June 2009:
How severe is the current drought in the Hill Country?

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Onion Creek. *photo by Jana Birchum*

Presentation organization

1. What is drought?
2. Assessment of drought conditions
   a. Drought indices based on precipitation and soil moisture
   b. Current streamflow discharges compared to past discharges
   c. Current reservoir levels and springflow discharges compared to past conditions
3. Summary and conclusions
4. Water use restrictions by Water Management Districts
5. Additional drought resources

1. What is drought?

- What are the types of drought?
  - meteorologic
  - agricultural
  - water supply availability
- When does a drought begin?
- What area does a drought cover?
- When does a drought end?

The last 2nd and 3rd questions usually are impossible to answer. The last question is usually much easier to answer—many droughts end with floods.

Colorado River at Austin, 1918 drought

2. Assessment of drought conditions
a. Drought indices

A summary of indices for evaluating drought are presented at http://www.drought.unl.edu/whatis/indices.htm#spi

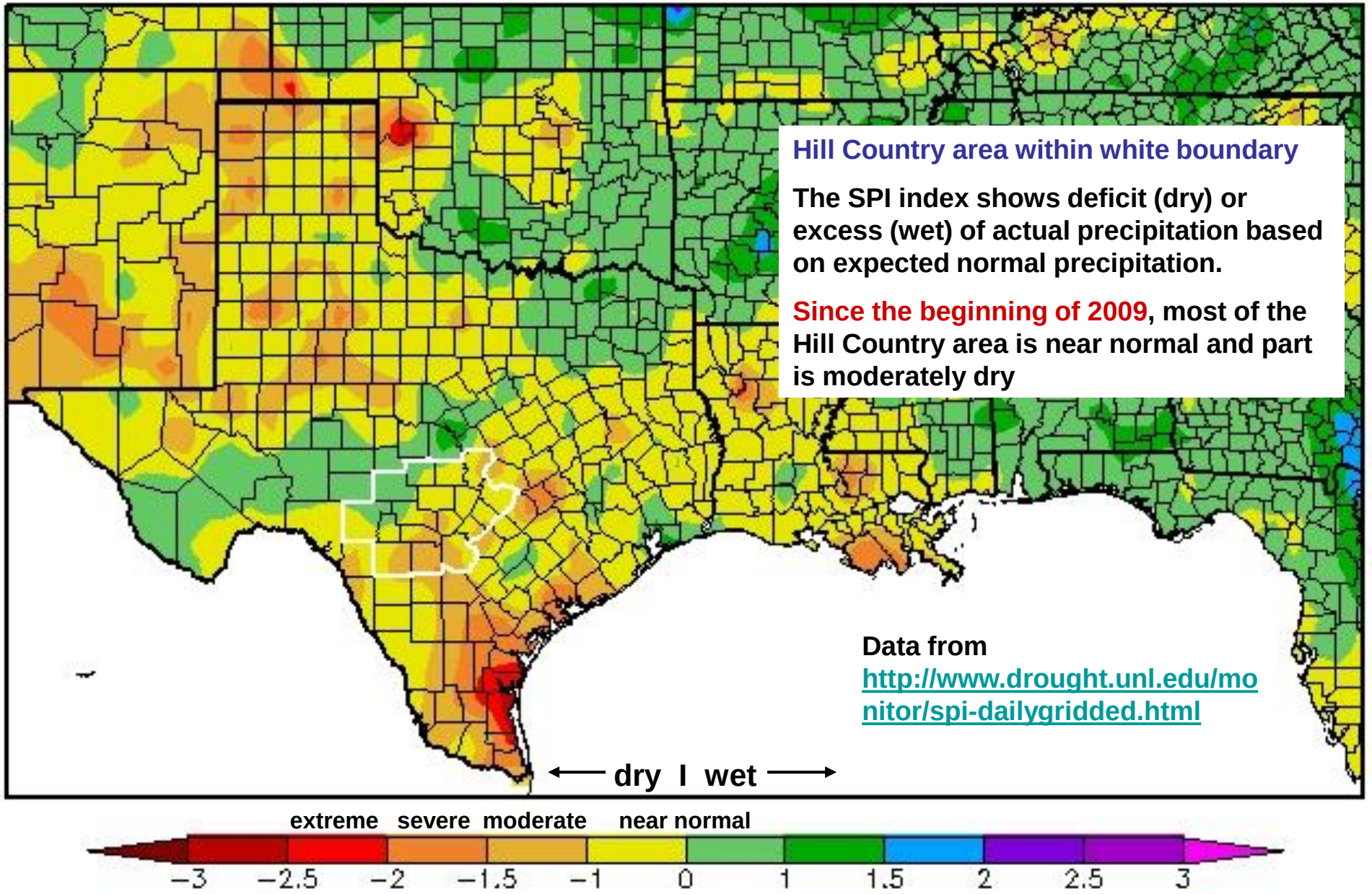
Two of the commonly used indices are presented herein:

The Standard Precipitation Index is based on the probability of precipitation for any time period—typically the past one month through the past several years. It evaluates precipitation deficit (dry) or access (wet) for the chosen time period.

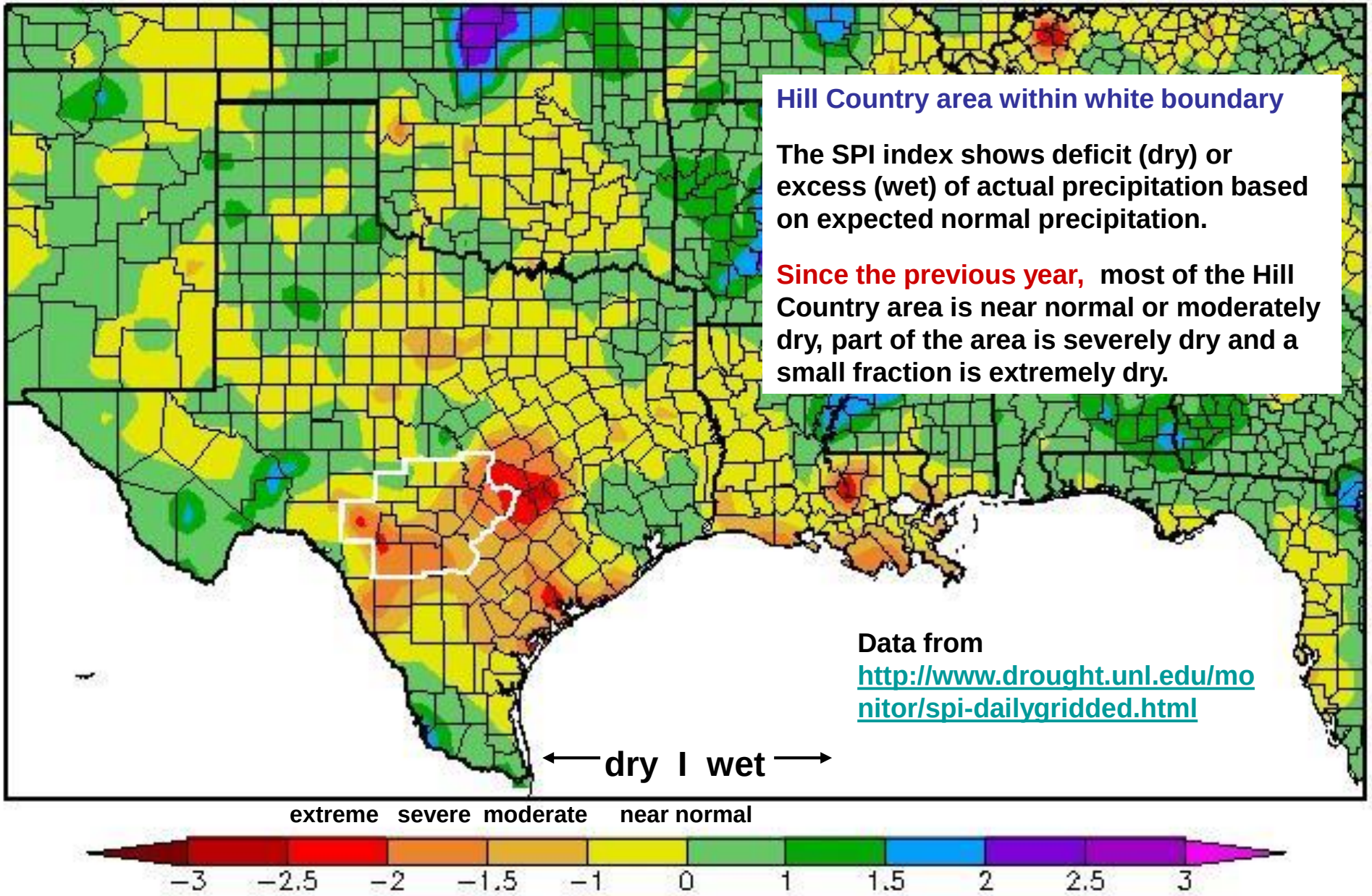
The Palmer Drought Severity Index is a soil moisture algorithm calibrated on a daily basis for relatively homogeneous regions entitled Climatic regions.

The next 5 slides present current drought indices for the Hill Country

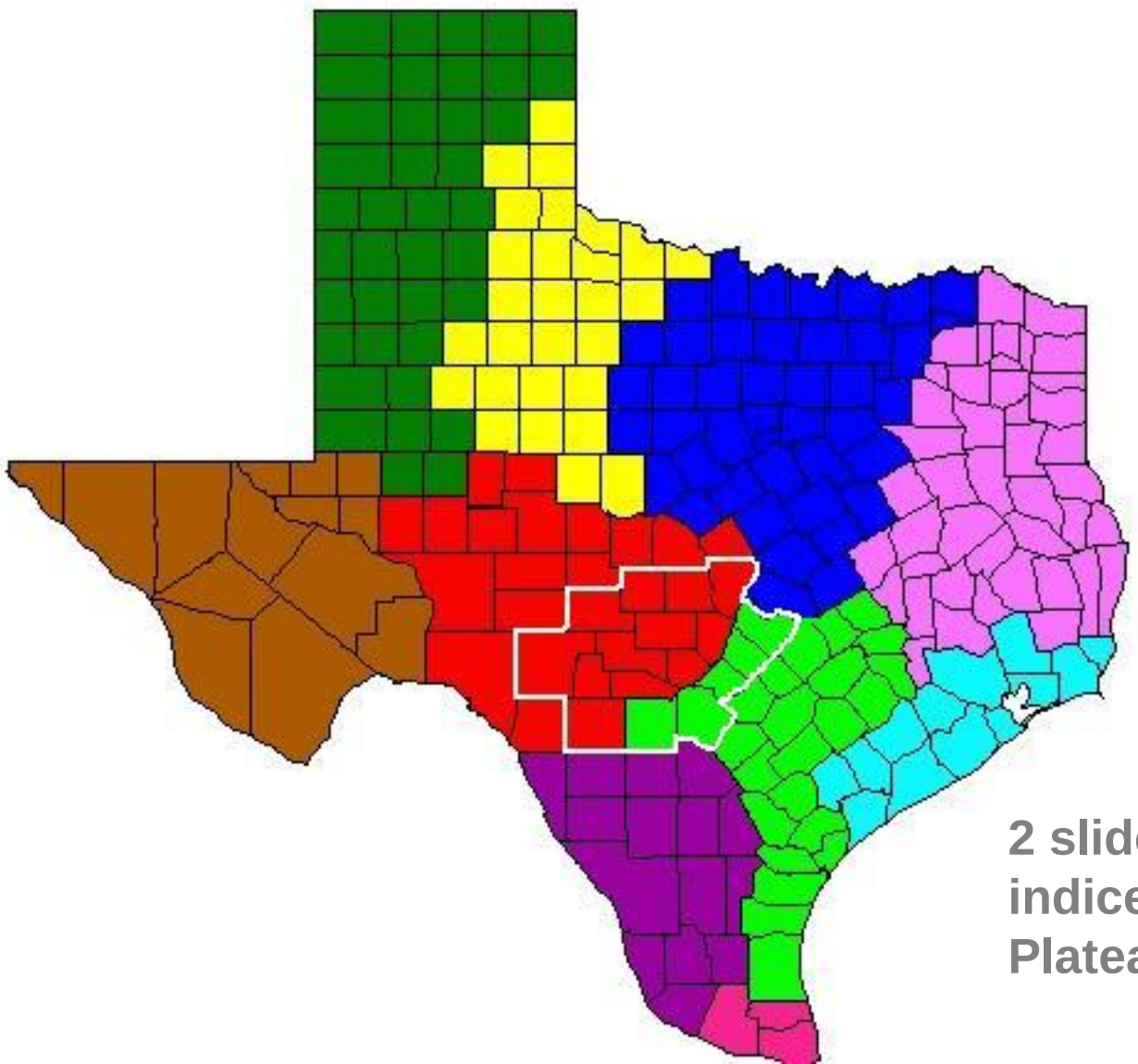
Standard Precipitation Index
Jan.1 - June 17, 2009



Standard Precipitation Index
June 17, 2008 - June 17, 2009



The Palmer Drought Severity Index is based on Climatic Regions shown below. The boundary for the Hill Country area is shown below in white--the Edwards Plateau Region best represents the Hill Country.



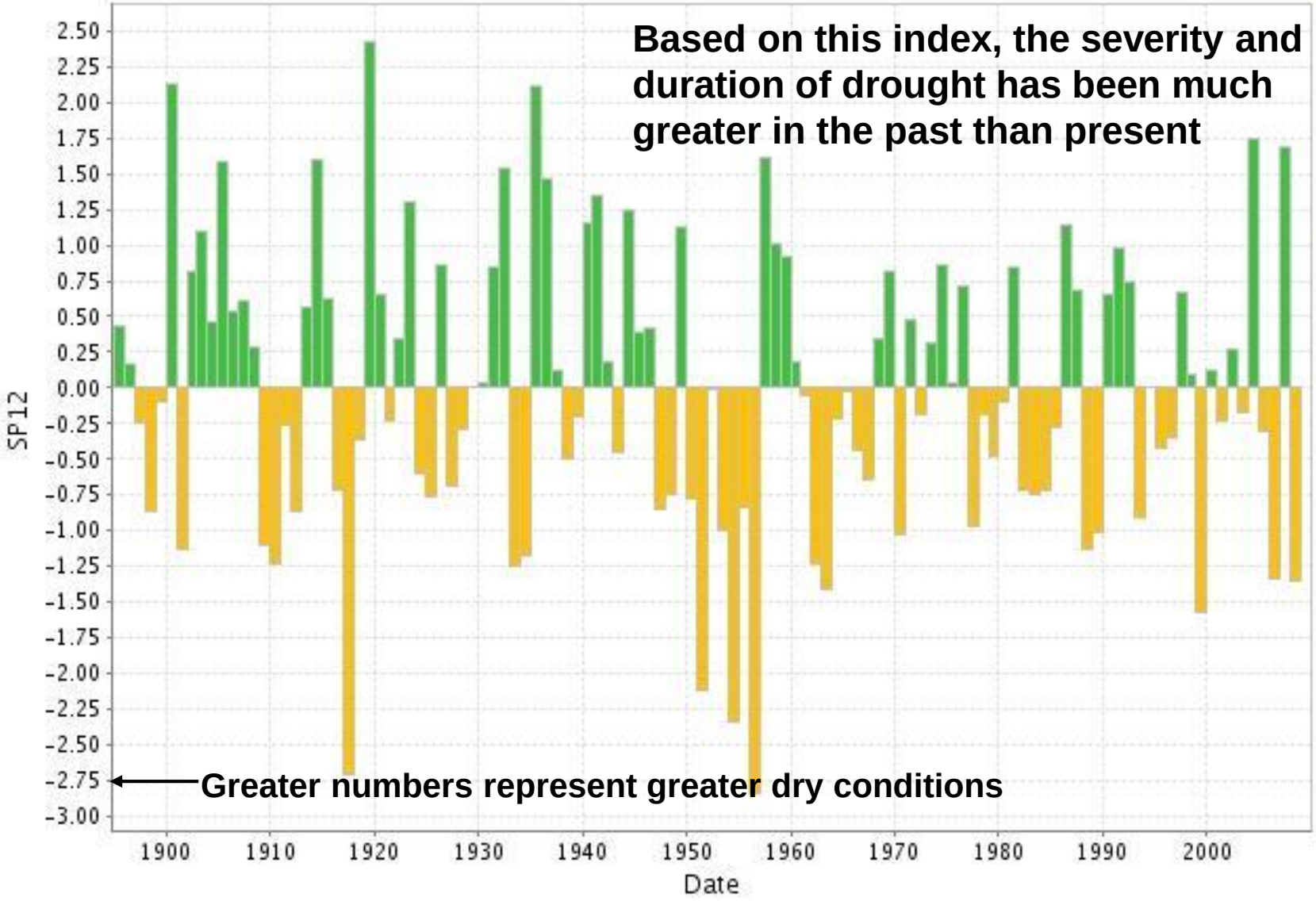
Map Legend

Key	Name
	High Plains
	Trans-Pecos
	Low Rolling Plains
	Edwards Plateau
	North Central Texas
	South Central Texas
	South Texas
	East Texas
	Upper Coast
	Lower Valley

2 slides presenting drought indices for the Edwards Plateau Region follow

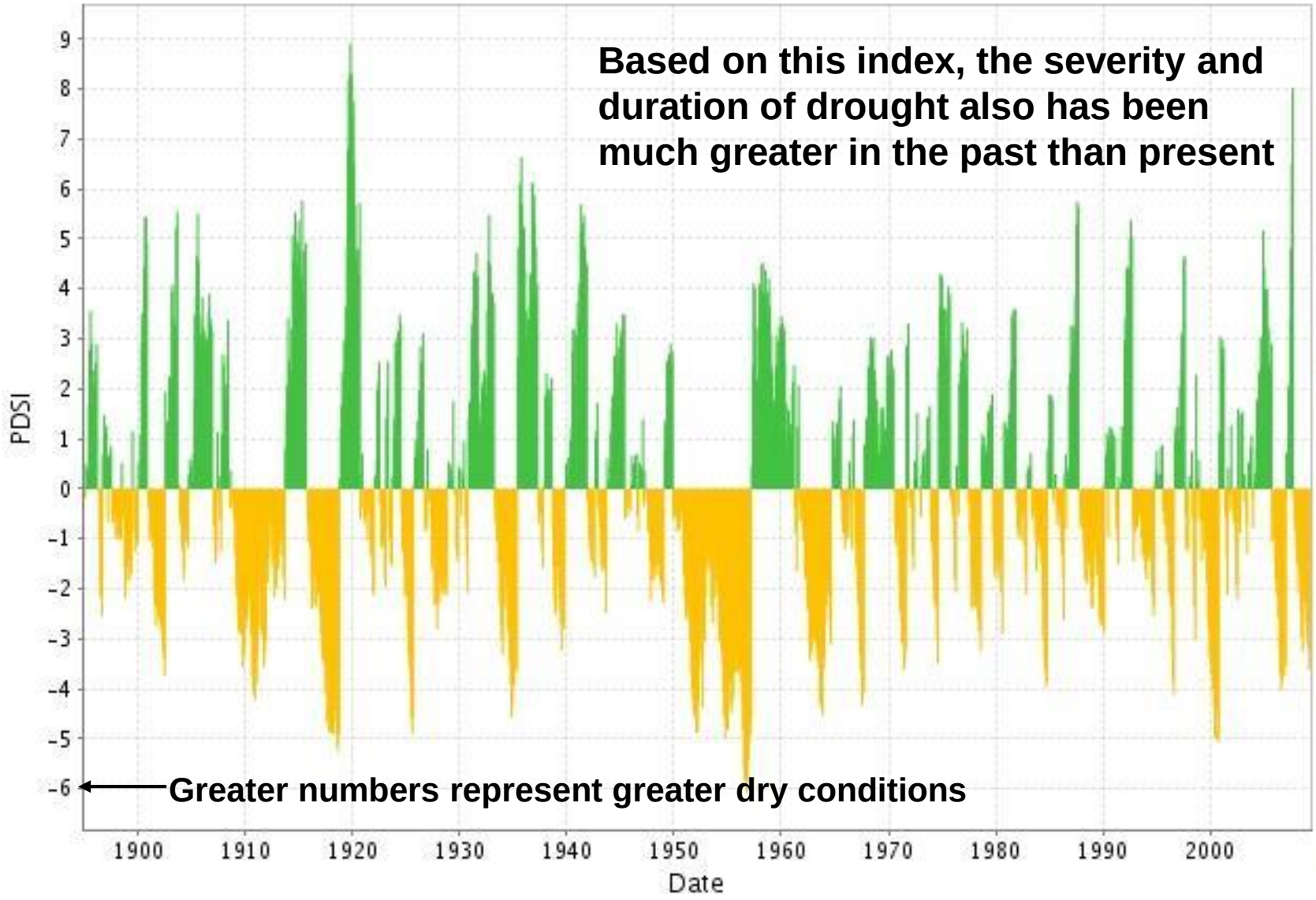
Standard Precipitation Index for 12 months periods for the Edwards Plateau, 1895-May 2009

Yellow - dry conditions; Green - wet conditions



Palmer Drought Severity Index, 1895 – May 2009

Yellow--dry conditions; Green—wet conditions



2 b. Assessment of drought based on streamflow conditions

Many streamflow gauging stations exist throughout the Hill Country area. Most of the Hill Country area provides runoff to these gages. Therefore an assessment of the flow for these gages represent hydrologic conditions for most of the Hill Country

The next 3 slides present assessment of drought based on current streamflow discharges compared with historic streamflow discharges

June 16, 2009 hydrologic conditions for streamflow

Circles represent streamflow gages

Explanation - Percentile classes						
Low	<10	10-24	25-75	76-90	>90	High
	Much below normal	Below normal	Normal	Above normal	Much above normal	

Summary from previous slide

The 50 percentile is the median flow.

Summary of the June 16, 2009 streamflow

- For **2** gages the flow is near normal, ranging from the 25-75 percentile.
- For **7** gages the flow ranges from the 10-24 percentile—for these sites the flow has been higher 90-76 percent of the time.
- However, for about **12** gages, the flow is less than the 10 percentile and the current flow is lowest for **3** gages.

Conclusion: Based on streamflow, the drought is moderate to severe within the Hill Country. However, it is not yet extreme.

Real time current and historic streamflow in the Hill Country

Click on the link below. It displays a Google map showing all streamflow gages (green triangles) in the area.

- You can zoom in and out of the map (feature on top left of map).
- Hold the left mouse button down over the map and move mouse to change the map view area
- Put pointer on green triangle to identify stream and gage location
- Click on triangle to see current flow (cfs—cubic feet per second) and water stage (ft - feet)
- Click on gage name (underscored in blue) to get to graphs and databases for the gage

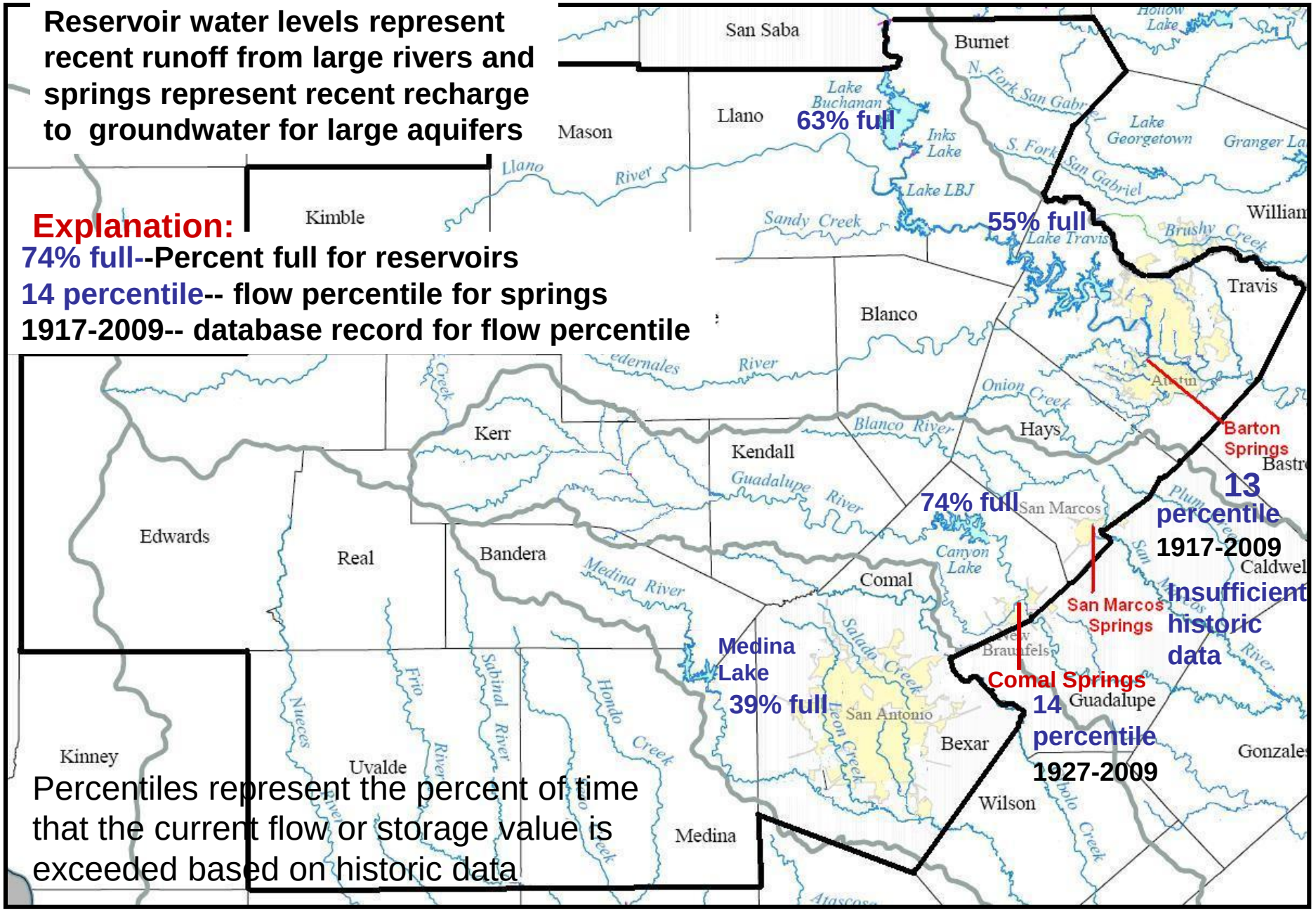
http://water.usgs.gov/waterwatch/uvmap/?ll=29.34626951093652,-99.9453753515625&ur=30.44157007151946 8,-97.9238891601562 5&m=Map&zl=9

2 c. Assessment of drought based on reservoir levels and springflow discharges

Reservoir water levels represent runoff from large basins thus represent hydrologic conditions for a large part of the Hill Country area. Likewise, Barton, San Marcos, and Comal Springs are 3 of the 4 largest springs in Texas, discharge water from aquifers with large recharge areas, thus also represent hydrologic conditions for a large part of the Hill Country.

The next 2 slides present assessment of drought based on current reservoir levels, and springflow discharges compared with historic springflow discharges

June 16, 2009 hydrologic conditions for springs and reservoirs



Summary from previous slide

Reservoirs (4 major reservoirs in the area)

- **Lake Buchanan and Lake Travis have been lower than the current water level for many months in 1984, 2000, and 2006-2007 and many months prior to 1980.**
- **Canyon Lake and Medina Lake each have the lowest water levels since the lakes filled.**

Springs (3 of the 4 largest Texas springs are in the area)

- **Barton Springs: For the data period (1917-2009), the flow has been lower than current flow about 13 % of the time—about 4400 days.**
- **San Marcos Springs: Insufficient historical data exist to calculate the percentile for current flow conditions.**
- **Comal Springs: For the data period (1927-2009), the flow has been lower than the current flow about 14% of the time—about 4200 days**

Conclusion:

1. **Springflows have been lower many times suggesting the drought is not extreme.**
2. **Much of the water in Lakes Buchanan and Travis originate from outside the Hill Country area where the drought is not as severe.**
3. **Lakes Canyon and Medina are at their lowest levels (extreme) due to dry conditions and increased water use due to increased population.**

3. Summary and conclusions

1. The Hill Country area contains a substantial database (precipitation and hydrologic data) by which to evaluate current drought conditions based on historic conditions.
2. The precipitation, soil moisture and hydrologic assessments conclude that the area is in moderate to severe drought conditions but not extreme.
3. Based on historic meteorologic and hydrologic conditions, several periods in the past 100 years have had droughts much more severe and of longer duration that the current drought.
4. The current water supply is substantially depleted and limited--many of the Water Management Districts have had to enact restrictions on water use due to limitations in water supply.
5. Water supply is limited due to the drought and increased water use due to demand from increased population.
6. Population projections predict the Hill Country area will grow substantially in the future.
7. It is likely that this or a future drought could become more substantial in severity and duration.
8. Therefore, it is likely that water supply would become severely limited before the end of this drought or during a future drought.

4. Water use restrictions by water management districts

Water use restrictions have been implemented by many of the Water Management Districts in the Hill Country. A list and link to those districts is presented in a slide show entitled "Texas Hill Country water management districts" at http://www.hillcountryalliance.org/HCA/Presentations. Some of the districts with water use restrictions are presented below:

- **Barton Springs Edwards Aquifer Conservation District.**
  Critical drought stage http://droughtmonitor.blogspot.com/
- **Blanco Pedernales Conservation District**
  Stage 2 drought conditions http://www.blancocountygroundwater.org/
  Click on "Drought Status"
- **Edwards Aquifer Authority**
  Critical period—stage 1 http://www.edwardsaquifer.org/
- **Hays Trinity Groundwater District**
  Critical drought stage http://www.haysgroundwater.com/
- **Central Texas Groundwater Conservation District**
  http://www.centraltexasgcd.org/index.htm

5. Additional drought resources

Texas Water Development Board drought page

http://www.twdb.state.tx.us/data/DROUGHT/drought_toc.asp

Texas Water Info drought monitoring

http://www.txwin.net/Monitoring/Meteorological/Drought/index.htm