

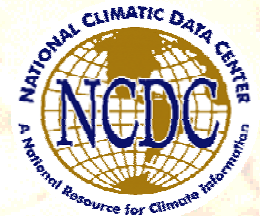
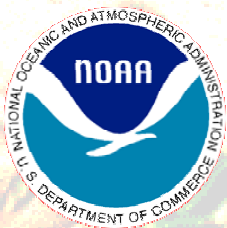
Assessing the State of Drought in the U.S.

Karin L. Gleason

Meteorologist

NOAA/NESDIS/NCDC

17 January 2002



Introduction

- **What is drought?**
 - Identify characteristics and types
- **Indices used to quantify drought**
 - Definitions
 - Strengths/limitations
- **Drought assessment tools**
 - U.S. Drought Monitor
 - Drought Termination & Amelioration web page

What is Drought?

- **Difficult to define and describe due to a wide variety of sectors affected by drought, its diverse geographical and temporal distribution as well as the many scales of drought.**
- **Common to all types of drought is the fact that droughts *originate from a deficiency of precipitation resulting from an unusual weather pattern.***

Types of Drought

- ***Short-term:*** Dry weather pattern lasts a short time
- ***Long-term:*** Atmospheric circulation pattern becomes entrenched and precipitation pattern lasts for several months to years.
- ***Agricultural:*** Insufficient precipitation during critical agricultural growth periods.
- ***Hydrological:*** Affects streamflow, groundwater and reservoir levels.
- ***Meteorological:*** A change in the atmospheric circulation pattern which results in a deficit of precipitation.

Indices Used to Quantify Drought

The following Palmer indices take precipitation, evapotranspiration and runoff into consideration:

➤ *Palmer Drought Index (PDI)*: A long-term meteorological drought index run on a weekly or monthly basis.

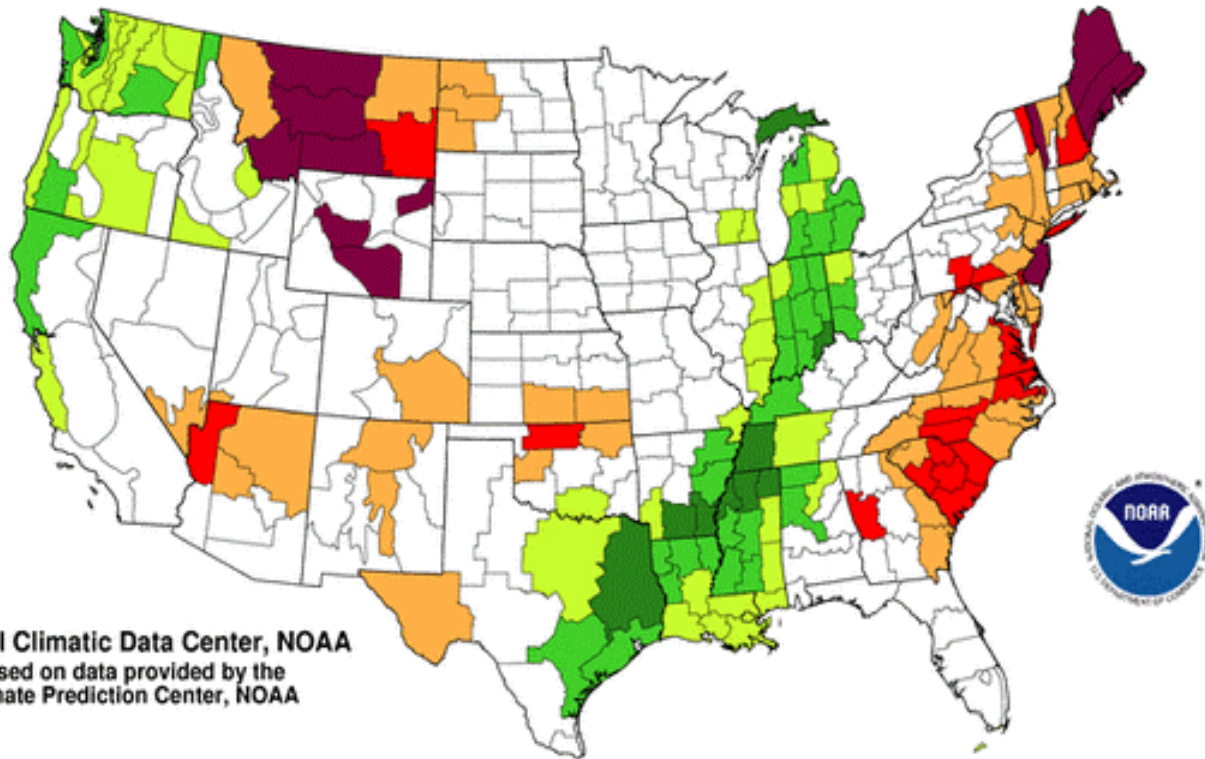
Strength: First comprehensive drought index in U.S.

Limitations: Slow to detect rapidly changing conditions
Not as well-suited for inhomogeneous regions

Not as effective in winter – snowpack not considered

Palmer Drought Index Long-Term (Meteorological) Conditions

December 30, 2001 - January 5, 2002



National Climatic Data Center, NOAA
based on data provided by the
Climate Prediction Center, NOAA

extreme
drought



-4.00
and
below

severe
drought



-3.00
to
-3.99

moderate
drought



-2.00
to
-2.99

mid-
range



-1.99
to
+1.99

moderately
moist



+2.00
to
+2.99

very
moist



+3.00
to
+3.99

extremely
moist



+4.00
and
above

Palmer Drought Indices - *Continued*

➤ *Crop Moisture Index (CMI)*: A short-term weekly index designed to reflect quickly changing soil moisture conditions for agricultural applications.

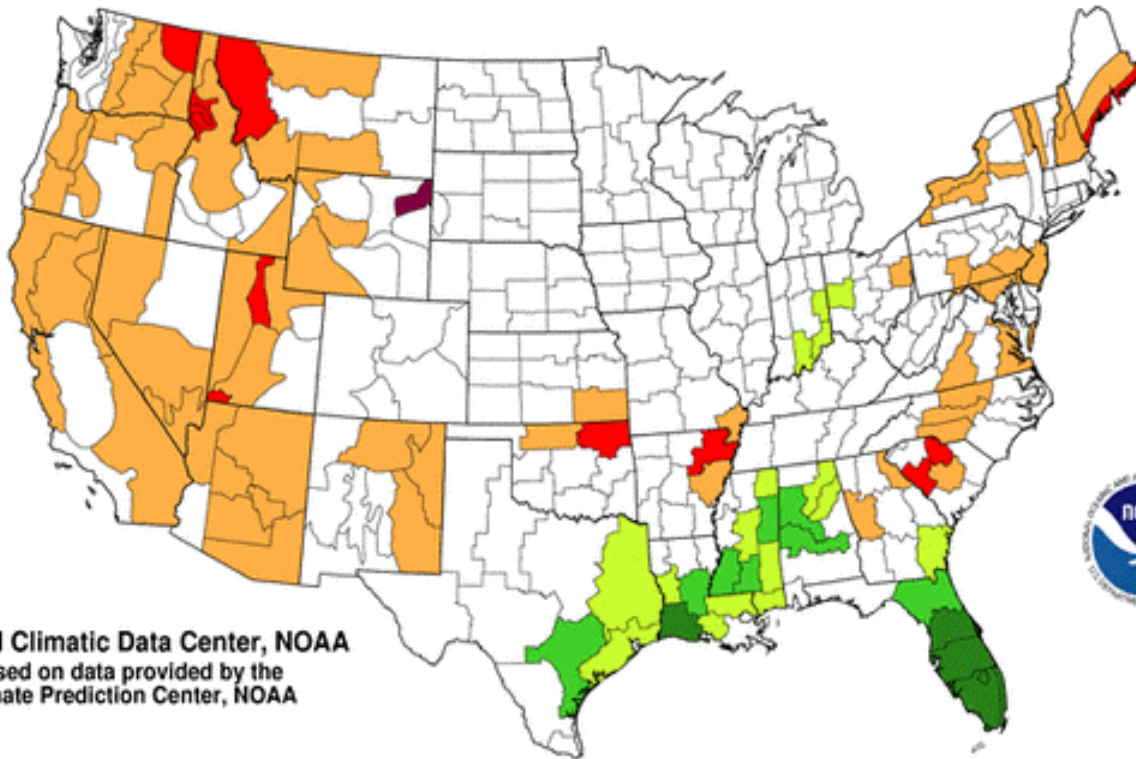
Limitation: Used mainly during growing season

➤ *Palmer Hydrological Drought Index (PHDI)*: A monthly index which quantifies long-term hydrological impacts.

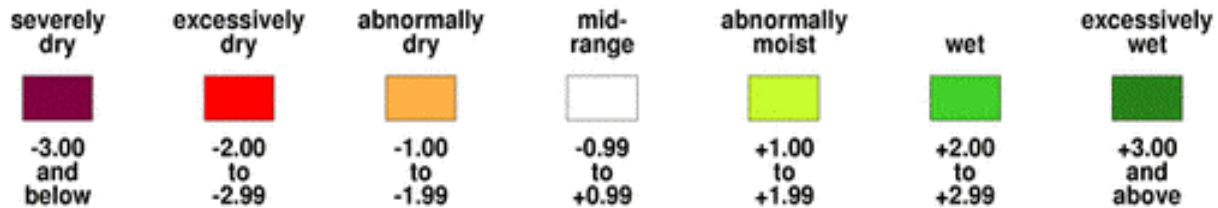
Limitation: Responds more slowly to changes than the PDI

Palmer Crop Moisture Index Short-Term Drought

September 9, 2001 - September 15, 2001



National Climatic Data Center, NOAA
based on data provided by the
Climate Prediction Center, NOAA



Palmer Drought Indices - *Continued*

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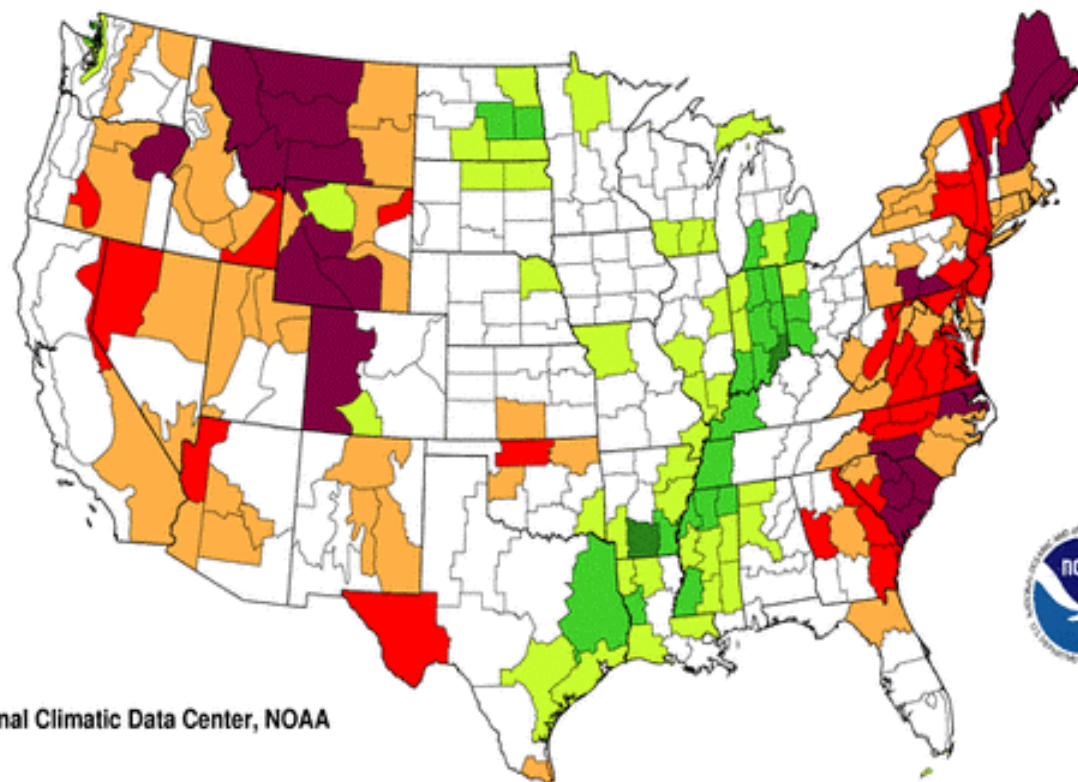
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➤ *Palmer Hydrological Drought Index (PHDI)*: A monthly index which quantifies long-term hydrological impacts.

Limitation: Responds more slowly to changes than the PDI

Palmer Hydrological Drought Index Long-Term (Hydrological) Conditions

December 2001



National Climatic Data Center, NOAA

extreme
drought



-4.00
to
below

severe
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-3.00
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moderate
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-2.00
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moderately
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Drought Indices - *Continued*

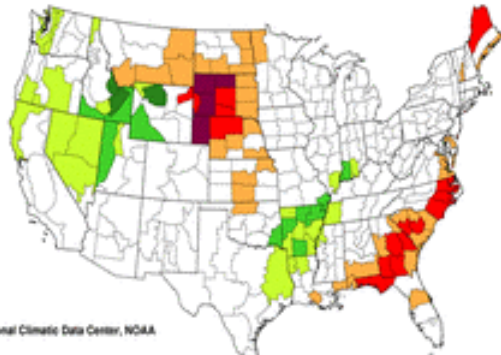
➤ *Standardized Precipitation Index (SPI)*: A monthly probability index considering only precipitation. Can be calculated for a variety of time-scales (usually, from 1 to 60 months).

Strengths: Recognizes drought on many time scales
Anticipates long-term drought cessation

Limitation: Only considers precipitation

Standardized Precipitation Index
One Month

December 2001

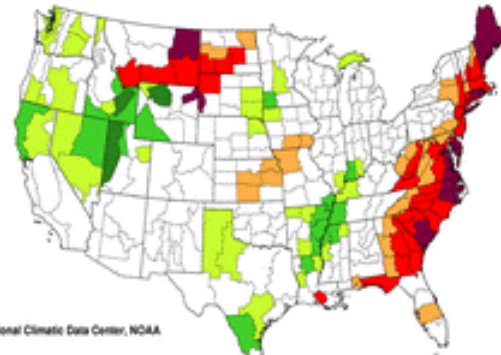


National Climatic Data Center, NOAA



Standardized Precipitation Index
Two Months

November-December 2001

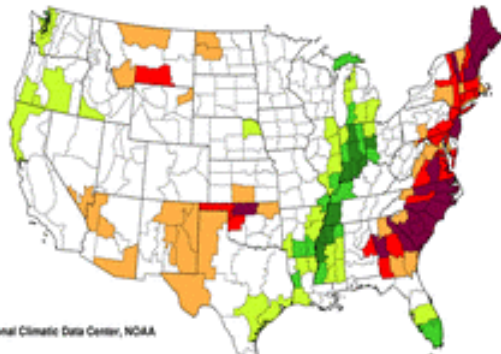


National Climatic Data Center, NOAA

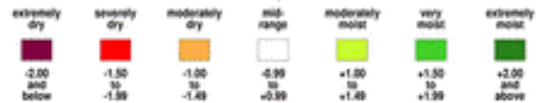


Standardized Precipitation Index
Six Months

July-December 2001

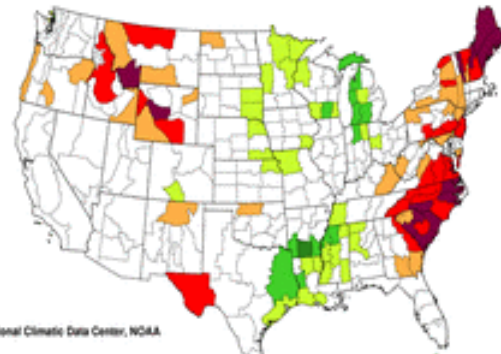


National Climatic Data Center, NOAA

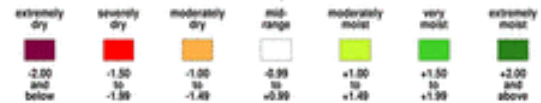


Standardized Precipitation Index
Twelve Months

January-December 2001



National Climatic Data Center, NOAA



Drought Indices - *Continued*

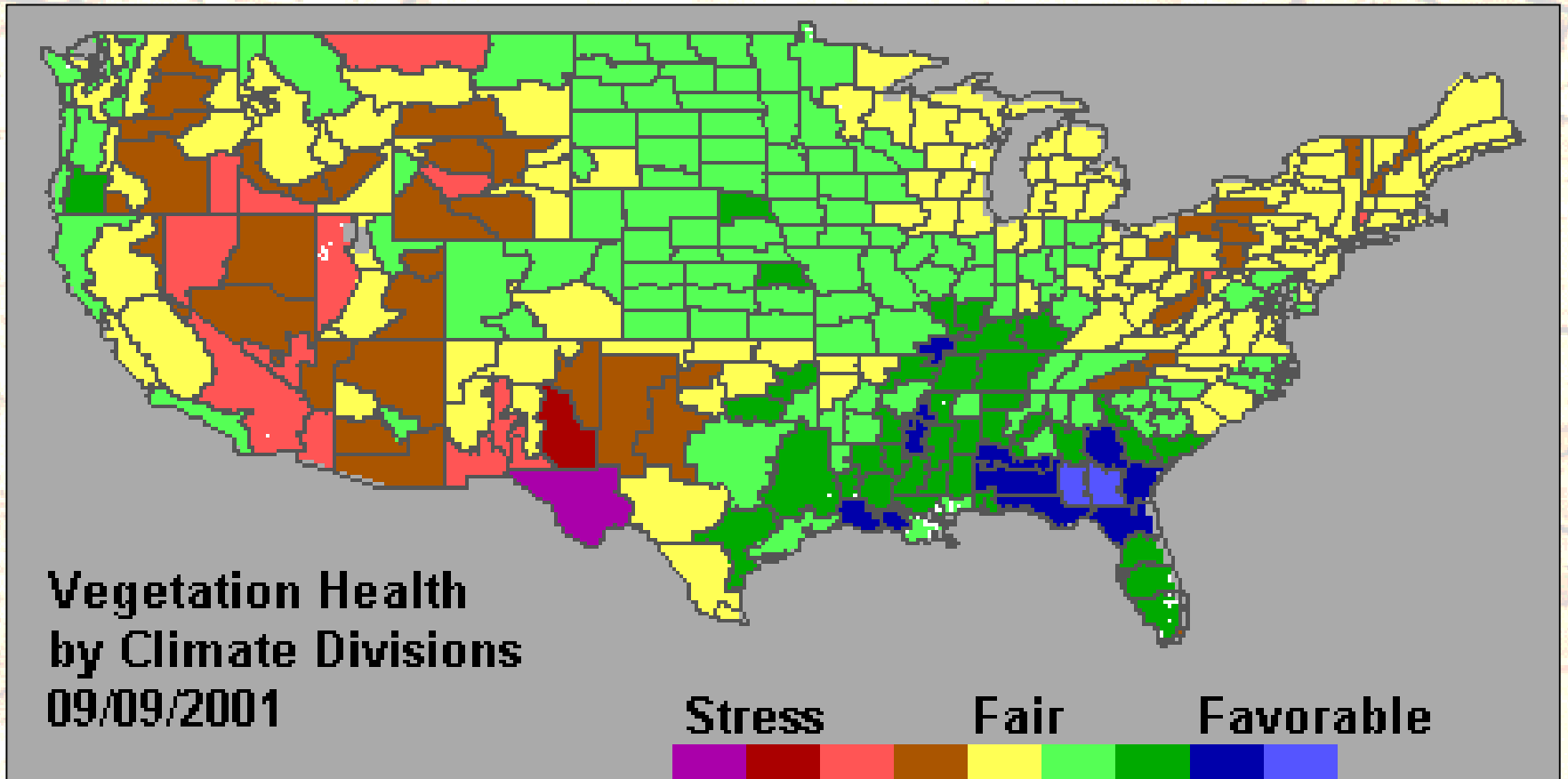
➤ *Satellite Vegetation Health Index (VHI)*: A satellite-derived index reflecting a combination of chlorophyll and moisture content in vegetation and changes in thermal conditions at the surface.

Limitation: Used mainly during growing season

➤ *Objective Blended Drought Index Percentiles (OBDI)*: A weekly index averaging PDI, soil moisture and 30-day precipitation ranking percentiles.

Strength: Incorporates both long and short term indices

Limitation: Opposite-phased long and short-term conditions may offset in final product



Drought Indices - *Continued*

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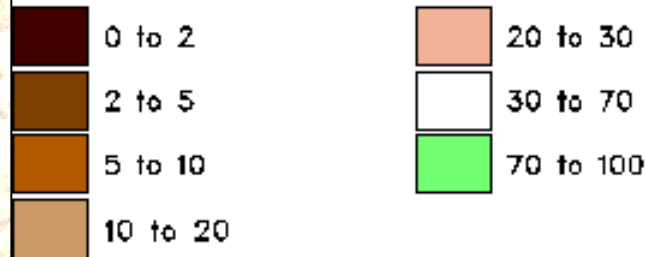
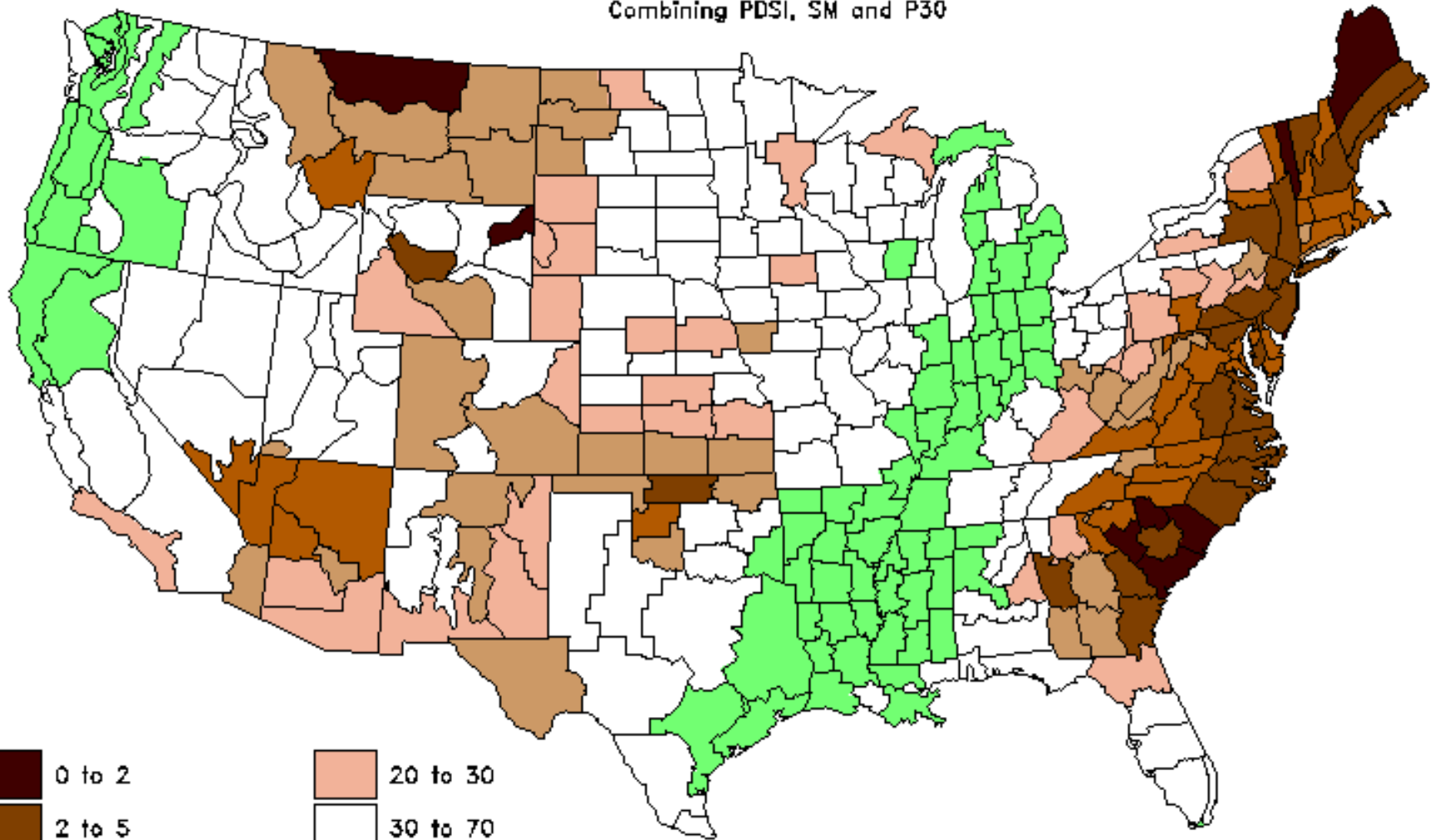
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Objective Blend of Drought Indices (OBDI) Percentile

Ending at 6 JAN 2002

Combining PDSI, SM and P30



CLIMATE PREDICTION CENTER, NOAA



Drought Indices - *Continued*

Other useful drought indices include:

- *% of Normal Precipitation*
- *USGS Streamflow Percentiles*
- *USDA/NASS Soil Moisture Measurements (SCAN)*
- *SNOTEL Measurements**
- *Surface Water Supply Index (SWSI)**

** Used in the West and primarily during the snow season*

Drought Assessment Tools

➤ *U.S. Drought Monitor*: A multi-agency weekly drought assessment product which depicts drought conditions of different time scales and of varying impacts using a blend of drought indices and local expert input.

➤ *Drought Termination and Amelioration*: A web tool used to quantify how much precipitation is needed and the probability of receiving such precipitation to end or ameliorate a PHDI drought of specified intensity (PHDI values of -2 to -6) on 1 to 6-month time scales.

Drought Monitor - *Continued*

Main Federal Partners:

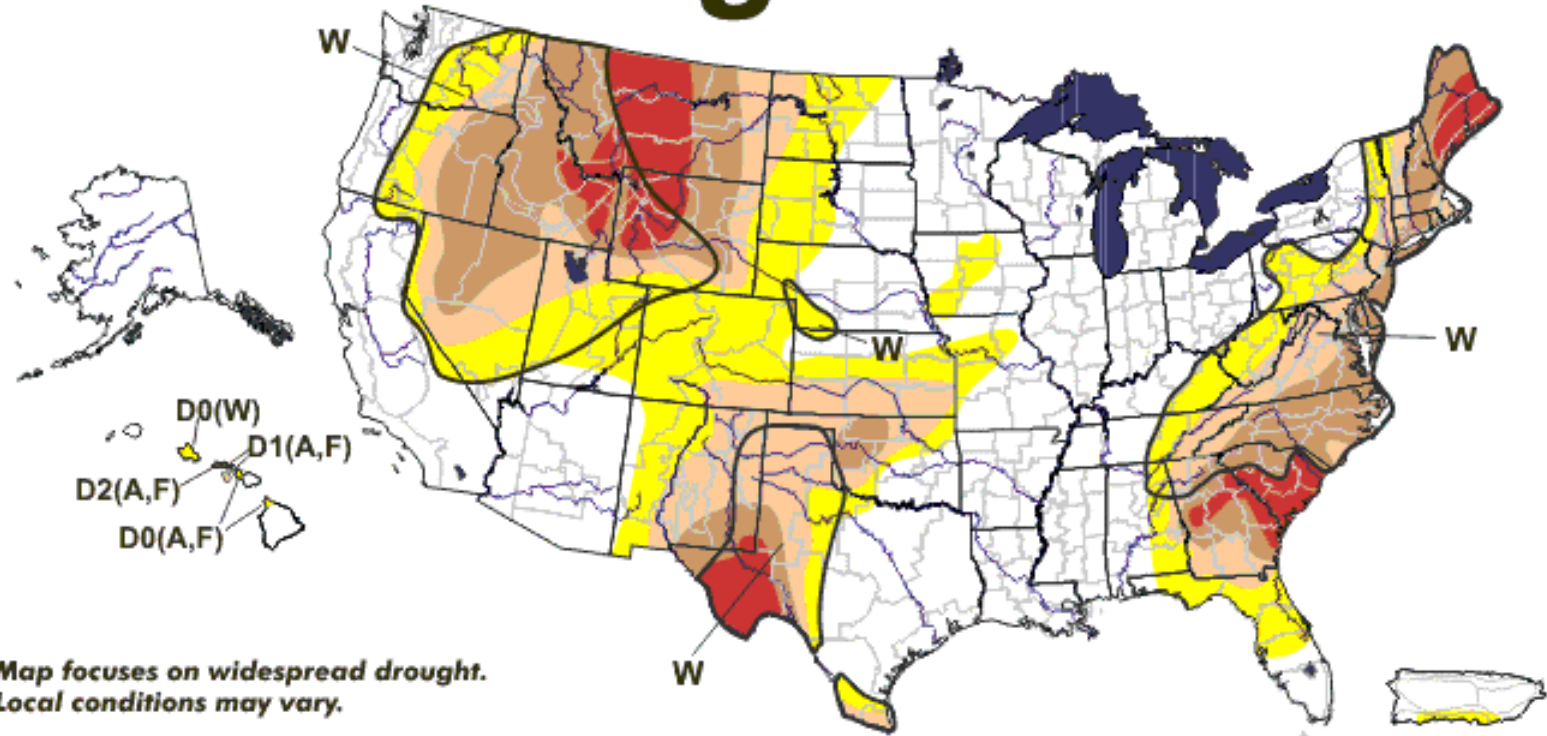
- Joint Agricultural Weather Facility (USDA and DOC/NOAA)
- Climate Prediction Center (DOC/NOAA/NWS)
- National Climatic Data Center (DOC/NOAA)

Academic Partner:

- National Drought Mitigation Center (University of Nebraska-Lincoln)

January 8, 2002 Valid 8 a.m. EST

U.S. Drought Monitor



**Map focuses on widespread drought.
Local conditions may vary.**

- D0 Abnormally Dry
- D1 Drought-Moderate
- D2 Drought-Severe
- D3 Drought-Extreme
- D4 Drought-Exceptional
- Delineates Overlapping Areas

Drought Impact Types:
A = Agriculture
W = Water (Hydrological)
F = Fire danger (Wildfires)
(No type = All 3 impacts)



See accompanying text summary for forecast statements
[Http://drought.unl.edu/monitor/monitor.html](http://drought.unl.edu/monitor/monitor.html)

● **Released Thursday, January 10, 2002** ●
Author: Richard Heim, NCDC/NOAA

<http://enso.unl.edu/monitor/monitor.html>

Drought Severity Classification

Categories of drought magnitude utilized in the Drought Monitor:

Category	Name	Percentile Chance*
D0	Abnormally Dry	21-30
D1	Drought - Moderate	11-20
D2	Drought - Severe	6 – 10
D3	Drought - Extreme	3 – 5
D4	Drought - Exceptional	#2

**percentile chance is for any given year out of 100 years.*

Primary Indicators used to determine categories include: PDI, CPC Soil Moisture Model Percentiles, USGS Weekly Streamflow Percentiles, Percent of Normal Precipitation, SPI and VHI.

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Drought Termination & Amelioration - *Continued*

Definitions:

- End of drought - PHDI ≤ -0.5
- Drought amelioration - PHDI ≤ -2.0

Imagery Details:

- Over 2000 maps depict precipitation needed and associated probabilities for droughts of specified intensities.
- Current maps depict precipitation amounts, associated probabilities and percent of normal precipitation needed to end or ameliorate existing drought conditions.

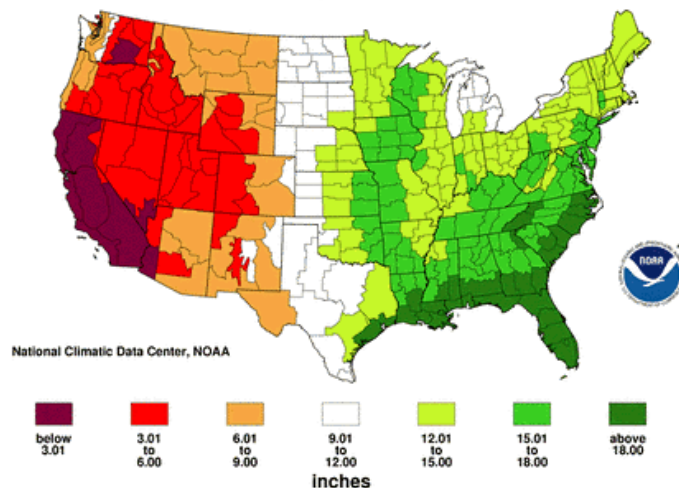


Drought Termination and Amelioration

National Climatic Data Center
Asheville, North Carolina



Precipitation Required to End a Level -2 PHDI
Drought in Three Months
June



[Background](#)

[Current Conditions](#)

[Precipitation Requirements](#)

Links to background information, current conditions and precipitation required to end or ameliorate drought across the U.S.



To view maps of precipitation required to end or ameliorate drought across the U.S., please select from the options below and then click "submit".

Type of Drought Reduction:

End

PHDI Level:

-2

Month:

January

Duration in Months:

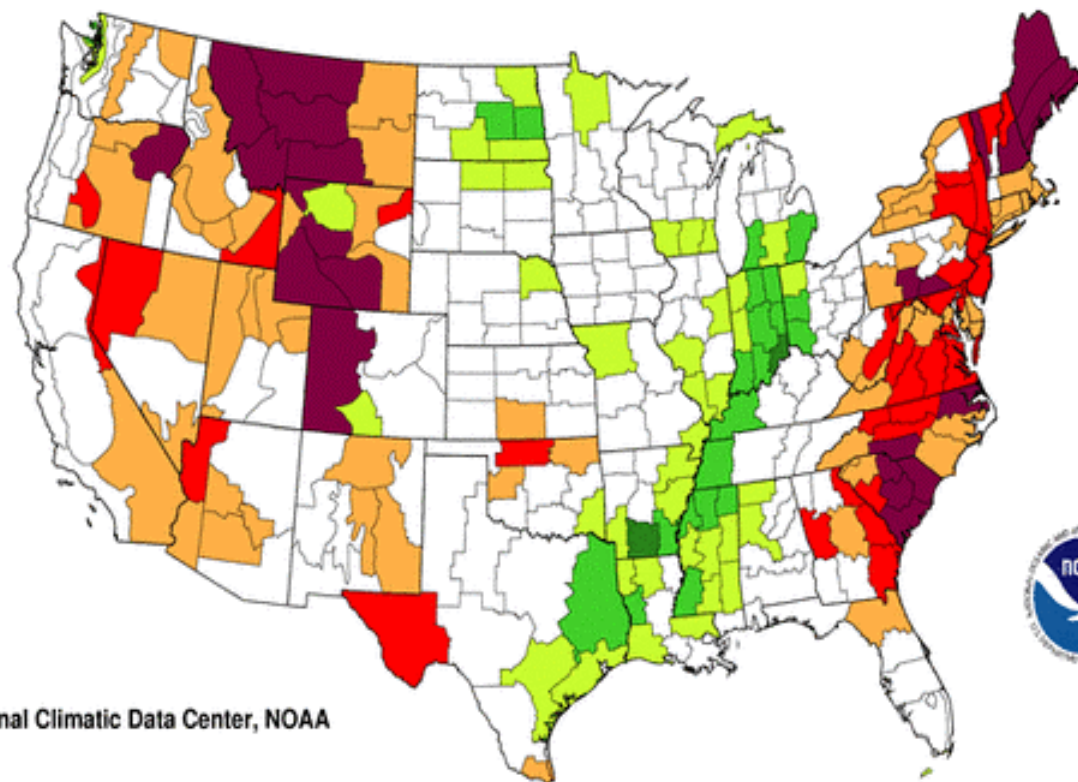
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[Submit](#)

The end of a drought is defined by a PHDI value of -0.5.
Drought amelioration is achieved when a PHDI value of -2.0 is reached.

Palmer Hydrological Drought Index Long-Term (Hydrological) Conditions

December 2001



National Climatic Data Center, NOAA

extreme
drought



-4.00
to
below

severe
drought



-3.00
to
-3.99

moderate
drought



-2.00
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-1.99
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+2.00
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very
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+3.00
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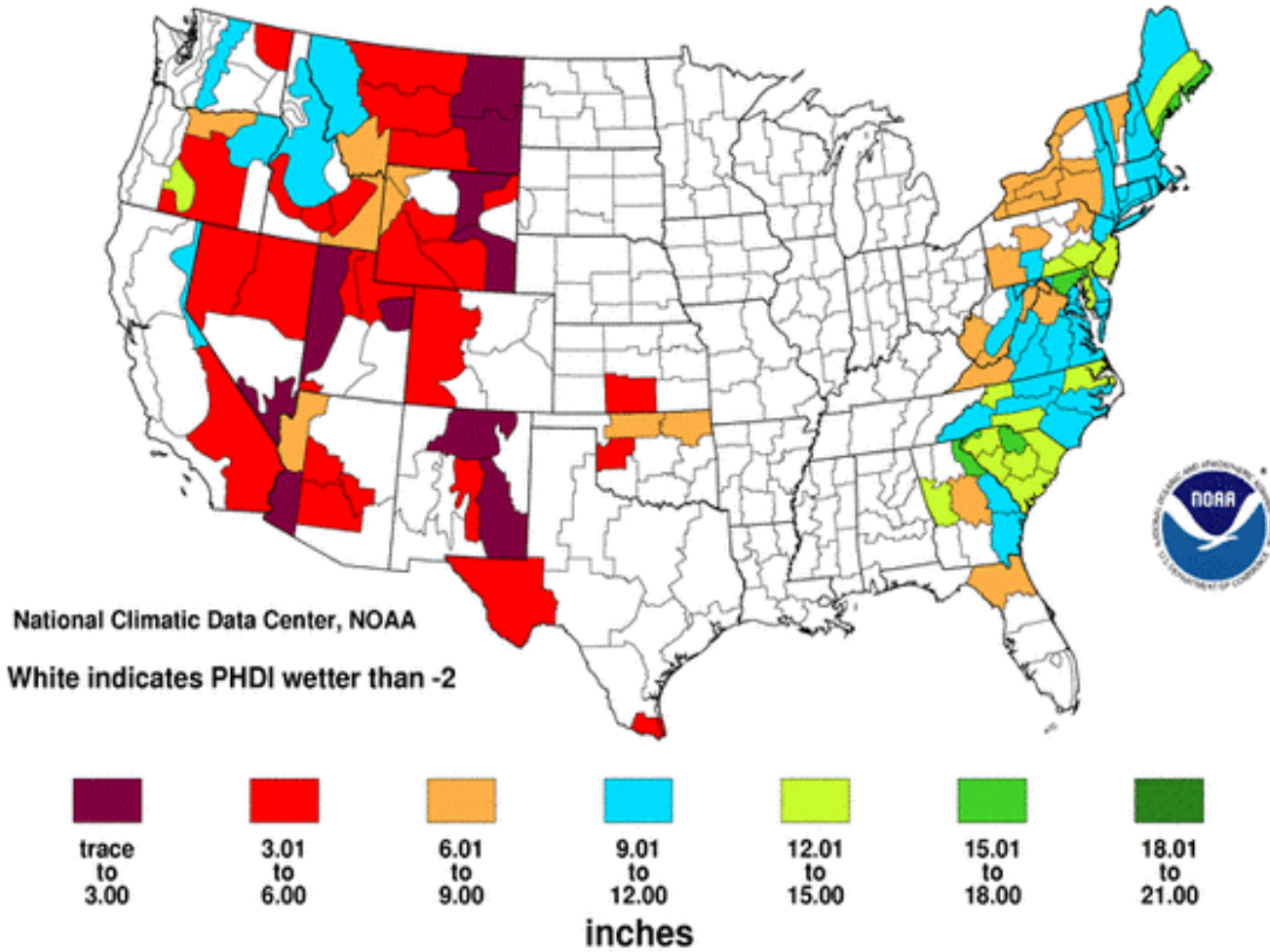
extremely
moist



+4.00
and
above

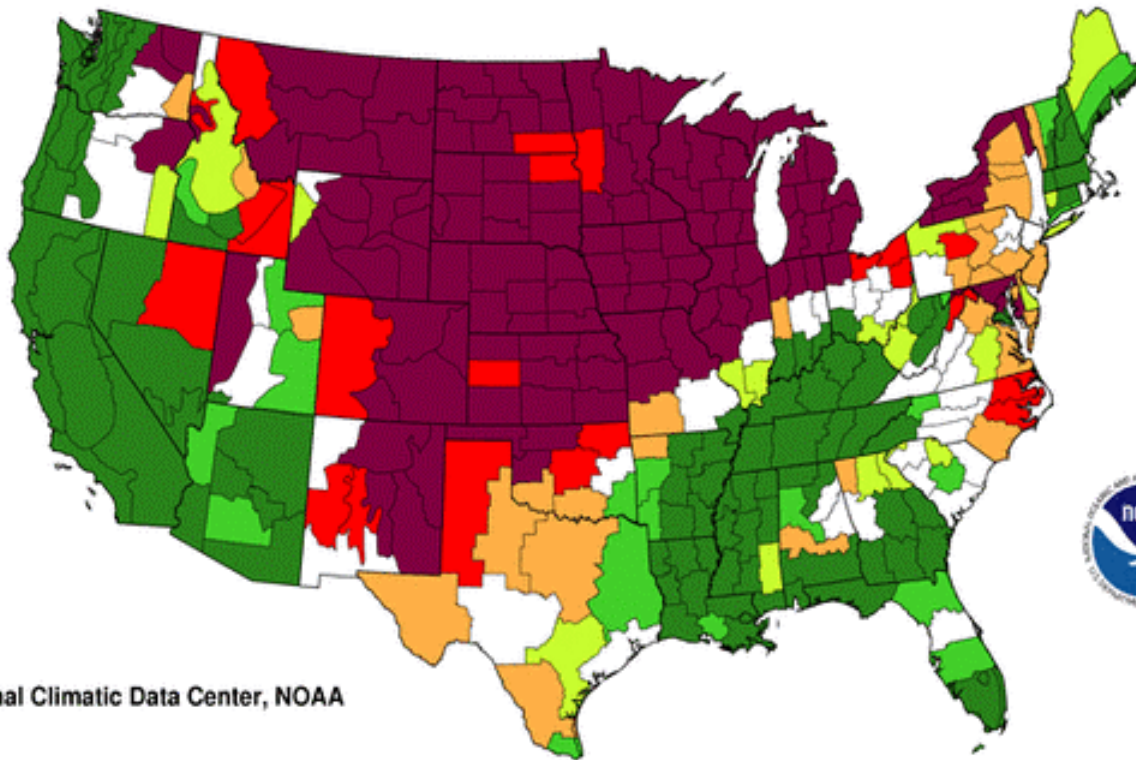
Precipitation Required to End Current Drought Conditions in One Month

December 2001



Probability of Precipitation Required to Ameliorate a Level -4 PHDI Drought in One Month

December



National Climatic Data Center, NOAA

0
to
0.25%

0.25%
to
0.50%

0.50%
to
0.75%

0.75%
to
1.00%

1.00%
to
1.25%

1.25%
to
1.50%

1.50%
to
11.2%

Summary

- **Drought is a complex phenomenon and means different things to different people.**
- **There exist a number of useful drought indicators which have distinct advantages and limitations.**
- **The U.S. Drought Monitor and the Drought Termination and Amelioration web page are two relatively new drought assessment tools.**