

HTGCD Drought Trigger Methodology

Radu Boghici, P.G.

August 29, 2022



A handwritten signature in black ink, appearing to be "Radu Boghici", written over the bottom portion of the professional seal.

1/10/23

Current Drought Indicators

- Blanco River and Pedernales River as current drought indicators
- **Additional Indicator***) – “Palmer Drought Index”
- **Drought Declared:** 30 consecutive days of flow below a drought trigger at **both** river gages.
- **Drought Lifted:** 60 consecutive days of flow above a drought trigger at **both** river gages.

*) US Drought Monitor uses the Palmer Drought Severity Index (PDSI) as input for their drought classification. I used the PDSI for this project.

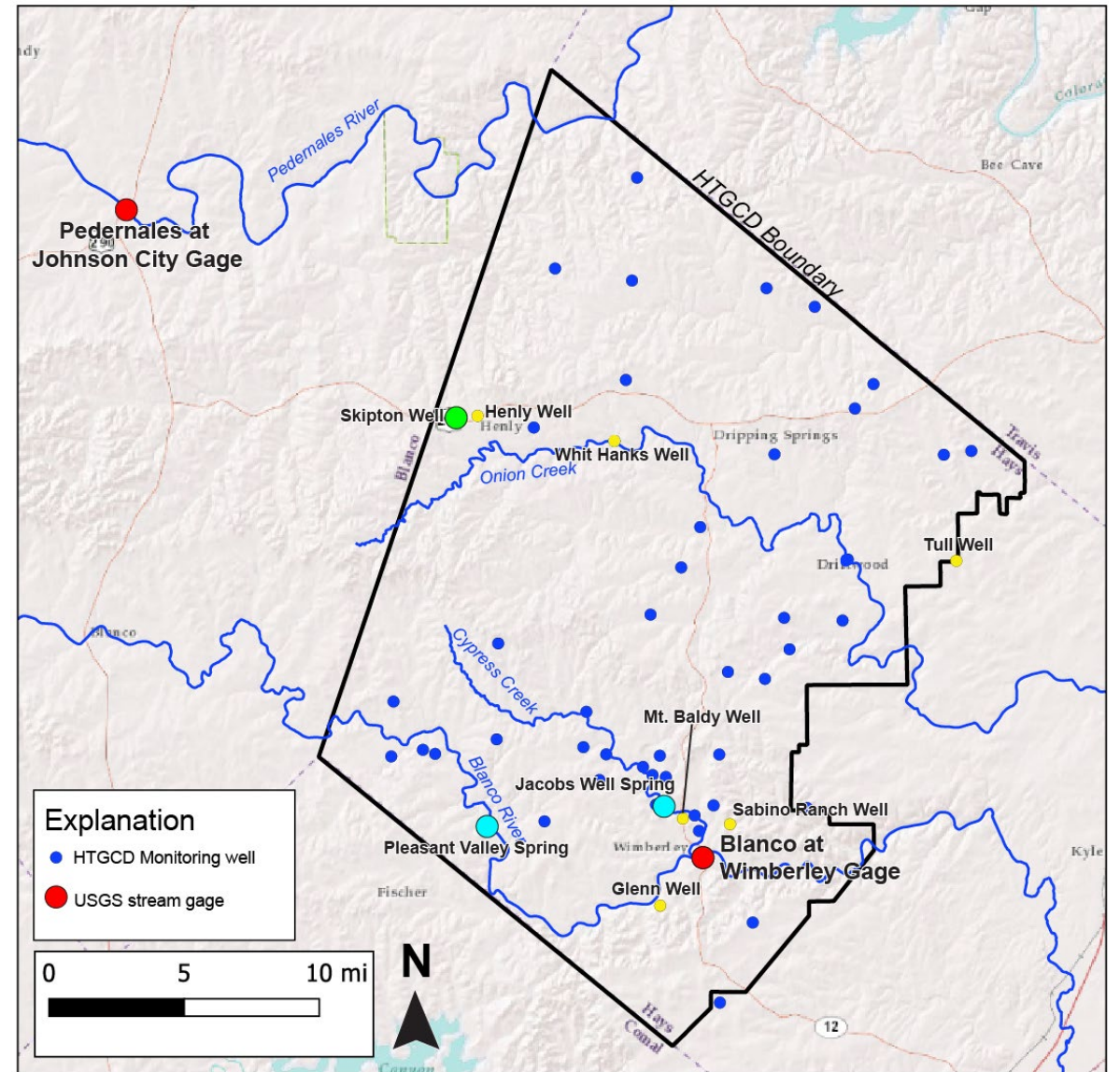


Figure 1. Location of river flow gauges (red dots)

Yardstick: U.S. Drought Monitor

U.S. Drought Monitor

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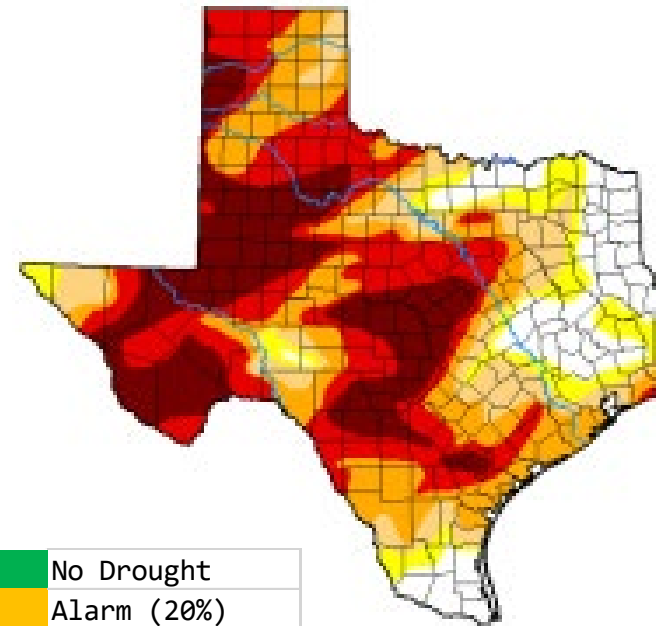
Drought Classification

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Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: <ul style="list-style-type: none"> short-term dryness slowing planting, growth of crops or pastures Coming out of drought: <ul style="list-style-type: none"> some lingering water deficits pastures or crops not fully recovered 	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	<ul style="list-style-type: none"> Some damage to crops, pastures Streams, reservoirs, or wells low, some water shortages developing or imminent Voluntary water-use restrictions requested 	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	<ul style="list-style-type: none"> Crop or pasture losses likely Water shortages common Water restrictions imposed 	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	<ul style="list-style-type: none"> Major crop/pasture losses Widespread water shortages or restrictions 	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	<ul style="list-style-type: none"> Exceptional and widespread crop/pasture losses Shortages of water in reservoirs, streams, and wells creating water emergencies 	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

U.S. Drought Monitor Texas

May 24, 2022
 (Released Thursday, May 26, 2022)
 Valid 8 a.m. EDT



The Drought Monitor features an broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <http://droughtmonitor.unl.edu/About.aspx>

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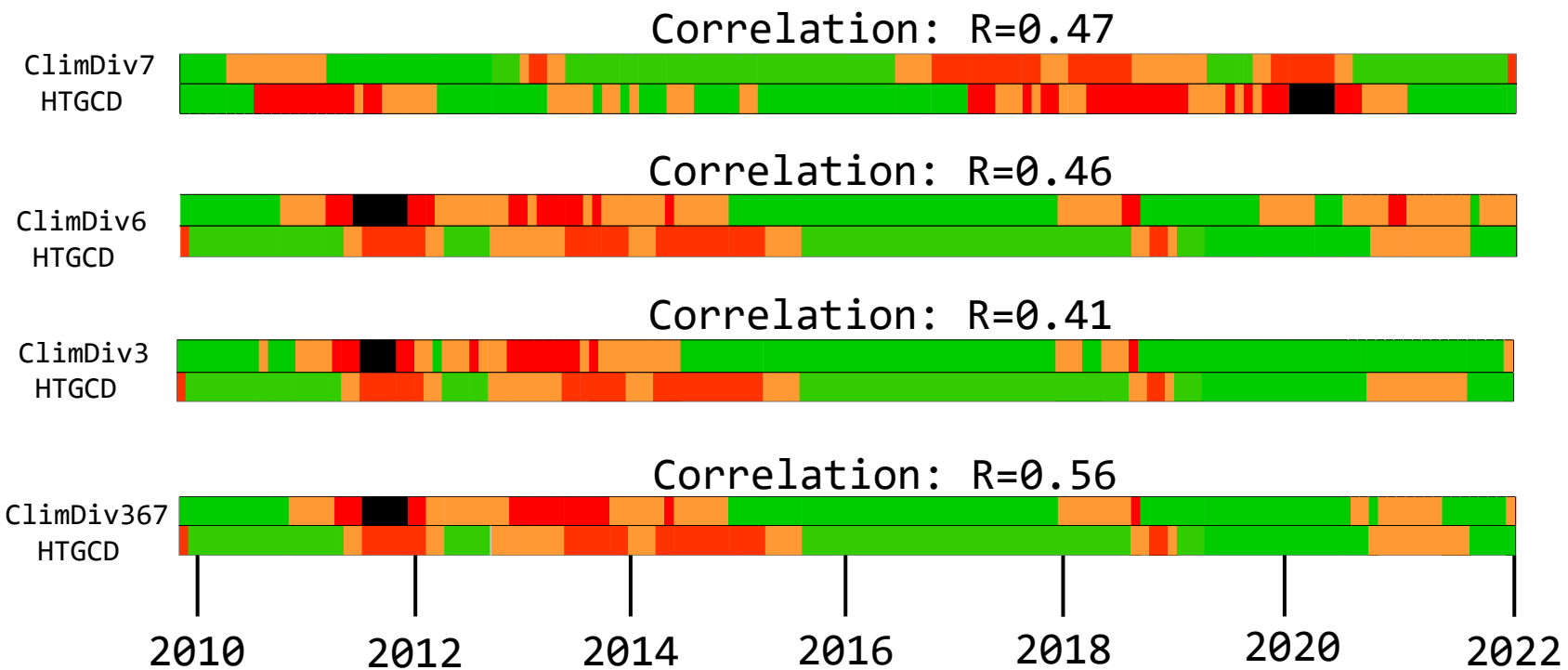
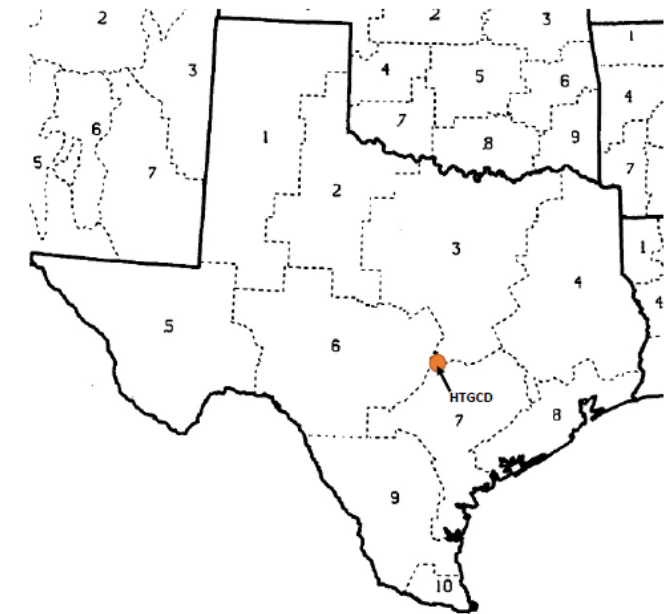


droughtmonitor.unl.edu

D0		No Drought
D1		Alarm (20%)
D2&D3		Critical (30%)
D4		Emergency (40%)

HTGCD Drought Declarations*) vs. U.S. Drought Monitor data

Climatic regions of Texas
(NOAA, 2022)



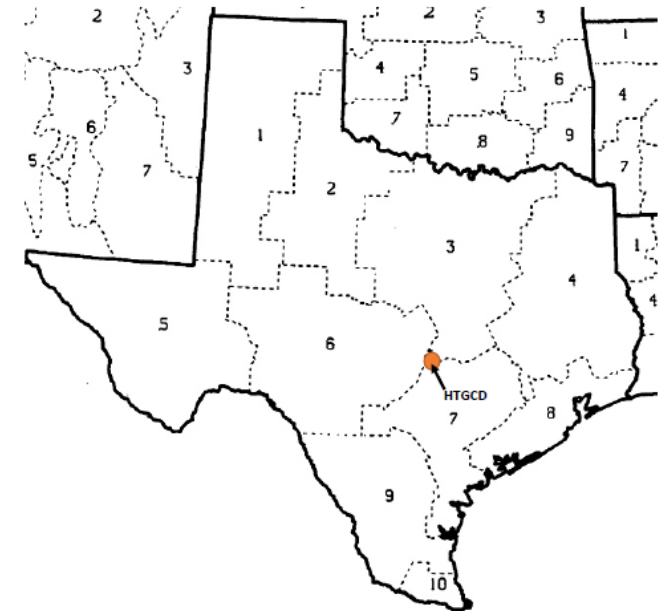
*) HTGCD drought declared according to Rule 13, including 30- and 60-day time periods to enter/leave drought stage.

HTGCD Drought Declarations vs. Individual Stream Gauges

Pedernales Only*		Blanco Only*		HTGCD (both Pedernales and Blanco)*	
No Drought	40%	No Drought	59%	No Drought	59%
Alarm	32%	Alarm	29%	Alarm	22%
Critical	12%	Critical	12%	Critical	19%
Emergency	16%	Emergency	0%	Emergency	0%

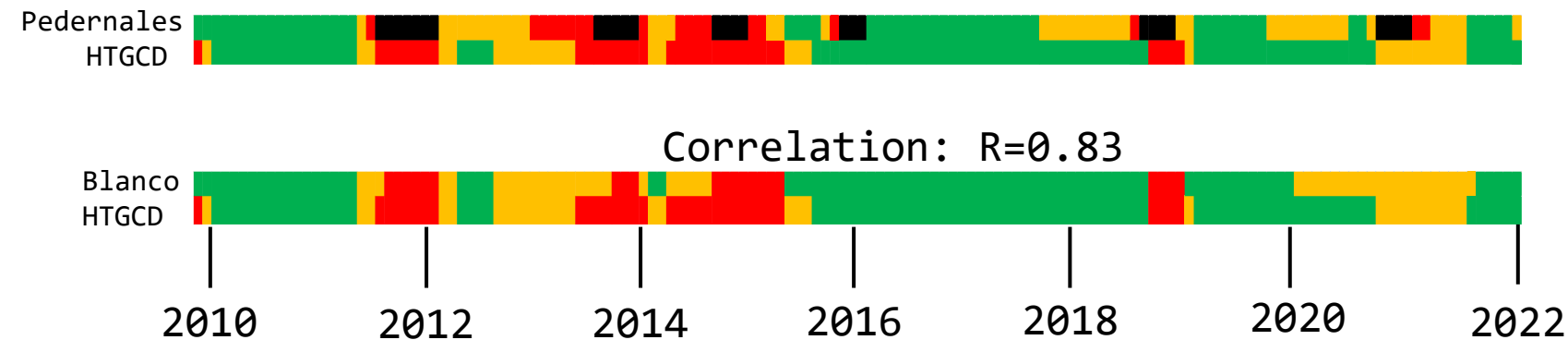
* Daily data, drought declared using HTGCD Rule 13.

Climatic regions of Texas
(NOAA, 2022)



Correlation: $R=0.70$

Correlation: $R=0.83$



Alternative 1: U.S. Drought Monitor

U.S. Drought Monitor

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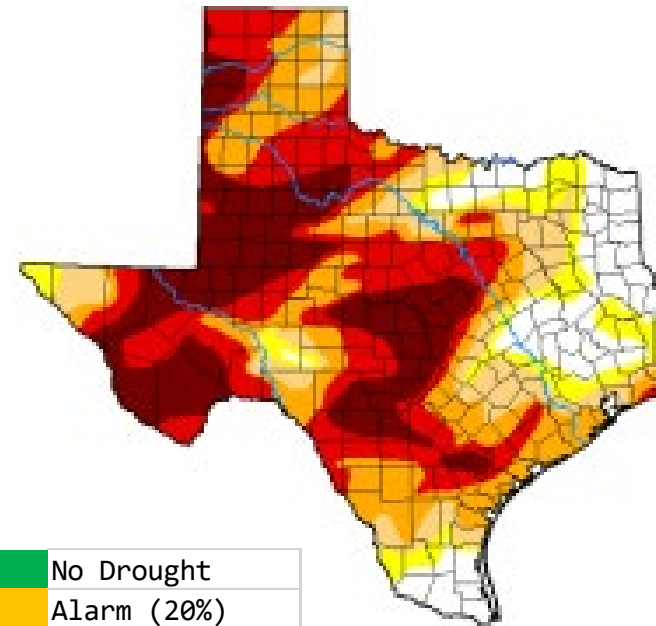
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Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <http://droughtmonitor.unl.edu/About.aspx>

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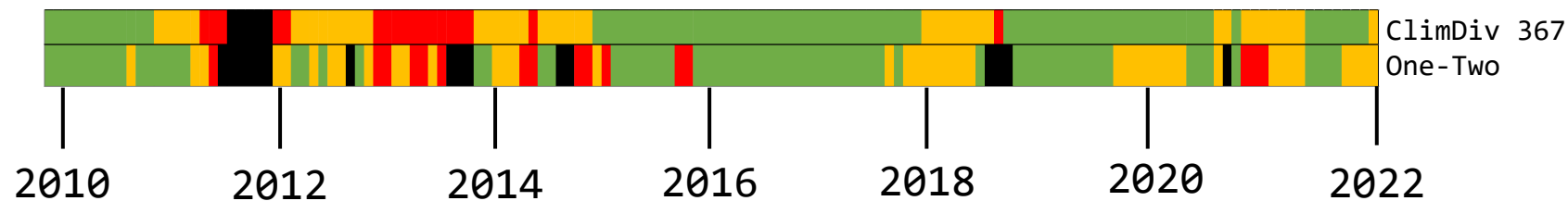
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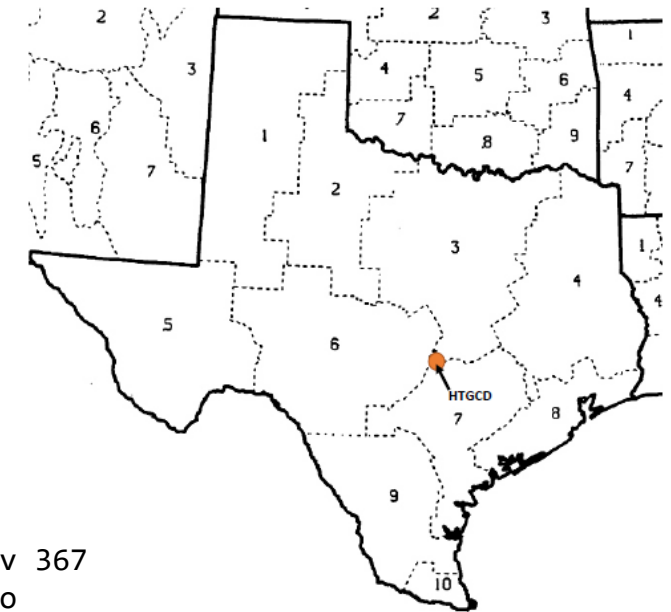
Alternative 2: 'One-Two' River Gauges Method

One gauge to enter drought;
Two gauges to exit drought.

Correlation: $R=0.68$



Climatic regions of Texas
 (NOAA, 2022)



Stage	Percent Time in Stage
No Drought	46%
Alarm	30%
Critical	13%
Emergency	11%
<i>Monthly Data, no Rule 13 delays</i>	

'One-Two' River Gauges Method

One gauge to enter drought;

Two gauges to exit drought;

30- and 60-day delays considered

Stage	Percent Time in Stage	
	"One-Two"	Current HTGCD
No Drought	31%	59%
Alarm	32%	22%
Critical	19%	19%
Emergency	19%	0%
<i>Daily Data, Rule 13 delays included</i>		

Combine “One-Two” and Drought Monitor (ClimDiv367 PDSI)

One gauge to enter drought;
Two gauges to exit drought;
30- and 60-day delays considered

Stage	Percent Time in Stage	
	"One-Two"&PDSI	Current HTGCD
No Drought	30%	59%
Alarm	22%	22%
Critical	27%	19%
Emergency	20%	0%

Daily Data, Rule 13 delays included