Guadalupe-Blanco River Authority

Presentation to CCR – March 26, 2009

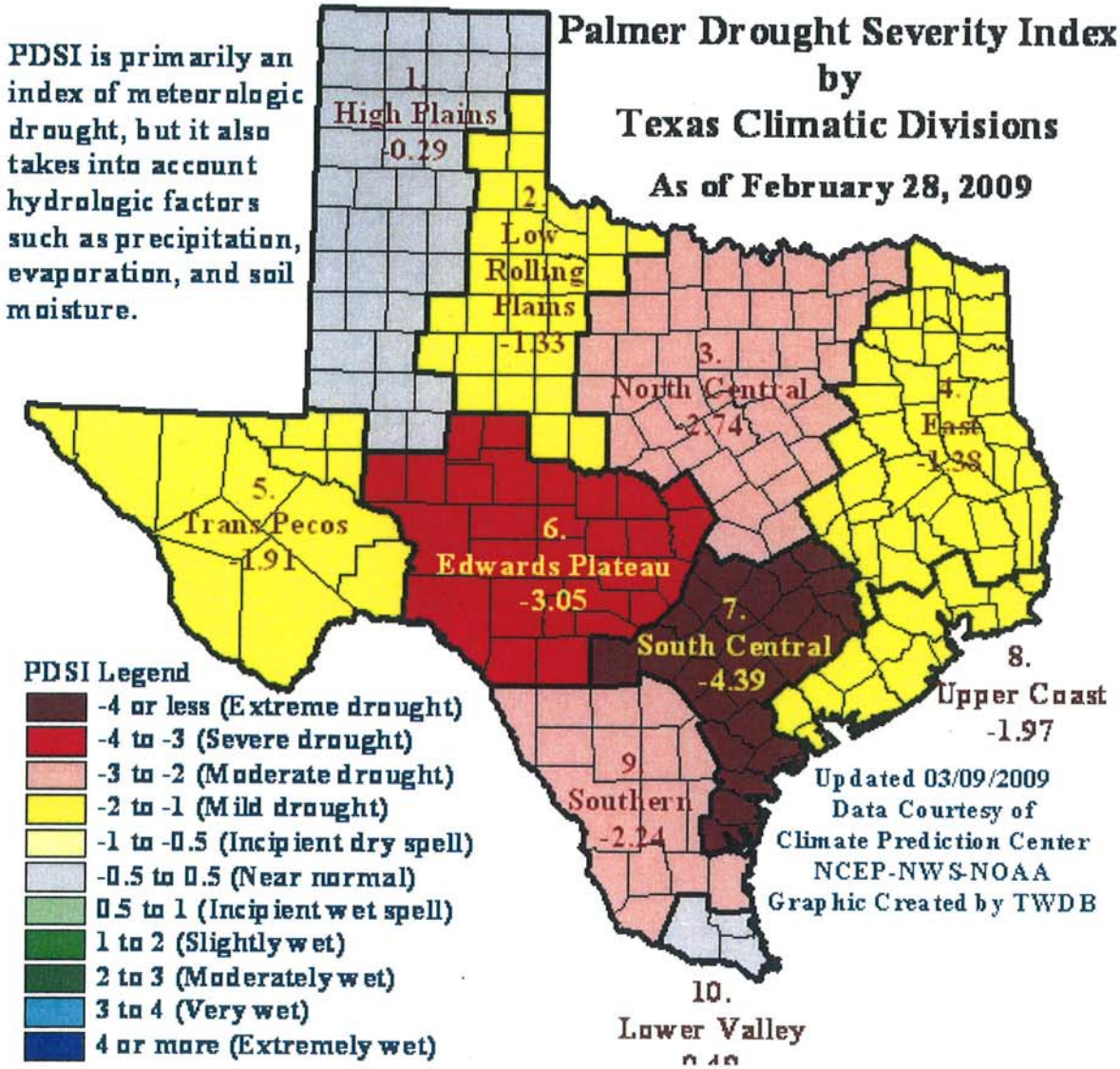
Texas Historic Drought

- 1891 – 1893
- 1896 – 1899
- 1901 -1902
- 1909 – 1912
- 1916 – 1918
- 1924 – 1925
- 1933 – 1934
- 1937 – 1939
- 1949 – 1956
- 1961 - 1964
- 1969 – 1971
- 1983 – 1985
- 1988 – 1990
- 1996 – 1998
- 1999 – 2000
- 2005 - 2007
- 2008 - ?

Palmer Drought Severity Index

- 4.0 or more — Extremely wet
- 3.0 to 3.99 — Very wet
- 2.0 to 2.99 — Moderately wet
- 1.0 to 1.99 — Slightly wet
- 0.5 to –0.5 — Near normal
- -1.0 to –1.99 — Mild drought
- -2.0 to –2.99 — Moderate drought
- -3.0 to –3.99 — Severe drought
- -4.00 or less — Extreme drought

Explanation of PDSI



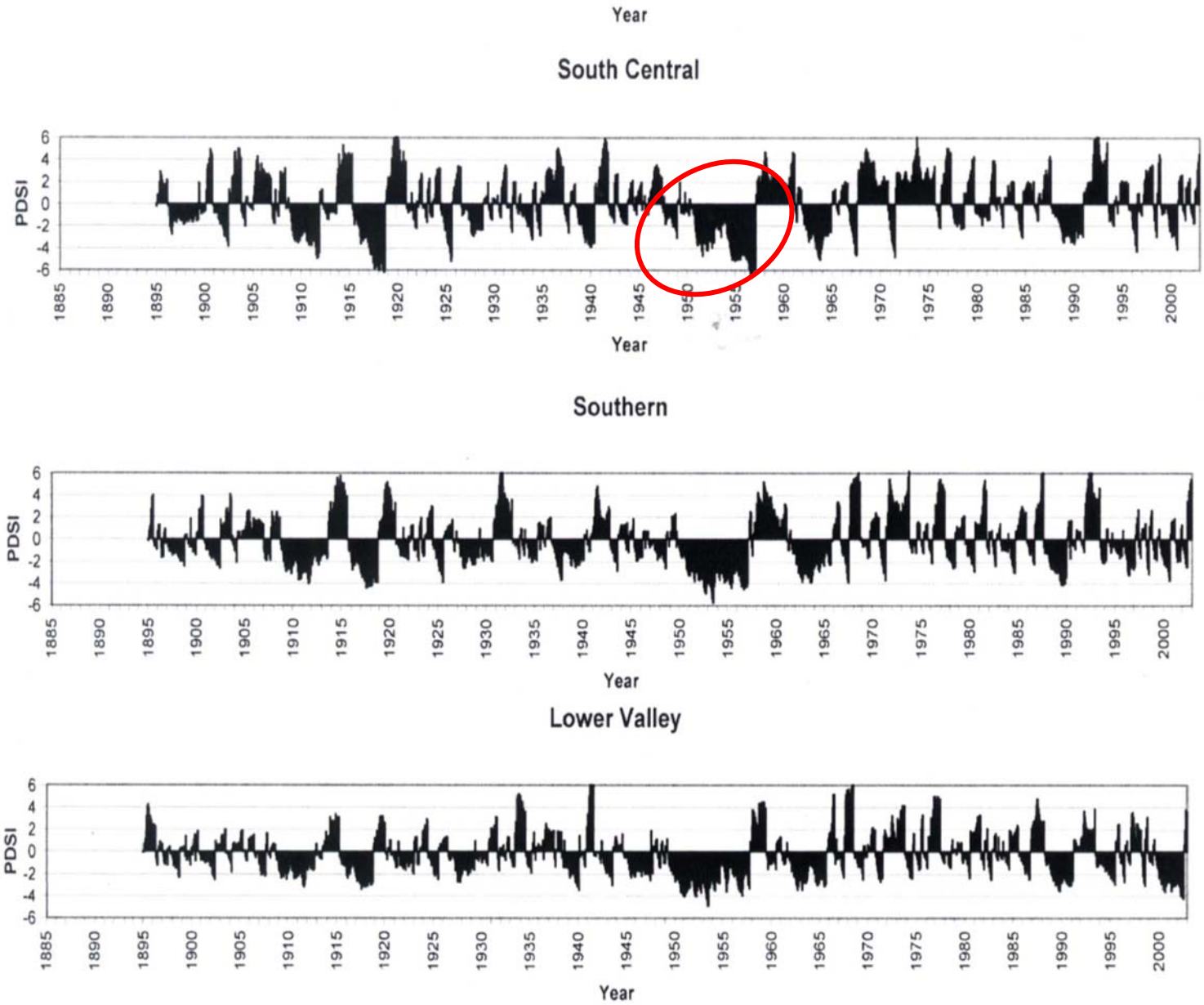
Historic Drought – Palmer Index
Maximum Monthly

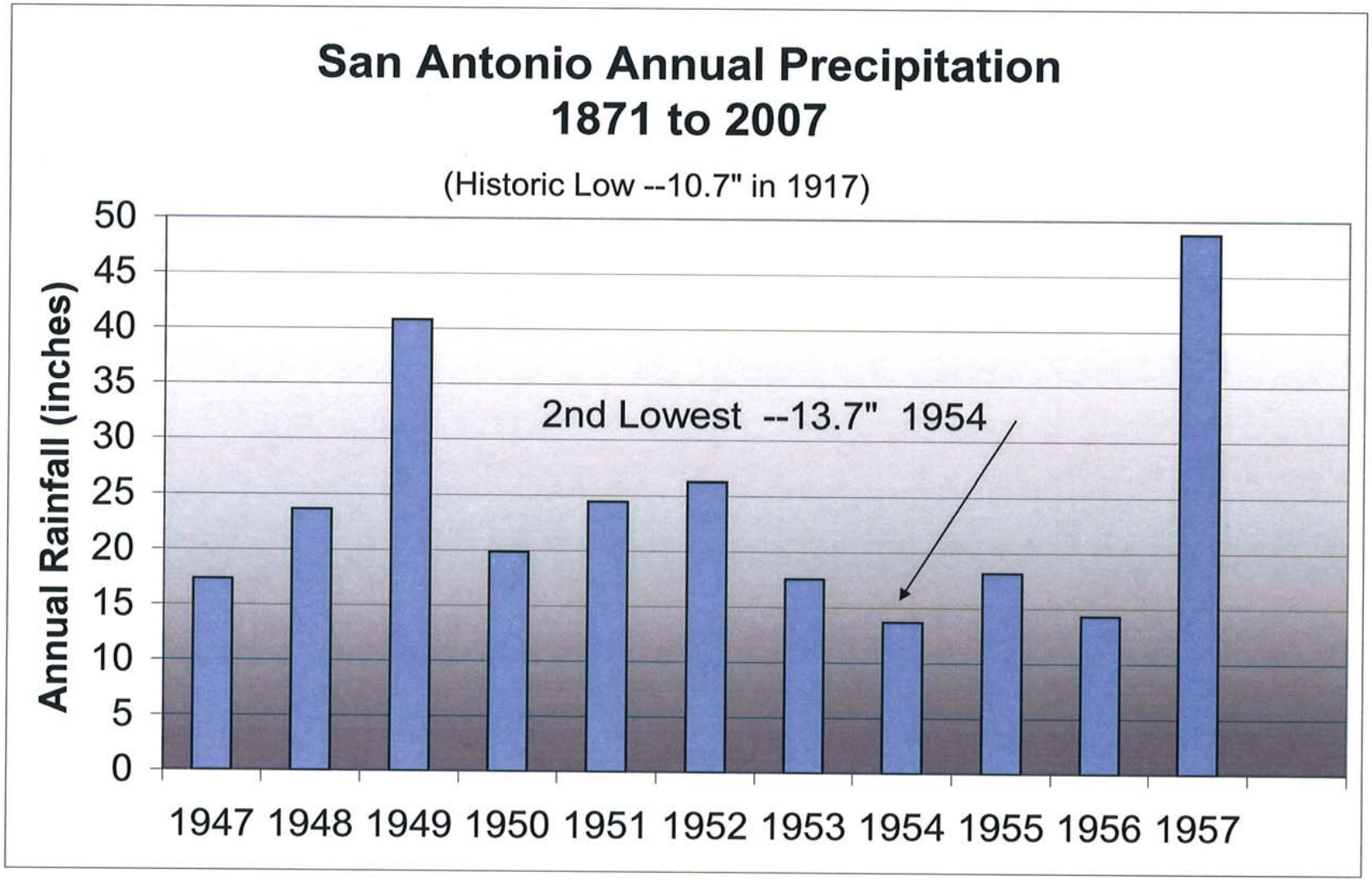
- 1891 – 1893
- 1896 – 1899 -2.7 PDSI
- 1901 -1902 -3.9 PDSI
- 1909 – 1912 -4.8 PDSI
- 1916 – 1918 -6.0 PDSI
- 1924 – 1925 -5.0 PDSI
- 1933 – 1934 -3.0 PDSI
- 1937 – 1939 -3.9 PDSI

- 1949 – 1956 -6.0 PDSI
- 1961 - 1964 -4.8 PDSI
- 1969 – 1971 -4.5 PDSI
- 1983 – 1985 -3.1 PDSI
- 1988 – 1990 -3.5 PDSI
- 1996 – 1998 -4.2 PDSI
- 1999 – 2000 -4.2 PDSI
- 2005 - 2007 -4.6 PDSI
- 2008 - ? -4.4 PDSI

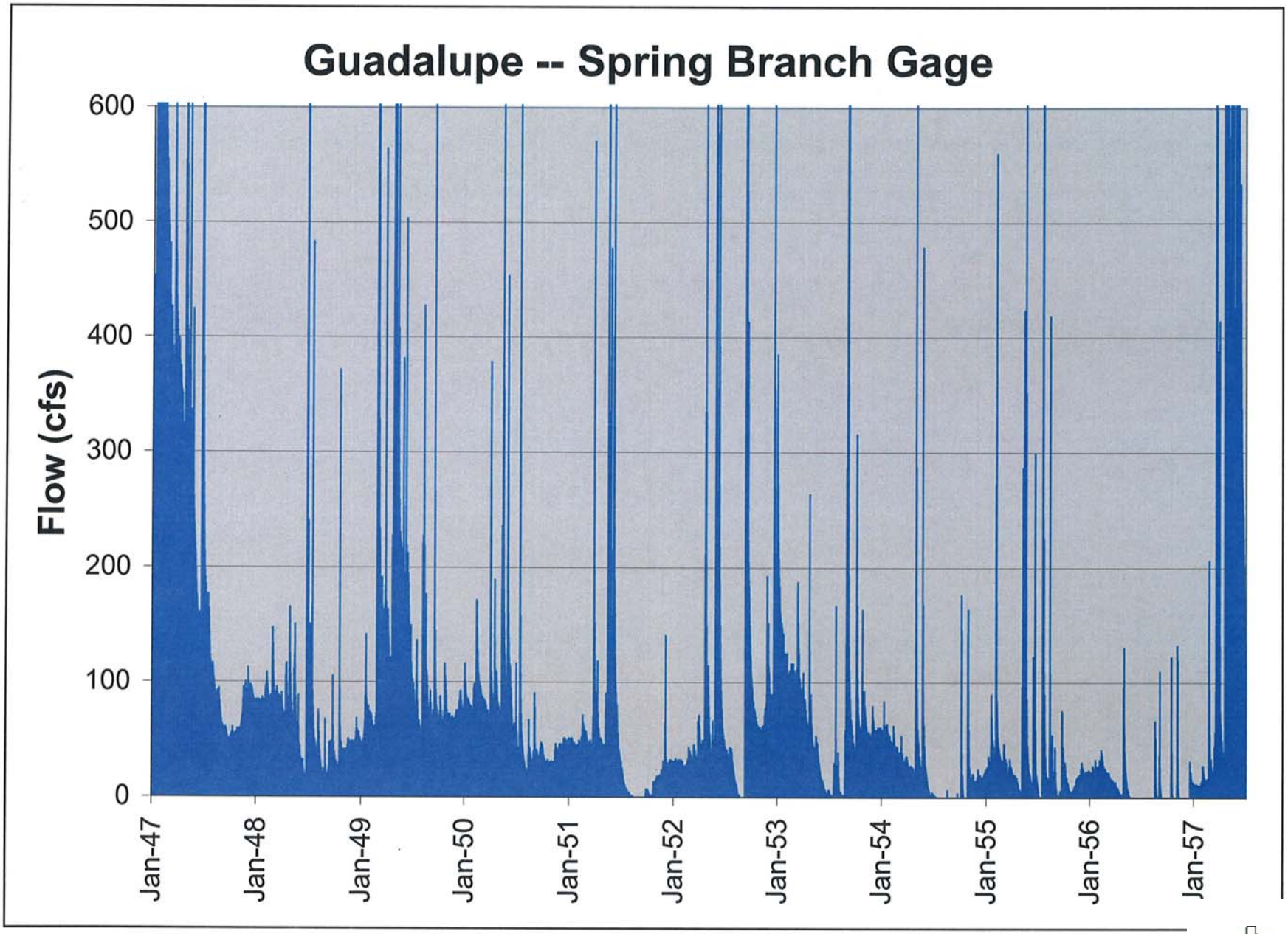
GBRA

TWDB Reconstructed Palmer Index




San Antonio Annual Precipitation
1871 to 2007
(Historic Low --10.7" in 1917)
Annual Rainfall (inches)
50
45
40
35
30
25
20
15
10
5
0
2nd Lowest --13.7" 1954
1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957

GBRA


Guadalupe -- Spring Branch Gage
Flow (cfs)
600
500
400
300
200
100
0
Jan-47
Jan-48
Jan-49
Jan-50
Jan-51
Jan-52
Jan-53
Jan-54
Jan-55
Jan-56
Jan-57

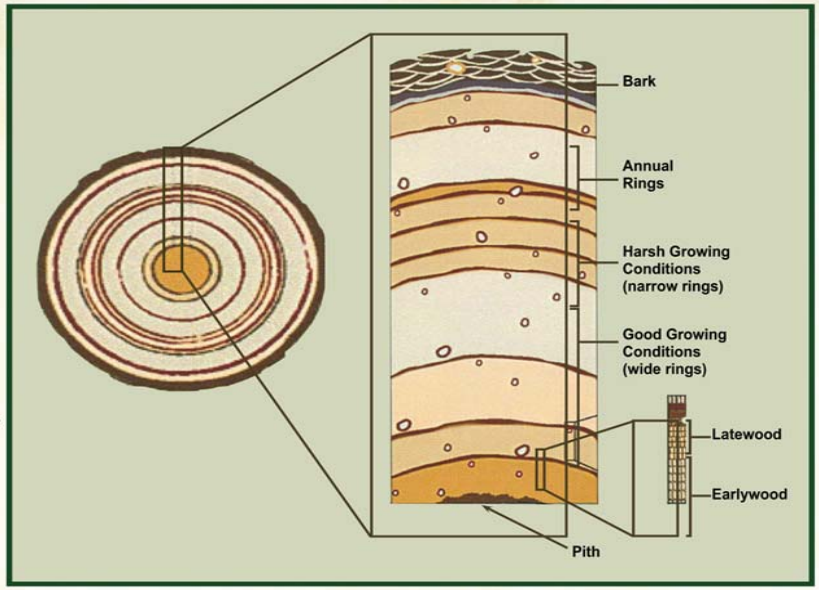
GBRA

Central Texas Tree-Ring Research

Dendrochronology (Tree Ring Study) is the dating and study of annual rings in trees.

What do Tree Rings Tell Us?

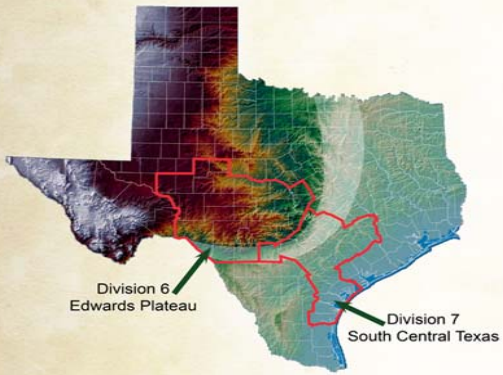
1. Each year a tree produces one ring and the ring widths can provide insights into its growing conditions (i.e. weather).
2. Provides a better understanding of current climate and environmental processes and conditions.
3. Improves understanding of possible future climate and environmental issues.



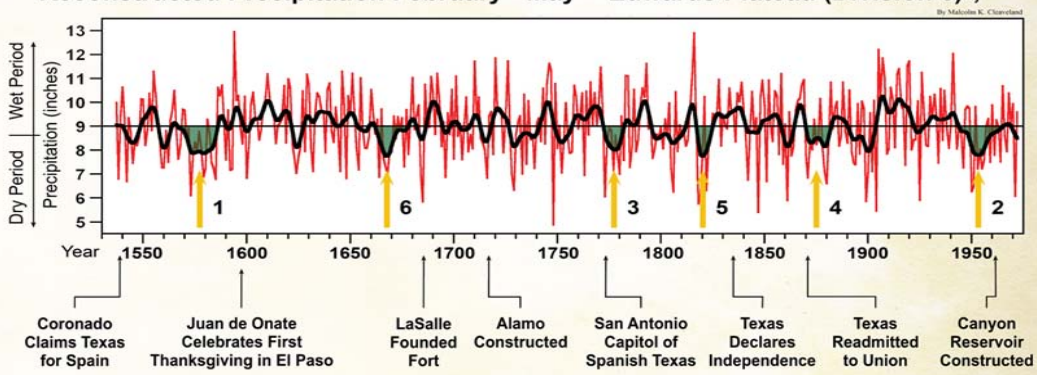
Drought is a big problem in Texas due to its semiarid and drought-prone climate, particularly in west and central Texas.

One means of overcoming the lack of observed data on past climate conditions is to use things strongly influenced by climate data as a substitute or "proxy" for instrumental data, e.g., pollen or **tree rings** (Stahle et al. 1988; Stahle and Cleaveland 1992; Cleaveland 2000; Fye and Cleaveland 2001; Watson and Core Writing Team 2001).

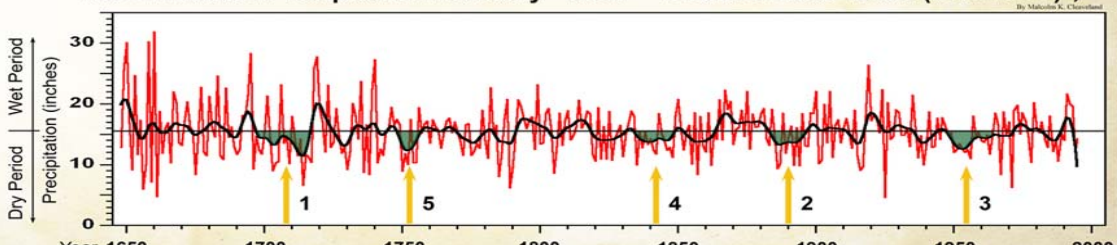
One of the best proxies (a substitute for instrumental data) to analyze the climate of Texas is **tree rings**. Trees that produce rings annually are widely distributed and readily available. Each ring can be dated exactly and the climate information is relatively easy to extract from propely dated samples (Stahle 1996; Fritts 2001).



Reconstructed Precipitation February - May -- Edwards Plateau (Division 6)*,**

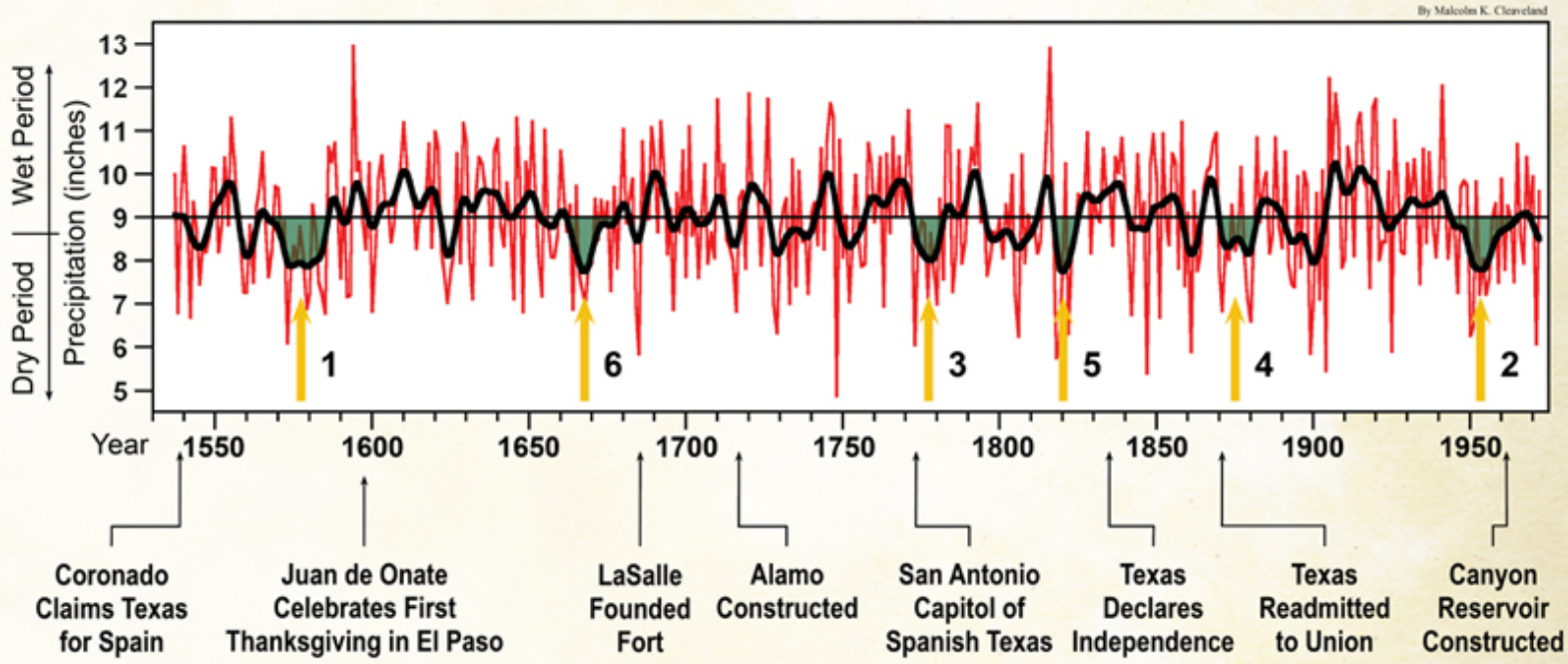


Reconstructed Precipitation February - June -- South Central Texas (Division 7)*,**

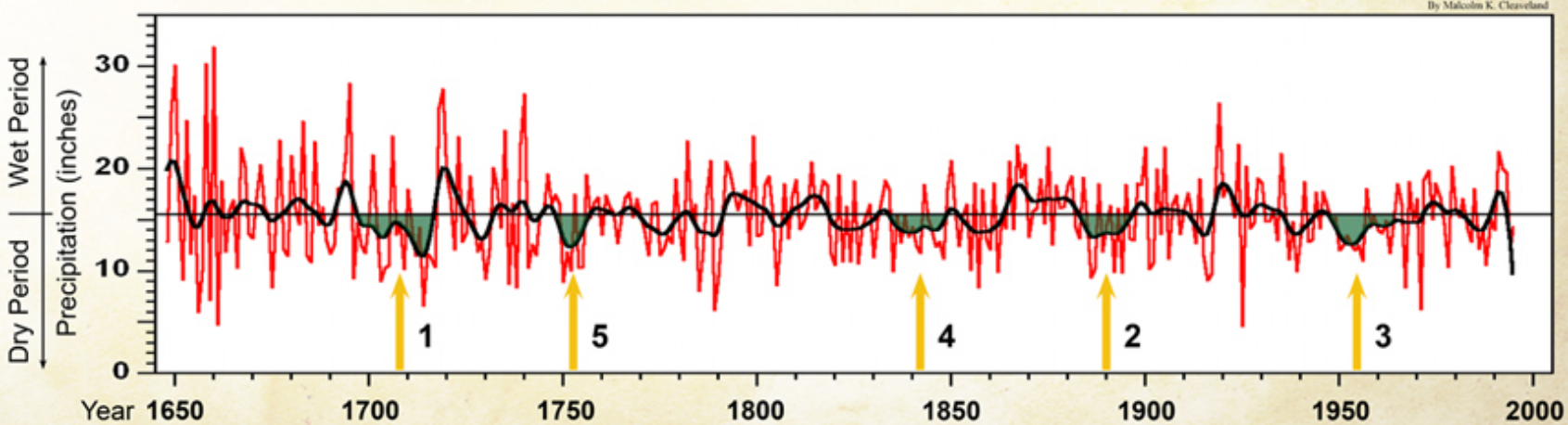


GBRA

Reconstructed Precipitation February - May -- Edwards Plateau (Division 6)*,**



Reconstructed Precipitation February - June -- South Central Texas (Division 7)*,**

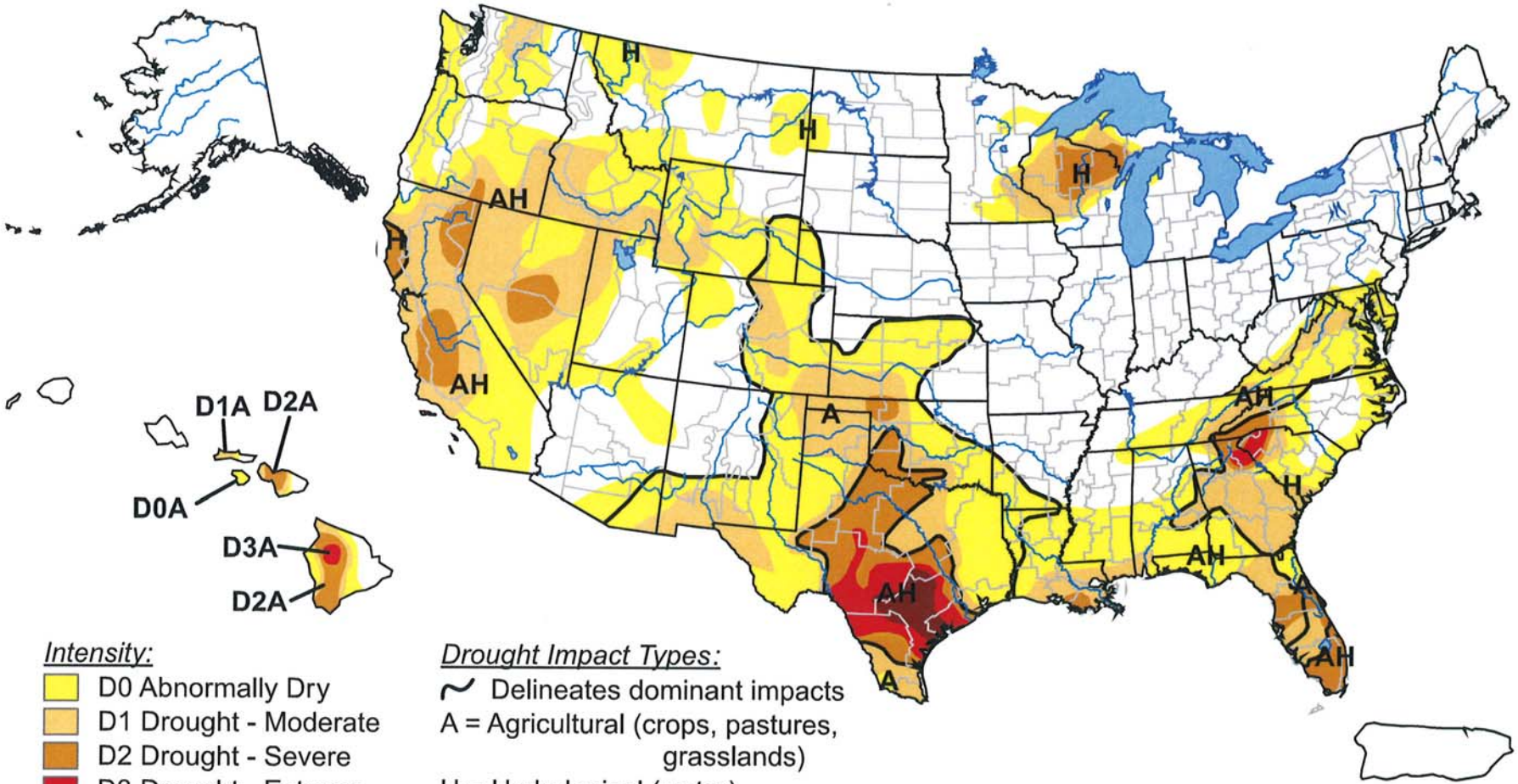


*Major multi-year droughts are shown in green.
**Multi-year droughts ranked by combination of severity and duration from most significant (1) to least significant (5 or 6).

GBRA

U.S. Drought Monitor

March 17, 2009
Valid 8 a.m. EDT



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

Drought Impact Types:
- ~ Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

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

http://drought.unl.edu/dm

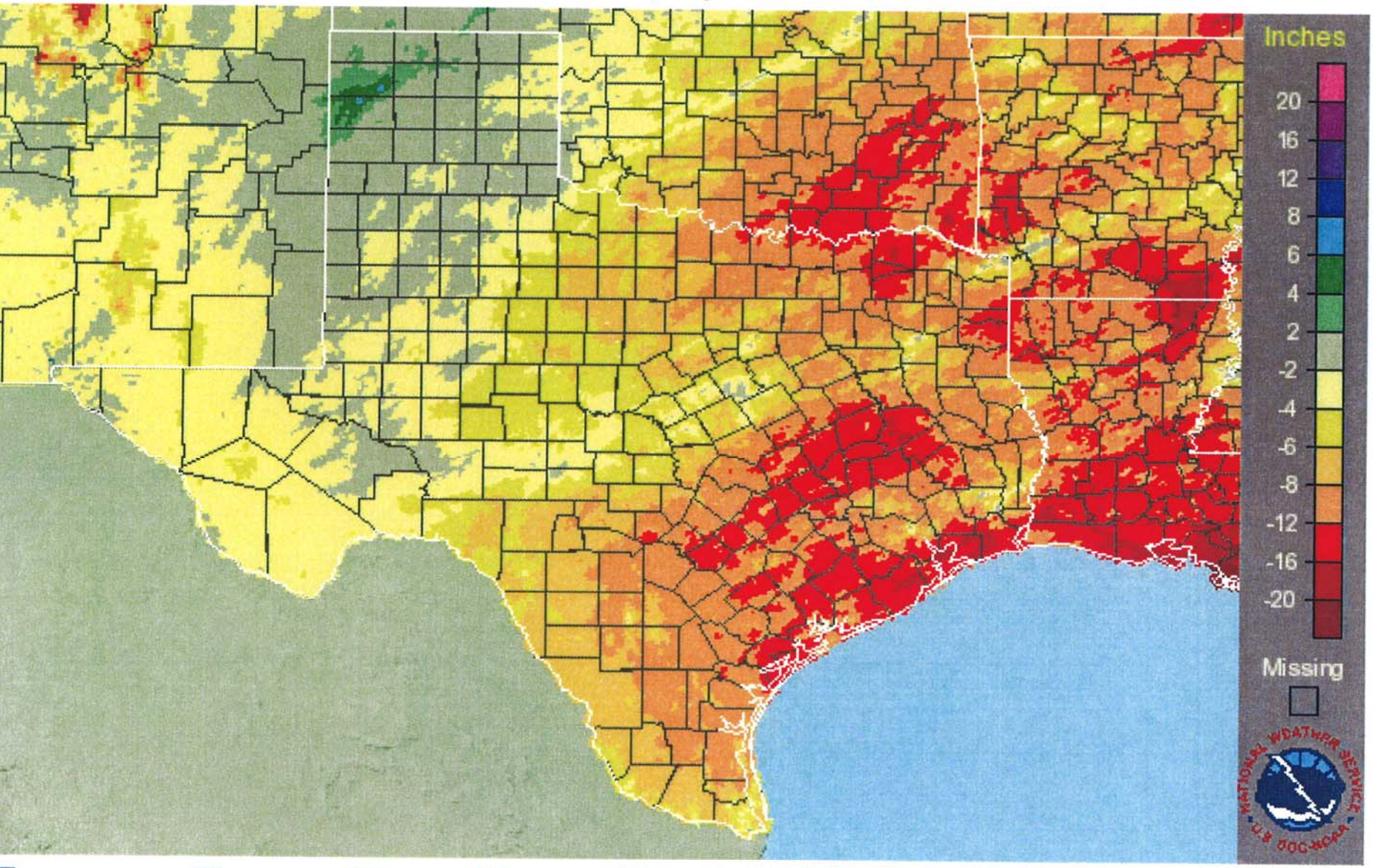
USDA National Drought Mitigation Center

Released Thursday, March 19, 2009

Author: Laura Edwards, Western Regional Climate Center

Departure from Normal Precipitation - Valid 3/26/2009 1200 UTC

Click on the image to zoom in
Click on "States" to zoom out



☑ Pcpn Amount ☑ Counties ☐ Rivers ☑ States ☐ Highway/City ☐ RFC Boundary

Last Update: 3/26/2009 1221

☐ **2. Product**

☐ **3. Location**

◉ States

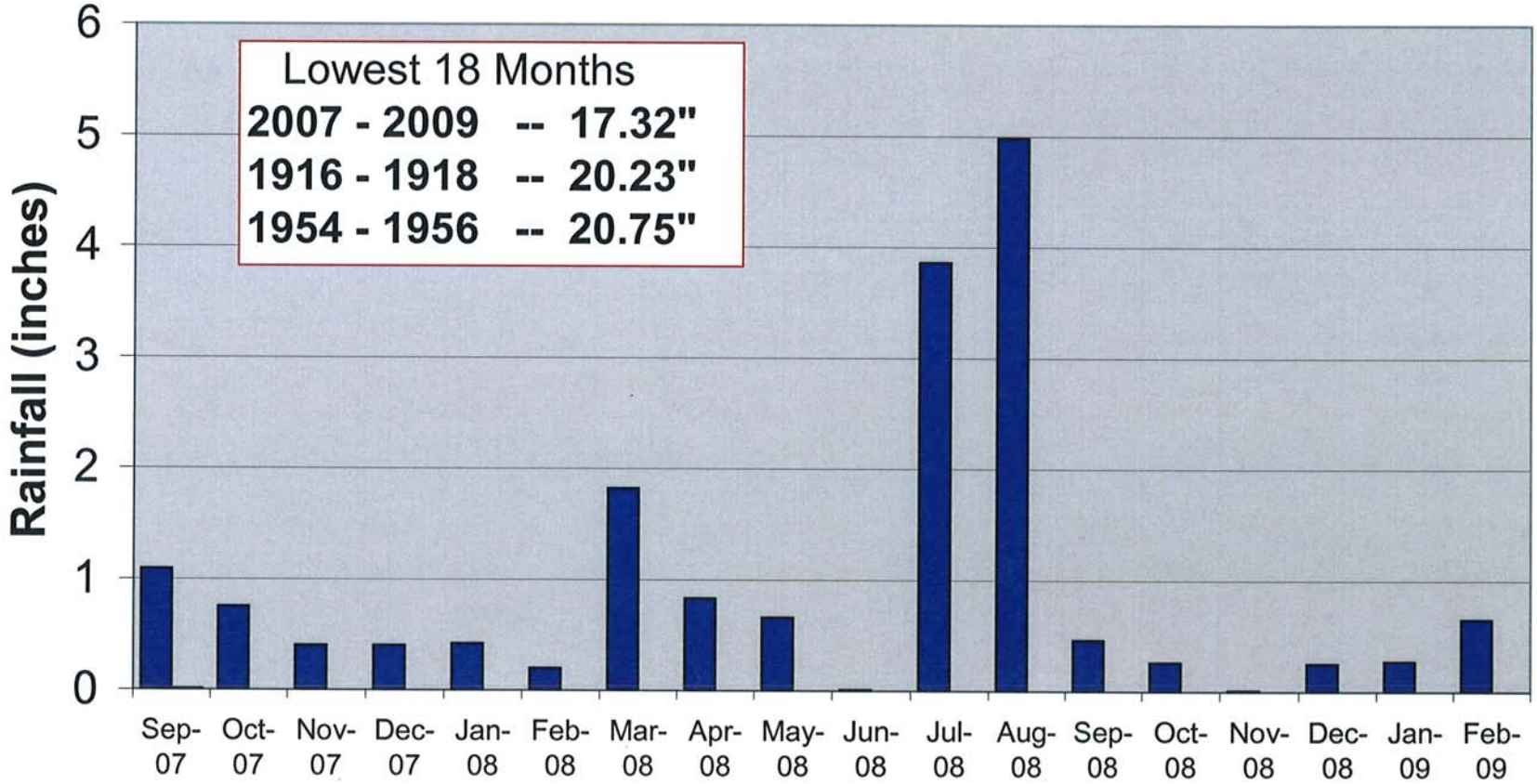
☐ **4. Units**

◉ English

San Antonio Station -- NWS Rainfall

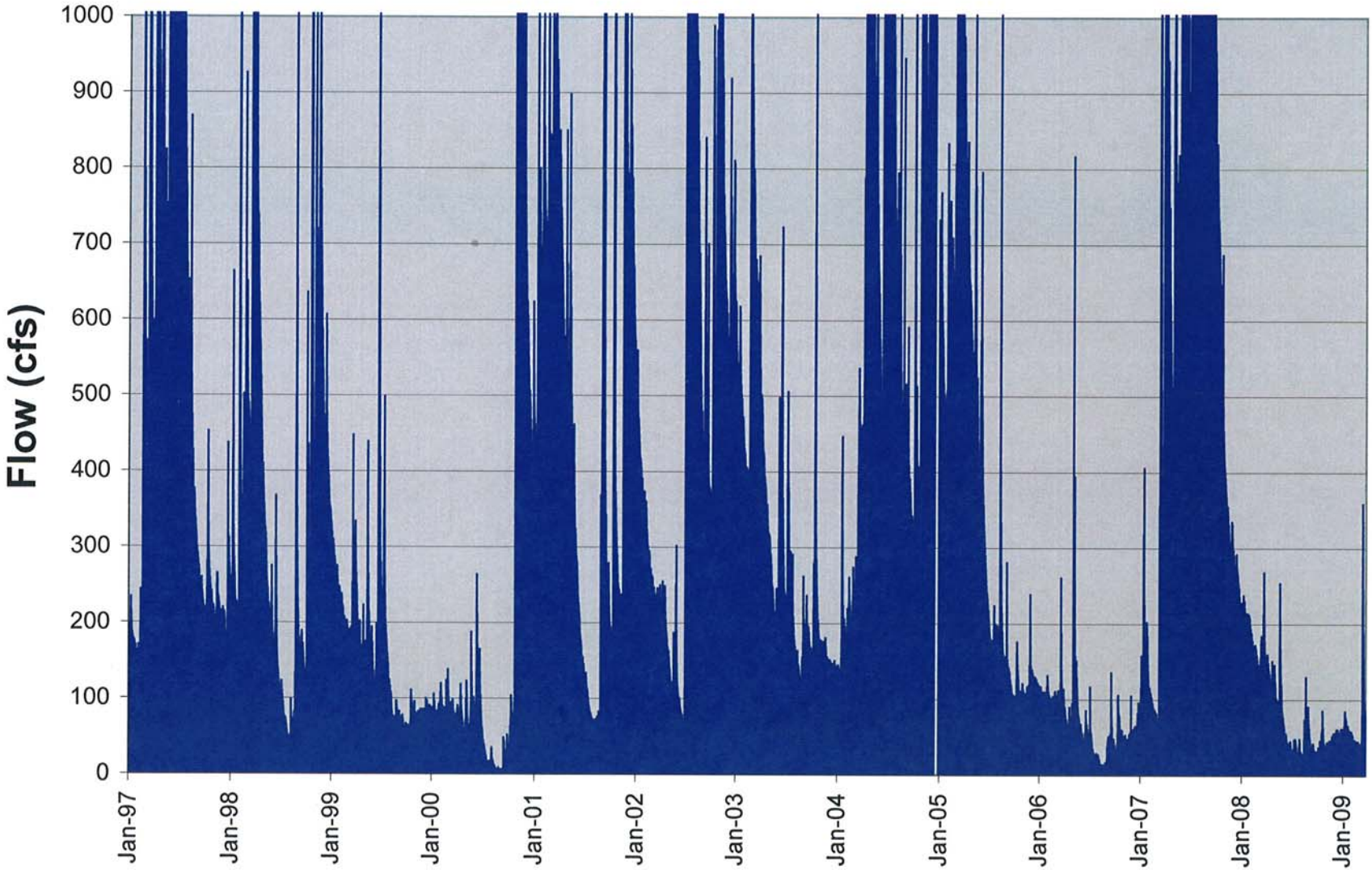
Sept 2007 to Feb 2009

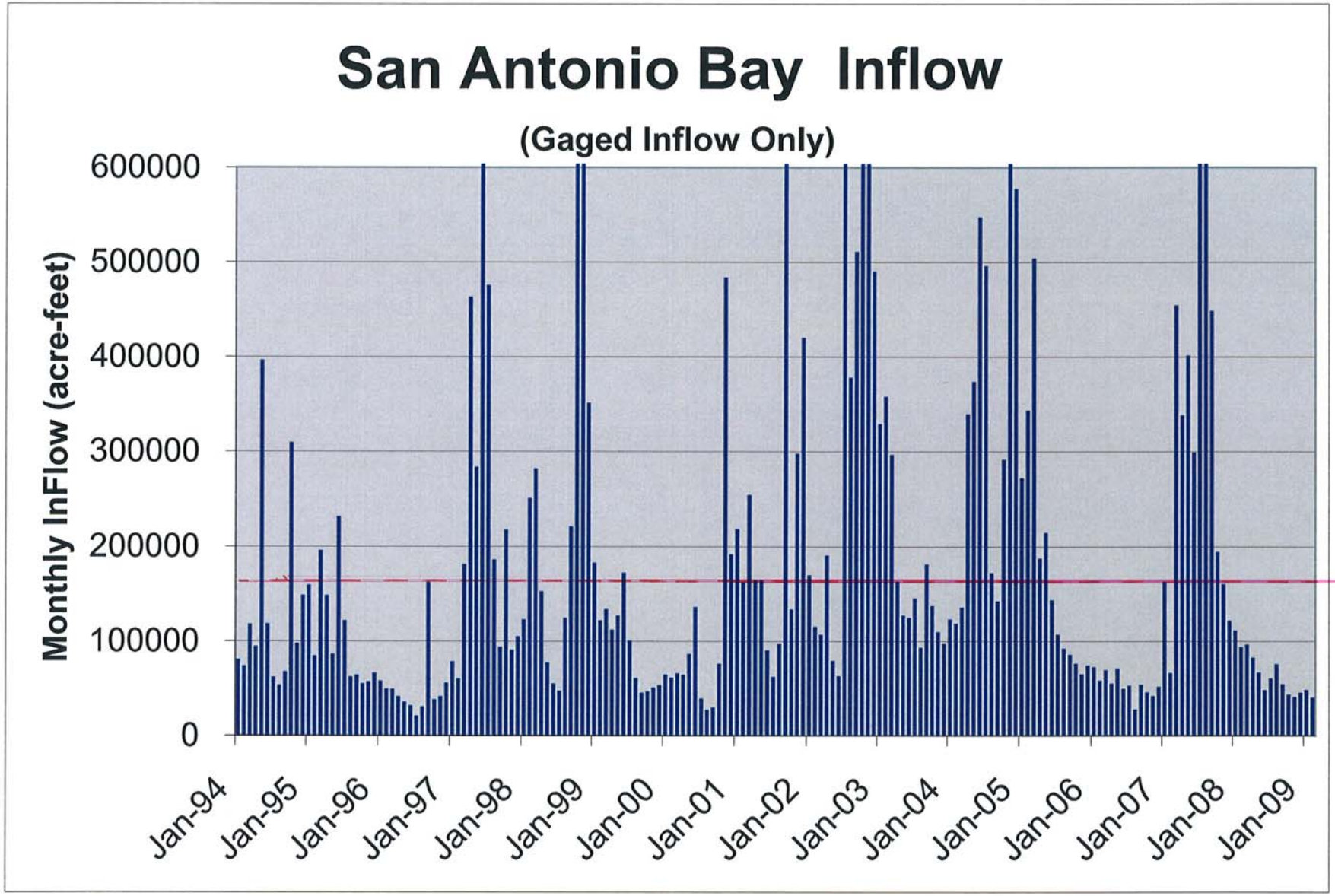
18 Months



GBRA

Guadalupe River @ Spring Branch

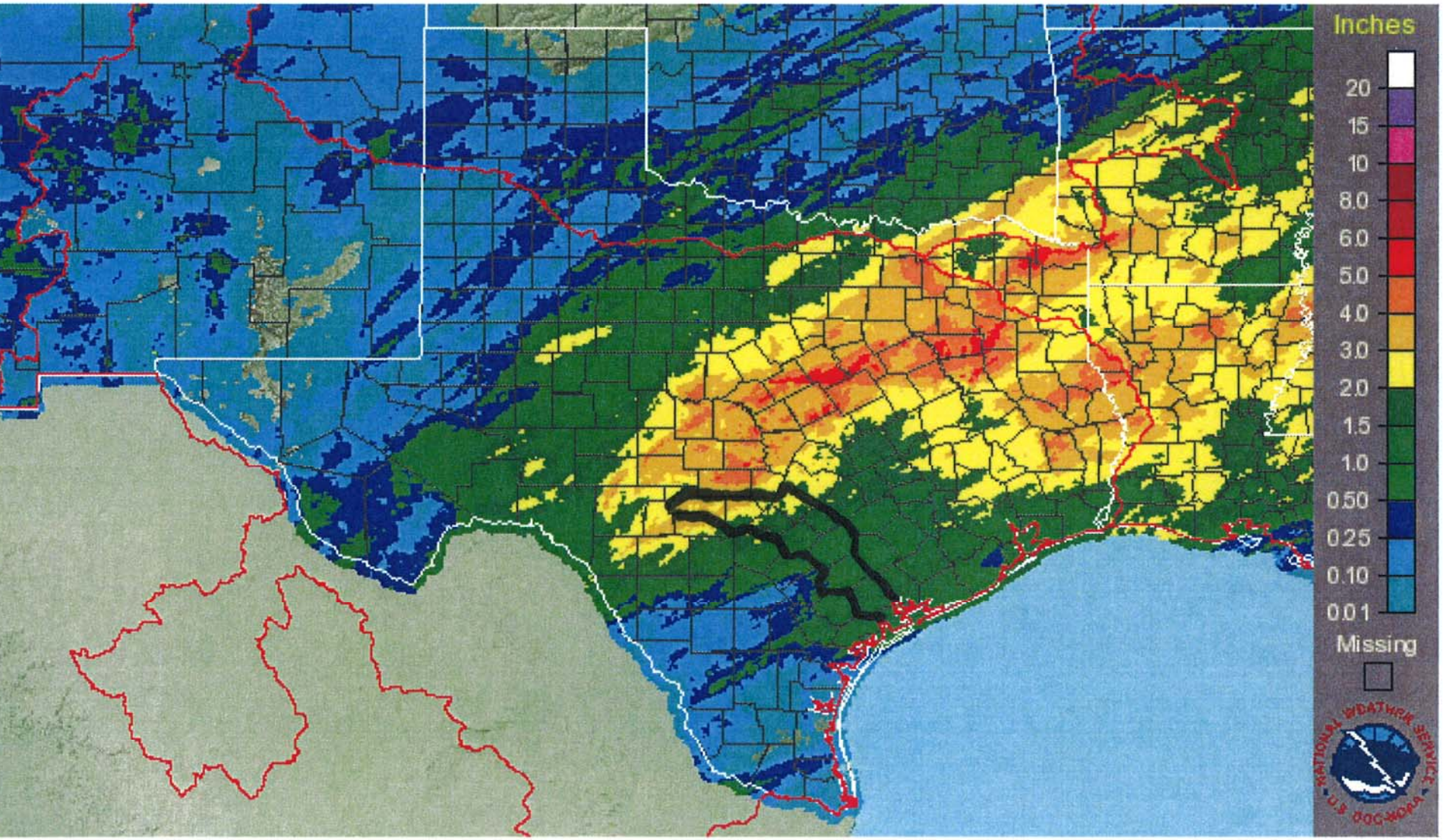



San Antonio Bay Inflow
(Gaged Inflow Only)
Monthly InFlow (acre-feet)
600000
500000
400000
300000
200000
100000
0
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09

xas

Day Observed Precipitation - Valid 3/15/2009 1200 UTC

Click on the image to zoom in
Click on "States" to zoom out



Topo | Pcpn Amount | Counties | Rivers | States | Highway/City | RFC Boundary

Last Update: 3/15/2009 1622

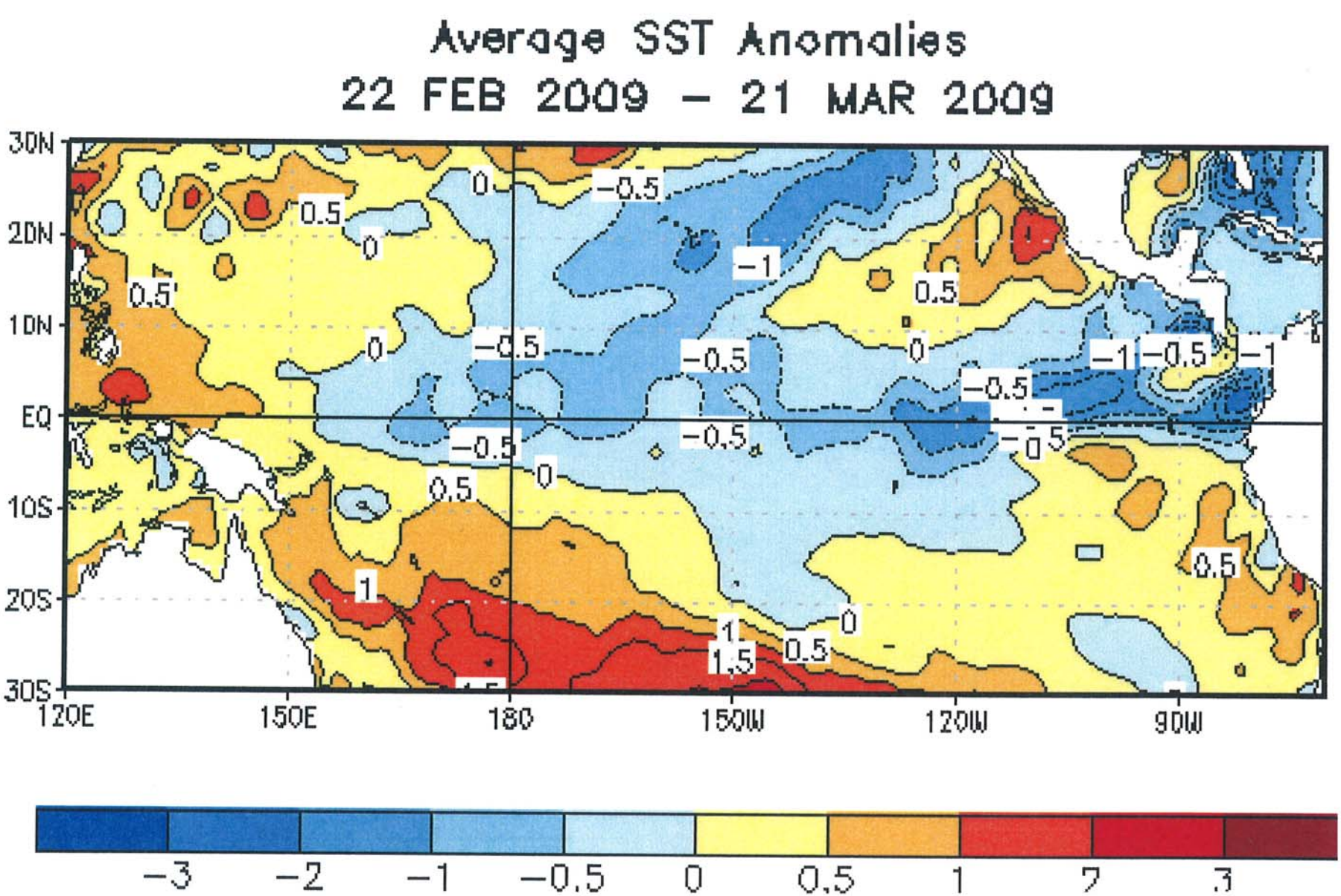
Guadalupe River Basin

08165300	N Fk Guadalupe Rv nr Hunt, TX	03/25 07:15	1.52	9.8	27.0	
08165500	Guadalupe Rv at Hunt, TX	03/25 07:15	7.76	27	47.0	200cfs
08166000	Johnson Ck nr Ingram, TX	03/25 07:00	0.50	56	16.0	
08166140	Guadalupe Rv abv Bear Ck at Kerrville, TX	03/25 07:45	2.99	49	110	270cfs
08166200	Guadalupe Rv at Kerrville, TX	03/25 07:45	1.72	59	116	
08166250	Guadalupe Rv nr Center Point, TX	03/25 07:45	3.65	52	82.0	
08167000	Guadalupe Rv at Comfort, TX	03/25 07:45	0.74	49	136	190cfs
08167347	Unm Trib Honey Ck Site 1C nr Spring Branch, TX	03/25 06:05	3.71	0.00	.000	
08167350	Unm Trib Honey Ck Site 1T nr Spring Branch, TX	03/25 07:25	1.01	0.00	.000	
08167353	Unm Trib Honey Ck Site 2T nr Spring Branch, TX	03/25 04:10	2.63	0.00	.000	
08167500	Guadalupe Rv nr Spring Branch, TX	03/25 07:00	2.28	75	205	520cfs
08167800	Guadalupe Rv at Sattler, TX	03/25 07:00	4.38	84	257	
08168000	Hueco Spgs nr New Braunfels, TX	03/25 06:30	6.92	8.4	59.0	
08168500	Guadalupe Rv abv Comal Rv at New Braunfels, TX	03/25 07:30	1.85	96	325	
08168797	Dry Comal Ck at Loop 337 nr New Braunfels, TX	03/25 07:00	5.13	0.00	.44	
08168913	Comal Rv (oc) nr Landa Lk, New Braunfels, TX	03/25 07:00	1.89	--	---	
08168932	Comal Rv (nc) nr Landa Lk, New Braunfels, TX	03/25 07:00	1.05	--	---	
08169000	Comal Rv at New Braunfels, TX	03/25 07:45	4.16	274	318	
08169500	Guadalupe Rv at New Braunfels, TX	03/25 07:45	9.60	--	---	
08169792	Guadalupe Rv at FM 1117 nr Seguin, TX	03/25 07:15	12.47	916	691	
08170500	San Marcos Rv at San Marcos, TX	03/25 07:45	4.17	102	191	
08170990	Jacobs Well Spg nr Wimberley, TX	03/25 07:30	2.66	0.54	4.30	
08171000	Blanco Rv at Wimberley, TX	03/25 07:45	3.34	11	90.0	
08171300	Blanco Rv nr Kyle, TX	03/25 07:30	3.12	0.00	90.0	
08172000	San Marcos Rv at Luling, TX	03/25 07:00	4.30	107	259	
08172400	Plum Ck at Lockhart, TX	03/25 04:15	1.26	1.4	5.40	
08173000	Plum Ck nr Luling, TX	03/25 07:00	4.64	7.1	19.0	
08173900	Guadalupe Rv at Gonzales, TX	03/25 07:45	11.86	608	1,280	
08174600	Peach Ck bl Dilworth, TX	03/25 07:00	9.14	7.7	10.0	
08175000	Sandies Ck nr Westhoff, TX	03/25 05:00	2.52	3.2	14.0	

CONSERVATION STORAGE DATA FOR SELECTED MAJOR TEXAS RESERVOIRS

Name of Lake or Reservoir	No. on Map	Conservation Storage Capacity (acre-feet)	Conservation Storage Late Feb. 2009 (acre-feet)	(%)	Change since Late January 2009 (acre-feet)	(%)	Change since Late February 2008 (acre-feet)	(%)
EDWARDS PLATEAU								
Oak Creek Reservoir	90	39,260	29,498	75	-519	-1	-8,273	-21
E V Spence Reservoir	91	517,272	50,248	10	-1,260	0	-21,657	-4
O C Fisher Lake	92	79,483	0	0	0	0	0	0
*O H Ivie Reservoir	93	554,335	298,454	54	-4,178	-1	-71,638	-13
Twin Buttes Reservoir	94	177,850	45,409	26	-815	0	-25,085	-14
Brady Creek Reservoir	95	29,110	13,811	47	-298	-1	-1,468	-5
Buchanan, Lake	96	875,610	572,643	65	-516	0	-247,772	-28
Lyndon B Johnson, Lake	97	113,690	112,854	99	0	0	6,056	5
*Amistad Reservoir (Texas)	98	1,840,849	1,895,000	103	16,000	1	-384,000	-21
*Amistad Reservoir (TX & Mexico)	(98)	3,275,532	3,275,532	100	0	0	421,532	13
TOTAL		4,227,459	3,017,917	71	8,414	0	-753,837	-18
SOUTH CENTRAL								
Travis, Lake	99	1,113,902	685,656	62	-12,299	-1	-428,246	-38
*Austin, Lake	100	21,804	20,972	96	0	0	-105	0
Somerville Lake	101	147,104	113,718	77	-1,526	-1	-33,386	-23
Canyon Lake	102	378,781	290,473	77	-1,729	0	-88,062	-23
Medina Lake	103	254,823	130,813	51	-5,636	-2	-102,091	-40
*Coleto Creek Reservoir	104	31,040	23,351	75	87	0	-7,219	-23
TOTAL		1,947,454	1,264,983	65	-21,103	-1	-659,109	-34
UPPER COAST								
Houston, Lake	105	128,863	128,863	100	0	0	0	0
Texana, Lake	106	153,246	101,100	66	-8,448	-6	-46,004	-30
TOTAL		282,109	229,963	82	-8,448	-3	-46,004	-16
SOUTHERN								
Choke Canyon Reservoir	107	695,262	552,674	79	-6,564	-1	-121,038	-17
Corpus Christi, Lake	108	256,961	161,845	63	-3,010	-1	-87,708	-34
*Falcon Reservoir (Texas)	109	1,551,034	1,563,000	101	-67,000	-4	386,000	25
*Falcon Reservoir (TX & Mexico)	(109)	2,646,817	2,646,817	100	0	0	1,251,817	47
TOTAL		2,503,257	2,277,519	91	-76,574	-3	177,254	7

LA NINO/ Southern Oscillation



EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

issued by

CLIMATE PREDICTION CENTER/NCEP/NWS

5 March 2009

ENSO Alert System Status: La Niña Advisory

Synopsis: La Niña is expected to gradually weaken with increasing chances (greater than 50%) for ENSO-neutral conditions during the Northern Hemisphere Spring.

Atmospheric and oceanic conditions during February 2009 continued to reflect La Niña. Equatorial sea surface temperatures (SST) across the central and east-central Pacific Ocean remained below-average (Fig. 1), but weakened throughout the month. The Niño-4 and Niño-3.4 SST indices also gradually increased, but remained −0.5°C or cooler (Fig. 2). Negative subsurface oceanic heat content anomalies (average temperatures in the upper 300m of the ocean, Fig. 3) and temperature anomalies at thermocline depth also weakened across the eastern half of the Pacific (Fig. 4). However, convection remained suppressed near the Date Line, and enhanced across Indonesia. Also, low-level easterly winds and upper-level westerly winds continued across the equatorial Pacific Ocean. Collectively, these oceanic and atmospheric anomalies are consistent with a weakening La Niña.

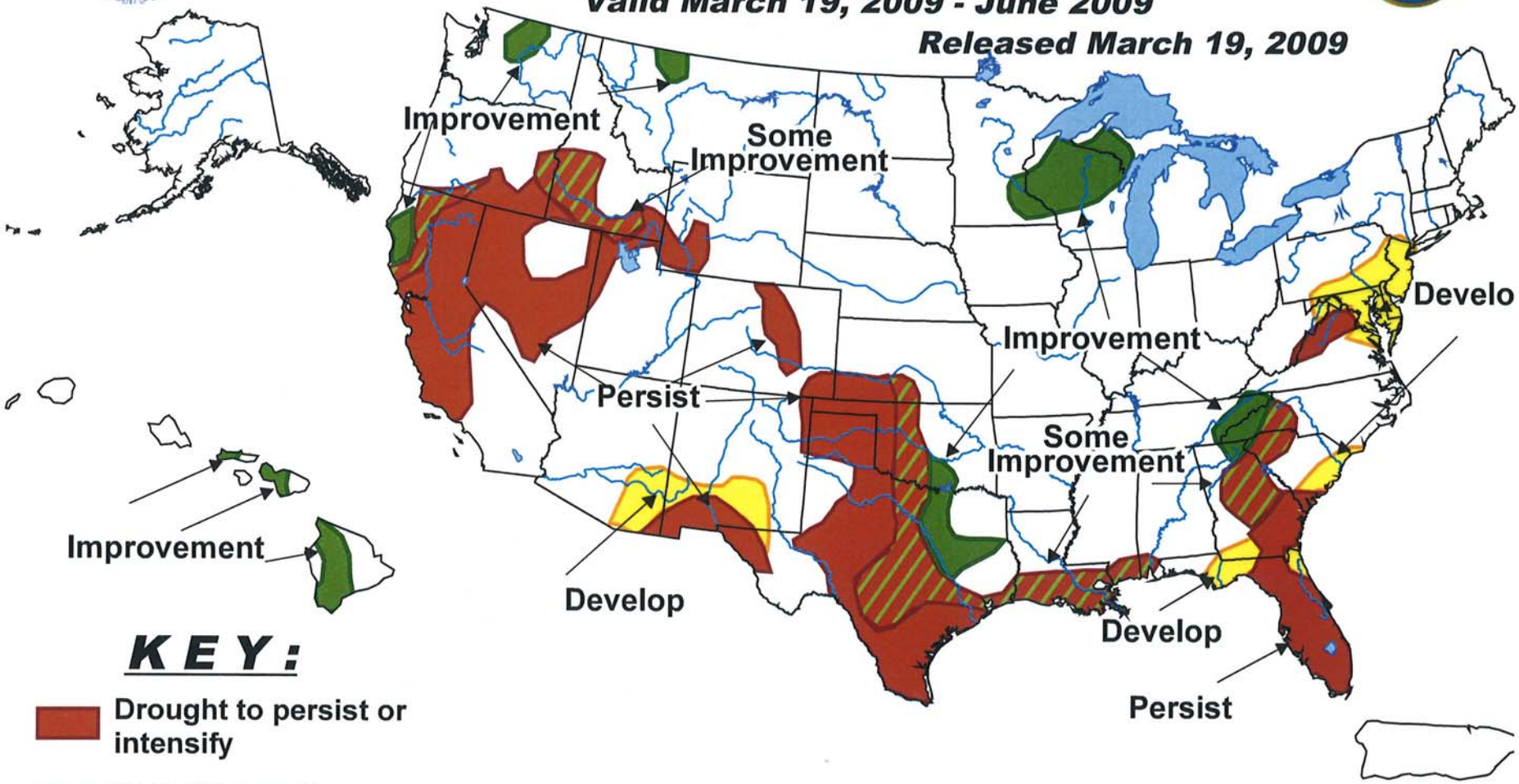
While nearly all the model forecasts for the Niño-3.4 region show that La Niña will have dissipated by May – July 2009, the exact timing of the transition to ENSO-neutral conditions is uncertain (Fig. 5). The timing of the expected transition will depend on the strength of the low-level easterly wind anomalies and on how quickly the reservoir of below-average subsurface temperatures dwindles. Therefore, based on current observations, recent trends, and model forecasts, La Niña is expected to gradually weaken with increasing chances (greater than 50%) for ENSO-neutral conditions during the Northern Hemisphere Spring.

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid March 19, 2009 - June 2009

Released March 19, 2009



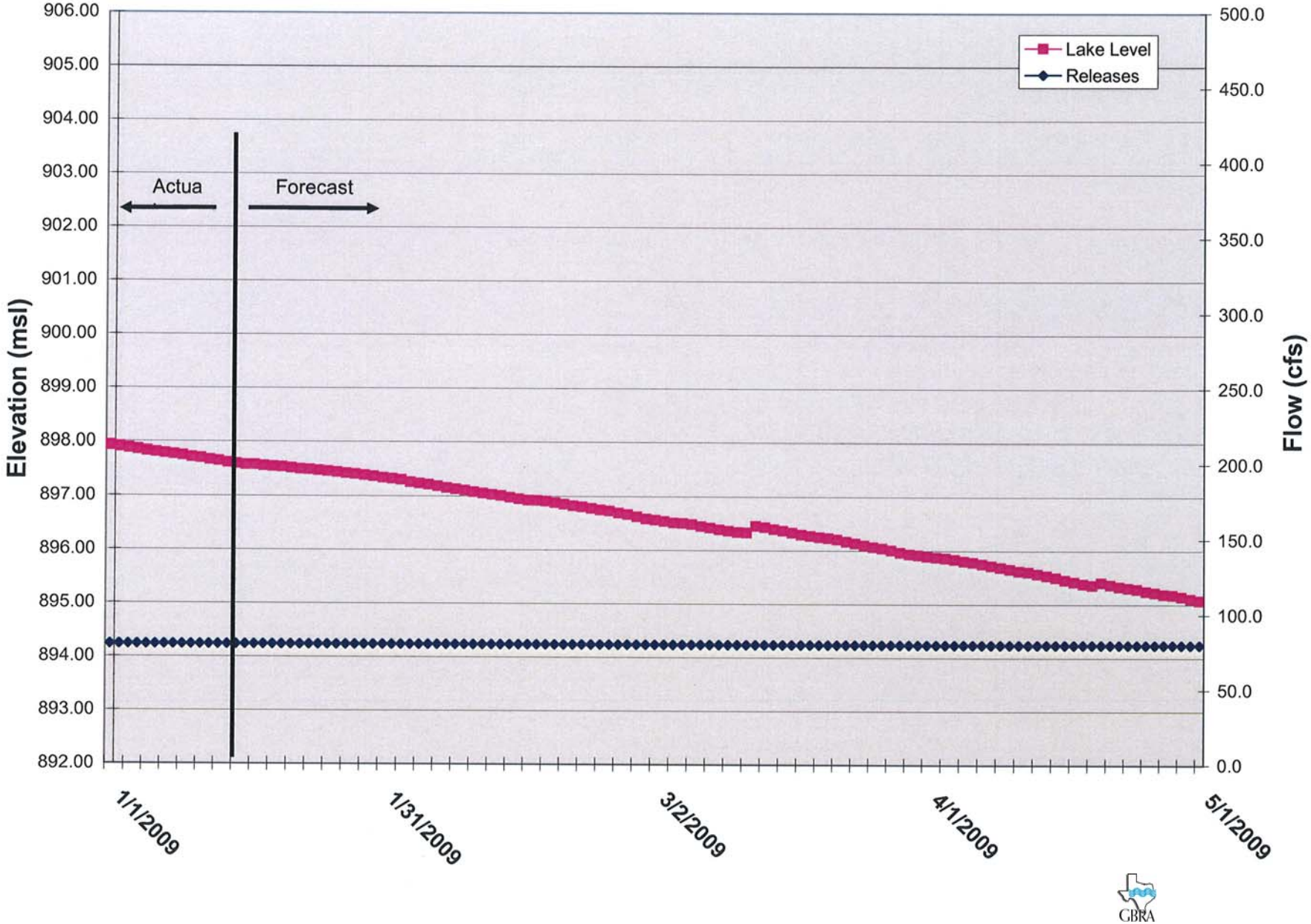
KEY:

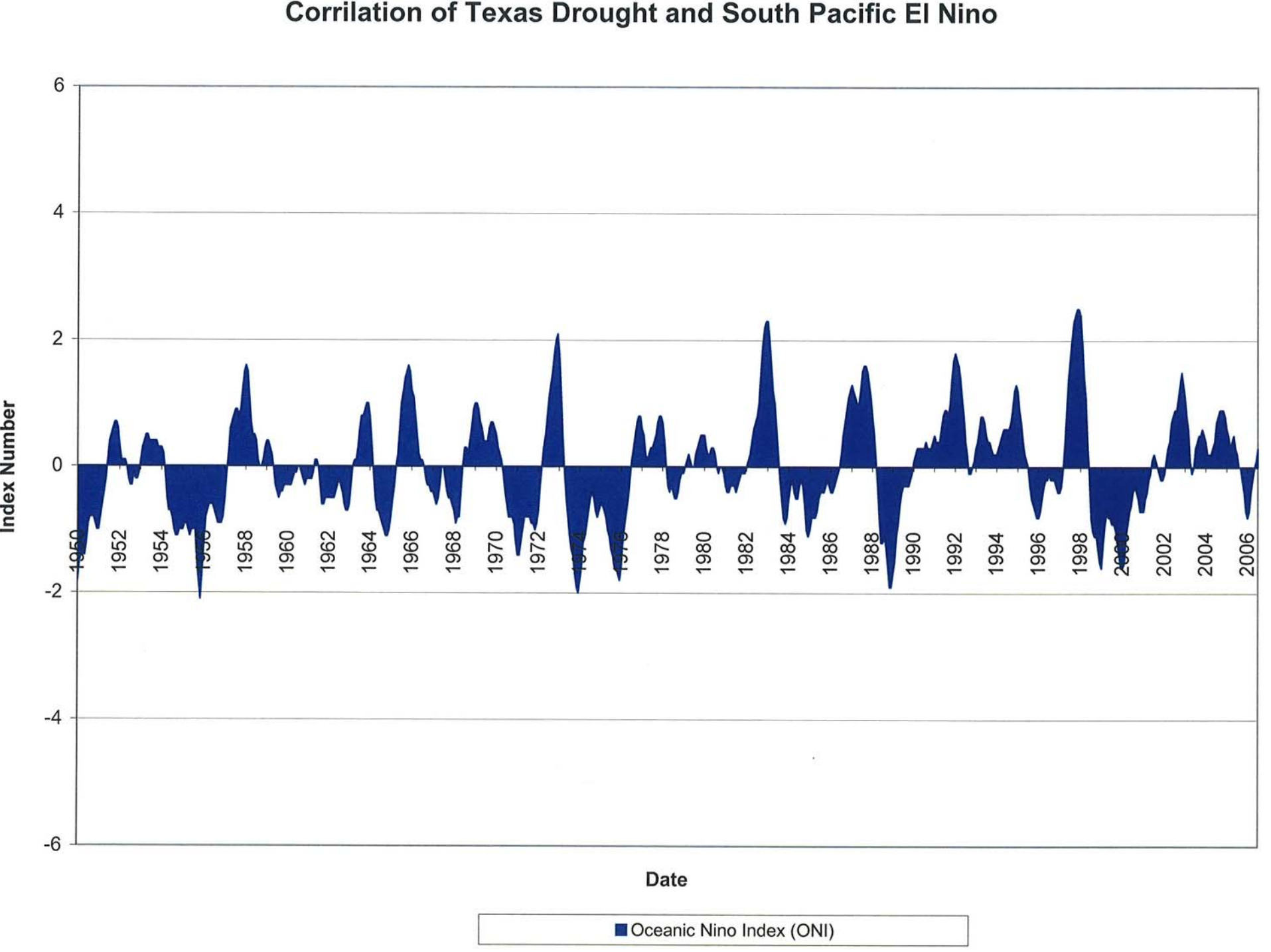
- Drought to persist or intensify
- Drought ongoing, some improvement
- Drought likely to improve, impacts ease
- Drought development likely

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.

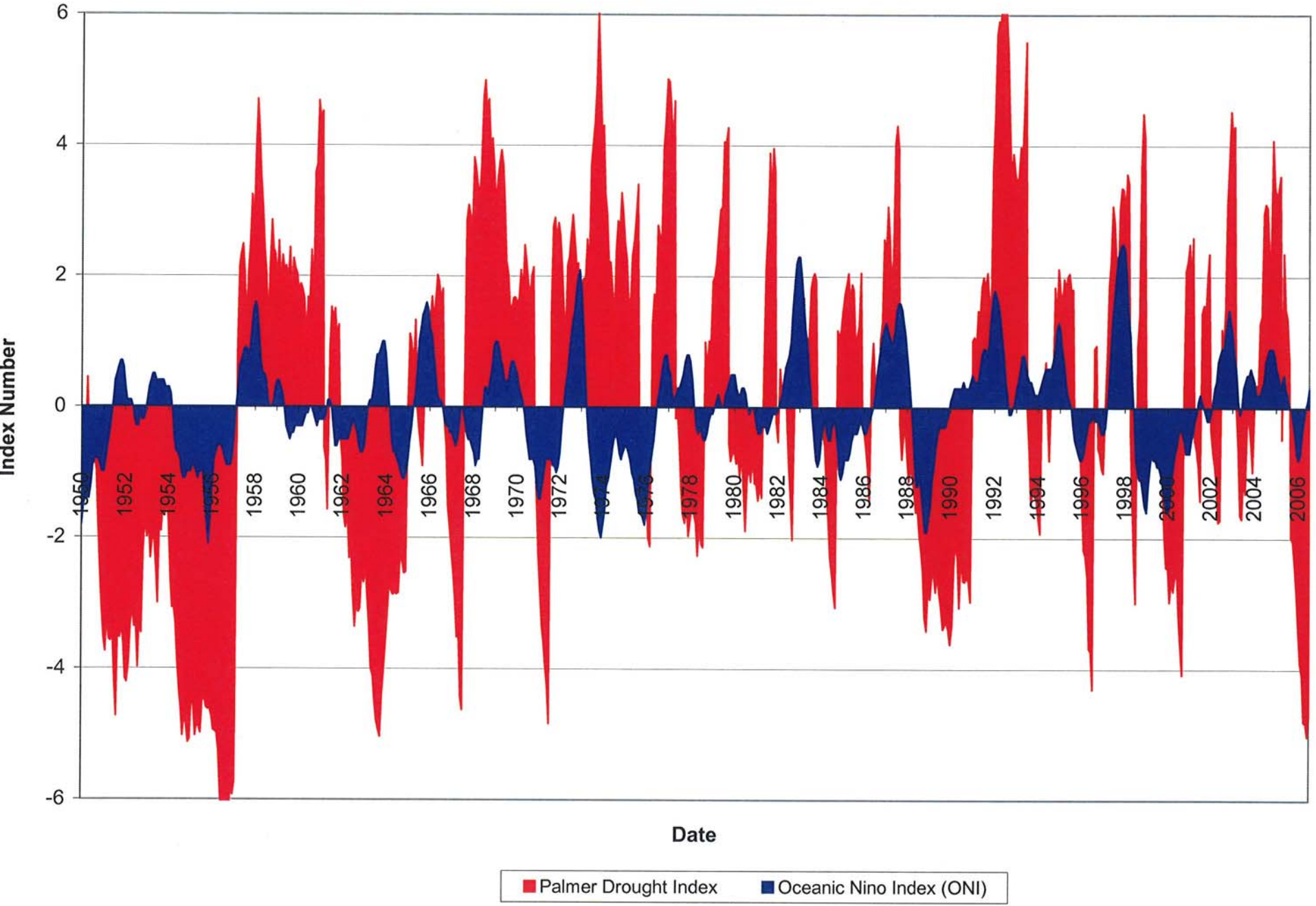
Canyon Lake Forecast Next 3 Months

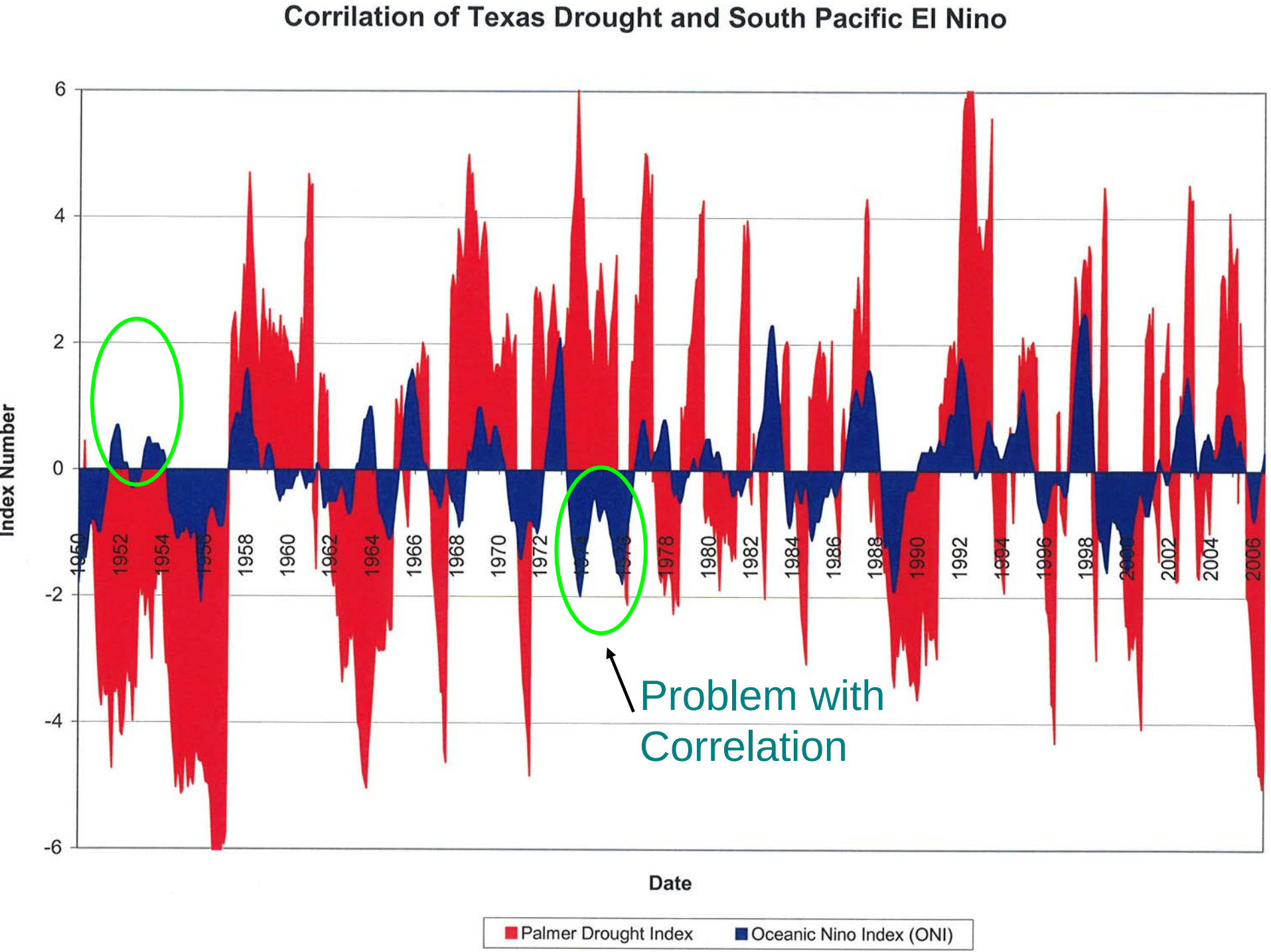
Jan 15, 2009




Corrilation of Texas Drought and South Pacific El Nino
6
4
2
0
-2
-4
-6
Index Number
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
Date
Oceanic Nino Index (ONI)

Corrilation of Texas Drought and South Pacific El Nino




Corrilation of Texas Drought and South Pacific El Nino
Index Number
6
4
2
0
-2
-4
-6
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
Problem with Correlation
Date
Palmer Drought Index
Oceanic Nino Index (ONI)