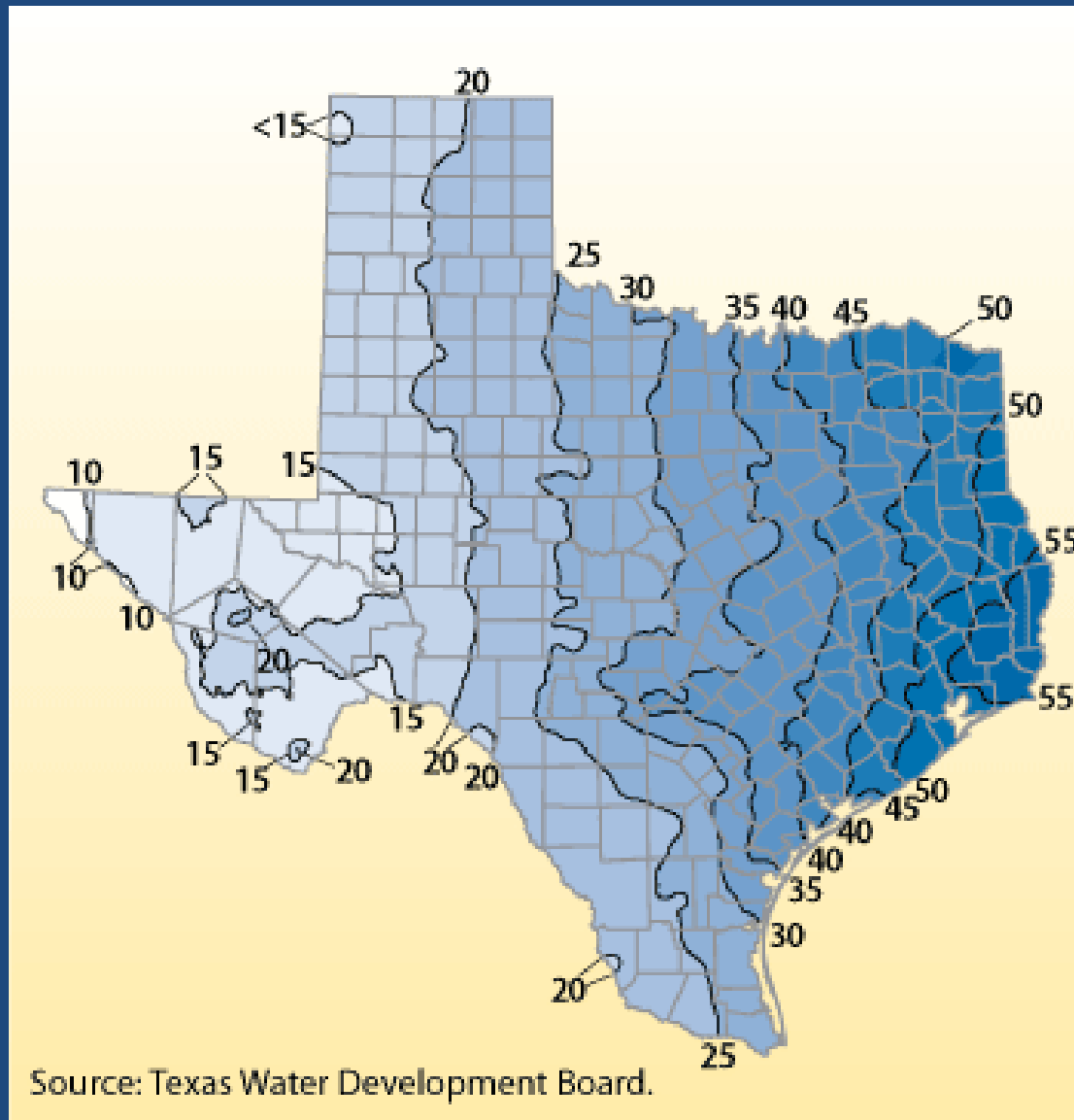




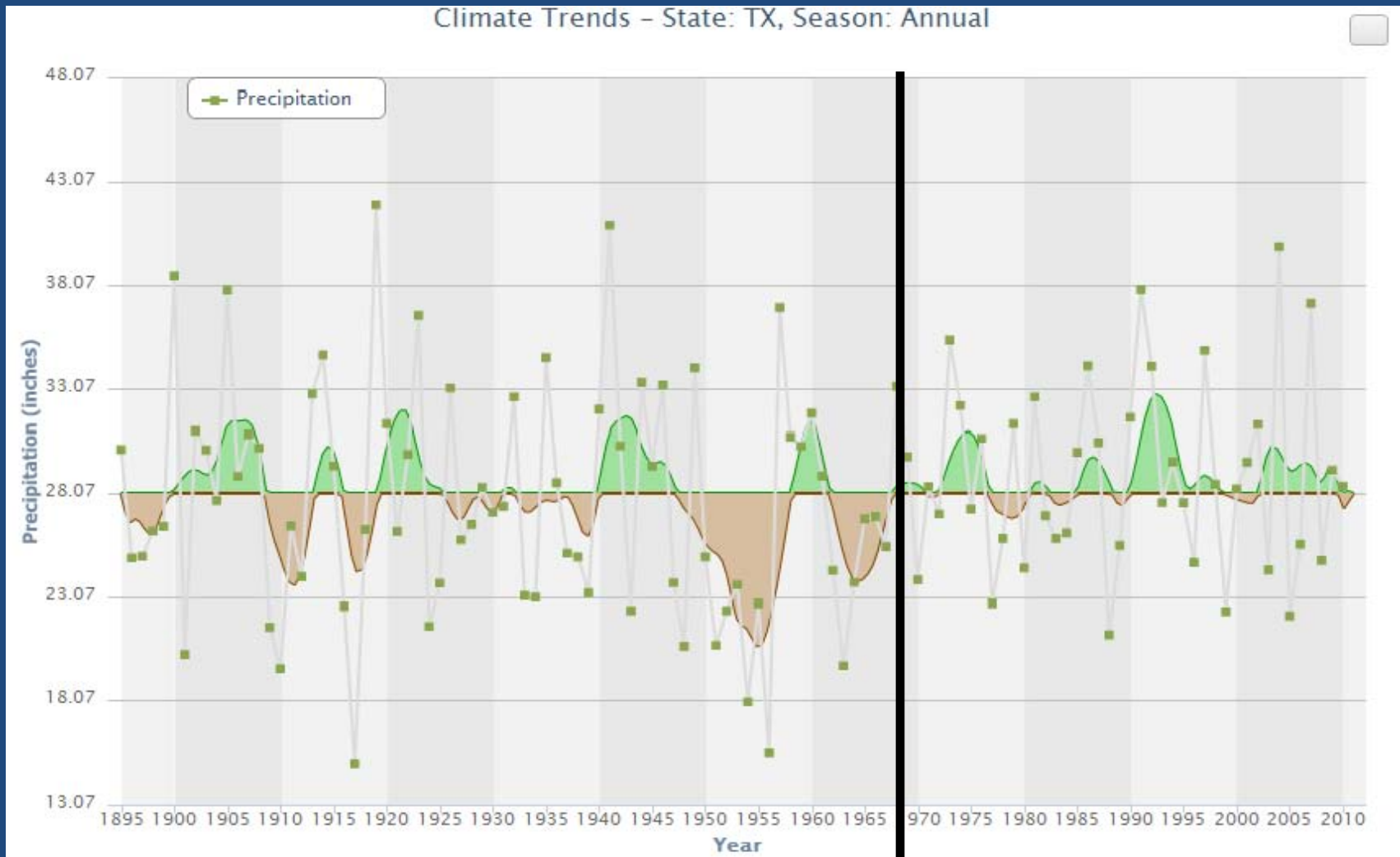
2010-2012 Drought

**Jeffrey Lindner
Meteorologist
Harris County Flood Control District
February 15, 2012**

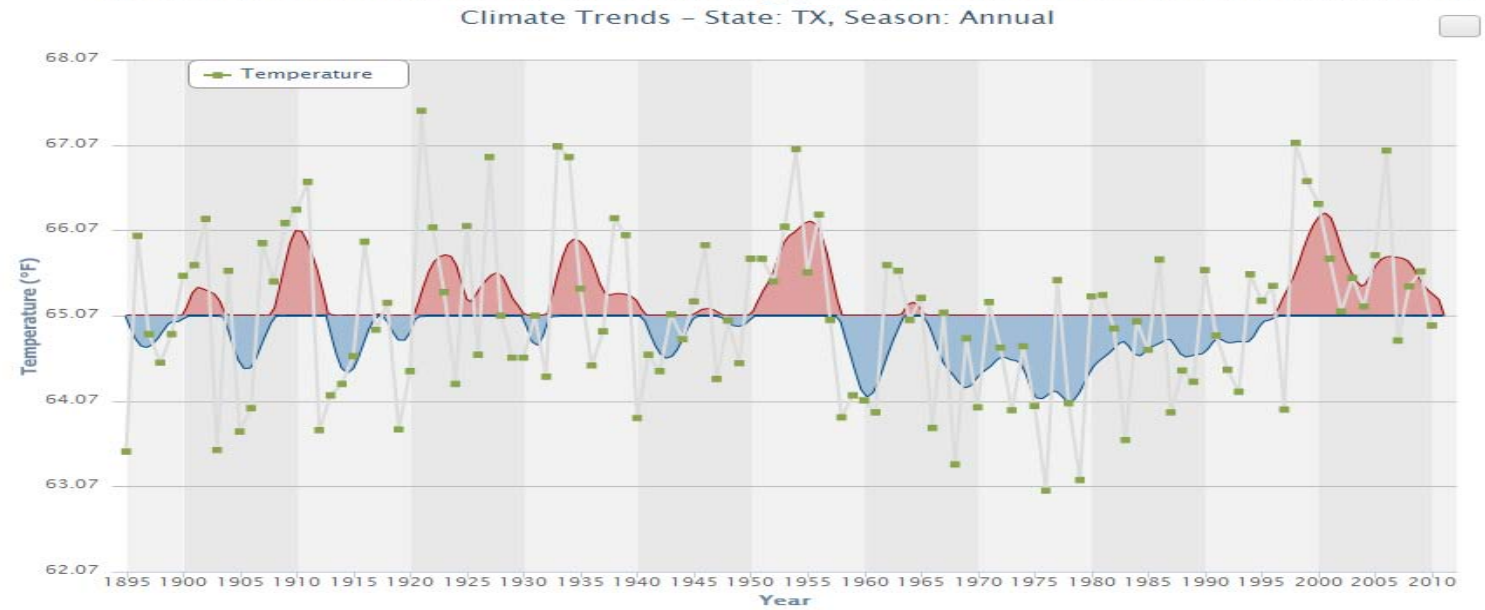
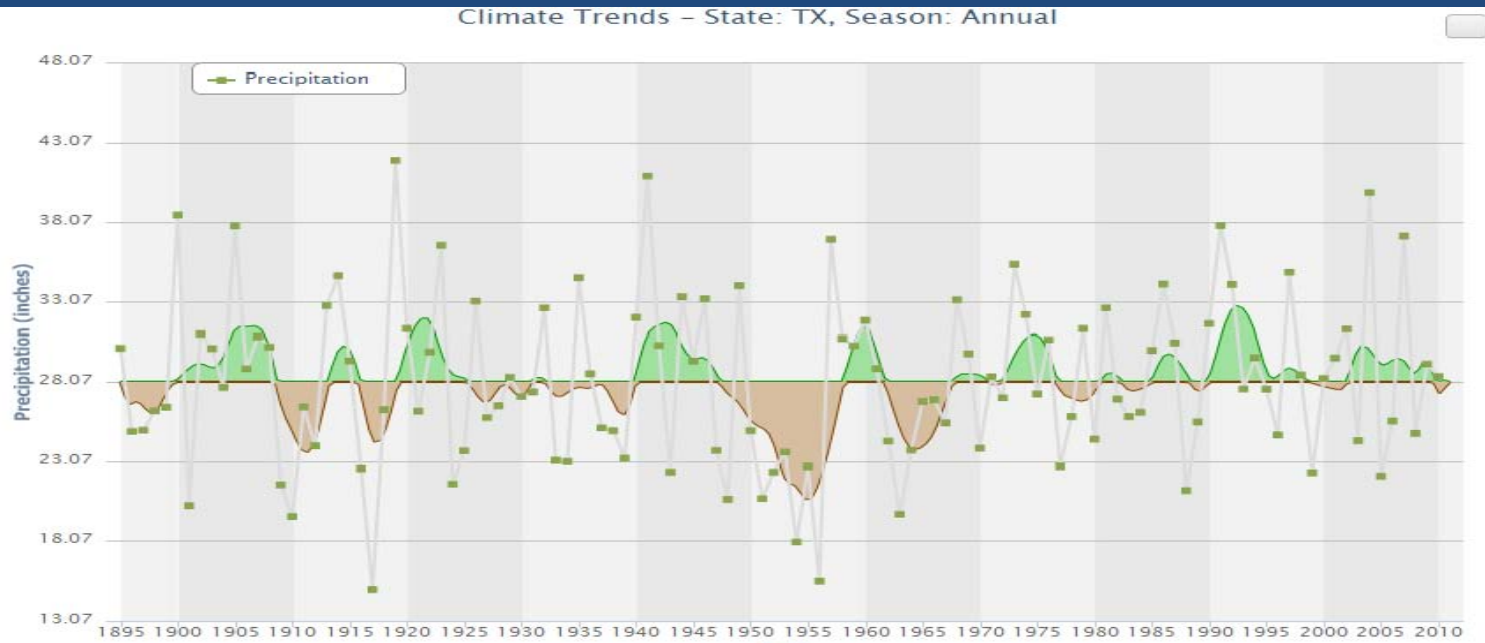
Texas Annual Rainfall



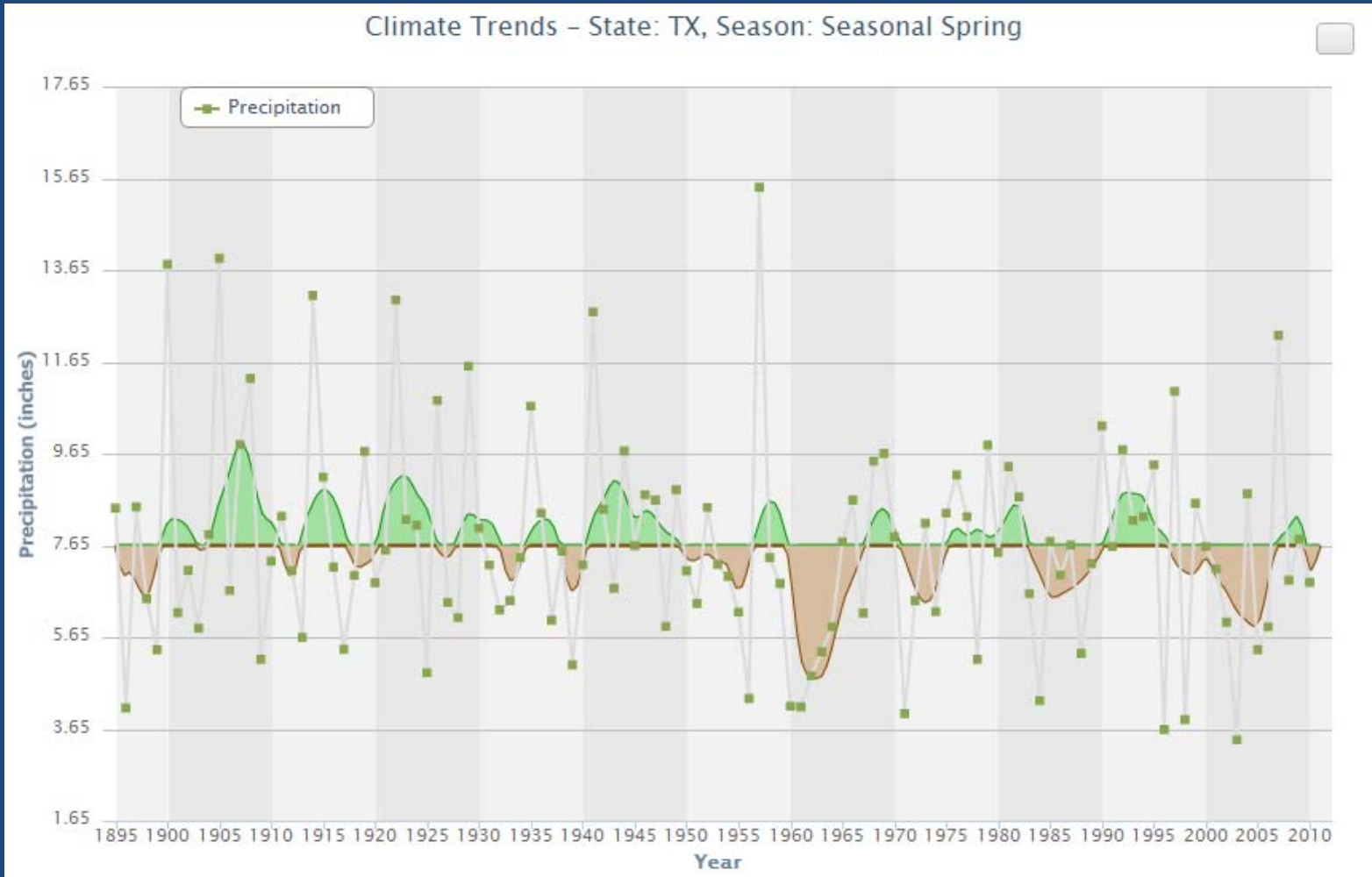
Texas Annual Rainfall 1895-2010



Notice Any Trends?

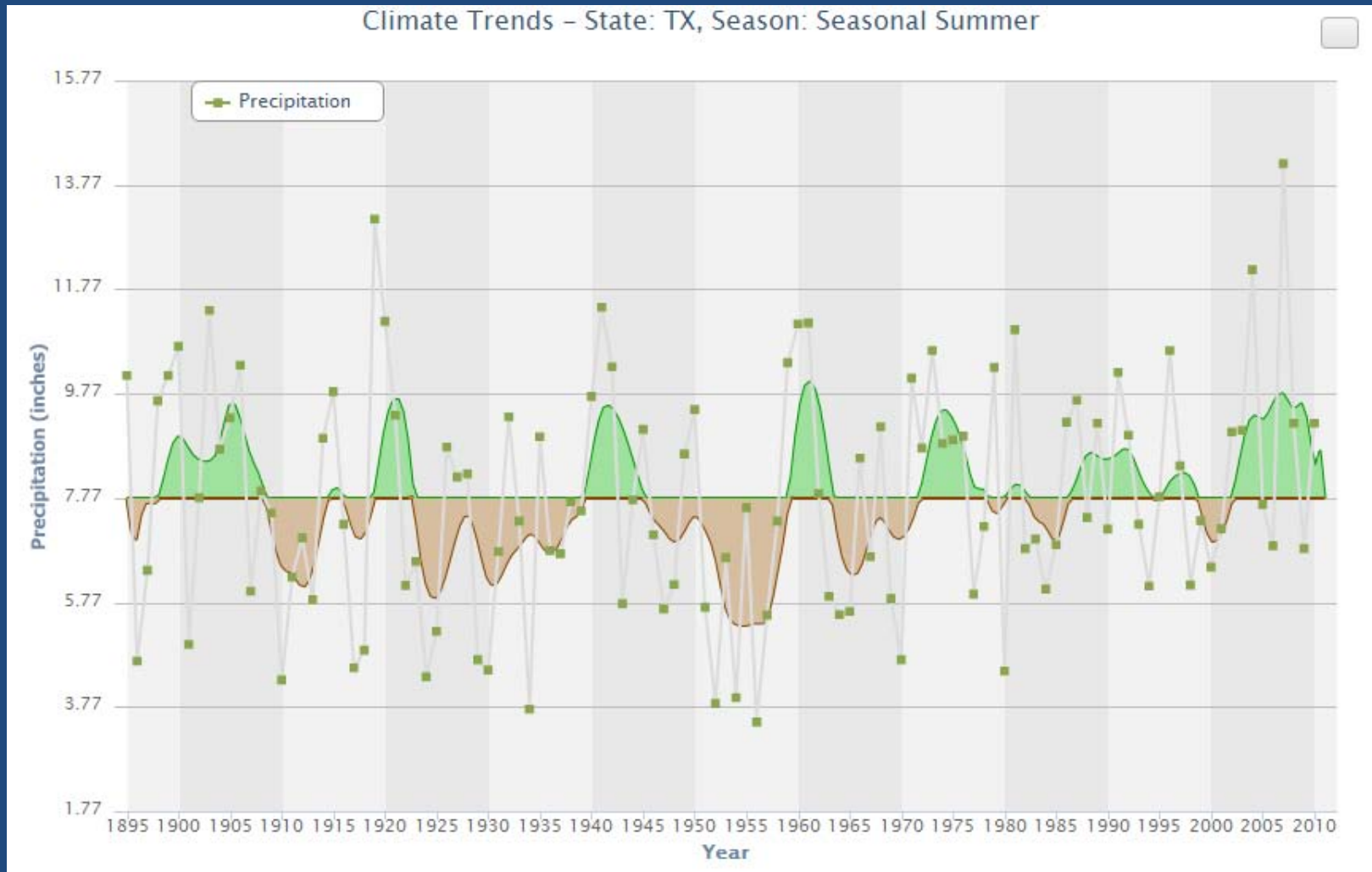


Texas Spring Rainfall 1895-2010



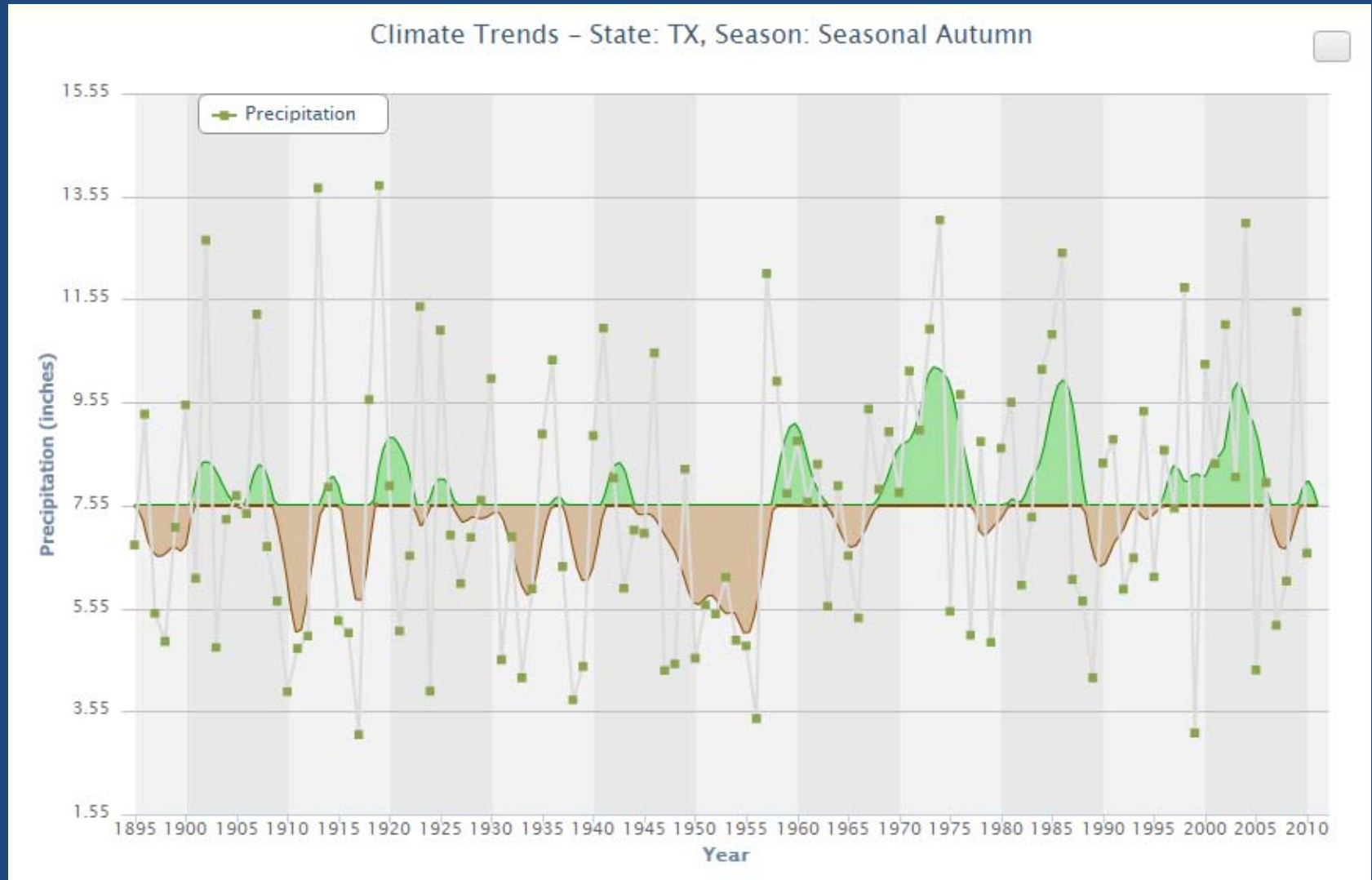
Less Spring rainfall since 1950

Texas Summer Rainfall 1895-2010



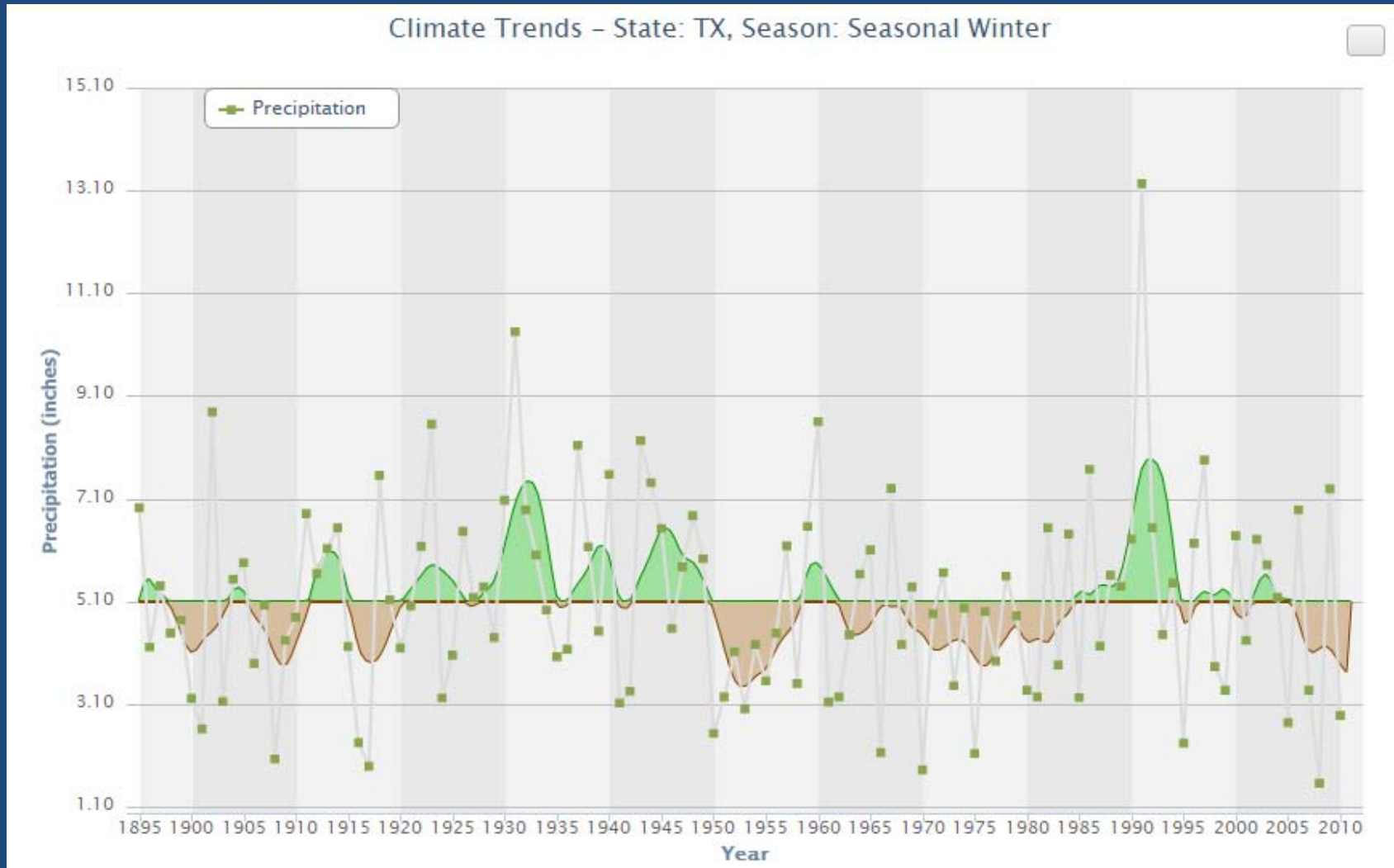
Greater summer rainfall since 1960

Texas Fall Rainfall 1895-2010



Greater Fall rainfall since 1960

Texas Winter Rainfall 1895-2010



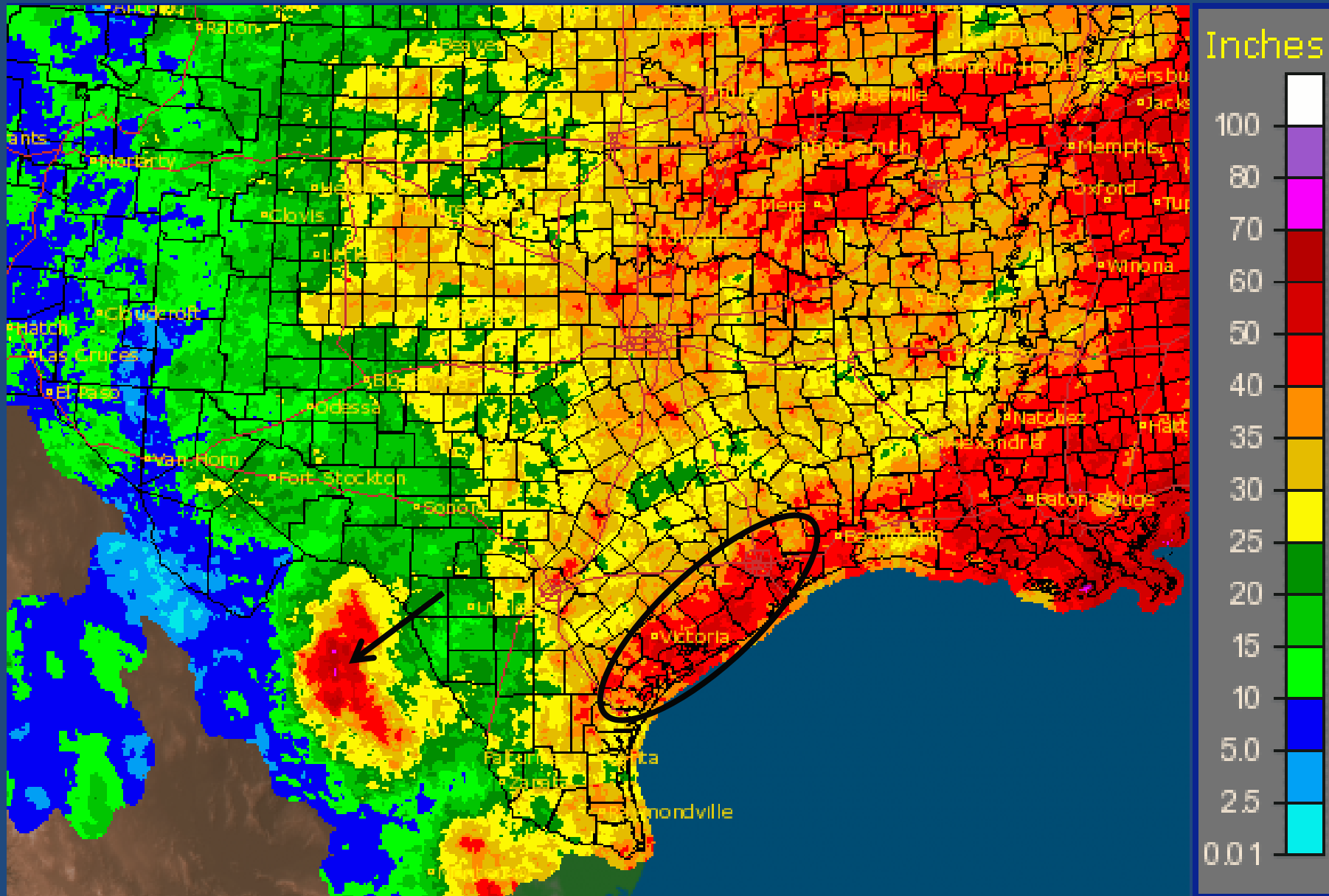
Less winter rainfall since 1950

Texas Climate Trends

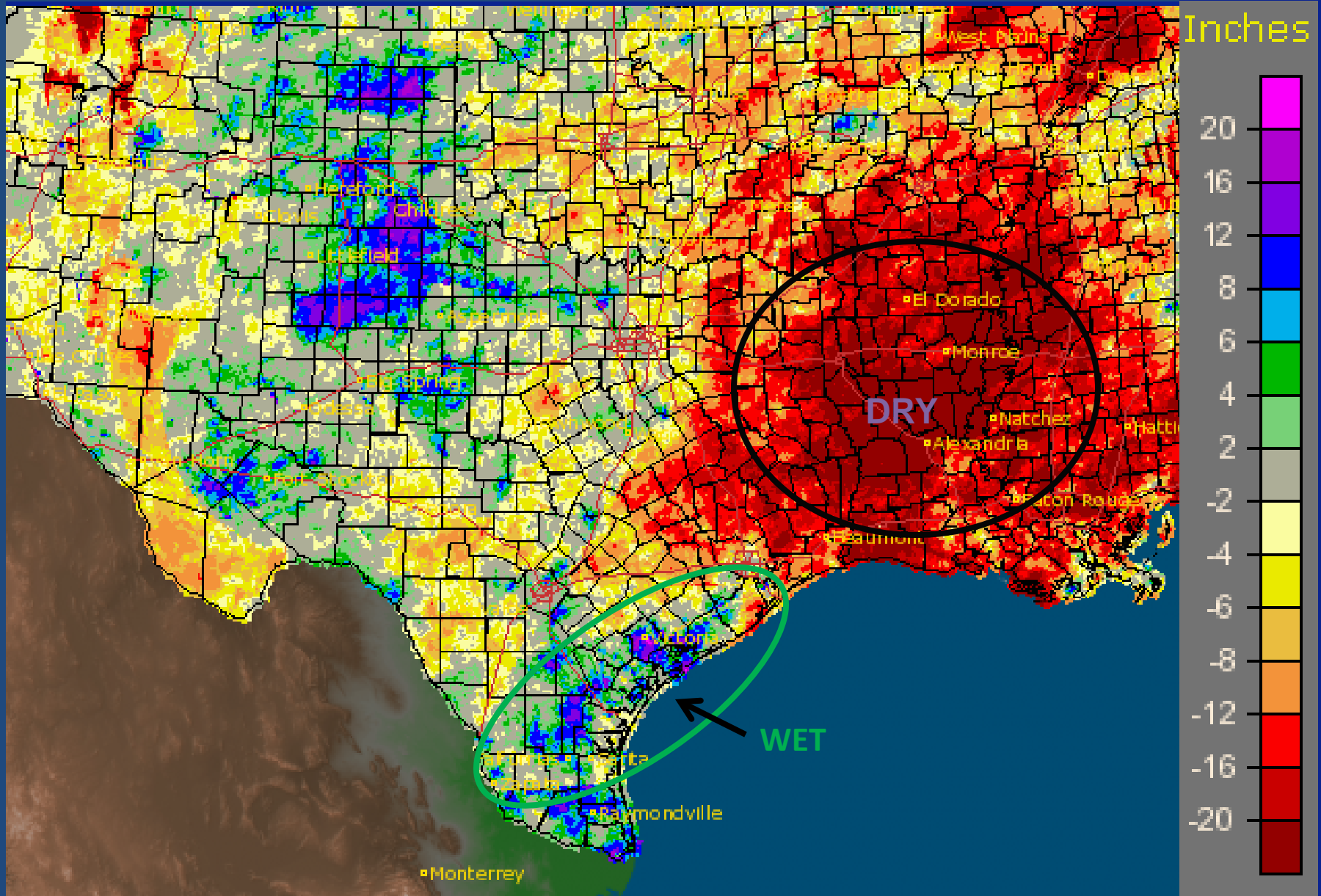
- Drier winter and spring seasons since 1950
- Wetter summer and fall seasons since 1960
- Overall Texas annual rainfall has been greater since 1960 compared 1895-1960
- Drought was much more common, long term, and severe pre 1960
- Annual temperatures have been above average since 1996



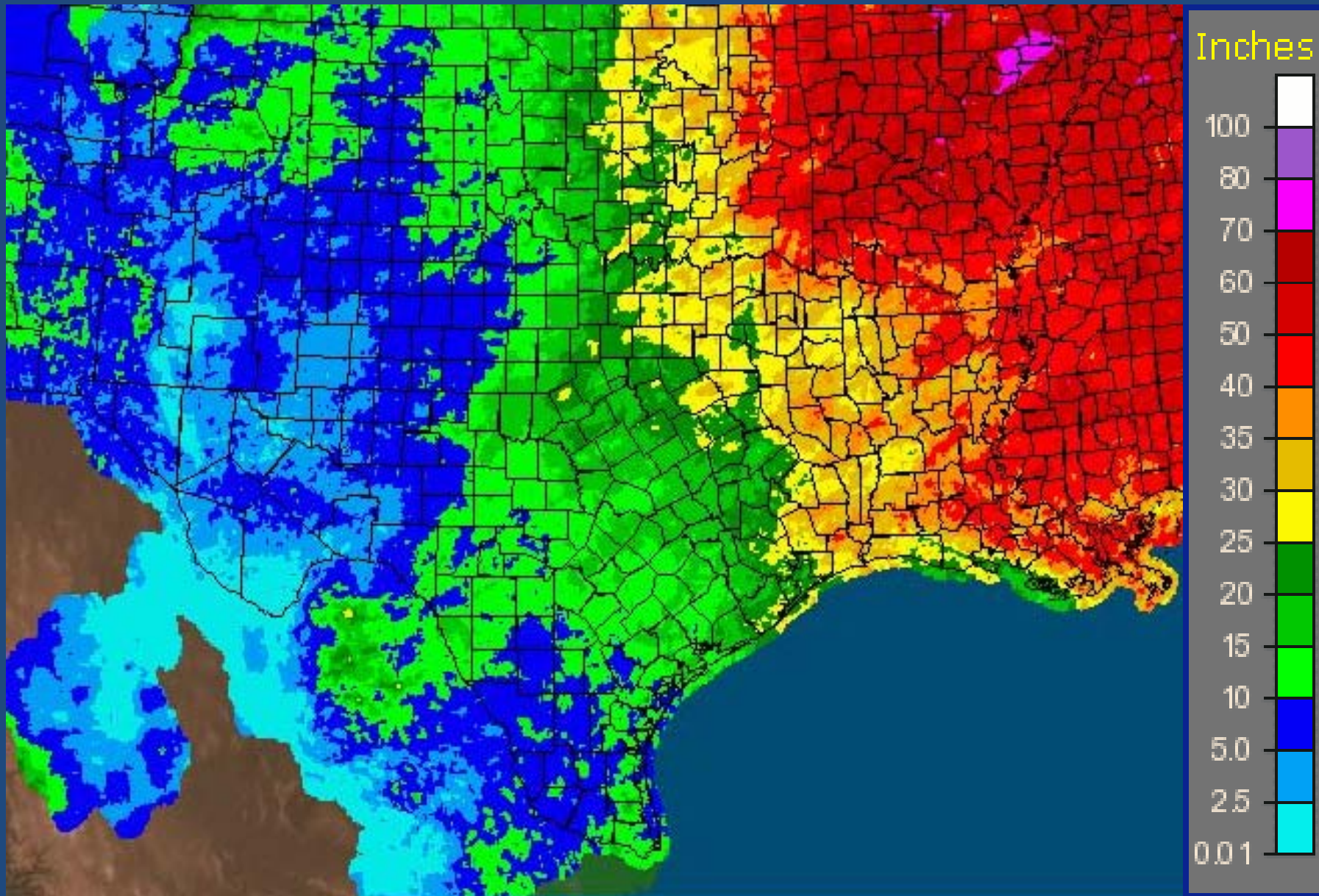
2010 Texas Rainfall



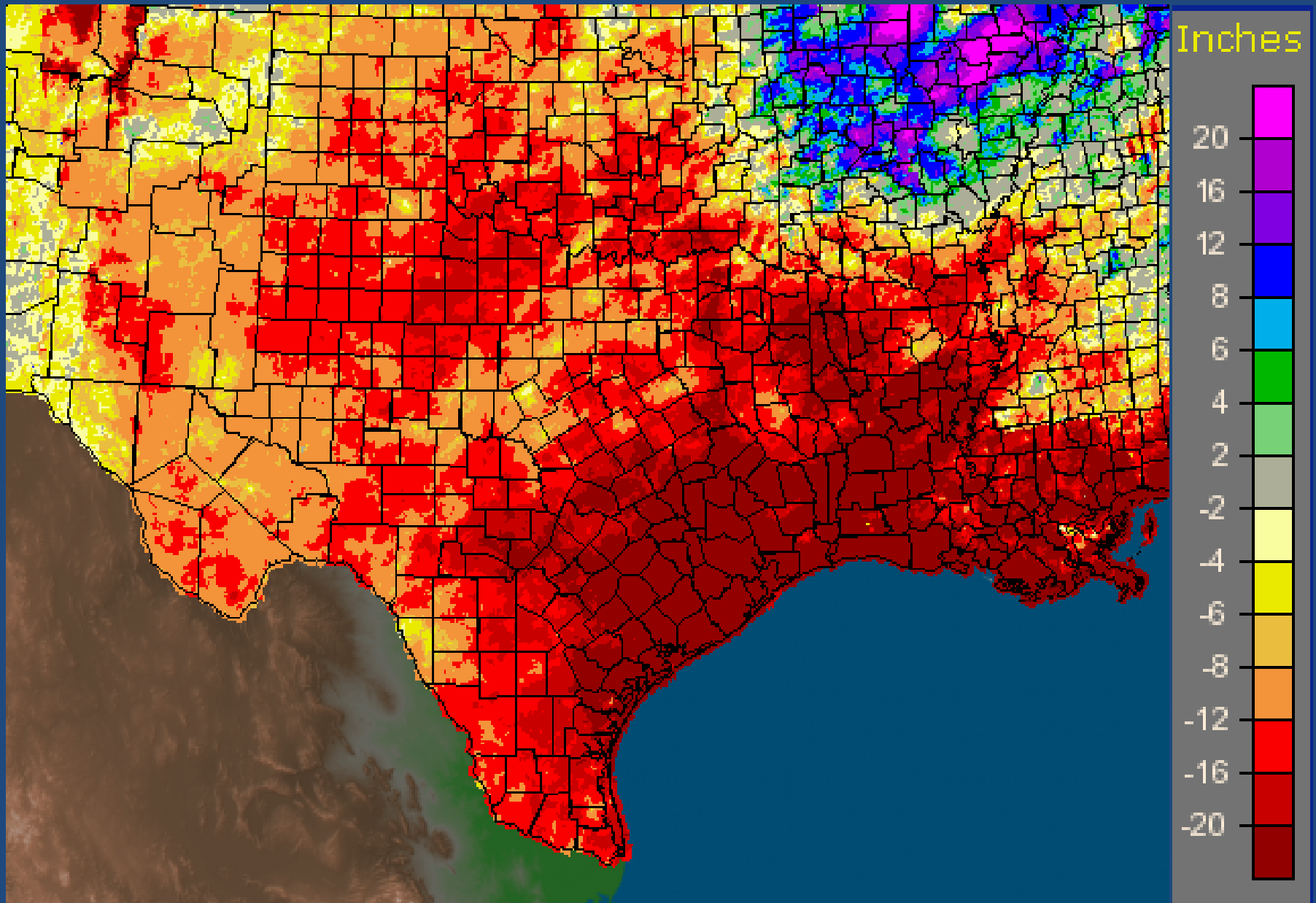
2010 Texas Rainfall Departures



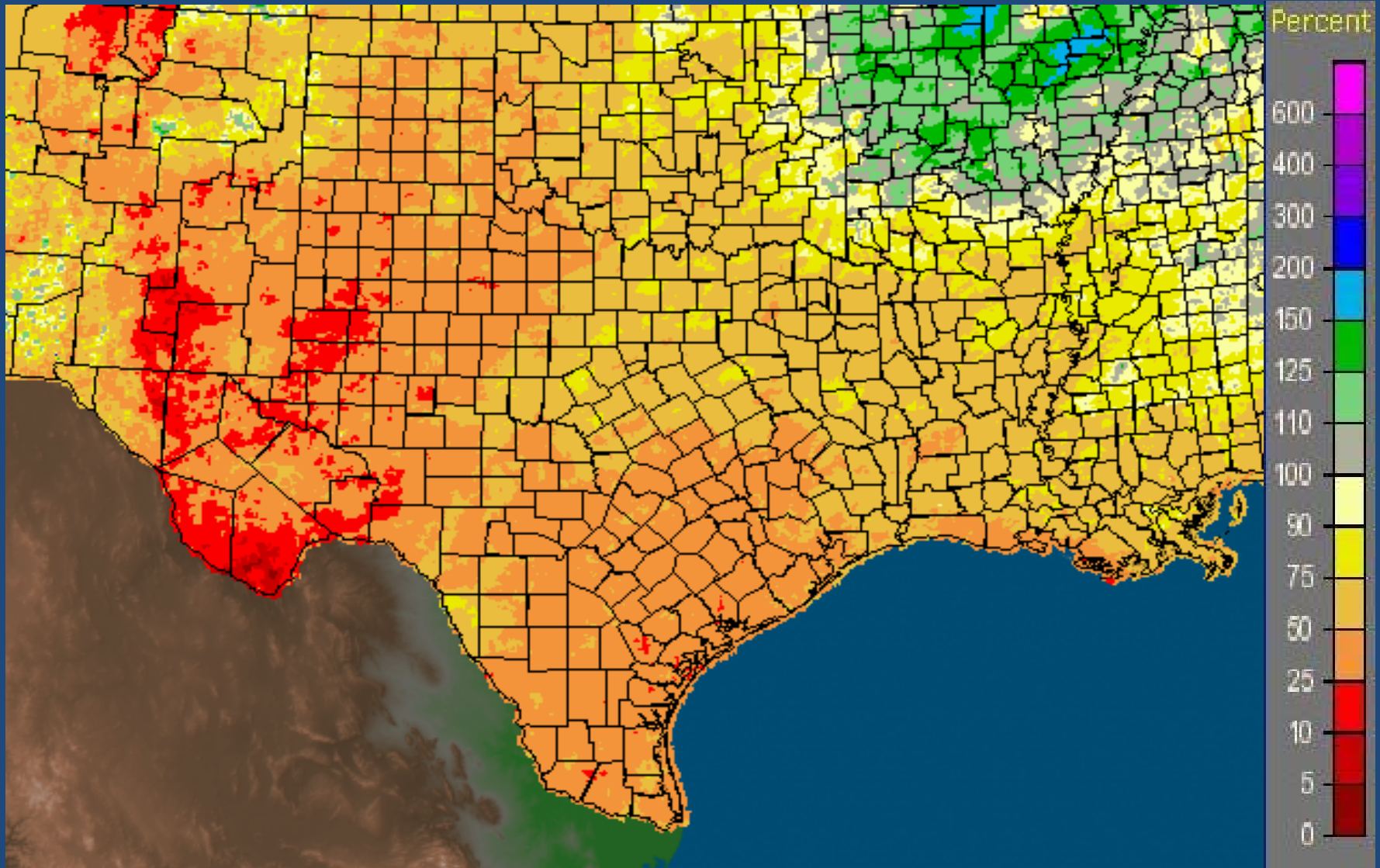
2011 Texas Rainfall



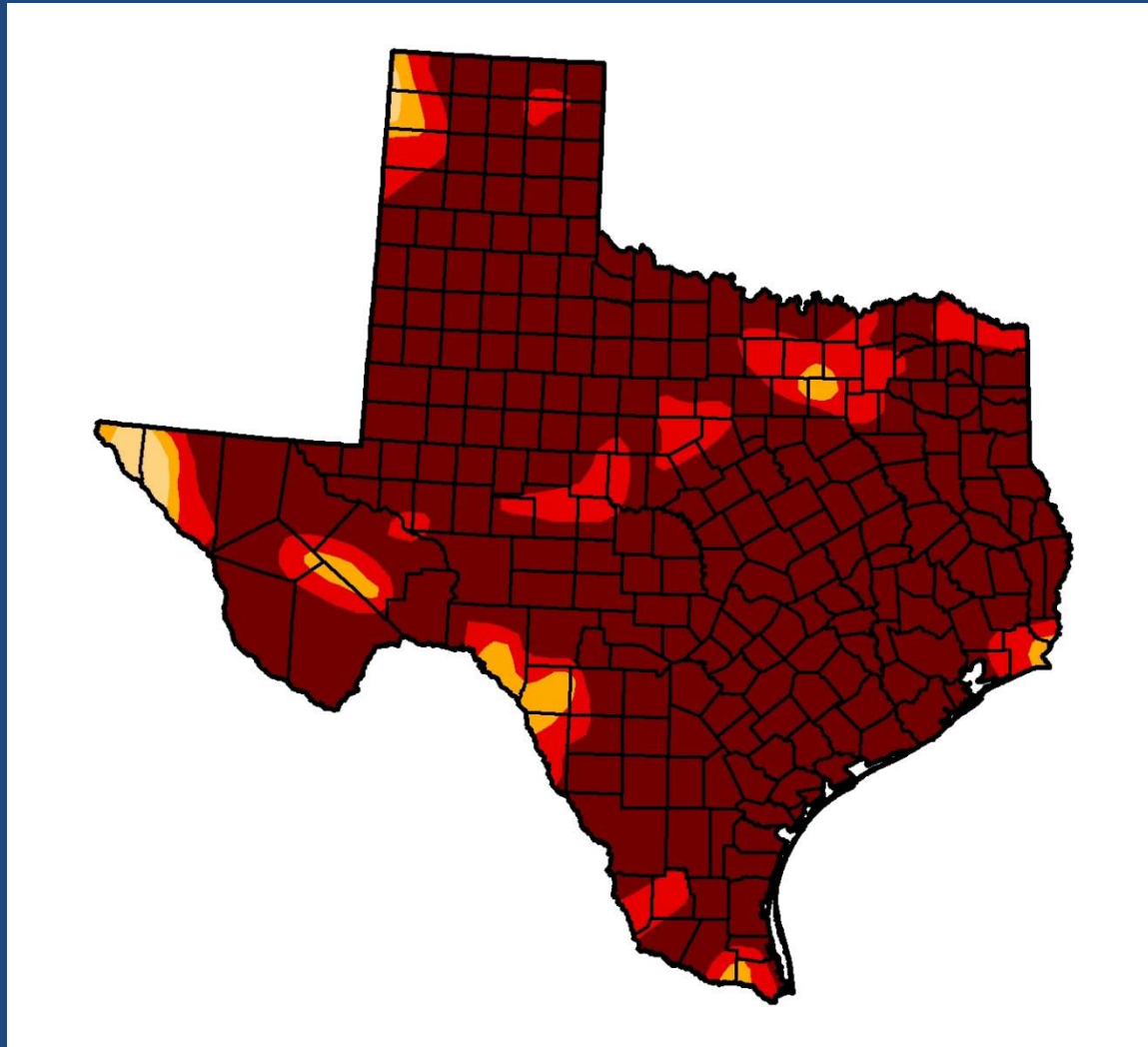
2011 Texas Rainfall Departures



2011 Texas Rainfall (% of Normal)



Drought Conditions 9-27-11



Week	Nothing	D0-D4	D1-D4	D2-D4	D3-D4	D4
September 27, 2011	0.00	100.00	100.00	99.16	96.65	85.75

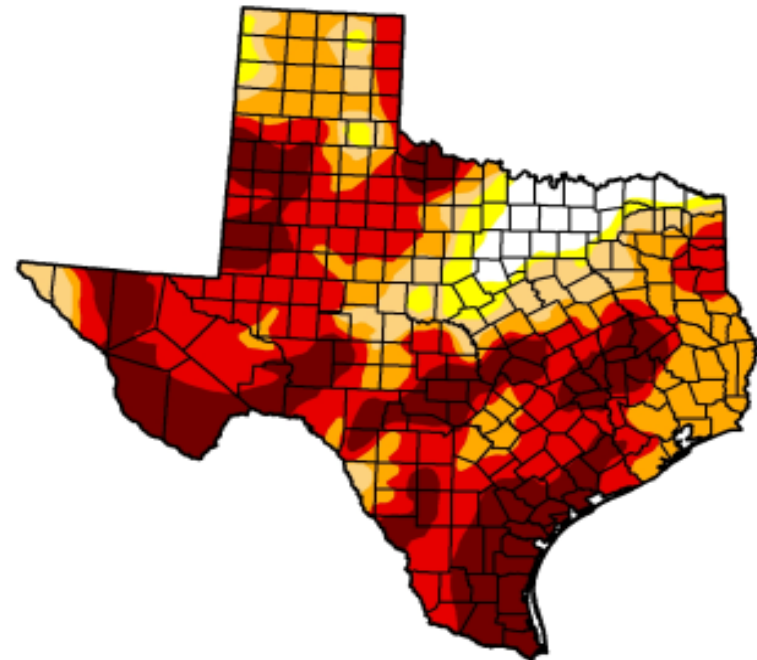
2012 Drought Conditions

U.S. Drought Monitor Texas

January 31, 2012
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	4.93	95.07	90.66	80.78	59.79	27.36
Last Week (01/24/2012 map)	0.52	99.48	95.08	82.60	62.47	25.27
3 Months Ago (11/01/2011 map)	0.00	100.00	100.00	98.18	90.42	64.95
Start of Calendar Year (12/27/2011 map)	0.01	99.99	97.83	84.81	67.32	32.36
Start of Water Year (09/27/2011 map)	0.00	100.00	100.00	99.16	96.65	85.75
One Year Ago (01/25/2011 map)	19.47	80.53	53.00	31.56	8.66	0.00



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>

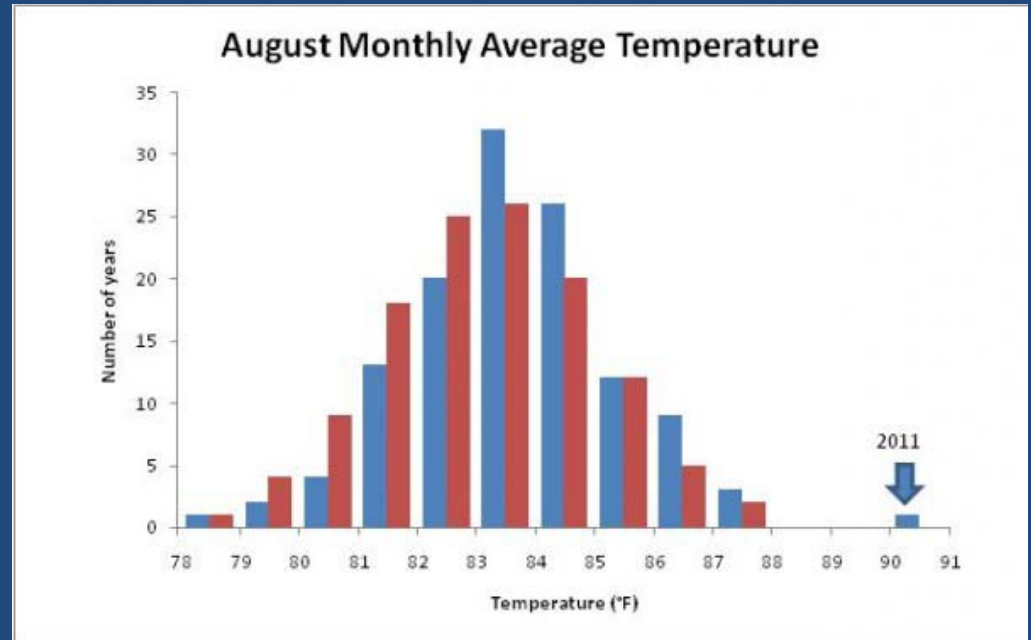


Released Thursday, February 2, 2012
Eric Luebehusen, USDA

2011 Summer Heat

Days at or above 100:

Houston IAH: 46 (32 in 1980)
Hobby: 18 (13 in 1998/2000)
Conroe: 53 (42 in 1998)
Huntsville: 72 (43 in 1980)
College Station: 69 (58 in 1917)
Dallas: 71 (69 in 1980)
Waco: 90 (63 in 1980)
Austin Mabry: 90 (69 in 1925)
San Antonio: 57 (59 in 2009)
Del Rio: 85 (78 in 1953)



Most Consecutive 100 degree days:

Houston IAH: 24 (14 in 1980)
Austin: 27 (21 in 2001)
Dallas: 40 (42 in 1980)
Waco: 44 (42 in 1980)

Top 4 Warmest months for Texas ever:

July 2011: 87.2
July 1998: 86.5
July 1980: 86.3
August 1952: 85.7

- Houston tied all-time record high of 109 on 8-27-11
- Galveston: 100 on 8-27-11 for only the 7th time ever
- Hottest June-August (summer) period ever!

2012 Drought Conditions

Lake Levels and Capacity Feb 6

Lake Conroe: -6.65 (72%)

Lake Houston: 0.00 (100%)

Lake Livingston: + 1.30 (100%)

Lake Somerville: -7.16 (54%)

Lake Texana: -9.29 (54%)

Lake Buchanan: -30.26 (40%)

Lake Travis: -53.99 (35%)

Lake Georgetown: -16.15 (53%)

Toledo Bend: -7.87 (71%)

Sam Rayburn: -9.55 (67%)



Lake Travis

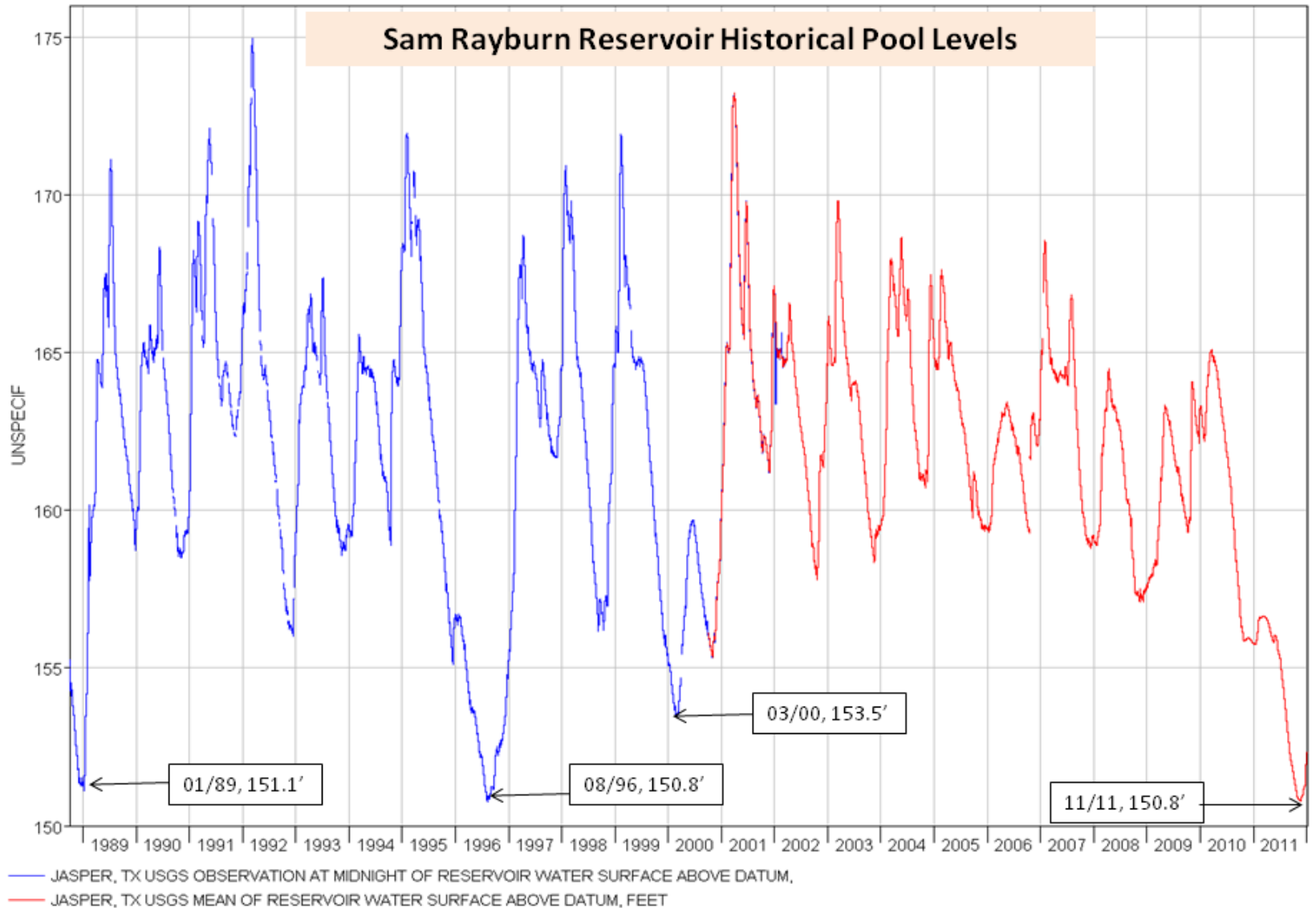


Lake Houston

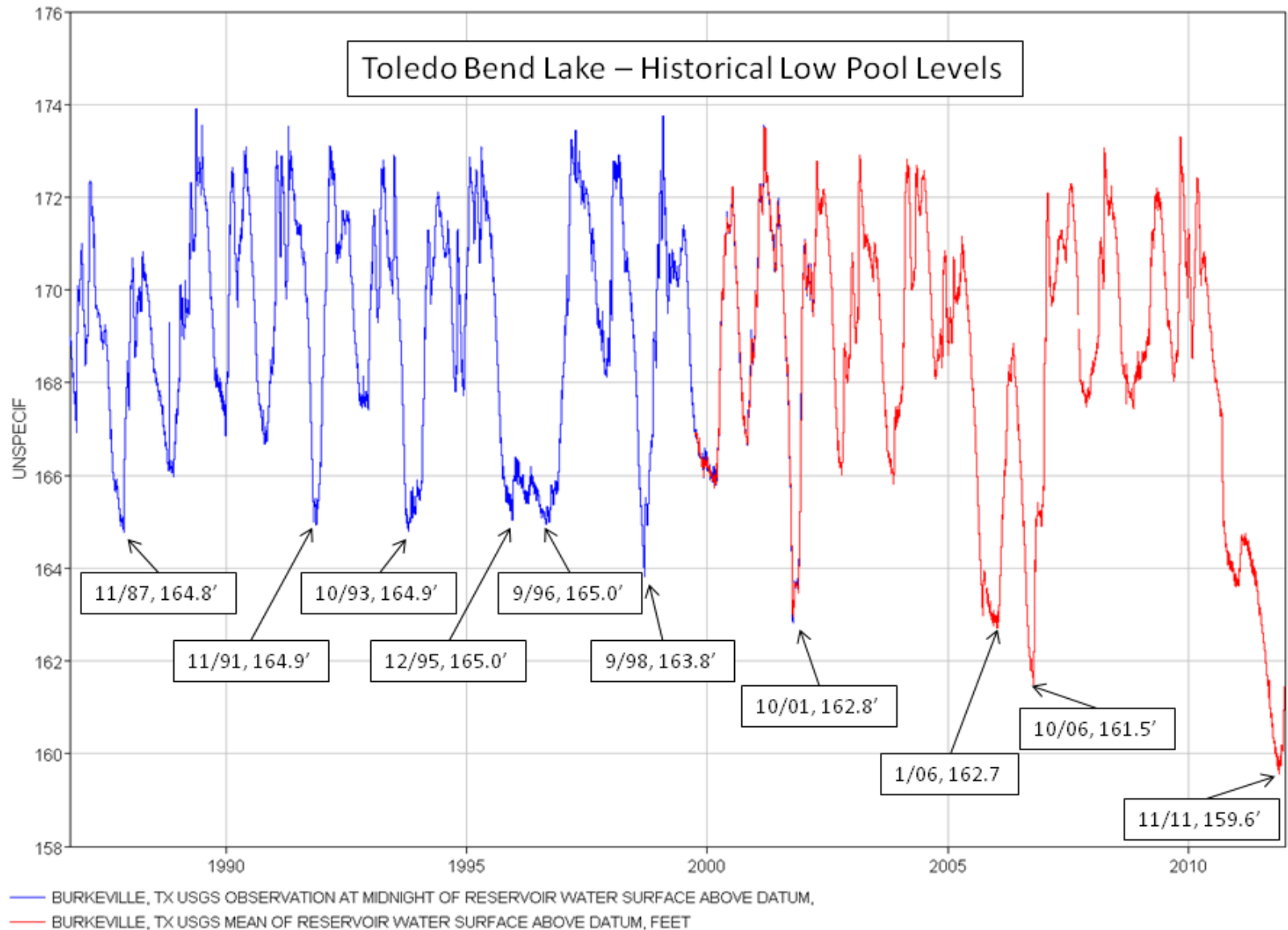


Lake Travis

Record Low Lake Levels



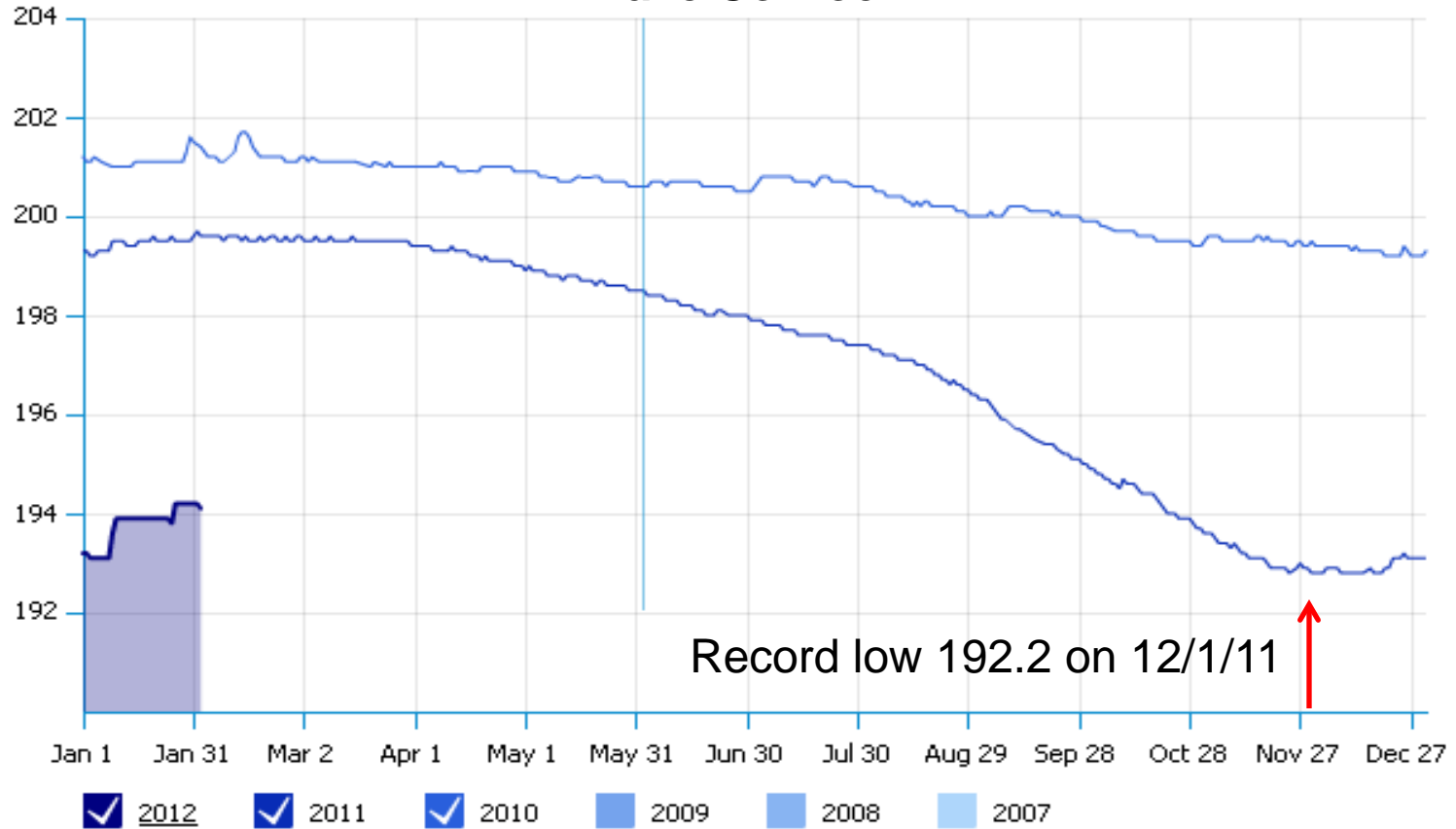
Record Low Lake Levels



Record Low Lake Levels

?

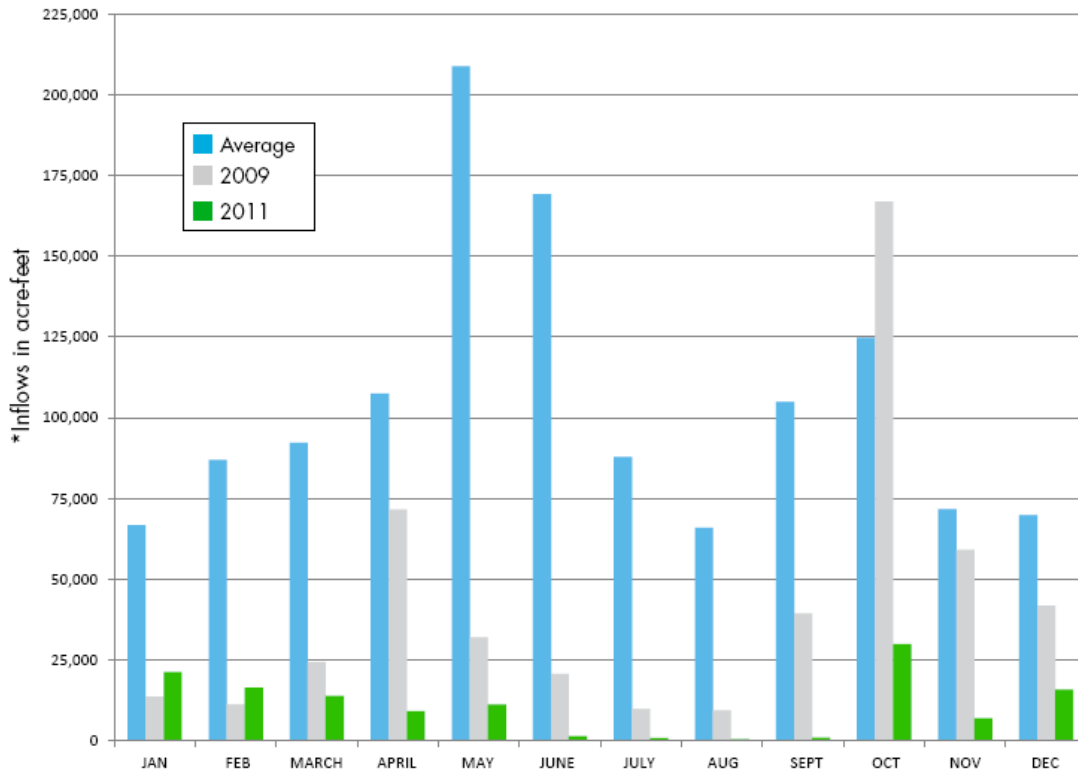
Lake Conroe



2011 Drought Conditions

Water flowing into the Highland Lakes

Rivers and streams are drying up



*Inflows: the estimated amount of water flowing into the Highland Lakes from rivers and streams.
Data for 2011 are preliminary and subject to change.

January - December totals
(in acre-feet)

Average: 1,256,710
2009: 499,732
2011: 127,699

Rank	Date	Inflows (acre-feet)
1	1952 - Aug.	210
2	1964 - July	347
3	2011 - Aug.	367
4	2011 - Sept.	658
5	2011 - July	720
6	2011 - June	1,341
7	1954 - Aug.	1,592
8	1954 - Sept.	2,194
9	2006 - Aug.	2,389
10	2000 - Aug.	2,584

LCRA Water Supply Projections

	2011	2012 (projections)		Historical Low**
	Dec. 13	Mar. 1*	June 1*	
Lake Travis (feet above mean sea level (ft msl))	626.65 (41.9 feet below monthly average)	620-623	617-621	614.18 (8/14/1951)
Lake Buchanan (ft msl)	988.46 (23.1 feet below monthly average)	982-984	977-981	983.70 (9/9/1952)
Combined Storage of lakes Buchanan and Travis (million acre-feet) / % of capacity	0.742 /37%	0.62-0.68 31%-34%	0.54-0.62 27%-31%	0.62 31% (9/9/1952)

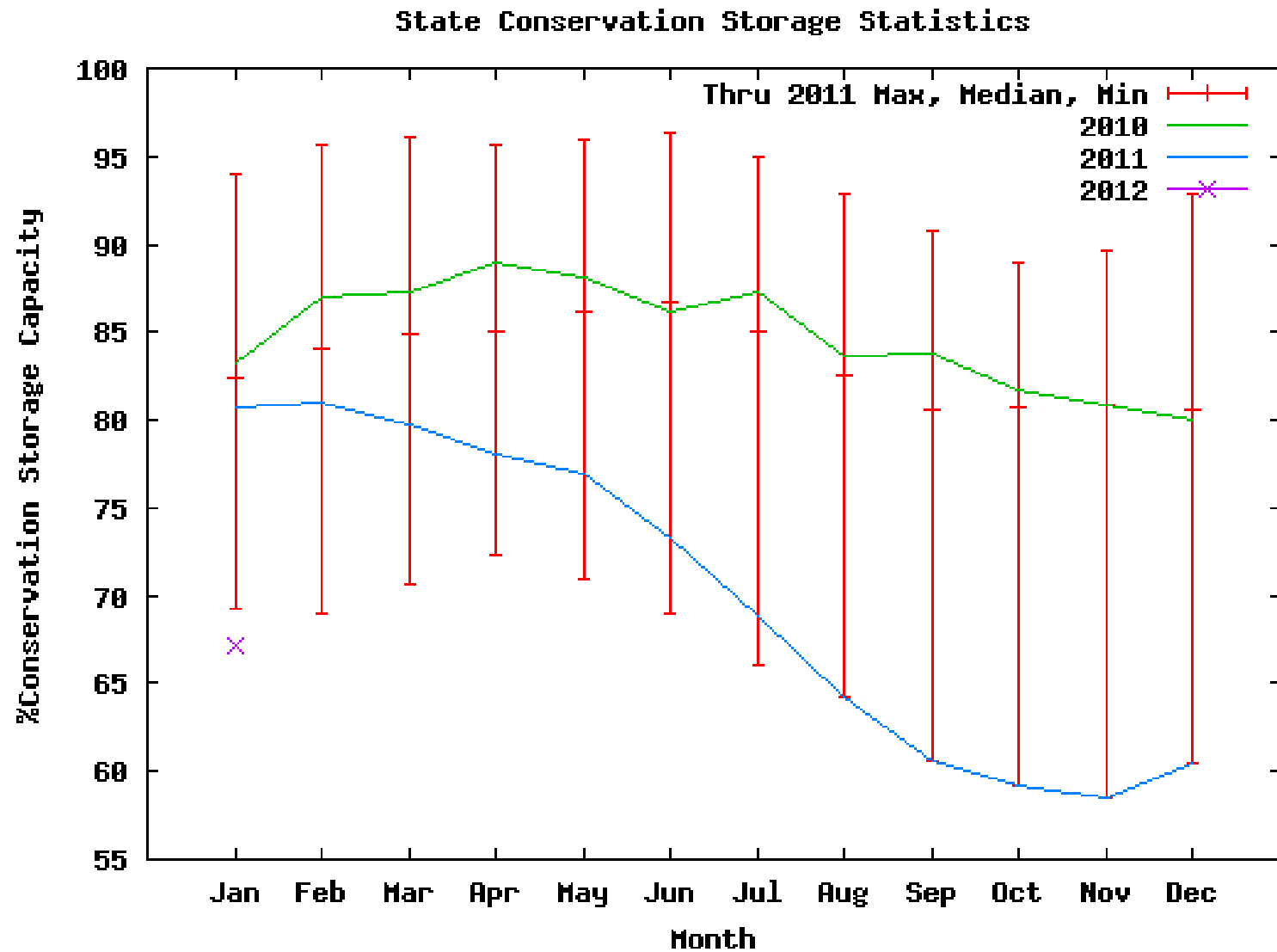
Lake Travis



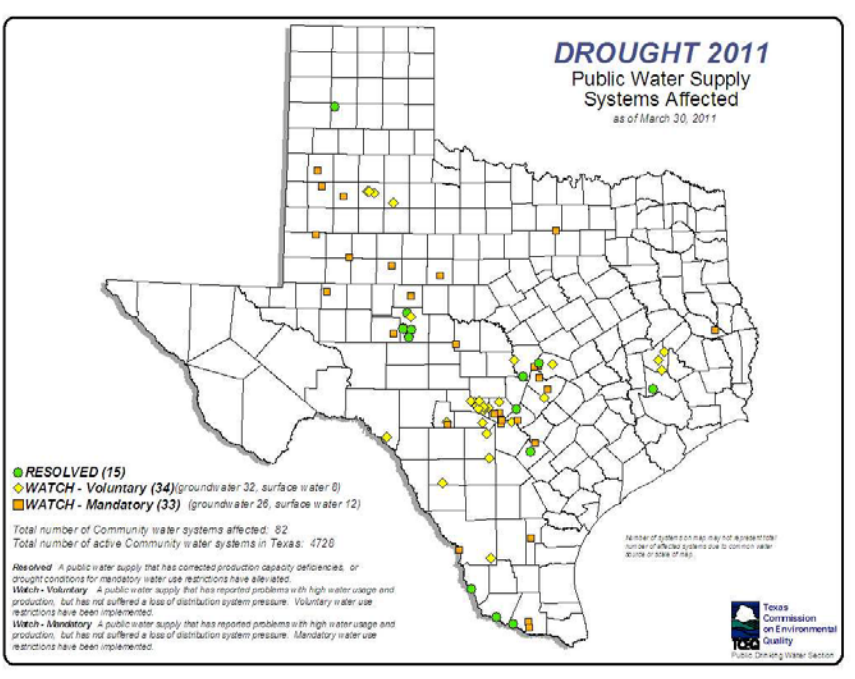
Pedernales River



Conservation Storage Statistics -TWDB



2011 Drought Conditions

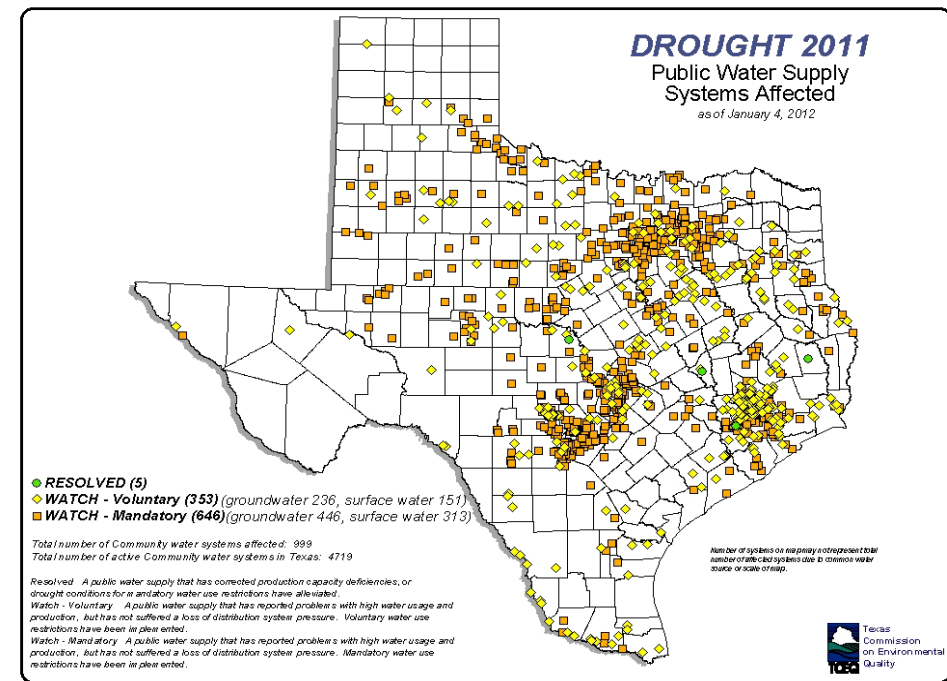


March 30, 2011

Mandatory: 646
Voluntary: 353

Mandatory: 33
Voluntary: 34

January 4, 2012



2010-2011 Drought

Top 5 Driest Years for Houston:

IAH	Hobby
1917 – 16.47 in	2011 – 25.41 in
1988 – 22.93 in	1988 – 26.65 in
2011 – 24.57 in	1956 – 28.32 in
1901 – 27.09 in	1954 – 28.76 in
1951 – 27.23 in	1931 – 31.11 in

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1917	1.29	1.56	0.65	2.30	2.21	0.83	3.30	1.13	1.95	0.32	0.93	1.19
2011	5.05	0.69	0.78	0.11	0.33	0.92	2.98	0.09	1.28	3.36	4.70	4.28

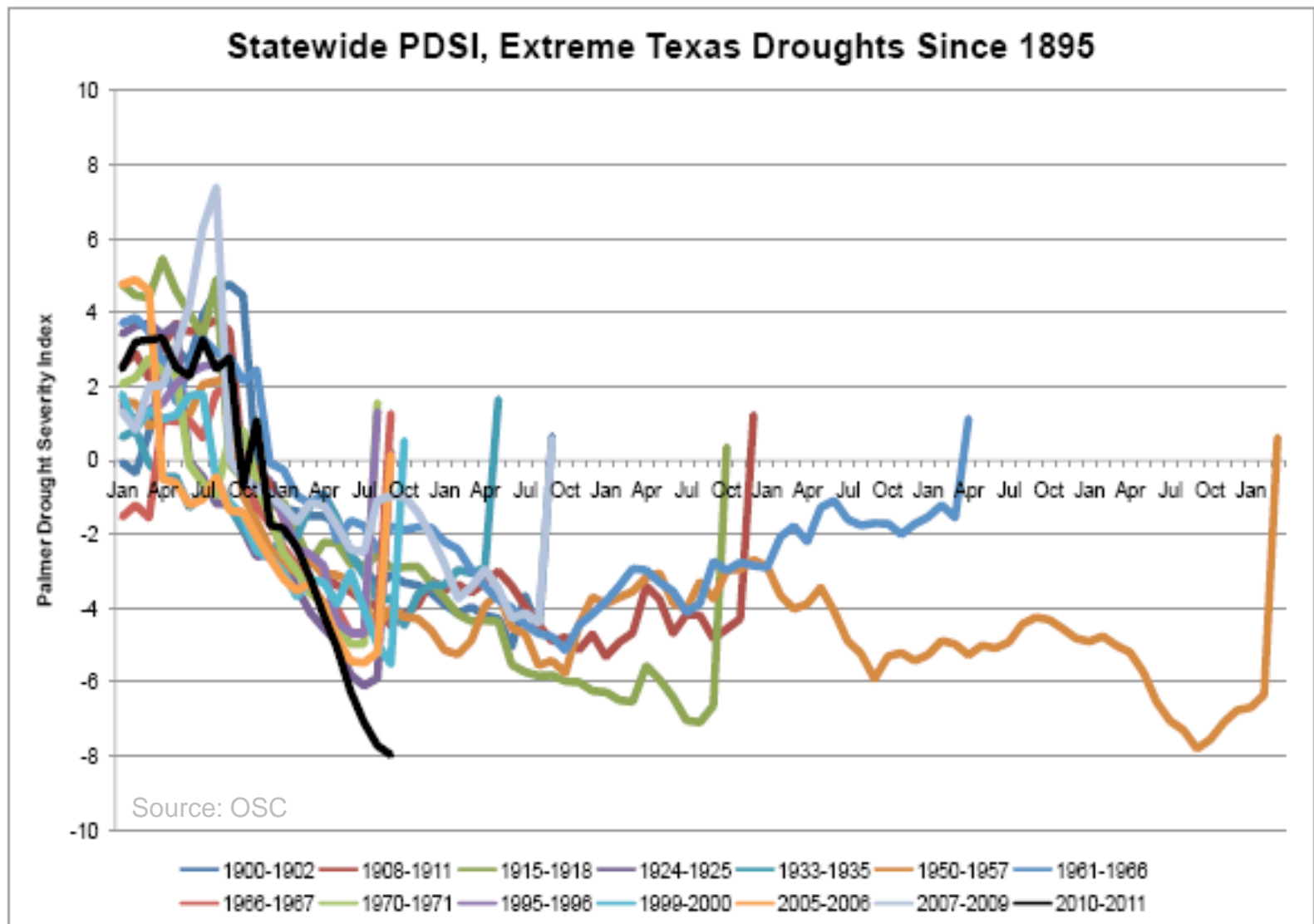
Texas Drought Rankings

1. 1950-1957 (Sept 1956 peak)
2. 2010-?
3. 1916-1918 (Aug 1918 peak)
4. 1924-1925 (July 1925 peak)
5. 1999-2000 (Sept 2000 peak)



<u>Drought</u>	<u>Lowest PDSI</u>
2010-2011	-7.97 SEP 2011
1951-1957	-7.80 SEP 1956
1916-1918	-7.09 AUG 1918
1924-1925	-6.10 JUL 1925
1999-2000	-5.51 SEP 2000

2010-2011 Drought



2010-2011 Drought

Driest 12-Month Period Ever (September 22, 2010 to September 23, 2011)

Location	Rainfall (in) (9-22-10 to 9-23-11)	Previous Rainfall Record (in)	Record Exceedance (in)
Bellville	12.75	19.90 (1987-88)	7.15
Conroe	17.42	22.51 (1924-25)	5.09
Freeport	17.98	24.77 (1953-54)	6.79
BUSH IAH	17.71	23.25 (1916-17)	5.54
Katy	14.67	27.31 (1987-88)	12.64
Livingston	17.77	31.35 (1947-48)	13.58
Tomball	12.44	22.15 (1960-61)	9.71
Wash on the Brazos	14.52	24.44 (1955-56)	9.92

Red: broke previous record by over 10 inches

Orange: broke previous record by over 5 inches

2010-2012 Drought

Rainfall Deficits (Jan 1 2010 to Feb 2 2012)

Bellville: -36.53
Brenham: -35.91
Baytown: -36.35
College Station: -32.83
Columbus: -29.59
Conroe: -38.68
Crockett: -26.23
Freeport: -47.61
Hobby: -33.97
IAH: -30.56
Katy: -26.38
Somerville: -30.07
Livingston: -46.58
Matagorda: -28.85
Huntsville: -49.49
Tomball: -54.36

Rainfall Deficits since Hurricane Ike

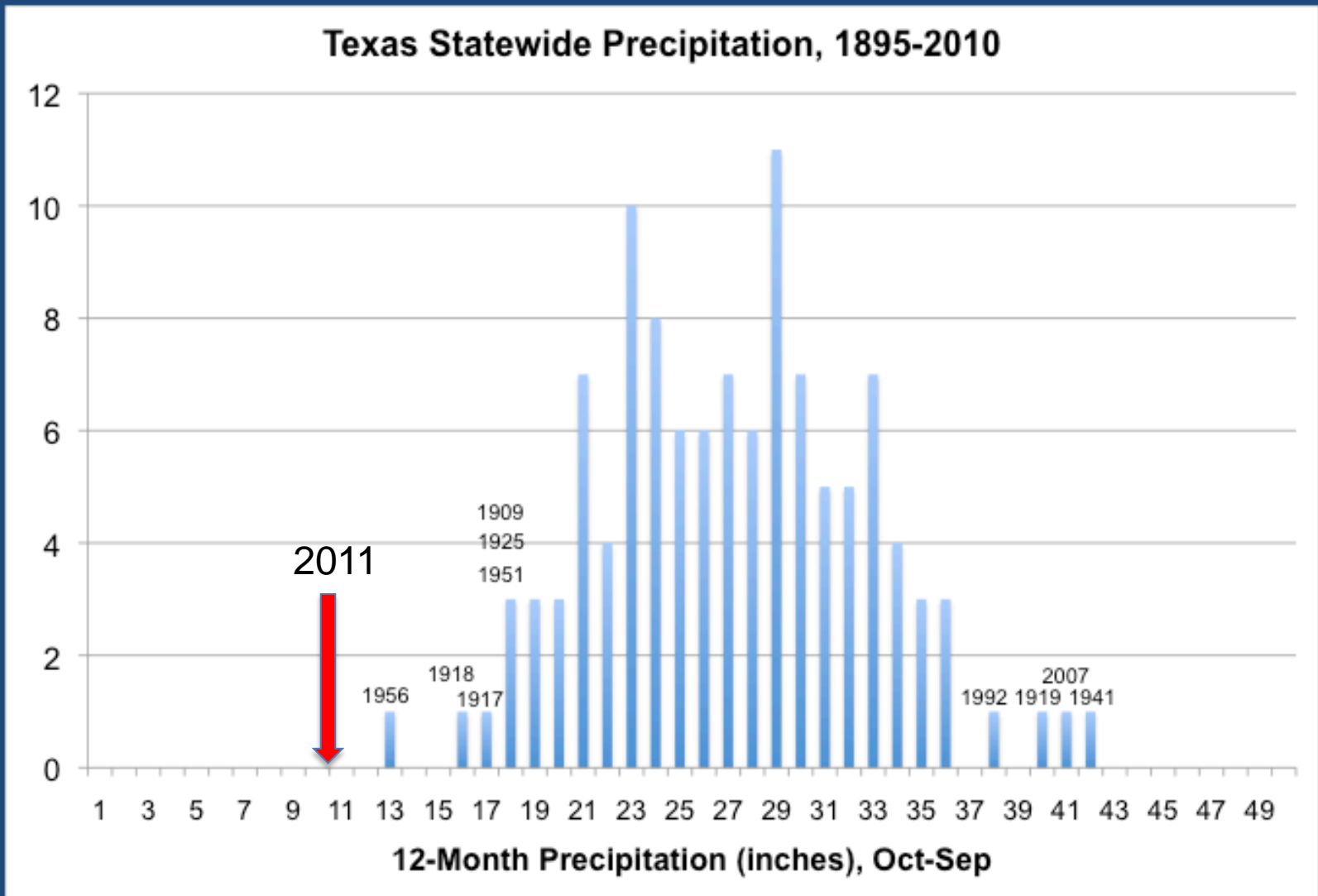
Baytown: -50.89
Galveston: -46.53
Houston IAH: -32.44
Houston Hobby: -38.02
College Station: -33.63
Richmond: -41.00
Bay City: -40.20
Wharton: -38.66
Livingston: -43.28

Have been in mild drought since Ike, but the last 15 months have been brutal

October 2010 to September 2011: Driest 1-year period ever for state of TX

2011: Driest year ever for the state of Texas (14.88 in, previous record 14.99 in 1917, average: 27.92 in)

2010-2011 Drought



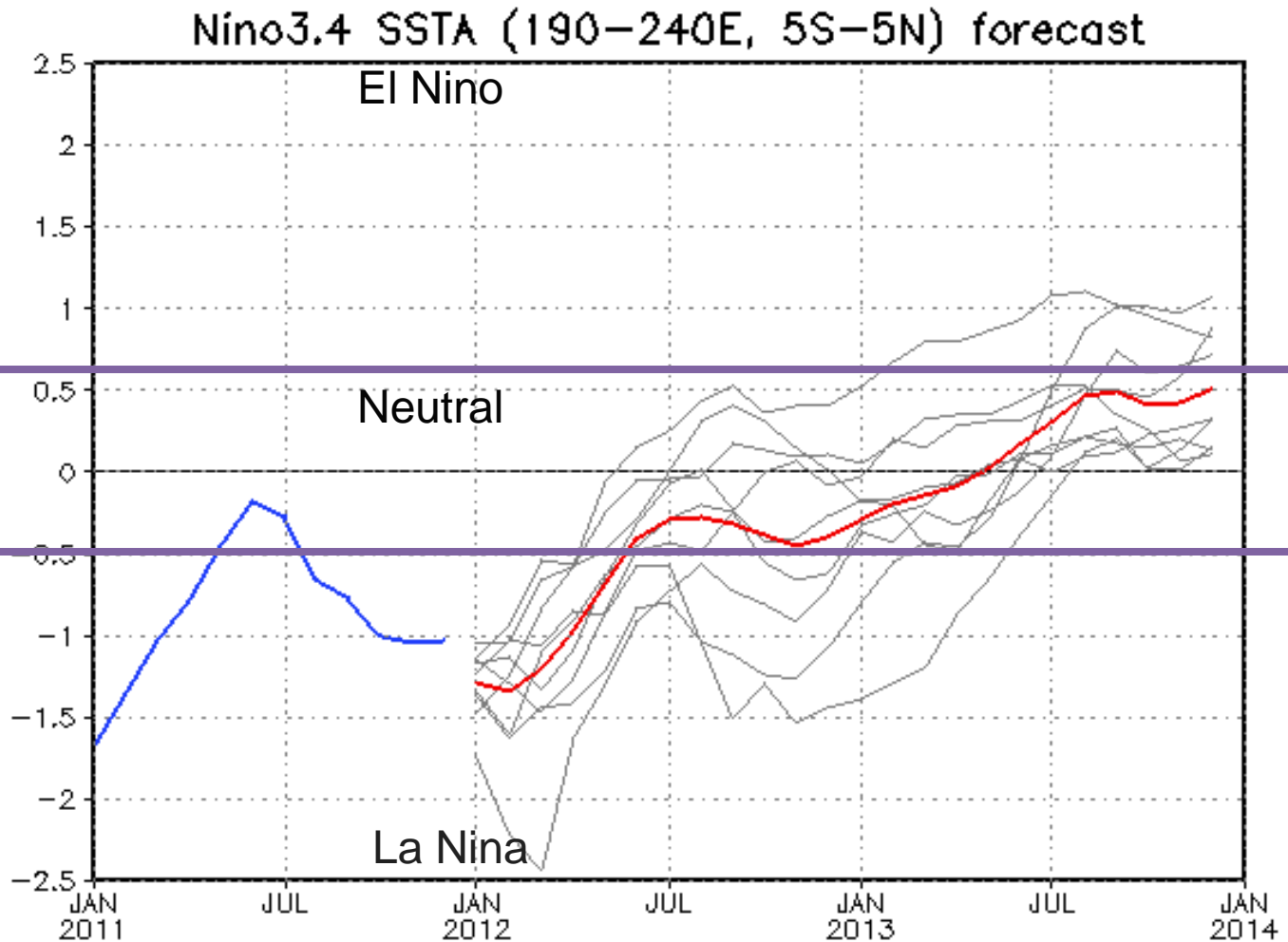
Driest year on record for Texas

2010-2011 Drought

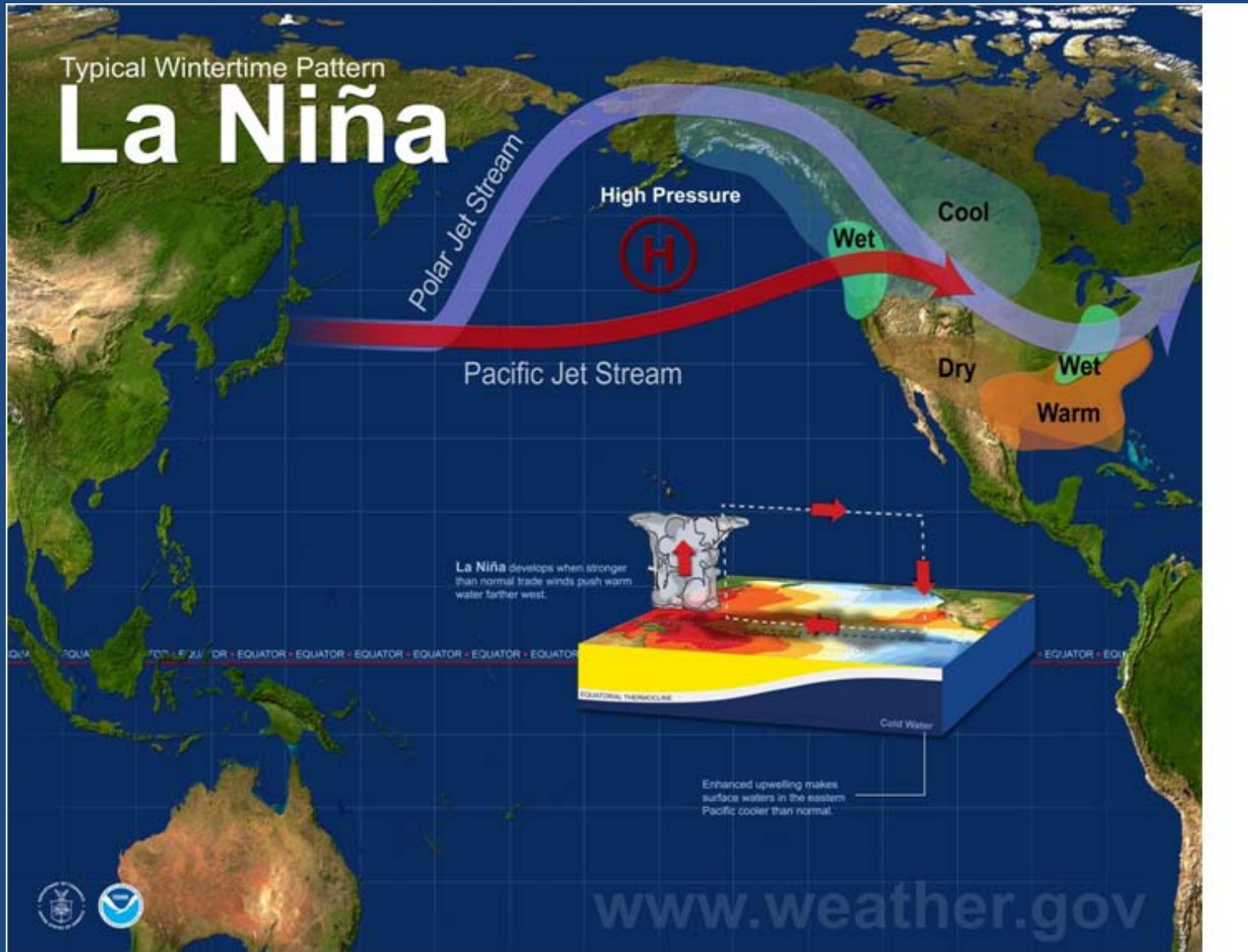
- 2nd worst in SE TX based on rainfall behind 1917-1918 (likely worst in some areas)
- 2nd worst drought in TX history (behind 1950's)
- At least 5.2 billion in economic losses so far, 90% of corn crop failed
- Hay no longer available for cattle
- Tremendous impacts on livestock, vegetation, economy
- 500 million trees lost across TX (10% of state canopy coverage)
 - Hardest hit (Harris, Montgomery, Grimes, Madison Counties)
 - 4 million additional trees lost to wildfires (1.5 million in Bastrop alone)
 - Over 12,000 trees lost in Memorial Park



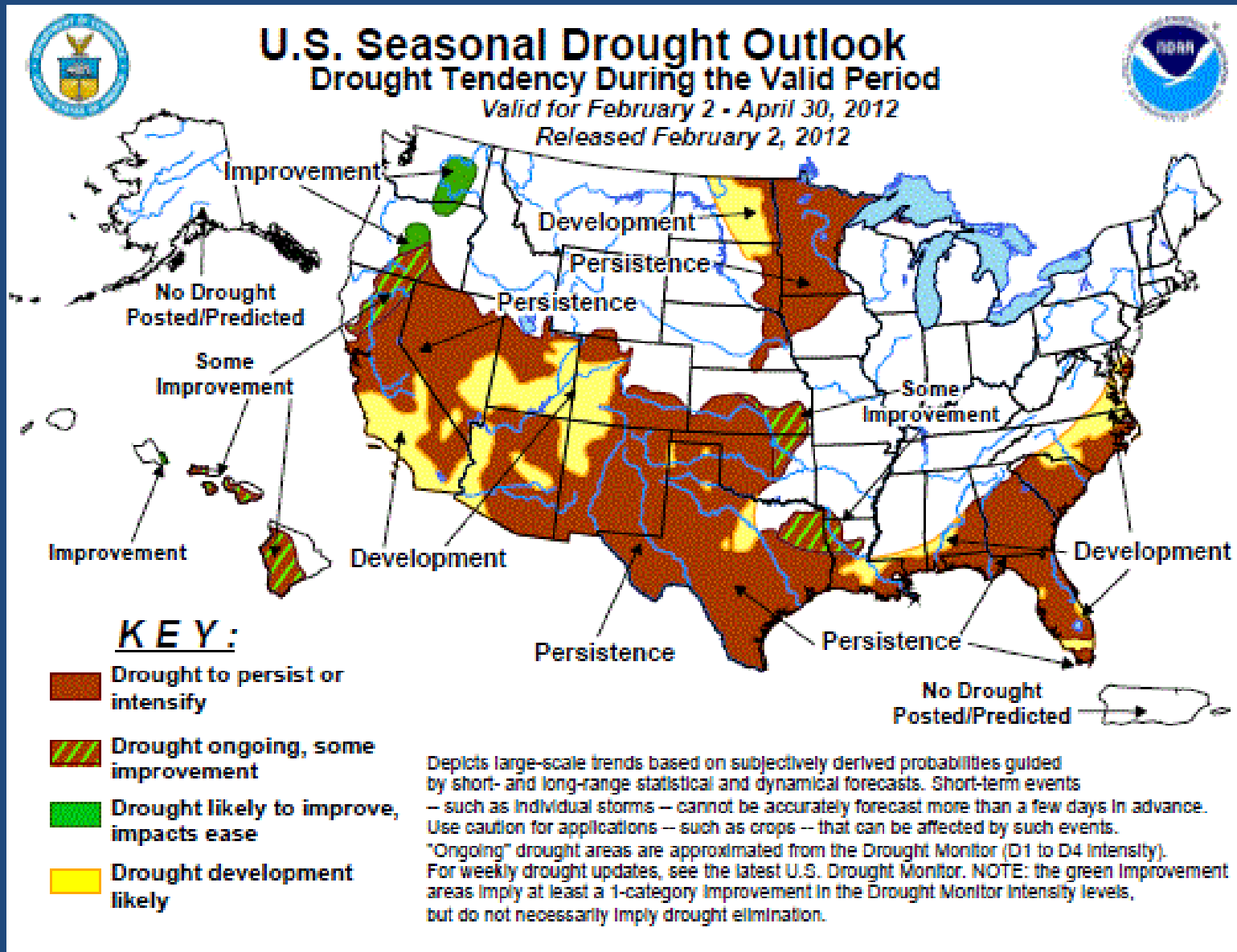
2011-2013 ENSO Forecast Models



La Niña Impacts



2012 Drought Forecast





Questions

Jeff.lindner@hcfcd.org