Historical Texas Drought Update

October 18, 2011

Bob Rose, LCRA Meteorologist
Worst Drought in Texas History

“Texas has experienced its most severe one-year drought on record”
John Nielsen-Gammon, Texas State Climatologist.

Driest October-September on record with 7.18 inches. Normal is 14.94.
Record low was 7.35 inches Oct 1901-Sep 1902.
Worst Drought in Texas History

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Hottest June, July and August on record. August was the hottest month ever recorded with an average temperature of 88.1 degrees, beating July 2011 with 87.1 degrees. Hottest month for any state ever in the US!
Texas Rainfall, Oct.-Sep.

Texas, Precipitation, October-September

- 9-Point Binomial Filter
- Trend -0.37"/Century
- Long Term Average
- Precipitation

7.35 in. 7.18 in.
Soil Moisture Anomaly

Calculated Soil Moisture Anomaly (mm)
OCT 16, 2011
Unprecedented Summer Heat!!!
SUMMER-LONG HEAT WAVE

AVERAGE JET STREAM

HOT CORE SINCE JUNE

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Temperature Departure from Normal, 6/1-8/31

Generated 9/11/2011 at HPRCC using provisional data.

Regional Climate Centers
Record Setting Summer Heat

• Many cities recorded their hottest June, July and August on record.
• Dozens of Texas cities recorded their longest stretch of consecutive 100-degree days.
• A multitude of Texas cities recorded a record number of 100-degree days.
• Second hottest summer on record for any state in any year.
The 2011 Drought in Historical Context

Summer (June-August) PDSI, Texas

Texas Observed Summer PDSI, 1895-2011

Tree-ring reconstruction of Texas Summer PDSI, 1550-1978

National Climatic Data Center, NOAA
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu/
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Going into Second Year of La Niña

January 6th

October 17th
Typical Patterns Associated with La Niña

La Niña develops when stronger than normal trade winds push warm water farther west. Enhanced upwelling makes surface waters in the eastern Pacific cooler than normal.
Trending Back into La Niña

PDF corrected CFS forecast Nino3.4 SST anomalies (K)

Latest 8 forecast members
Earliest 8 forecast members
Other forecast members
Forecast ensemble mean
NCDC daily analysis

El Niño
La Niña
Drought Outlook through December

U.S. Seasonal Drought Outlook
Drought Tendency During the Valid Period
Valid October 6 - December 31, 2011
Released October 6, 2011

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.
Jan-Mar Anomalies Based on 2nd Year La Niña

Composite Precipitation Anomalies (inches)
Versus 1981–2010 Longterm Average
Apr-May Anomalies Based on 2nd Year La Niña

Composite Precipitation Anomalies (inches)
Versus 1981–2010 Longterm Average
Ending Drought in 1 Month

Precipitation Required to End Current Drought Conditions in One Month

September 2011

National Climatic Data Center, NOAA

White indicates PHDI wetter than -2

<table>
<thead>
<tr>
<th>Trace to 3.00</th>
<th>3.01 to 6.00</th>
<th>6.01 to 9.00</th>
<th>9.01 to 12.00</th>
<th>12.01 to 15.00</th>
<th>15.01 to 18.00</th>
<th>18.01 to 21.00</th>
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Rain Needed to End the Drought in 6 Months

Precipitation Required to End Current Drought Conditions in Six Months

September 2011

National Climatic Data Center, NOAA

White indicates PHDI wetter than -2

- trace to 5.00
- 5.01 to 10.00
- 10.01 to 15.00
- 15.01 to 20.00
- 20.01 to 25.00
- 25.01 to 30.00
- 30.01 to 35.00
Could drought last till 2020?

The drought has forced Brian Eckert, surveying cracks in an empty stock tank on land he leases in Gillespie County, to reduce his herd of cattle. The region's climate is amid a 20- to 40-year dry phase, the state climatologist says.

Planners urged to prepare for record water shortage

Texas could be in the midst of a drought the history books have never seen, meaning water planners need to prepare for worse than what they've seen, state climatologist John Nielsen-Gammon said Thursday.

The current drought could last until 2020, because the region's climate is in the middle of a 20- to 40-year dry phase, Nielsen-Gammon said.

Water planners, including state

"Sooner or later there will be a drought that's worse" (than the drought of record), Nielsen-Gammon said. "The planning needs to be able to cover the bases not just for the worst that we've seen but also have a plan going forward in case conditions become worse than that."

The state's water development board, which conducts long-term...
Pacific Decadal Oscillation

MULTIVARIATE ENSO INDEX

NOAA/ESRL/Physical Science Division – University of Colorado at Boulder/CIRES/CDC
Similar Conditions to the 1950s?

monthly values for the PDO index: 1900-September 2009

PDO

AMO
Percent Area of Texas in Drought, Jan 2001-Sep 2011
The 2011 Atlantic Hurricane Season
An Active Season, but Not for Texas
Historical Hurricane Tracks after September 24th
Take Home Points

• No clear end in sight to the ongoing drought; could last well into 2012.

• Scattered rains possible this fall and winter but not heavy enough to temper the drought.

• Intense droughts are hard to break.

• Tropical storms rains now not likely.

• La Niña is back. Late fall and winter expected to be drier than normal.

• Dry years interspersed with wet years.
Water flowing into the Highland Lakes

January - September totals (in acre-feet)

Average: 991,848
2009: 231,918
2011: 74,719

View the graph
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.

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Lake Buchanan Level Forecast

Top of Conservation Storage is 1018 to 1020 ft-msl

Historic
- Wet Conditions
- Average Conditions
- Drought Conditions
- Extreme Drought Conditions

PAST
FUTURE

10/11/2011
Subject to Revision
REA
Highland Lakes Storage

Where we’ve been

Lakes Buchanan and Travis full at 2.01 MAF

What could happen

2010 Water Management Plan Trigger Points

1.9 MAF - 94% Total Combined Capacity
On Jan. 1 or July 1, interruptible supplies are ceased for all customers except four major irrigation operations.

1.7 MAF - On Jan. 1 - Bay and Estuary
Reduce bay and estuary releases to meet 150 percent of critical needs (limited by Storable Inflows).

1.4 MAF - Any time - Firm Demands
Request firm customers to implement voluntary water use reduction measures to achieve a 5 percent reduction in use.

1.4 MAF - On Jan. 1 - Interruptible Supply
Begin gradual curtailment of interruptible supply to four major irrigation operations. Curtailment increases with lower storage levels. Environmental releases for instream flows are reduced to meet critical needs.

1.1 MAF - On Jan. 1 - Bay and Estuary
Environmental releases for bay and estuaries are reduced to meet critical needs.

900,000 AF - Any time - Firm Demands
Request firm customers to implement mandatory water use restrictions to achieve a 10-20 percent reduction in use. Meet with customers to develop a curtailment plan should drought worsen.

600,000 AF - Drought Worse Than Drought of Record - Cease Interruptible and Curtail Firm
If criteria indicate drought worse than record, begin curtailment of firm supply after ceasing interruptible supply (timing based on duration of drought).

Historic Lake Capacity

Forecast - Wet Conditions
Forecast - Average Conditions
Forecast - Drought Conditions
Forecast - Extreme Drought Conditions

Note: MAF equals One Million Acre-Feet
One Acre-Foot (AF) equals 325,851 gallons.

Date: October 10, 2011