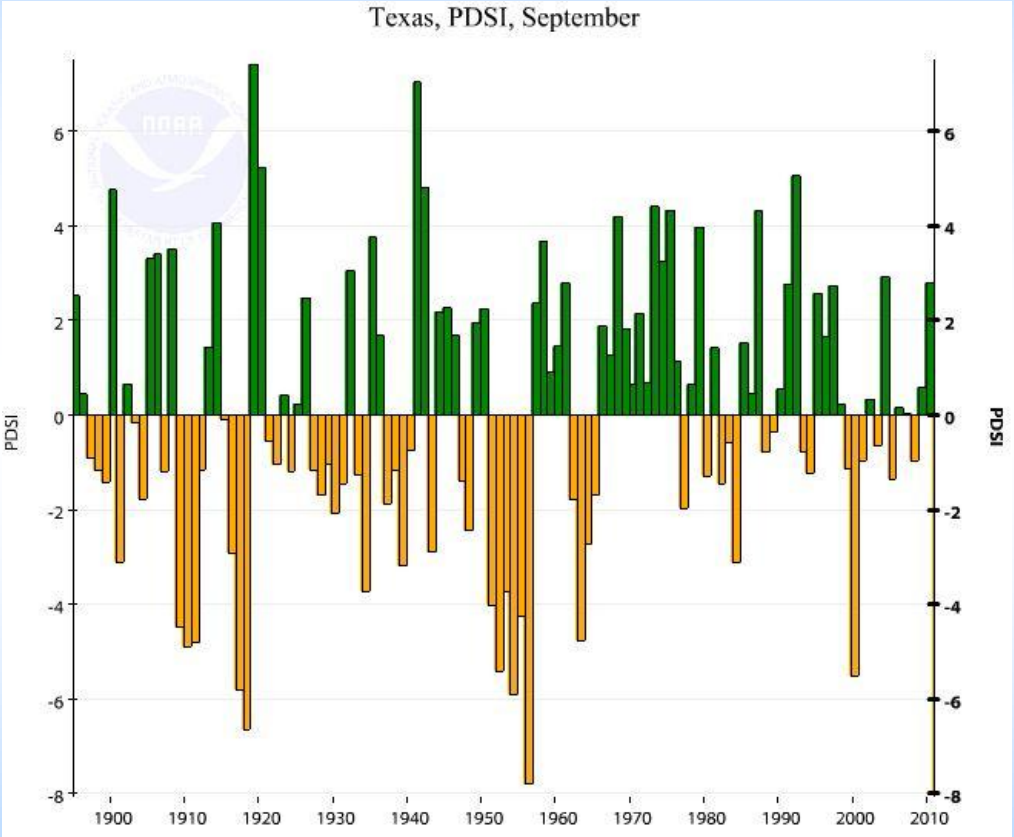


Graph Courtesy of SCIPP

At the End of September 2011, all time frames from 4 months to 12 months were the driest ever.

Period	Amount	20th Century Average	Departure	Rank	Wettest/Driest Since	Record Year
Sep 2011 1-month period	1.08" (27.43 mm)	2.97" (75.44 mm)	-1.89" (-48.01 mm)	7th Driest 111st Wettest	Driest since: 1956 Wettest since: 2010	Driest: 1931 Wettest: 1936
Aug - Sep 2011 2-month period	1.80" (45.72 mm)	5.28" (134.11 mm)	-3.48" (-88.39 mm)	3rd Driest 115th Wettest	Driest since: 2000 Wettest since: 2010	Driest: 2000 Wettest: 1974
Jul - Sep 2011 3-month period	2.53" (64.26 mm)	7.61" (193.29 mm)	-5.08" (-129.03 mm)	2nd Driest 116th Wettest	Driest since: 2000 Wettest since: 2010	Driest: 2000 Wettest: 1900
Jun - Sep 2011 4-month period	3.56" (90.42 mm)	10.55" (267.97 mm)	-6.99" (-177.55 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1919
May - Sep 2011 5-month period	5.16" (131.06 mm)	14.06" (357.12 mm)	-8.90" (-226.06 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1919
Apr - Sep 2011 6-month period	5.93" (150.62 mm)	16.52" (419.61 mm)	-10.59" (-268.99 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1900
Mar - Sep 2011 7-month period	6.22" (157.99 mm)	18.26" (463.80 mm)	-12.04" (-305.81 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1900
Feb - Sep 2011 8-month period	6.96" (176.78 mm)	19.94" (506.48 mm)	-12.98" (-329.70 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Jan - Sep 2011 9-month period	8.59" (218.19 mm)	21.49" (545.85 mm)	-12.90" (-327.66 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 2007
Dec 2010 - Sep 2011 10-month period	9.33" (236.98 mm)	23.38" (593.85 mm)	-14.05" (-356.87 mm)	1st Driest 116th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 2007
Nov 2010 - Sep 2011 11-month period	10.36" (263.14 mm)	25.25" (641.35 mm)	-14.89" (-378.21 mm)	1st Driest 116th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Oct 2010 - Sep 2011 12-month period	11.18" (283.97 mm)	27.87" (707.90 mm)	-16.69" (-423.93 mm)	1st Driest 116th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Apr 2010 - Sep 2011 18-month period	30.18" (766.57 mm)	44.52" (1,130.81 mm)	-14.34" (765.57 mm)	3rd Driest 114th Wettest	Driest since: 1956 Wettest since: 2010	Driest: 1918 Wettest: 1941

Drought of 2010/2011 the Most Intense on Record as Measured by the PDSI.



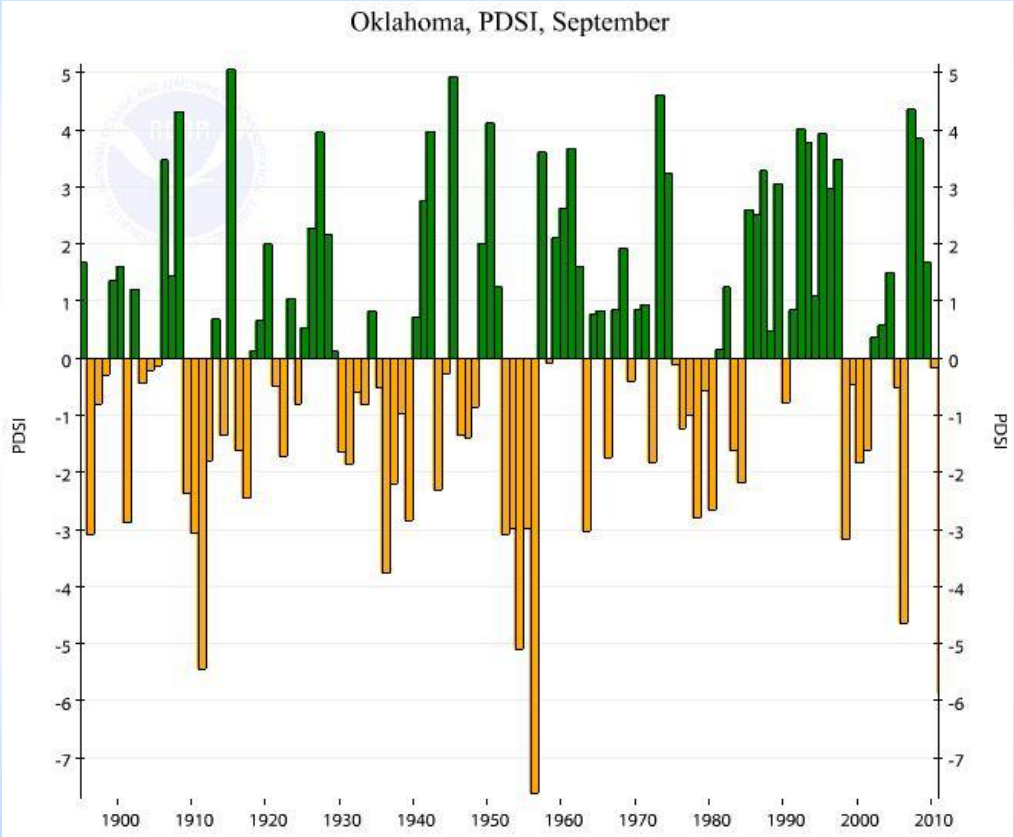
0	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
.51	-0.97	0.34	-0.65	2.92	-1.36	0.15	0.03	-0.97	0.58	2.79	-7.97

PDSI of -7.97 the lowest on record, eclipsing -7.80 in 9/56.

Oklahoma at the end of September 2011 was not OK

Period	Amount	20th Century Average	Departure	Rank	Wettest/Driest Since	Record Year
Sep 2011 1-month period	1.52" (38.61 mm)	3.41" (86.61 mm)	-1.89" (-48.00 mm)	19th Driest 98th Wettest Ties: 1901	Driest since: 2004 Wettest since: 2010	Driest: 1956 Wettest: 1945
Aug - Sep 2011 2-month period	3.83" (97.28 mm)	6.25" (158.75 mm)	-2.42" (-61.47 mm)	19th Driest 99th Wettest	Driest since: 2000 Wettest since: 2010	Driest: 2000 Wettest: 1974
Jul - Sep 2011 3-month period	4.54" (115.32 mm)	9.10" (231.14 mm)	-4.56" (-115.82 mm)	6th Driest 111st Wettest Ties: 1900	Driest since: 2000 Wettest since: 2010	Driest: 1954 Wettest: 1996
Jun - Sep 2011 4-month period	5.67" (144.02 mm)	13.14" (333.76 mm)	-7.47" (-189.74 mm)	2nd Driest 116th Wettest	Driest since: 1954 Wettest since: 2010	Driest: 1954 Wettest: 1945
May - Sep 2011 5-month period	9.74" (247.40 mm)	18.04" (458.22 mm)	-8.30" (-210.82 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 2007
Apr - Sep 2011 6-month period	13.07" (331.98 mm)	21.44" (544.58 mm)	-8.37" (-212.60 mm)	2nd Driest 116th Wettest	Driest since: 1956 Wettest since: 2010	Driest: 1956 Wettest: 1957
Mar - Sep 2011 7-month period	13.78" (350.01 mm)	23.92" (607.57 mm)	-10.14" (-257.56 mm)	2nd Driest 116th Wettest	Driest since: 1956 Wettest since: 2010	Driest: 1956 Wettest: 1957
Feb - Sep 2011 8-month period	15.24" (387.10 mm)	25.56" (649.22 mm)	-10.32" (-262.12 mm)	2nd Driest 116th Wettest	Driest since: 1956 Wettest since: 2010	Driest: 1956 Wettest: 1957
Jan - Sep 2011 9-month period	15.59" (395.99 mm)	27.01" (686.05 mm)	-11.42" (-290.06 mm)	2nd Driest 116th Wettest	Driest since: 1956 Wettest since: 2010	Driest: 1956 Wettest: 1957
Dec 2010 - Sep 2011 10-month period	16.46" (418.08 mm)	28.73" (729.74 mm)	-12.27" (-311.66 mm)	2nd Driest 115th Wettest	Driest since: 1956 Wettest since: 2010	Driest: 1956 Wettest: 1957
Nov 2010 - Sep 2011 11-month period	18.33" (465.58 mm)	30.93" (785.62 mm)	-12.60" (-320.04 mm)	2nd Driest 115th Wettest	Driest since: 1956 Wettest since: 2010	Driest: 1956 Wettest: 2007
Oct 2010 - Sep 2011 12-month period	20.05" (509.27 mm)	33.95" (862.33 mm)	-13.90" (-353.06 mm)	2nd Driest 115th Wettest	Driest since: 1956 Wettest since: 2010	Driest: 1956 Wettest: 1973

2nd Most Intense Drought on Record for OK at the end of September 2011



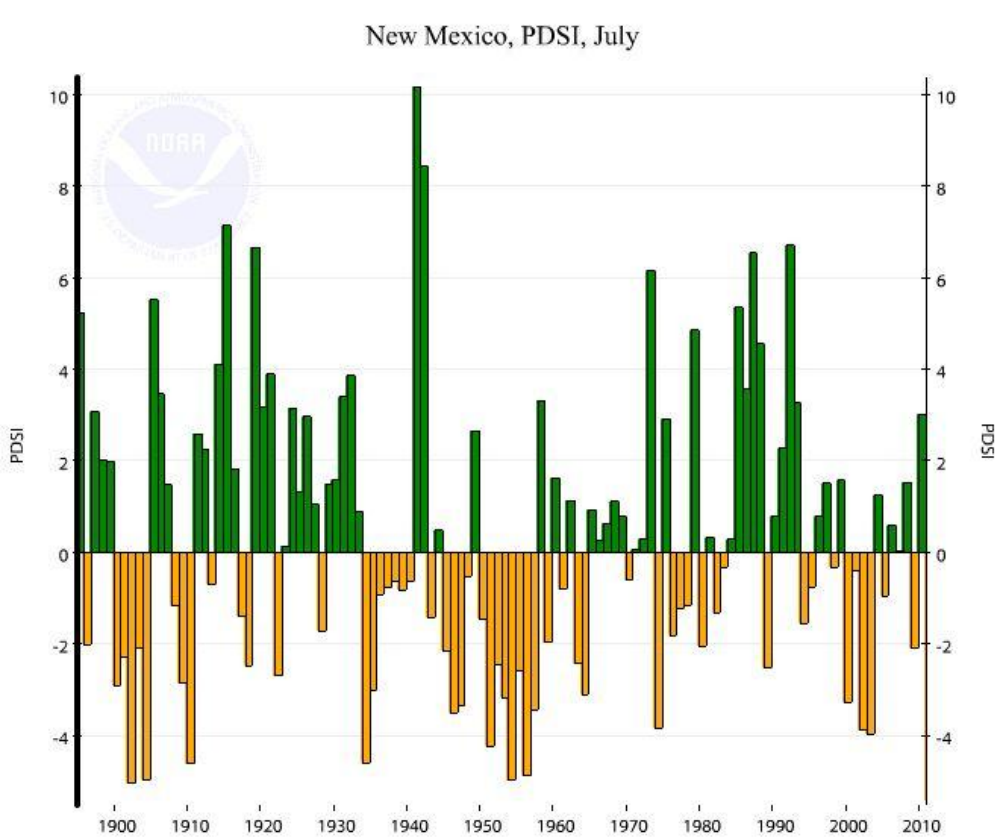
0	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
.84	-1.62	0.36	0.57	1.50	-0.51	-4.64	4.35	3.84	1.68	-0.18	-5.86

-5.86 PDSI second only to -7.5 in 1956.

New Mexico at the end of July 2011

Period	Amount	20th Century Average	Departure	Rank	Wettest/Driest Since	Record Year
Jul 2011 1-month period	1.44" (36.58 mm)	2.43" (61.72 mm)	-0.99" (-25.14 mm)	14th Driest 104th Wettest	Driest since: 2005 Wettest since: 2010	Driest: 2003 Wettest: 1914
Jun - Jul 2011 2-month period	1.61" (40.89 mm)	3.56" (90.42 mm)	-1.95" (-49.53 mm)	3rd Driest 115th Wettest	Driest since: 2005 Wettest since: 2010	Driest: 1980 Wettest: 1921
May - Jul 2011 3-month period	1.86" (47.24 mm)	4.56" (115.82 mm)	-2.70" (-68.58 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1921
Apr - Jul 2011 4-month period	2.17" (55.12 mm)	5.26" (133.60 mm)	-3.09" (-78.48 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Mar - Jul 2011 5-month period	2.32" (58.93 mm)	5.95" (151.13 mm)	-3.63" (-92.20 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Feb - Jul 2011 6-month period	2.67" (67.82 mm)	6.51" (165.35 mm)	-3.84" (-97.53 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Jan - Jul 2011 7-month period	2.75" (69.85 mm)	7.11" (180.59 mm)	-4.36" (-110.74 mm)	1st Driest 117th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Dec 2010 - Jul 2011 8-month period	3.54" (89.92 mm)	7.80" (198.12 mm)	-4.26" (-108.20 mm)	1st Driest 116th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Nov 2010 - Jul 2011 9-month period	3.63" (92.20 mm)	8.39" (213.11 mm)	-4.76" (-120.91 mm)	1st Driest 116th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Oct 2010 - Jul 2011 10-month period	4.43" (112.52 mm)	9.54" (242.32 mm)	-5.11" (-129.80 mm)	1st Driest 116th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Sep 2010 - Jul 2011 11-month period	5.91" (150.11 mm)	11.13" (282.70 mm)	-5.22" (-132.59 mm)	1st Driest 116th Wettest	Driest to Date Wettest since: 2010	Driest: 2011 Wettest: 1941
Aug 2010 - Jul 2011 12-month period	8.15" (207.01 mm)	13.51" (343.15 mm)	-5.36" (-136.14 mm)	3rd Driest 114th Wettest	Driest since: 1974 Wettest since: 2010	Driest: 1974 Wettest: 1941

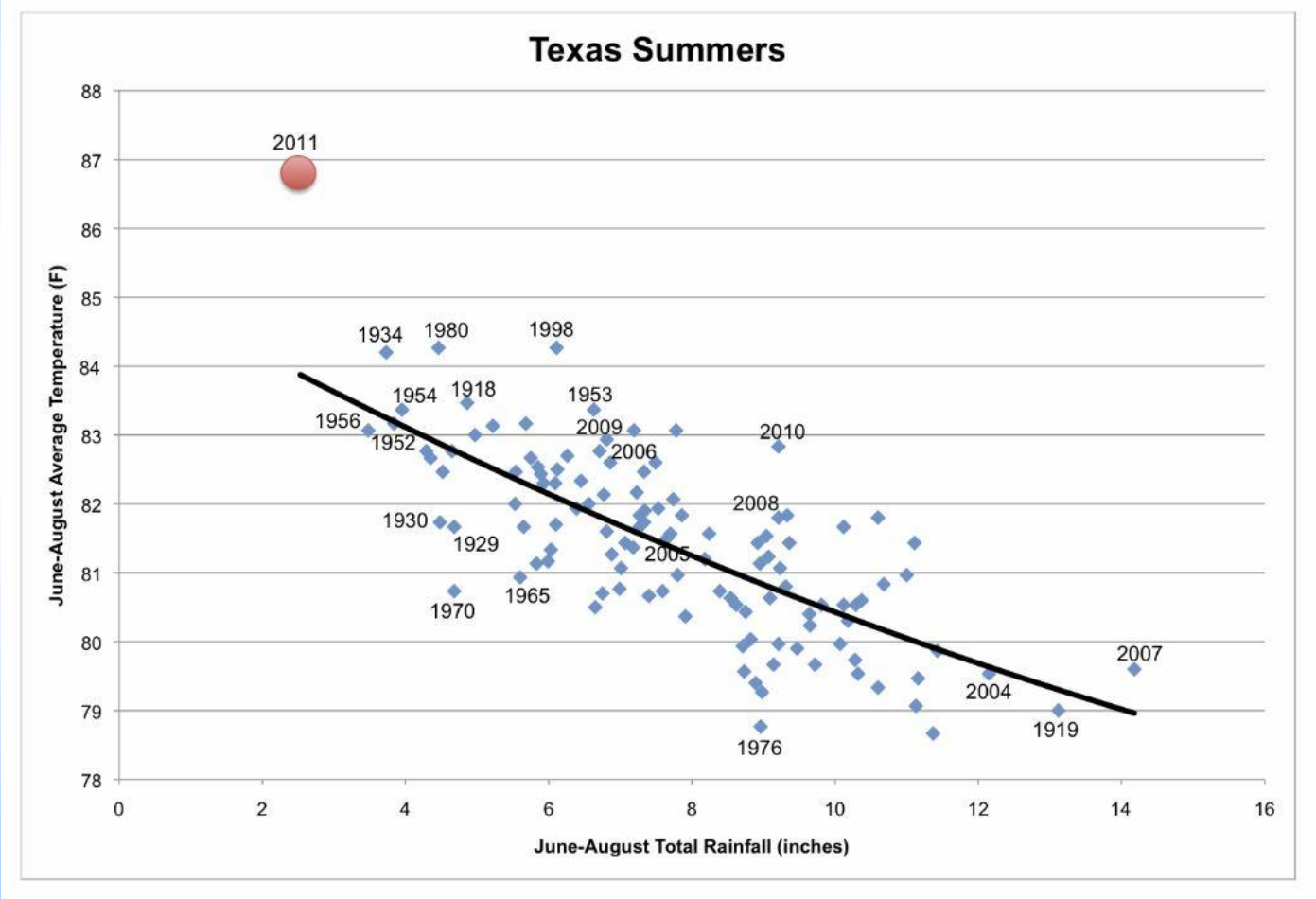
Most Intense 1 Year Drought on Record for NM at the end of July.



0	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
.28	-0.39	-3.88	-3.96	1.25	-0.95	0.59	0.02	1.53	-2.09	3.01	-5.42

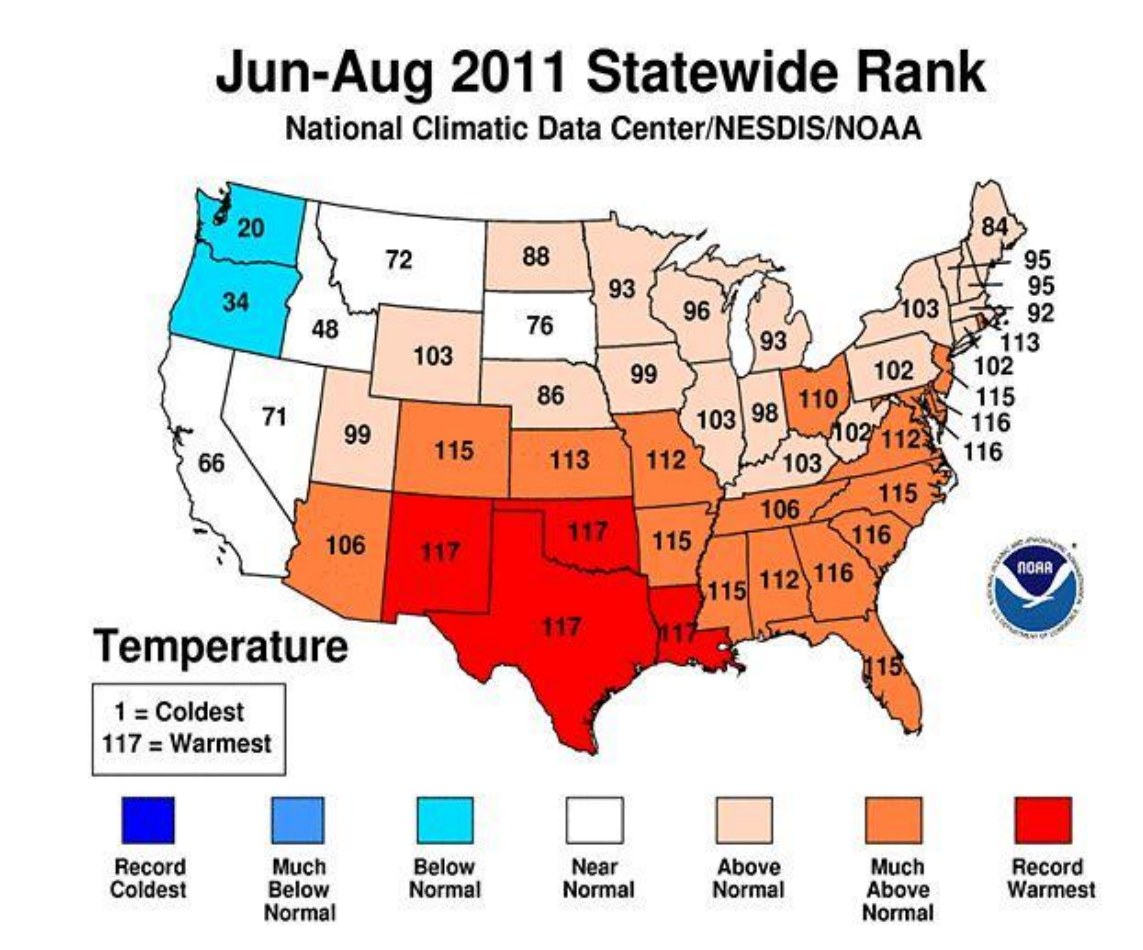
PDSI of -5.42 the lowest ever for end of July.

With the Drought Came the Summertime Heat. A Historically Unparalleled Combination



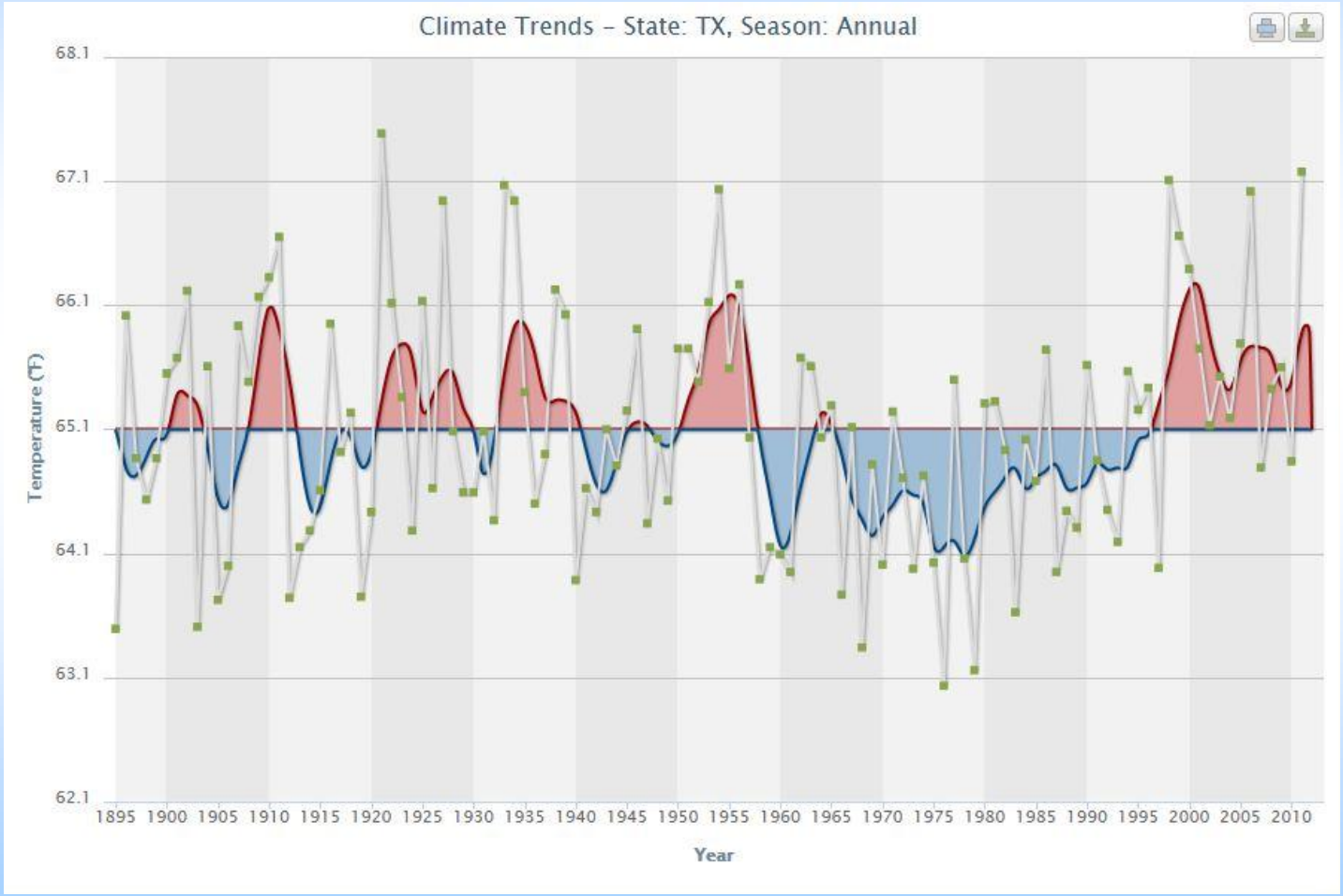
Graph Compiled by Prof. John Nielsen-Gammon.

Oklahoma, Texas, Louisiana, and New Mexico all had their Hottest Summers Ever on Record.

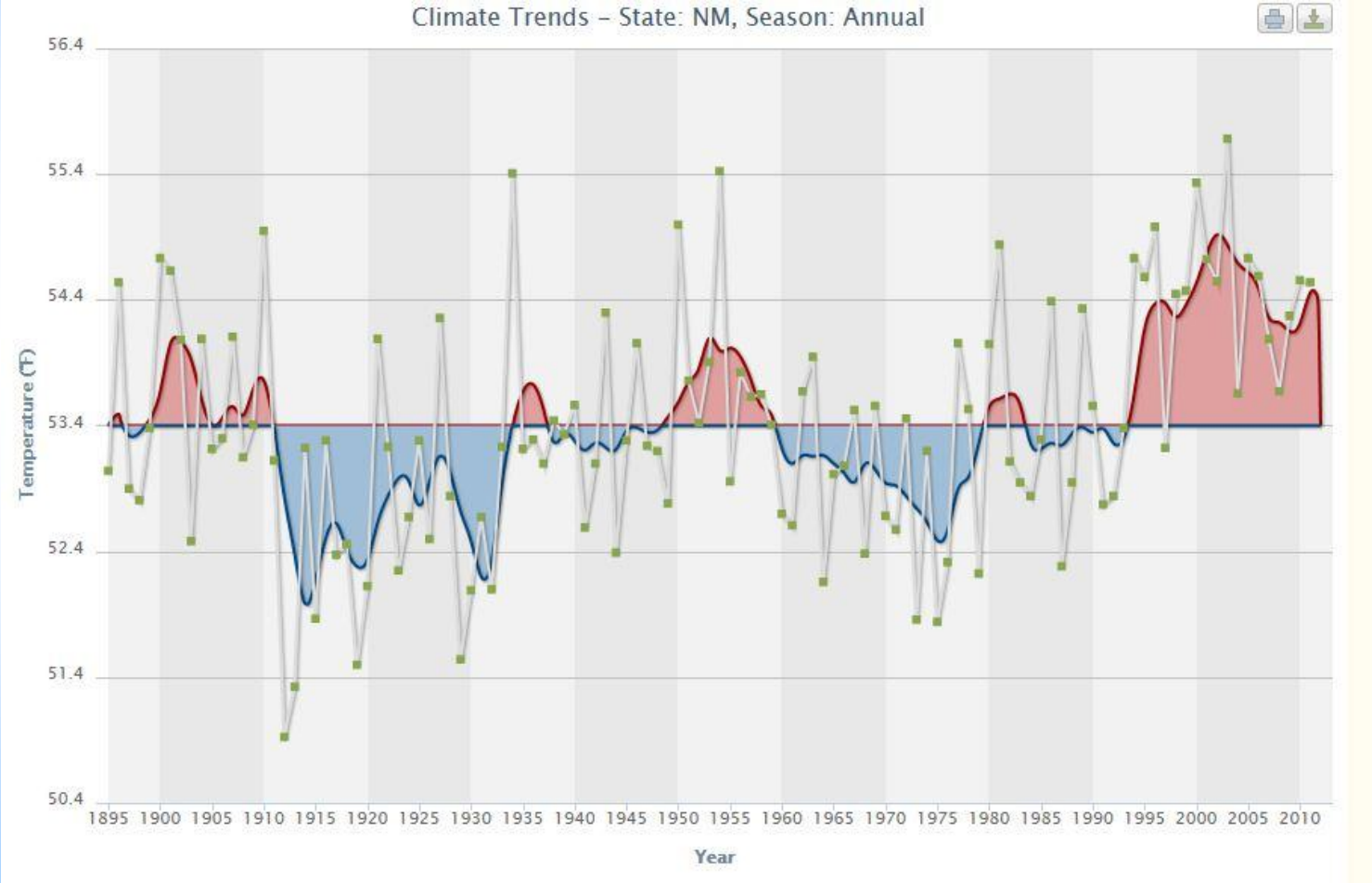


OK had #1 hottest summer ever since 1895 for US state, with TX having the #2 hottest summer ever and LA the #4 hottest summer ever.

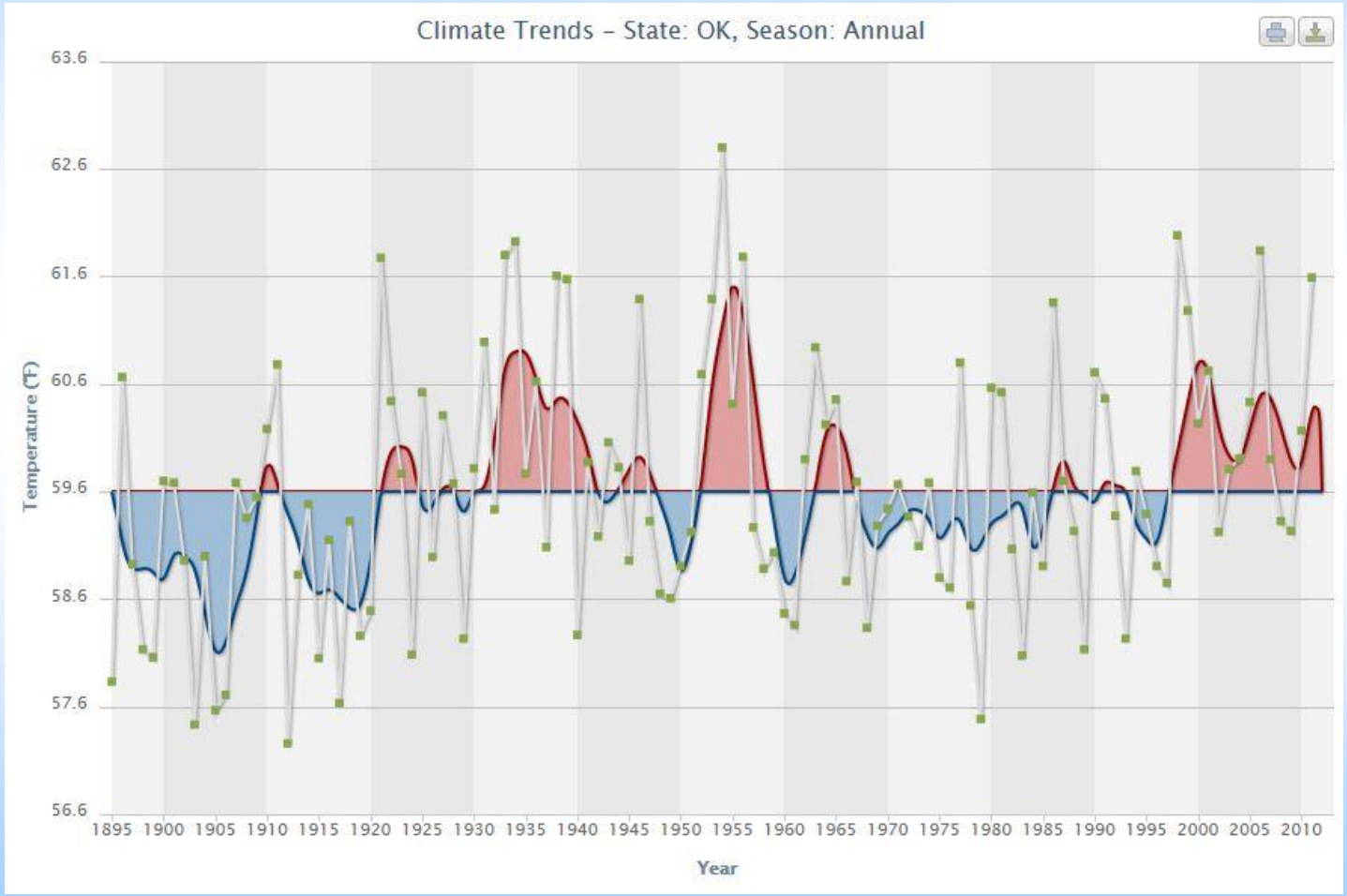
Yearly Observed Average Temperature in TX with a 5 year Rolling Average



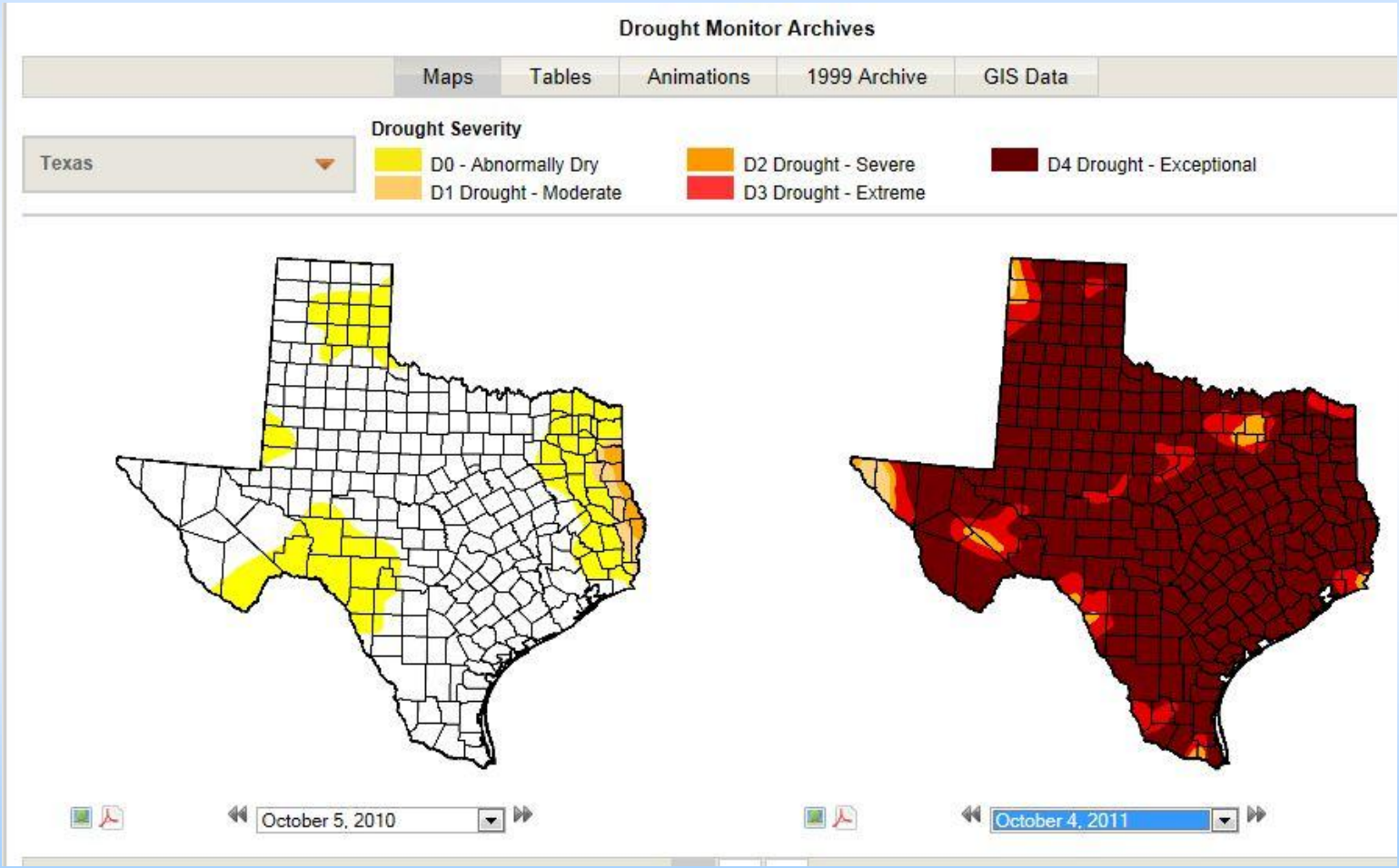
Yearly Observed Average Temperature in NM with a 5 year Rolling Average



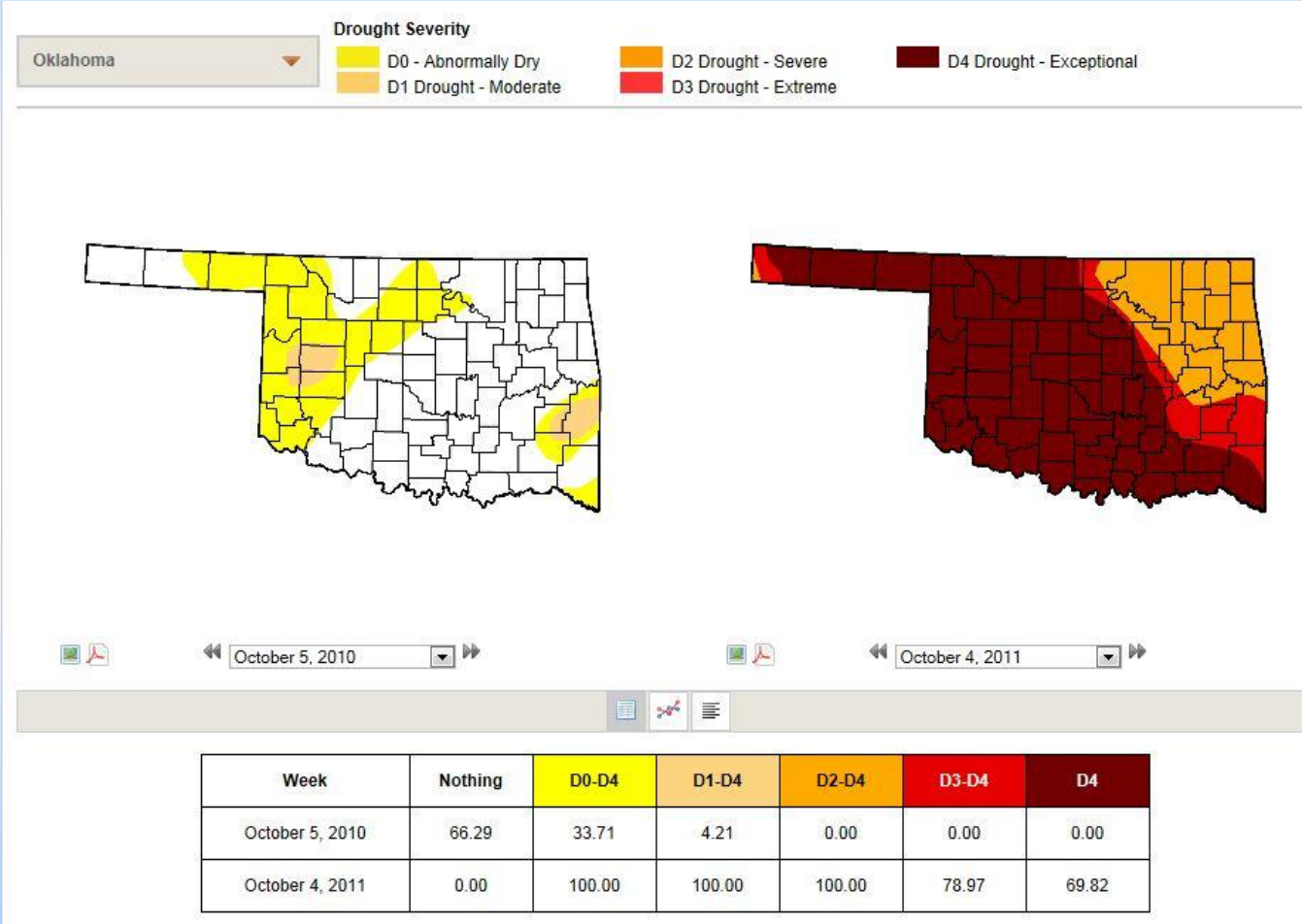
Yearly Observed Average Temperature in OK with a 5 year Rolling Average



88% of TX in Exceptional Drought (D4) status on 10/4/11.

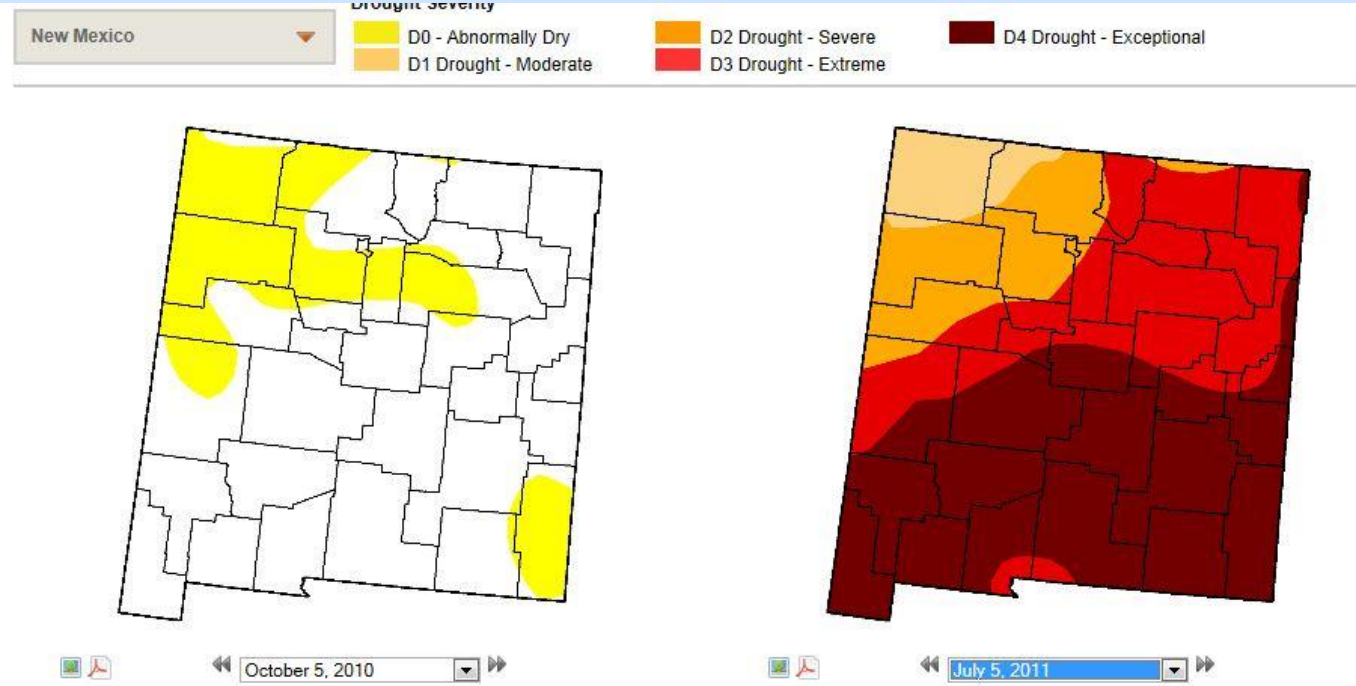


70% of Oklahoma in D4 status on 10/4/11



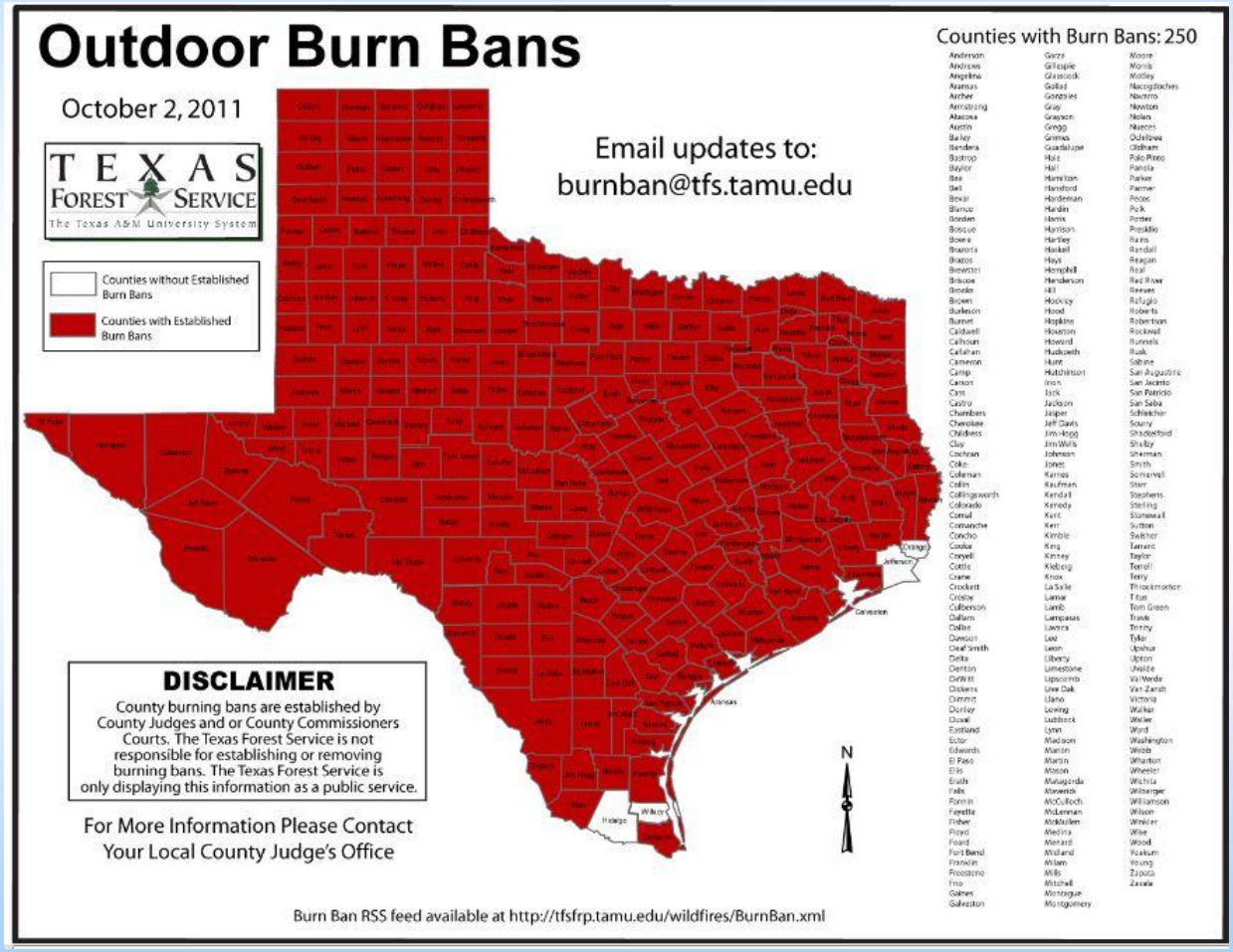
Week	Nothing	D0-D4	D1-D4	D2-D4	D3-D4	D4
October 5, 2010	66.29	33.71	4.21	0.00	0.00	0.00
October 4, 2011	0.00	100.00	100.00	100.00	78.97	69.82

49% of NM in D4 status on 7/5/11.



Week	Nothing	D0-D4	D1-D4	D2-D4	D3-D4	D4
October 5, 2010	76.66	23.34	0.00	0.00	0.00	0.00
July 5, 2011	0.00	100.00	100.00	93.96	79.34	49.09

At Peak of Drought in early October, 2011, Texas was a Sea of Red.



250 of 254 counties had burn bans in effect.

Texas Forest Service: "2011 was the worst year ever in TX for Wildfires."

- Over 4 million acres burned by wildfires in TX, or an area the size of Rhode Island and Connecticut combined.
- Over 2800 houses destroyed and over 2700 other structures destroyed.
- 10 fatalities.

Cumulative Acres Burned by Wildfire in TX.

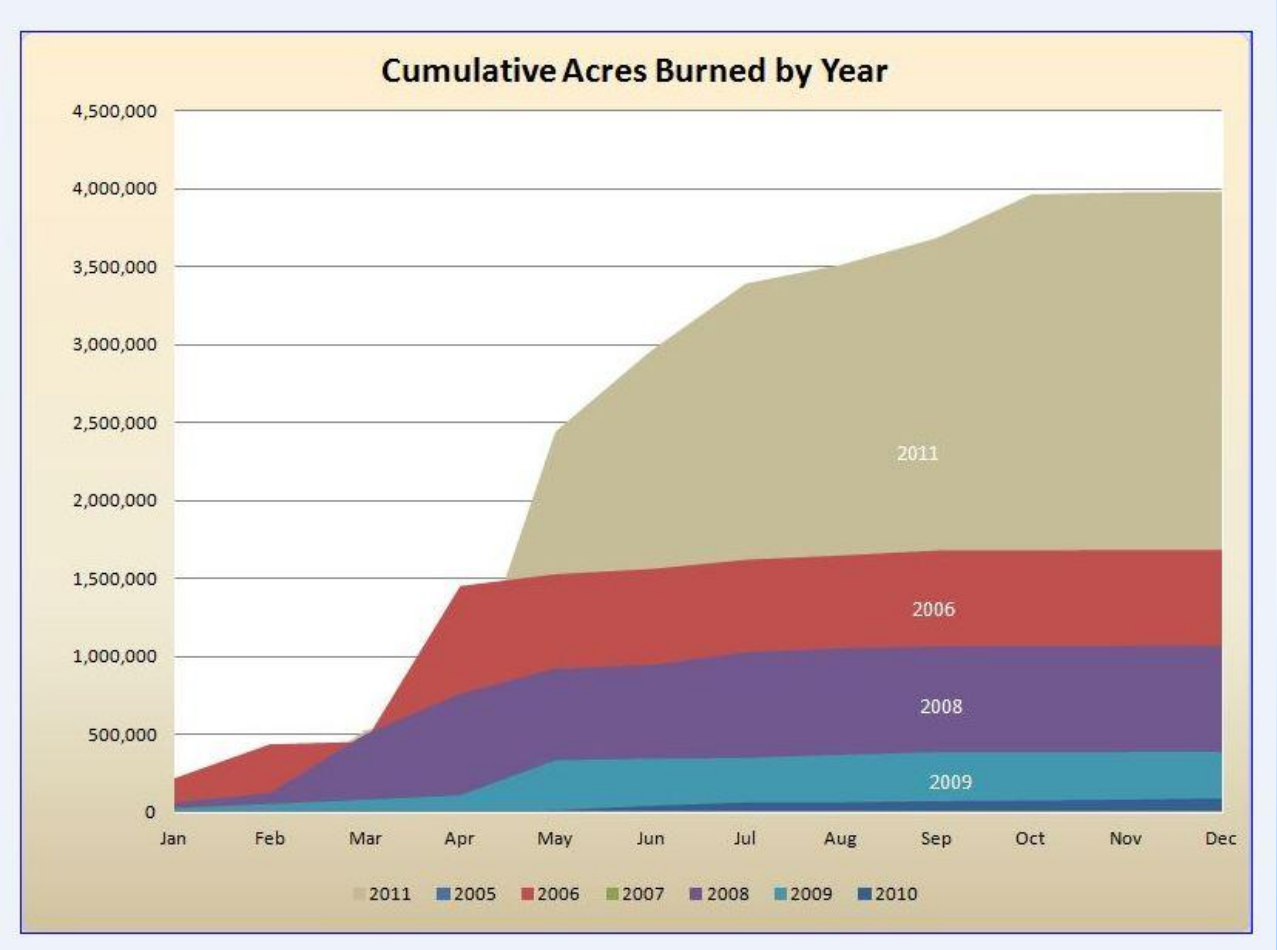
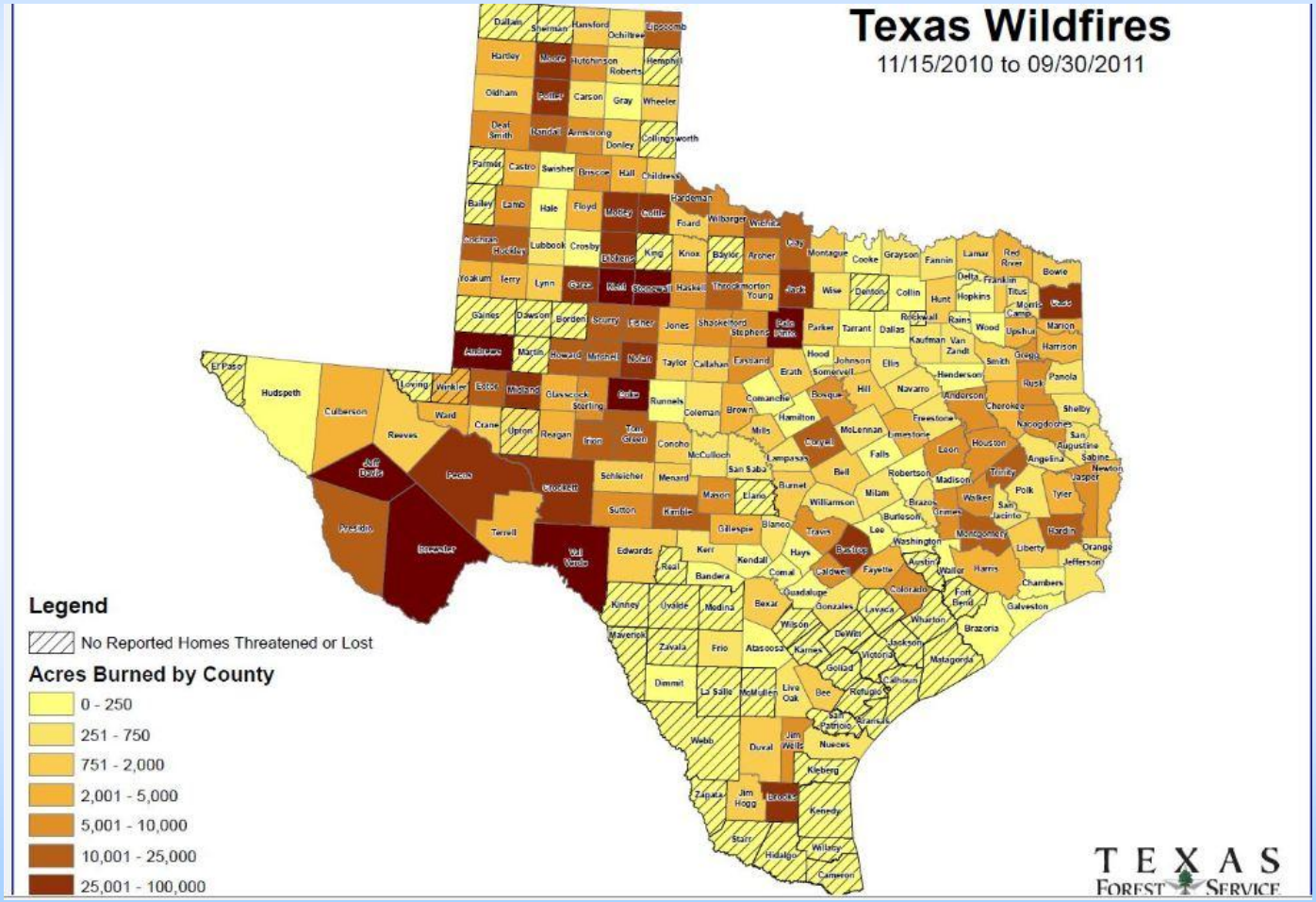


Image courtesy of Texas Forest Service

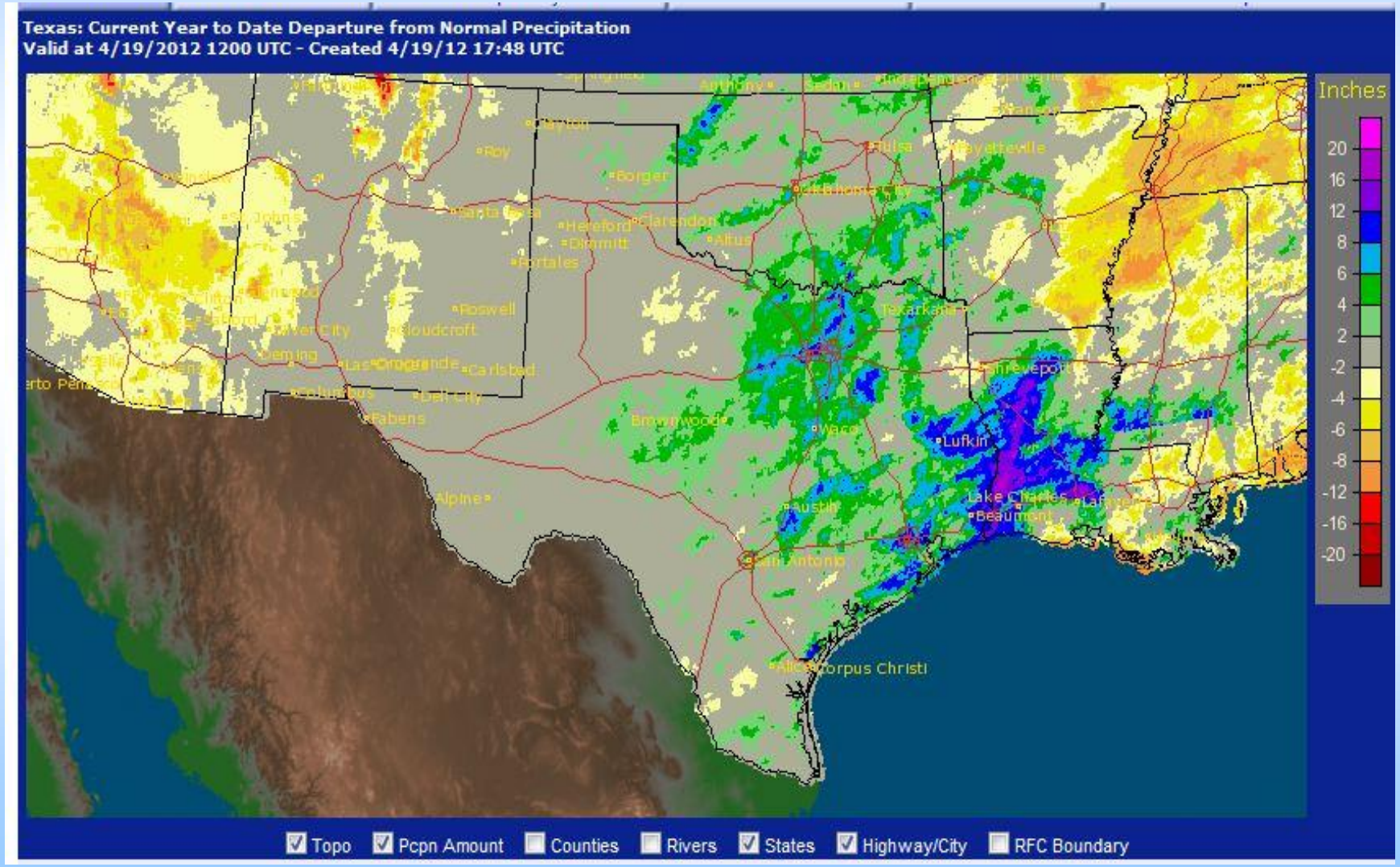
Drought and Wildfires were Indiscriminant in 2011.



Total Losses of Over $10 Billion in Texas Caused by Drought and Wildfires.

- March 2012 analysis by the Texas AgriLife Extension Service estimates livestock losses of $3.2B and crop losses of $4.4B, for a total loss of $7.6B
- Cotton the hardest hit with $2.2B
- Lost hay production next at $750M.
- Additional losses caused by wildfires pegged at an additional $5B in lost grazing land and destroyed structures.

Nearly all of TX, OK, and eastern NM has seen normal to above normal precipitation in 2012.



Considerable Improvement in the Past 6 Months, Despite the 2nd Round of La Nina, but…

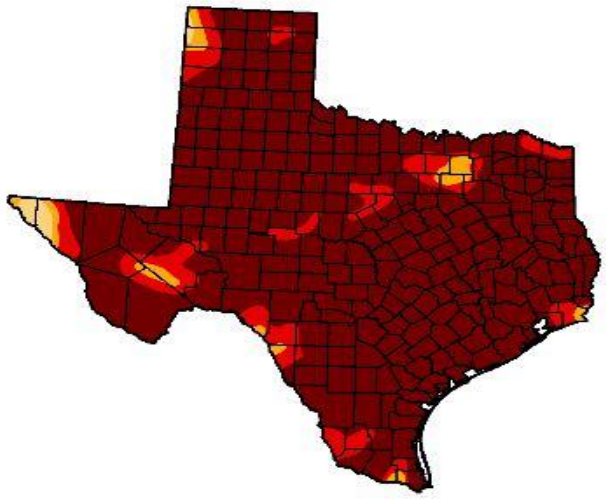
Drought Monitor Archives

Maps | Tables | Animations | 1999 Archive | GIS Data

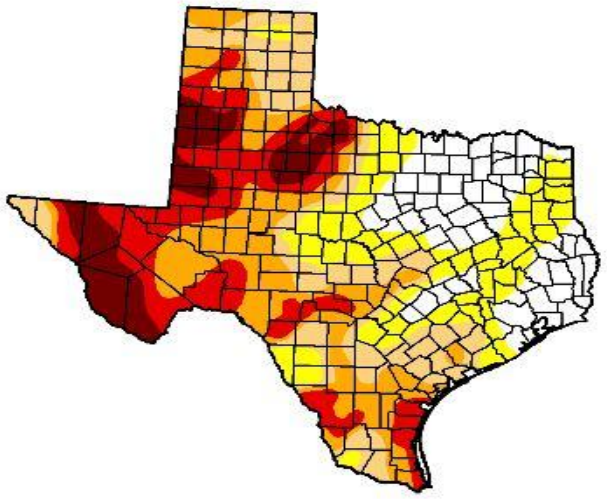
Texas

Drought Severity

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



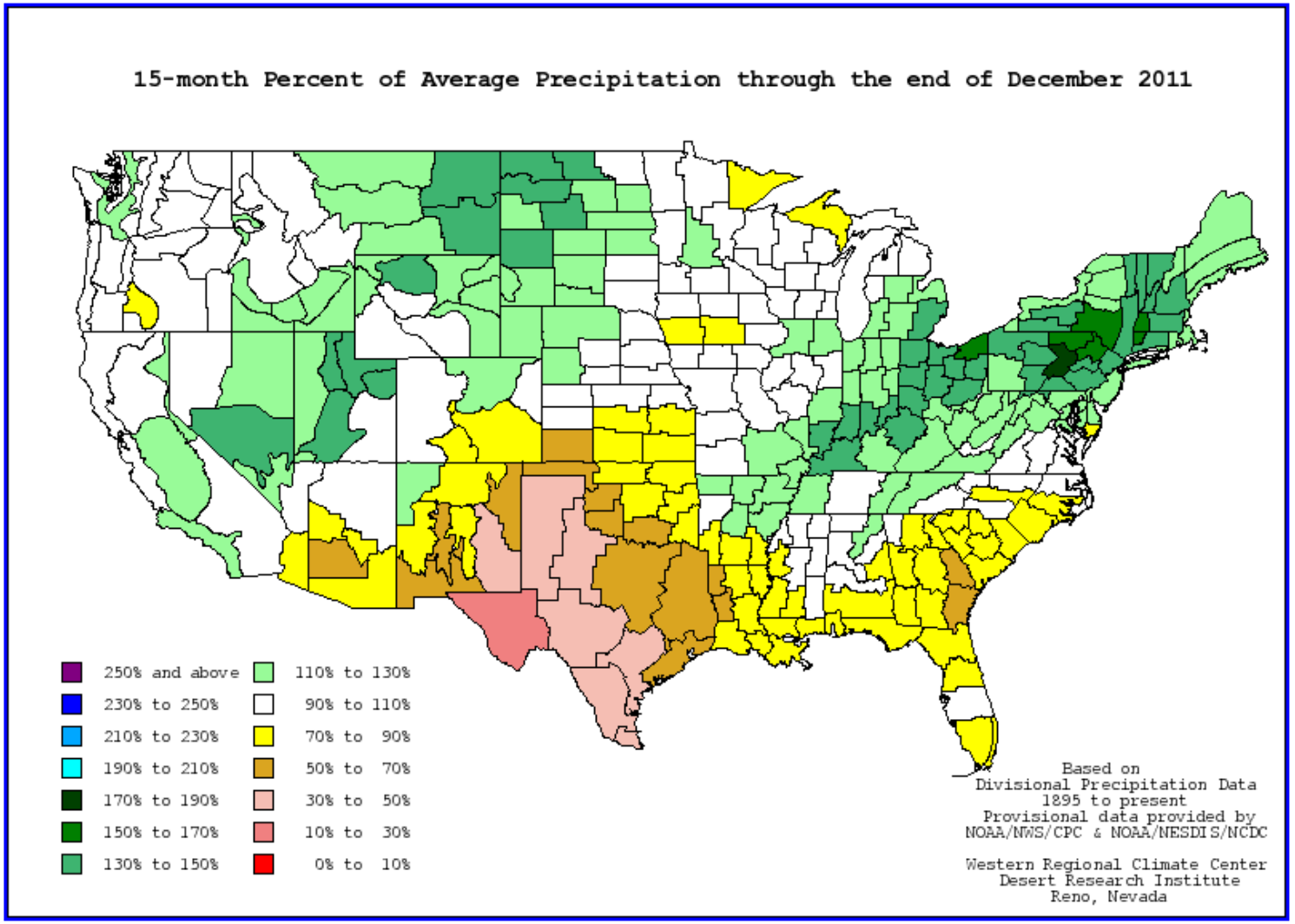
October 4, 2011



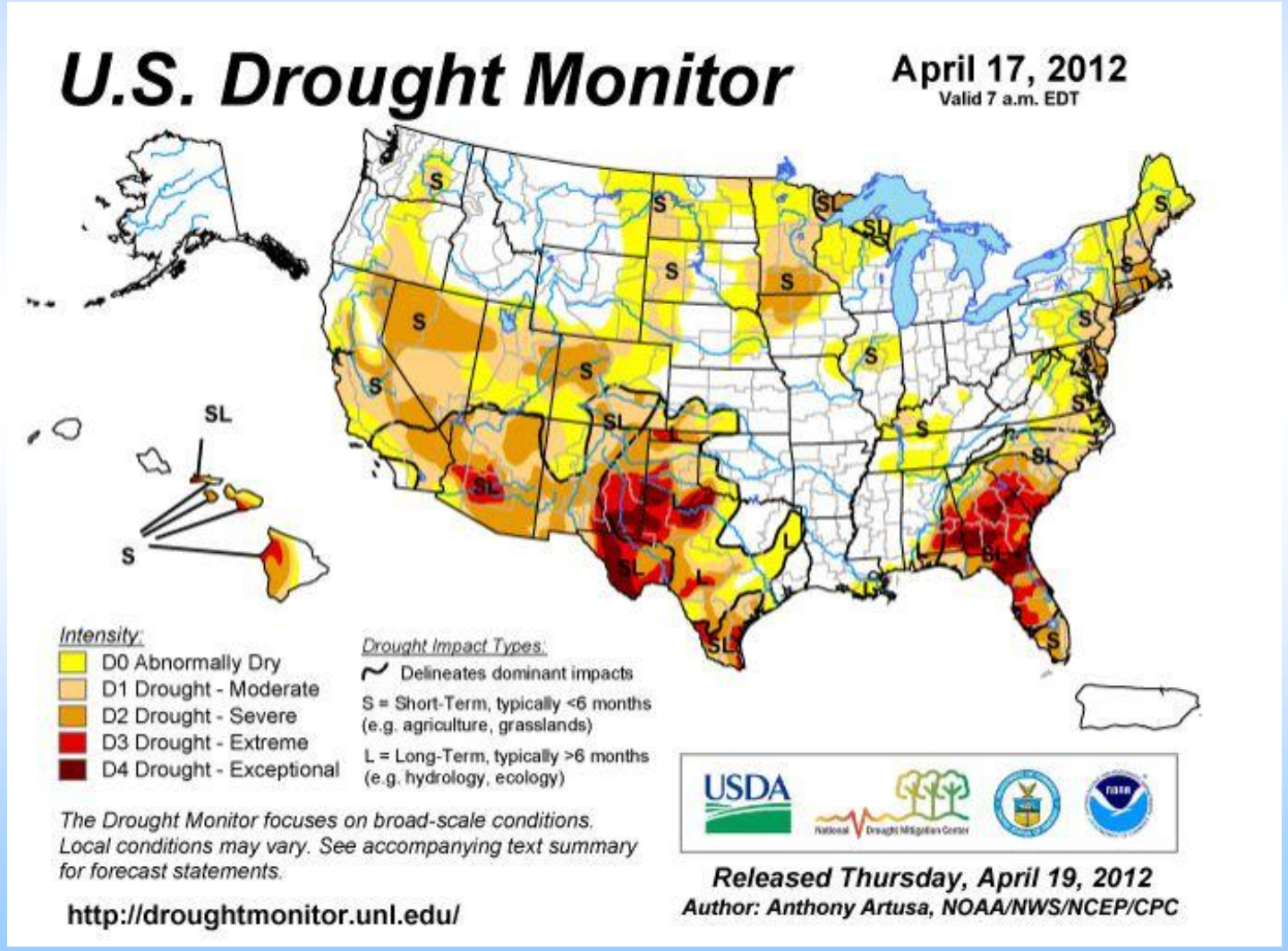
April 17, 2012

Week	Nothing	D0-D4	D1-D4	D2-D4	D3-D4	D4
October 4, 2011	0.00	100.00	100.00	99.16	96.99	87.99
April 17, 2012	18.19	81.81	63.82	46.70	26.80	9.64

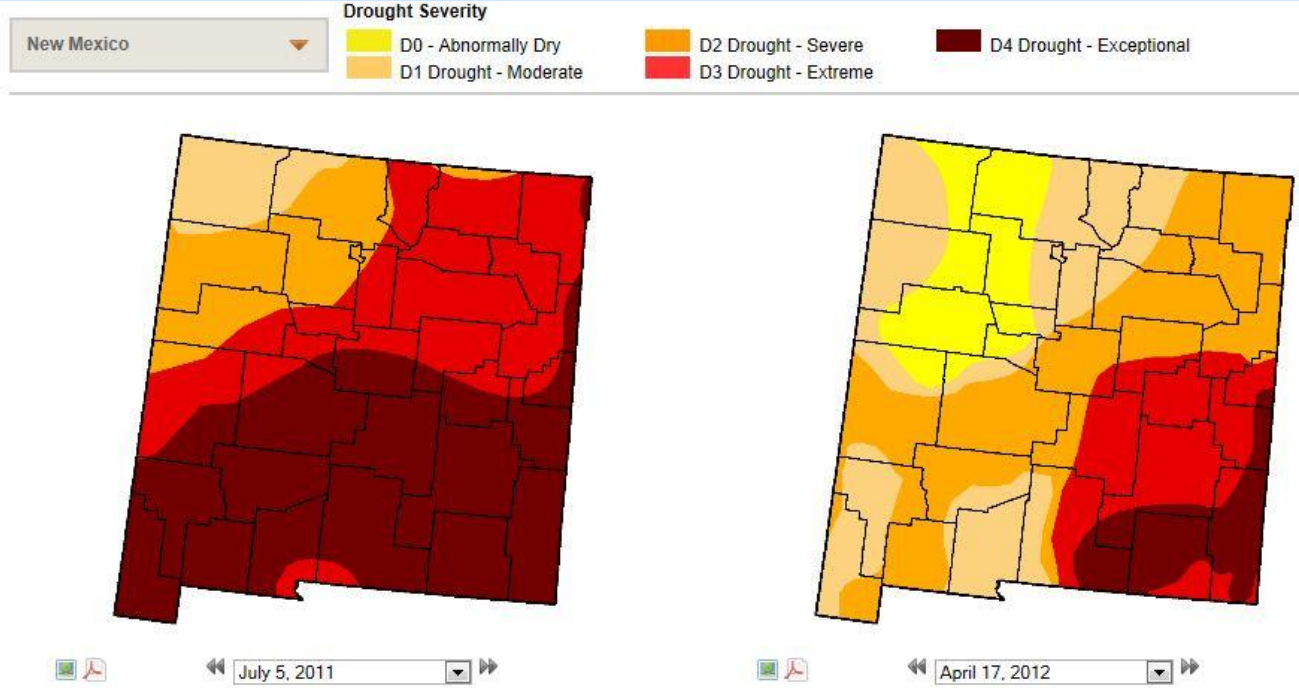
15 Month Percent of Avg. Precipitation Through December 2011. Far West TX below 30%.



Areas with most pronounced precipitation deficit have still not recovered from drought.

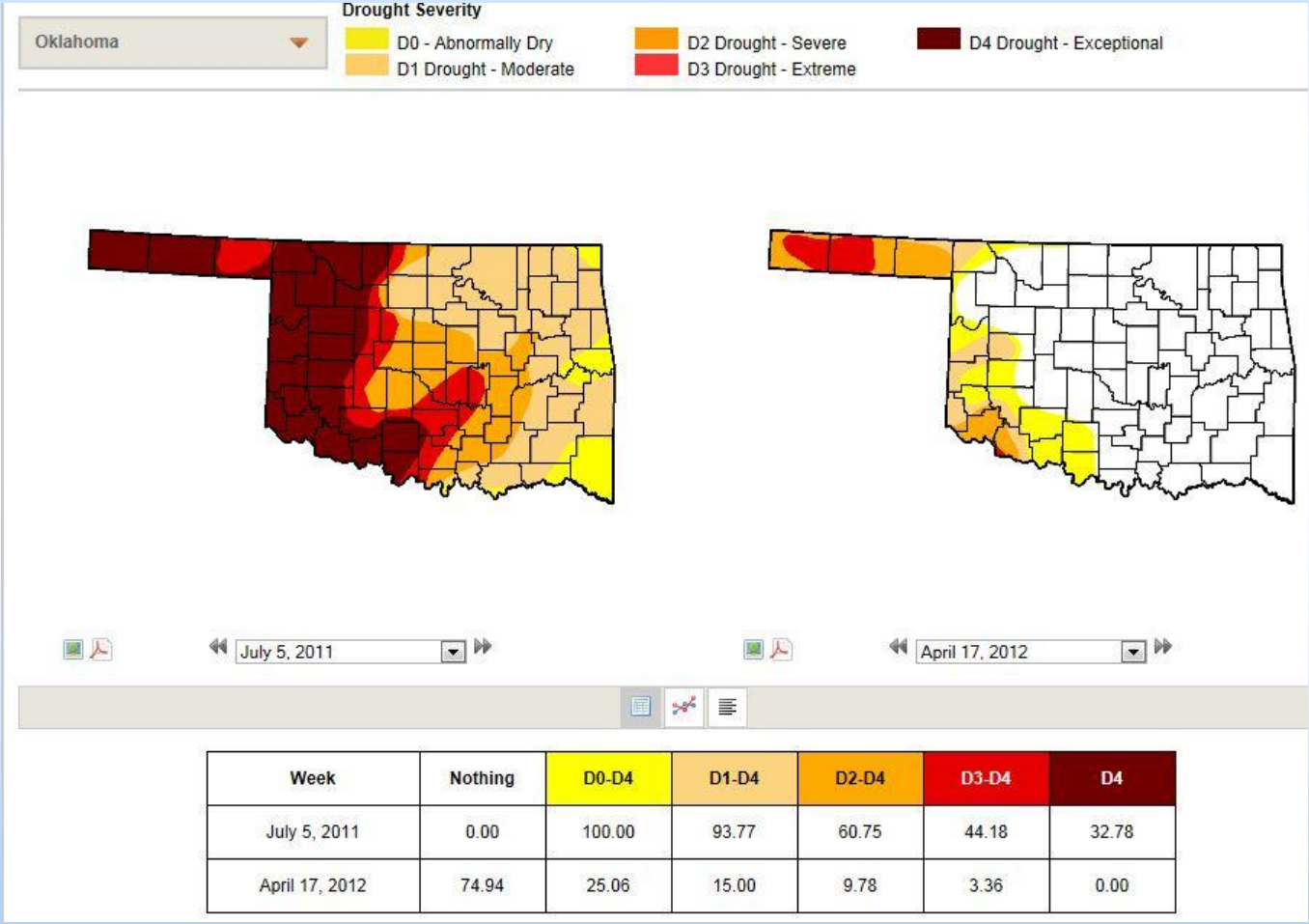


Some Improvement in the past 6 Months Despite the 2nd Round of La Nina.



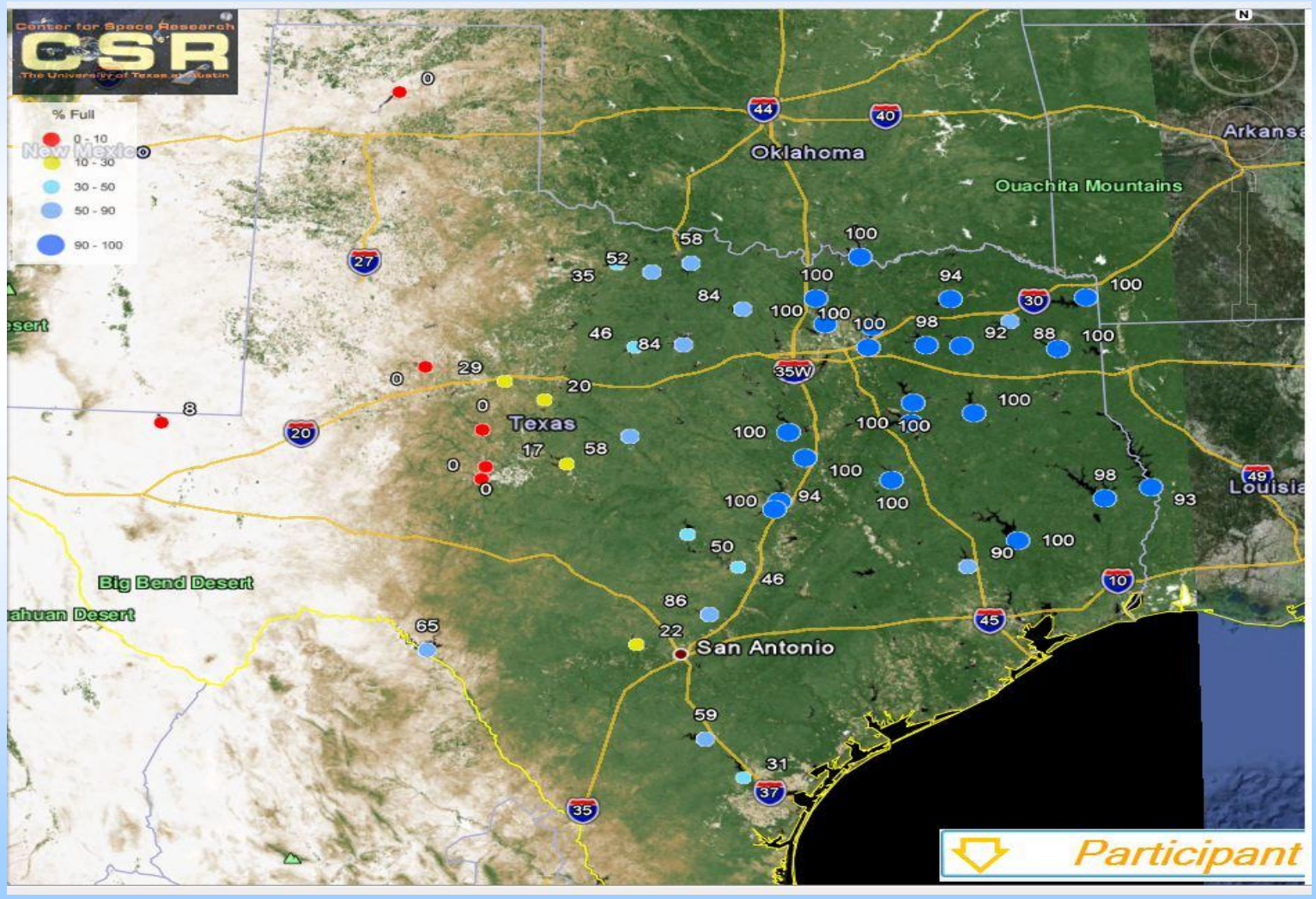
Week	Nothing	D0-D4	D1-D4	D2-D4	D3-D4	D4
July 5, 2011	0.00	100.00	100.00	93.96	79.34	49.09
April 17, 2012	0.00	100.00	86.48	58.54	24.94	8.86

Marked Improvement in the past 6 Months Despite the 2nd Round of La Nina

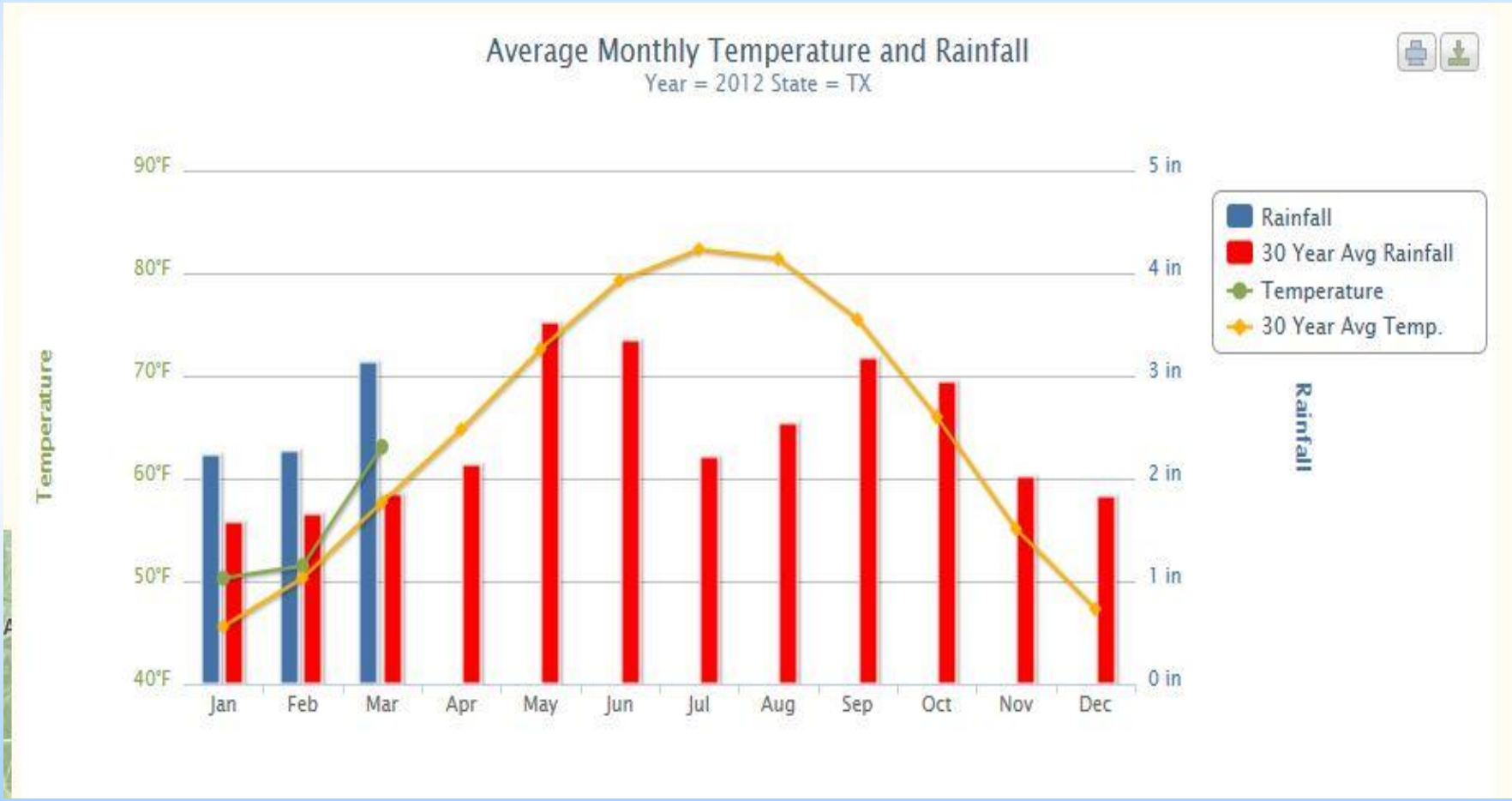


Week	Nothing	D0-D4	D1-D4	D2-D4	D3-D4	D4
July 5, 2011	0.00	100.00	93.77	60.75	44.18	32.78
April 17, 2012	74.94	25.06	15.00	9.78	3.36	0.00

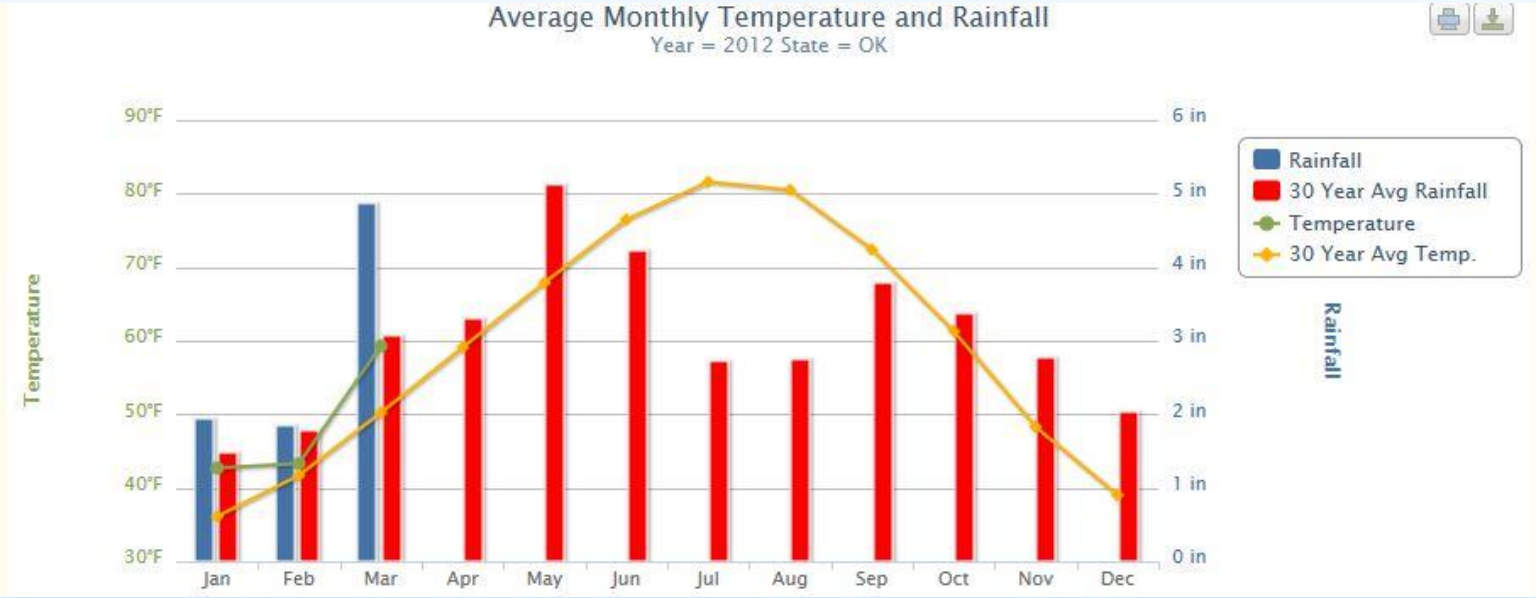
Main Concern Now: Reservoir Levels in West TX.



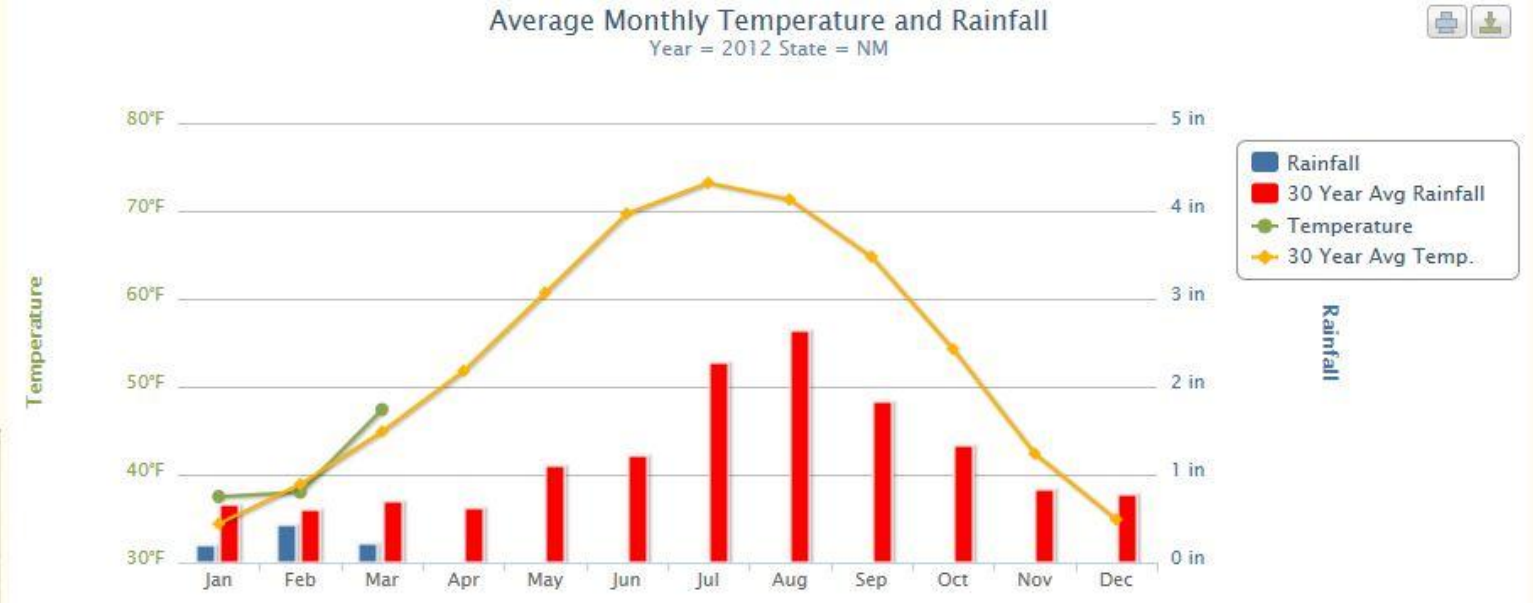
Moving Into our Wettest Time of the Year Gives Hope for Continued Improvements in TX



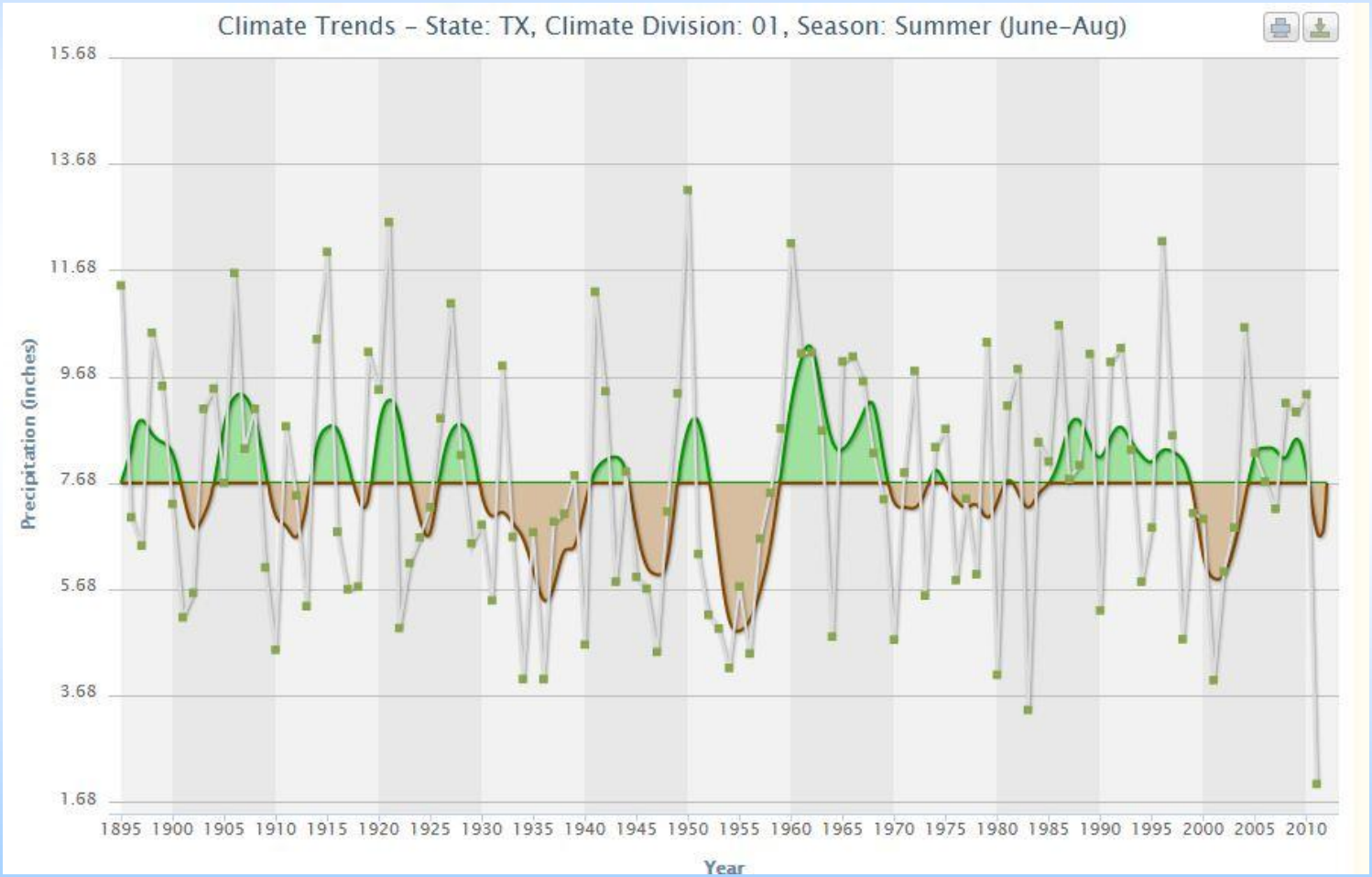
May and June are the two wettest months of the year in OK, so drought improvement should continue.



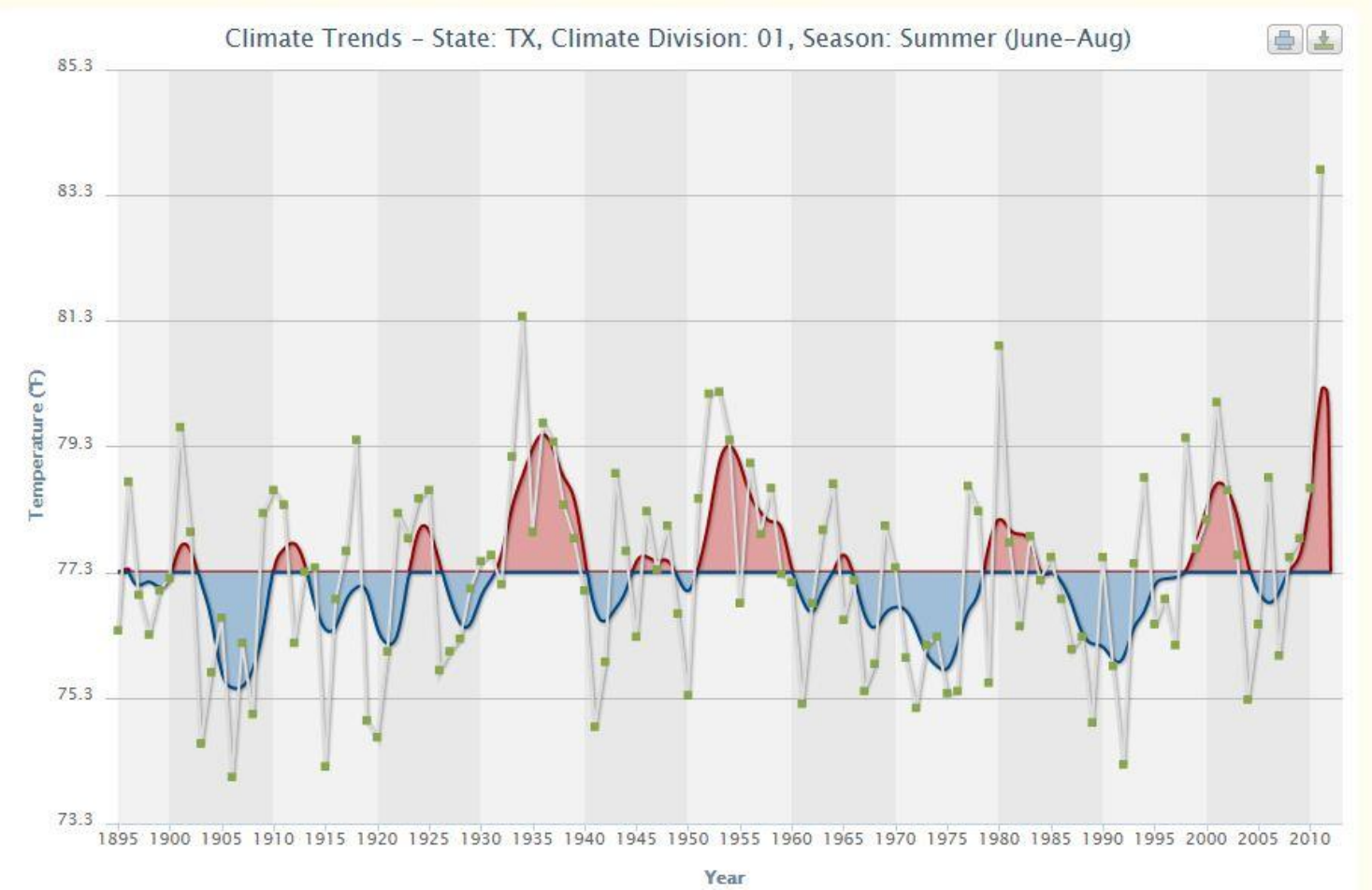
Having an Active Monsoon Season in July and August will determine long term drought situation for NM. Nearly 50% (6.75”) of the yearly NM precip total (13.5”) falls in Jul/Aug/Sep.



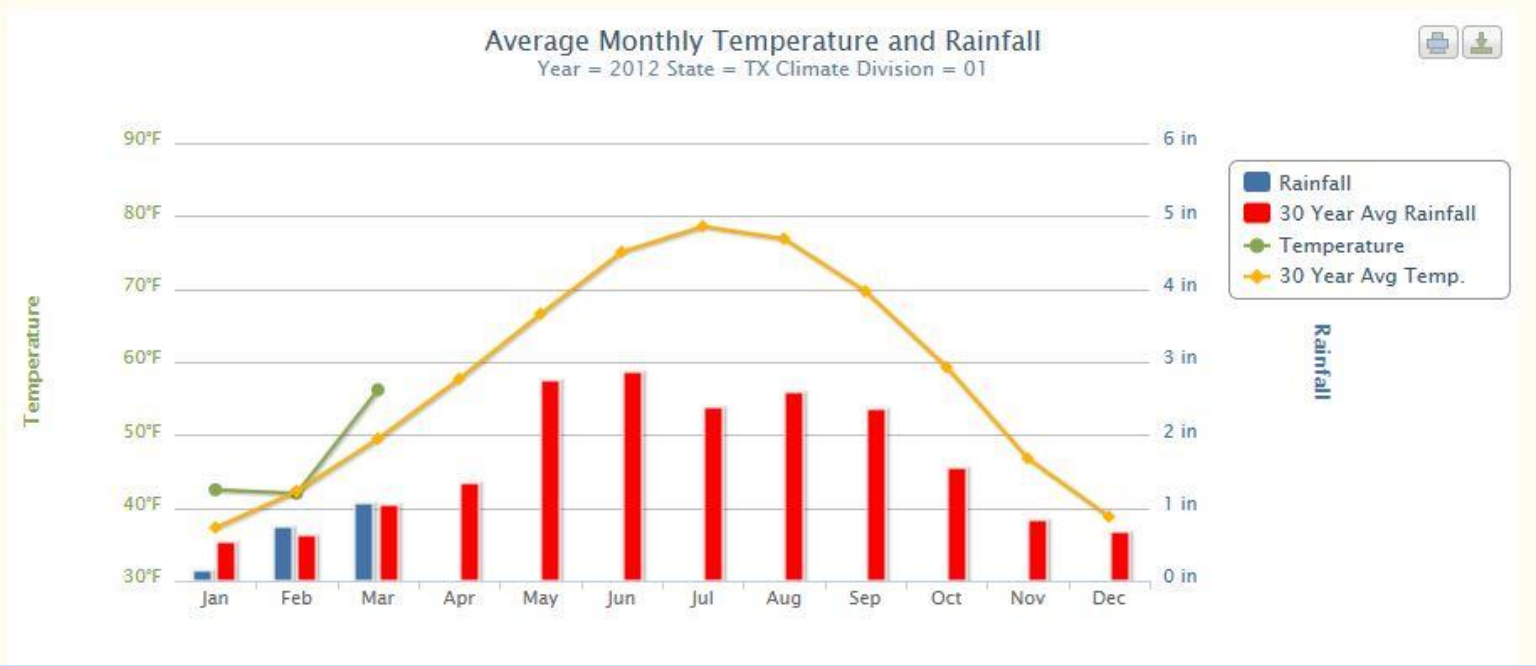
Record Dry Summer in TX High Plains in 2011



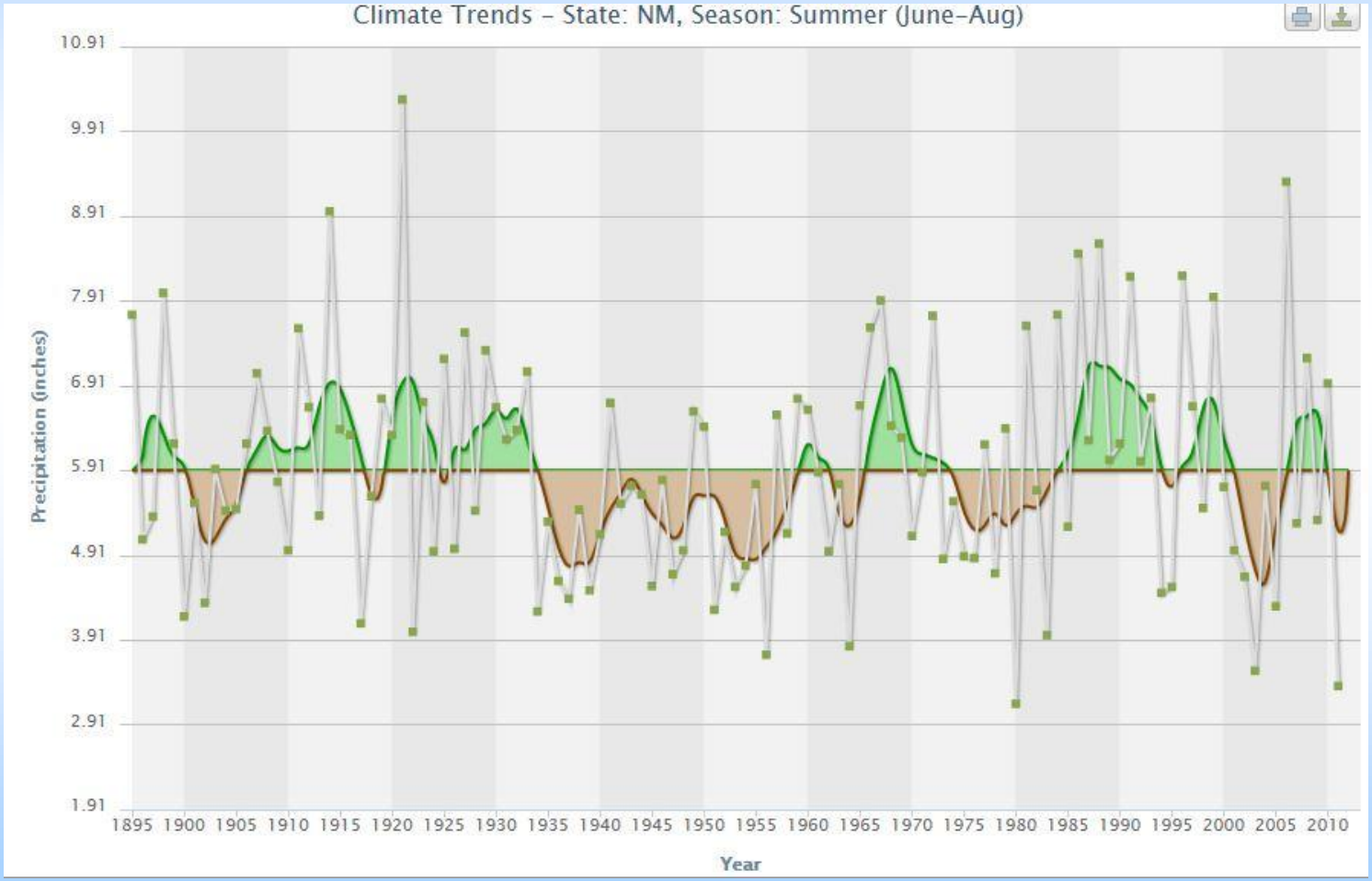
Record Heat in TX High Plains in Summer 2011



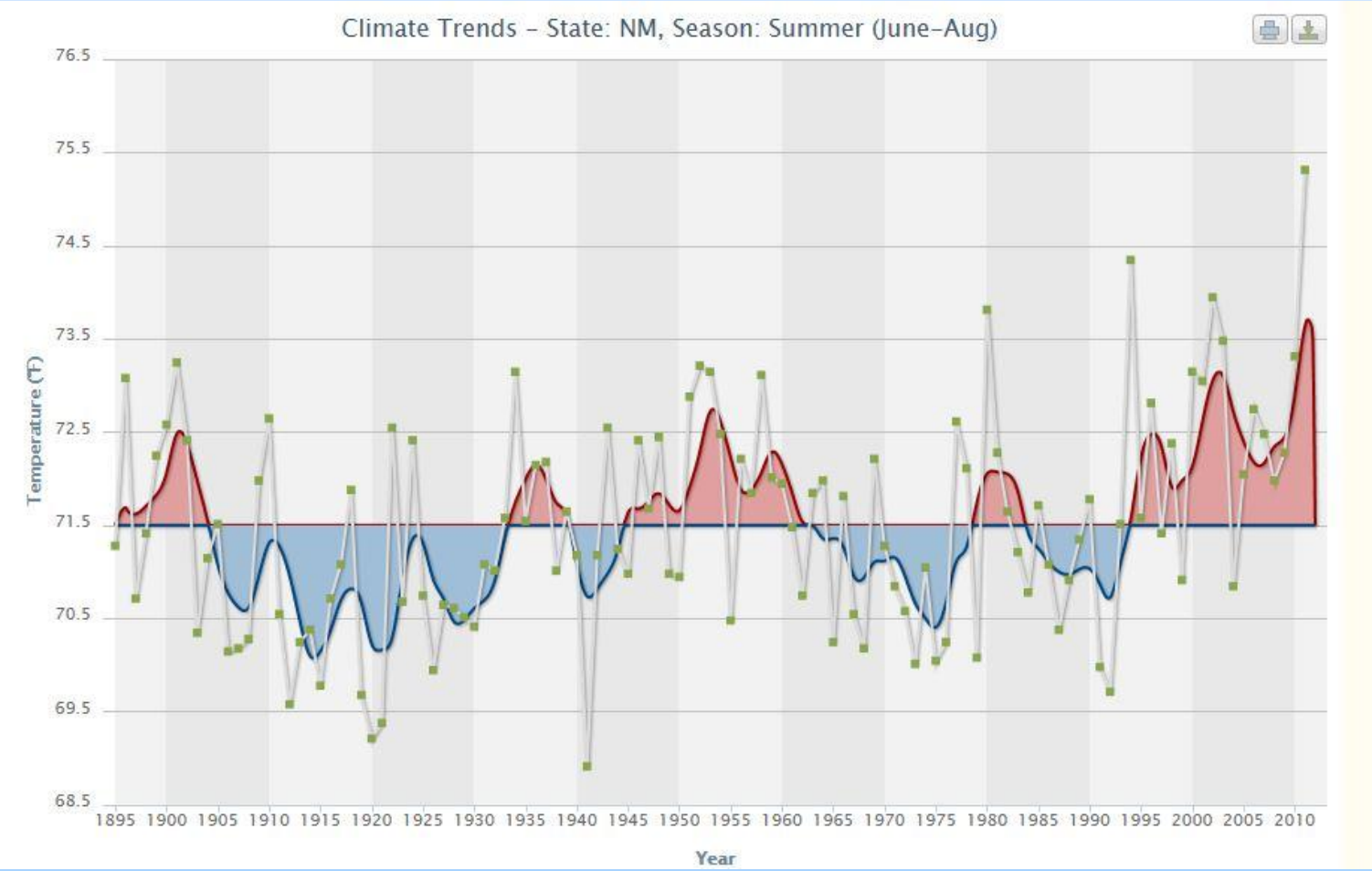
Slightly below normal precipitation in TX High Plains in early 2012 a continued cause for concern moving into the May/June wet season.



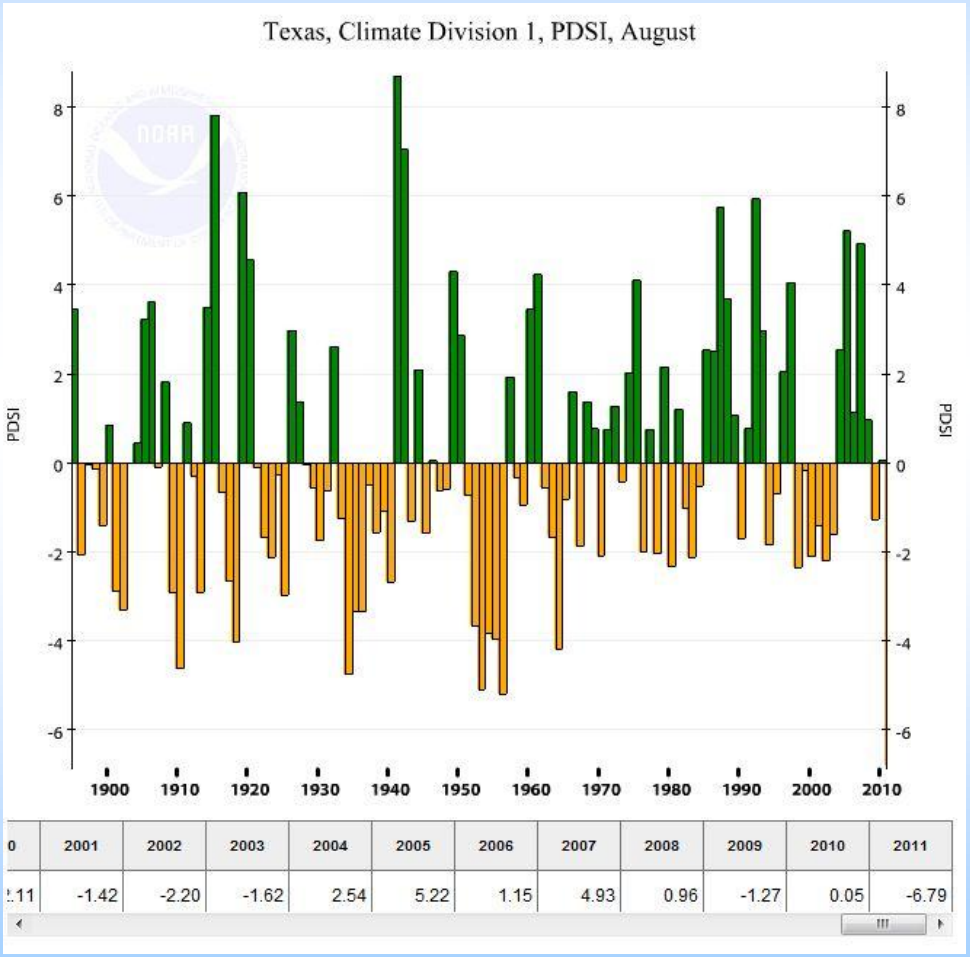
Summer Monsoonal Rainfall Trends for New Mexico. 2nd Driest Summer on Record in 2011 begets…



…warmest summer on record.



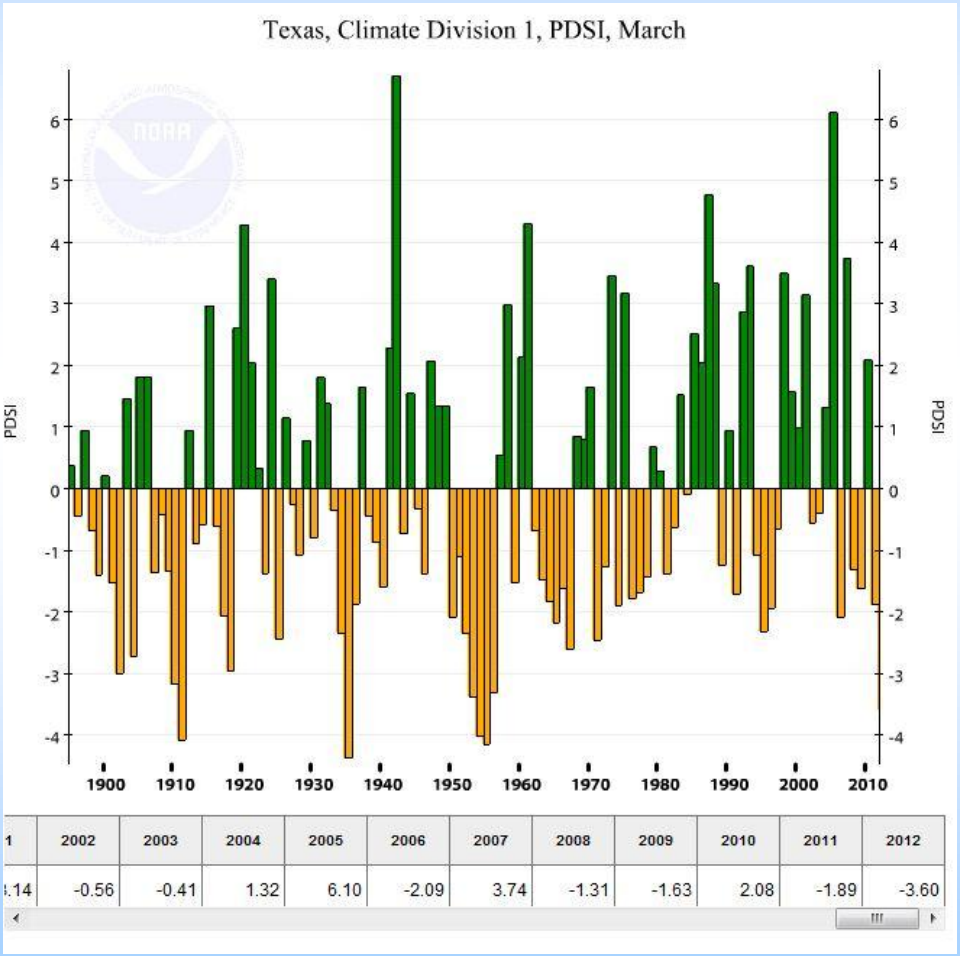
August 2011 saw most intense 1 year drought conditions ever on record for the TX High Plains.



0	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
.11	-1.42	-2.20	-1.62	2.54	5.22	1.15	4.93	0.96	-1.27	0.05	-6.79

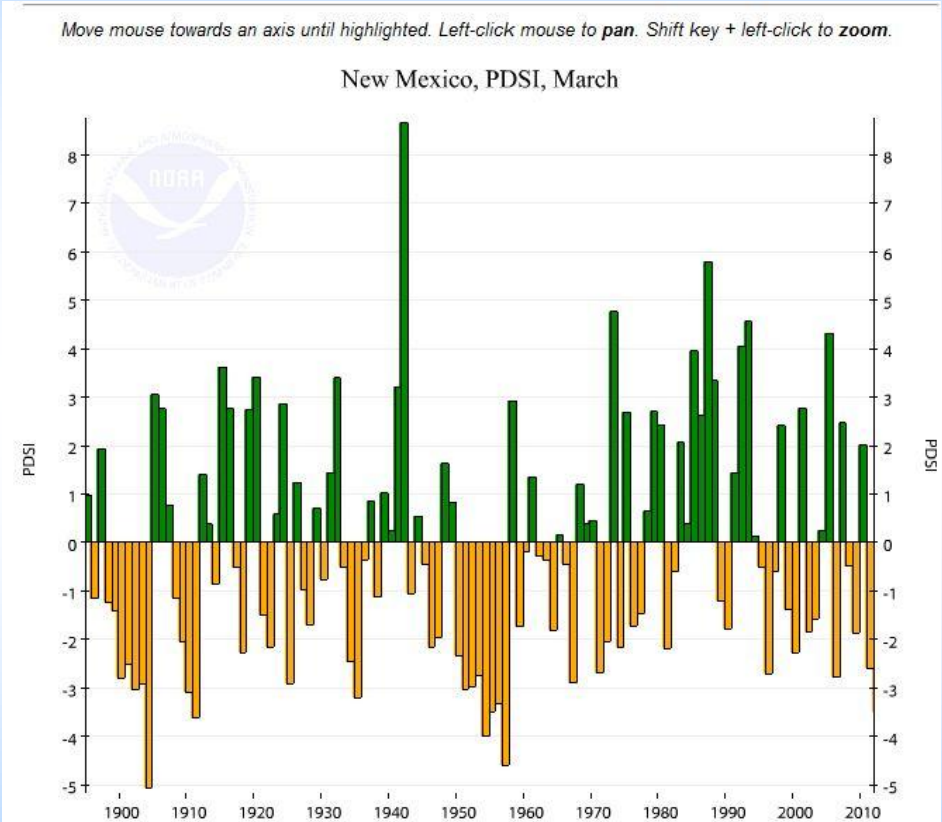
PDSI of -6.79 in August 2011.

…but recent precipitation has improved conditions (relatively speaking).



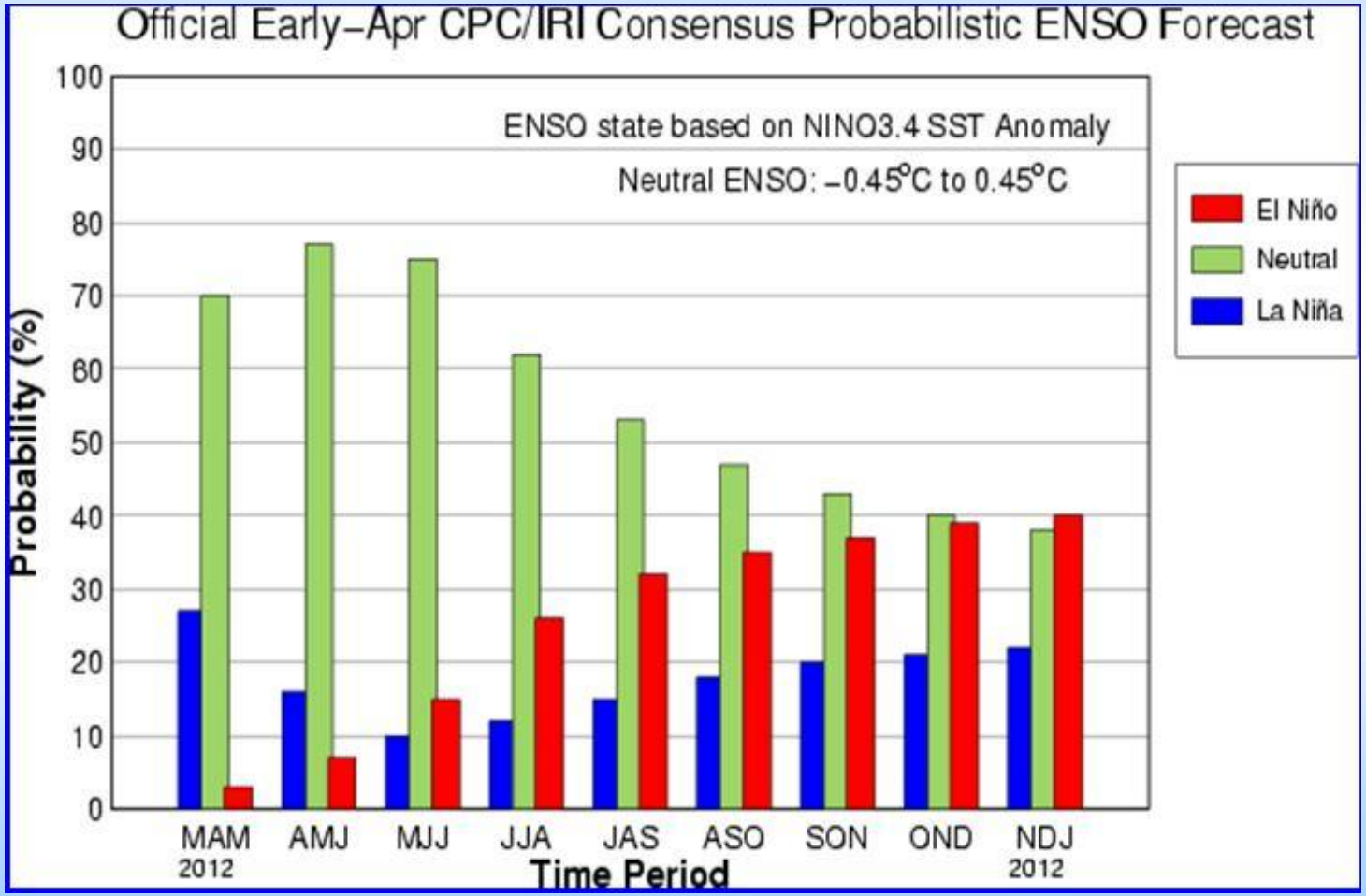
1	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
.14	-0.56	-0.41	1.32	6.10	-2.09	3.74	-1.31	-1.63	2.08	-1.89	-3.60

…likewise in New Mexico

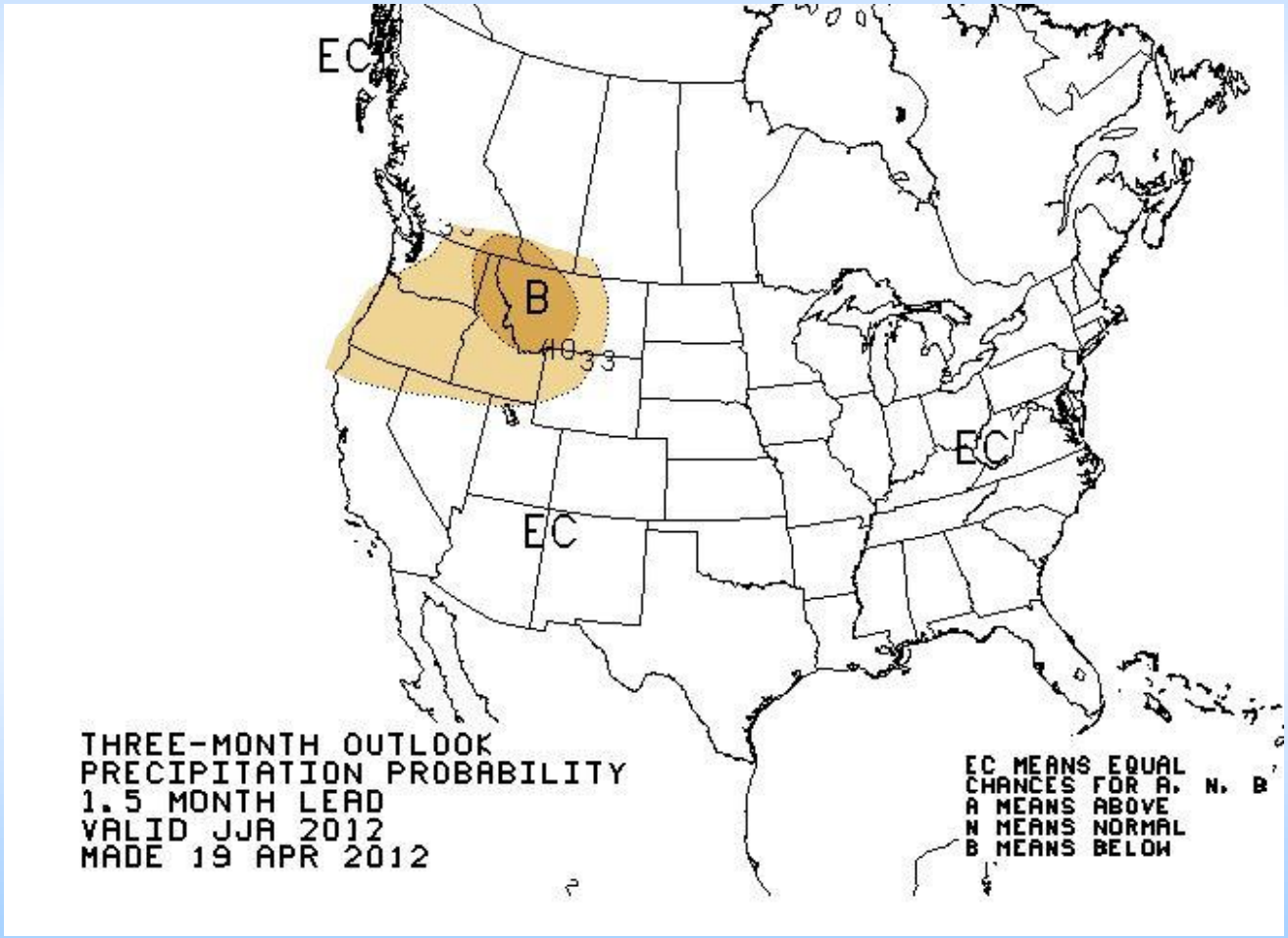


1	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
.77	-1.85	-1.57	0.25	4.32	-2.78	2.47	-0.49	-1.86	2.01	-2.59	-3.50

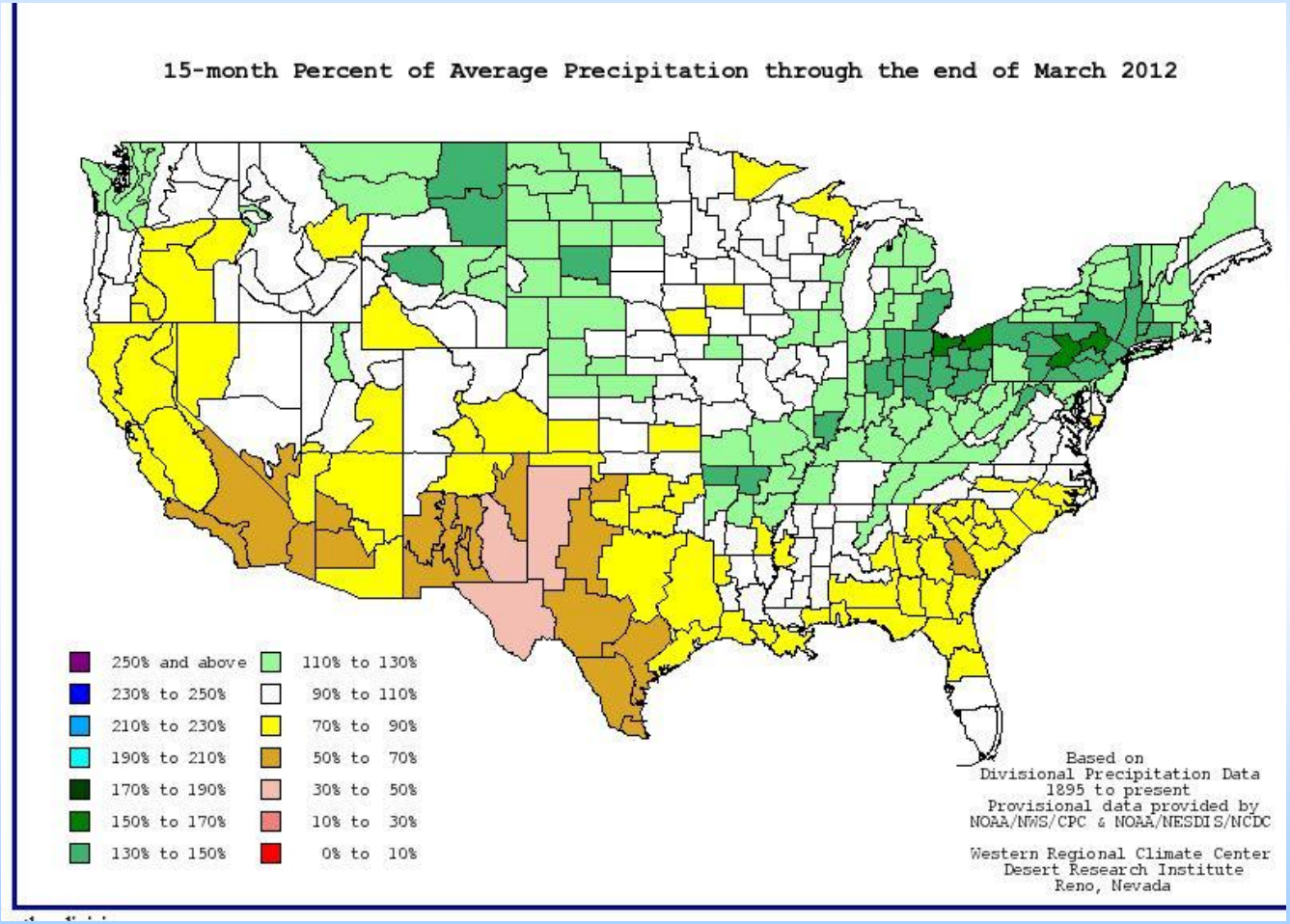
Good News!!! Probability of El Nino this winter outweigh those of La Nina by 2 to 1.



Latest NWS Climate Prediction Center Forecast for this Summer.

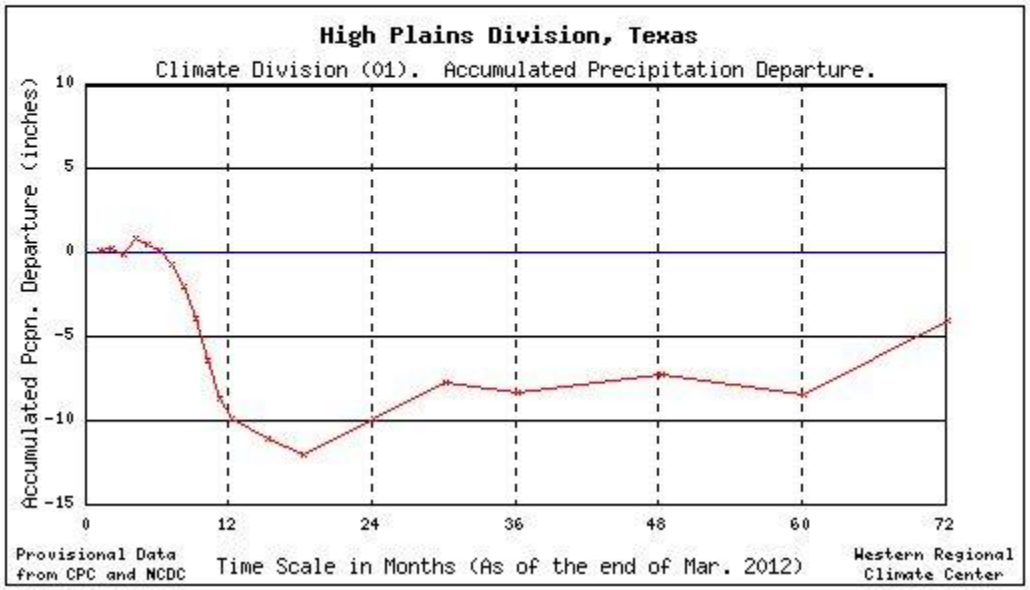


15 Month Percent of Average Precipitation through March 2012. Problem areas remain problem areas.



Precipitation Deficit for TX High Plains Climate Division. Average annual precipitation about 18”/year.

Accumulated Precipitation Departure from Normal



- Questions??

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817-978-2652 x 130