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International Commission on Irrigation and Drainage (ICID)



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**What are the limitations to monitoring
drought?**

2nd Indo Global Irrigation Summit

24-25 June 2026, New Delhi India

What are the limitations to monitoring drought?

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2nd Indo-Global Irrigation Summit
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What is drought and why is it important to ICID?

- From an agricultural and operational standpoint, drought is expressed when precipitation falls considerably below evapotranspiration for a prolonged period of time.
- As a result of soil moisture depletion, crop yields can be severely stressed, leading to low or no crop yields.
- The situation can be compounded by other meteorological variables, such as high temperatures.
- Livestock can also be affected by drought since feed availability and supplies can be reduced, and animals maybe affected the h

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Drought is a slow-moving natural disaster affect food and water security, leading to shortages of water and famine.

According to the WHO:

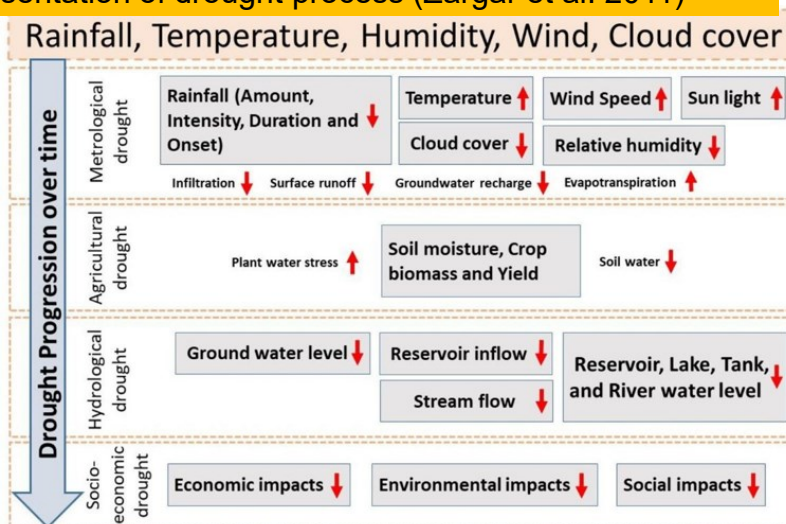
- 55 million people globally are affected by droughts every year.
- Drought threatens people's livelihoods, increases the risk of disease and death, and fuels mass migration.
- Water scarcity impacts 40% of the world's population, and as many as 700 million people are at-risk of being displaced as a result of drought by 2030.

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Schematic representation of drought process (Zargar et al. 2011)



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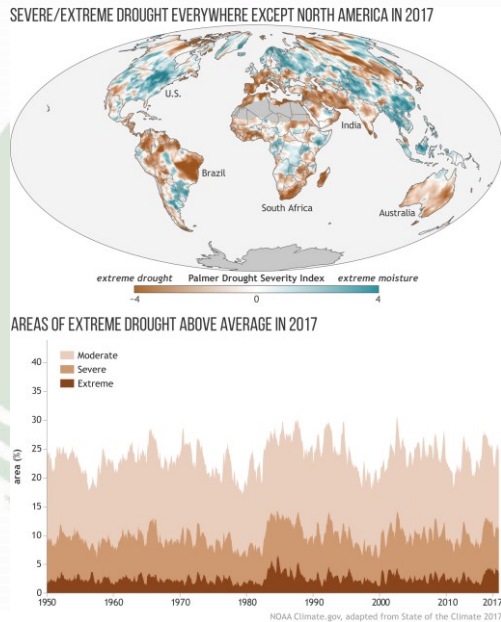
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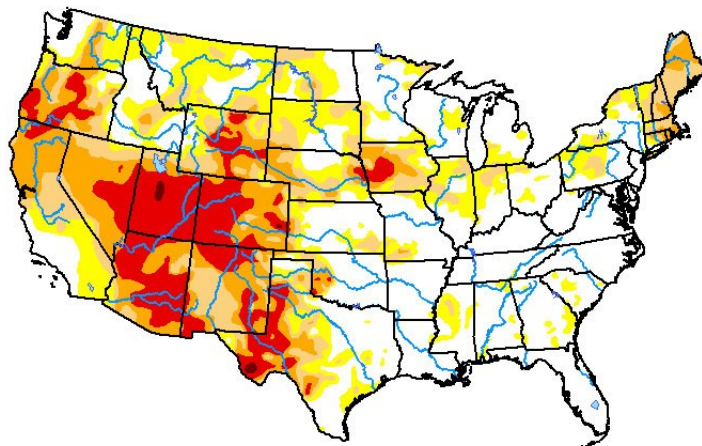
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NOAA 2017 State of the climate: Global drought

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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 <https://droughtmonitor.unl.edu/About.aspx>

Author:

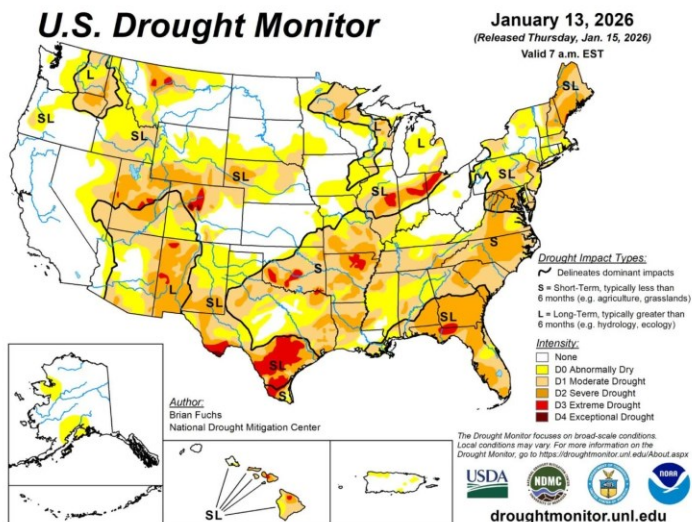
Richard Tinker
CPC/NOAA/NWS/NCEP

USDM for 9/8/2020



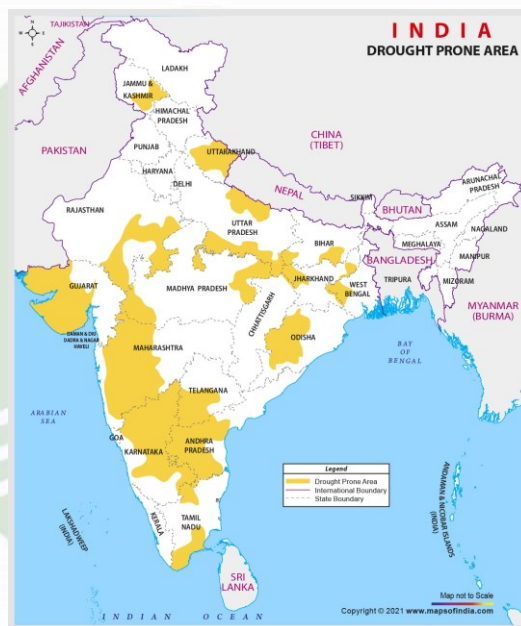
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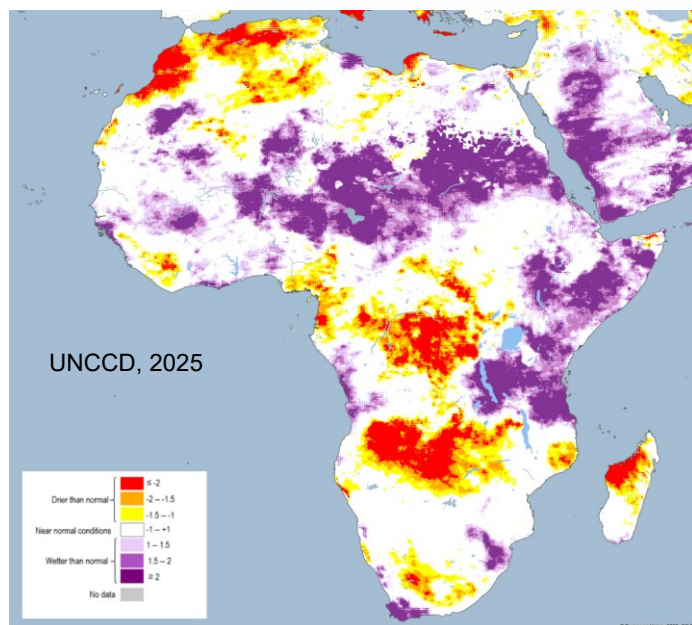
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- 90 million people face acute hunger across Eastern and Southern Africa.
- Some areas in the region have been experiencing the worst drought recorded.
- In Ethiopia, Zimbabwe, Zambia and Malawi, maize and wheat crops have suffered repeated failures.
- In Zimbabwe the 2024 corn crop was down 70 per cent year on year; maize prices doubled.
- Some 43,000 people in Somalia died in 2022 alone due to drought-linked hunger.
- The crisis continued through 2025, with a quarter of the population facing food insecurity.
- Zambezi River fell to 20 per cent of its long-term average leading to energy shortages.



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Drought classification:

- Meteorological drought
- Agricultural drought
- Hydrological drought
- Socioeconomic drought

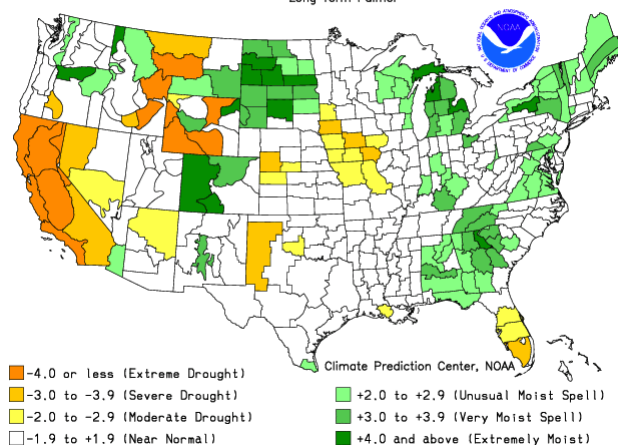
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Drought Severity Index by Division
Weekly Value for Period Ending JAN 25, 2014
Long Term Palmer



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The Palmer Drought Severity Index (PDSI) uses temperature and precipitation to estimate relative dryness.

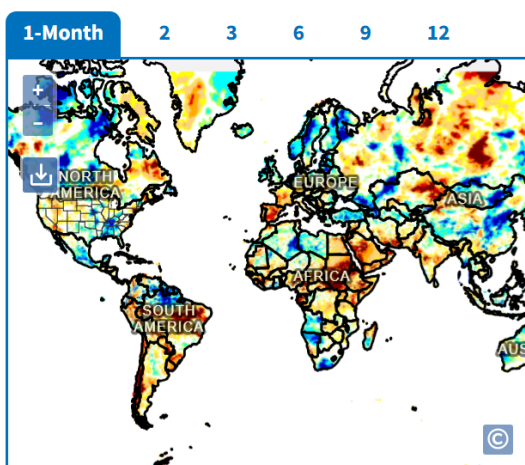
- Reasonable at quantifying long-term drought.
- Uses temperature and a water balance model, to capture effect of global warming on drought through changes in potential ET.
- Monthly PDSI values do not capture droughts on time scales less than 12 months



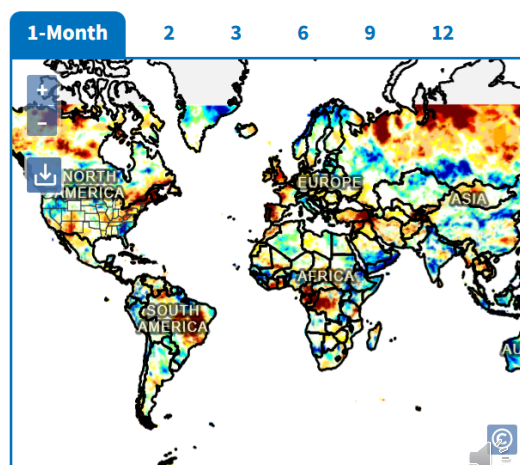
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Standardized Precipitation Index
(SPI)



Standardized Precip.
Evapotranspiration Index (SPEI)

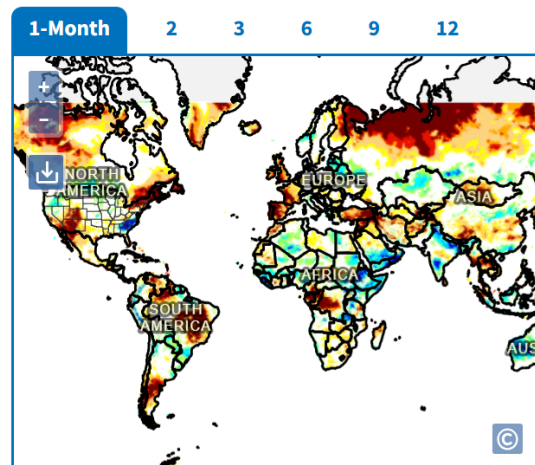


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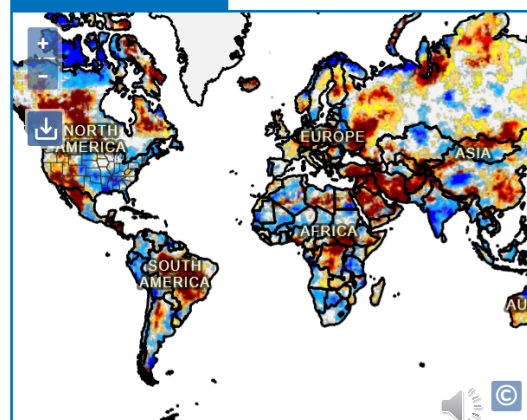
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Evaporative Demand Drought Index (EDDI)



Vegetation and Soil Moisture

GRACE Shallow Groundwater Veg. Health
GRACE Surface Soil GRACE Root Zone



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The Challenges:

- i). Understanding the causes of drought, and perhaps persistent drought, particularly with respect to climate;
- ii). Predicting or forecasting drought;
- iii). Studying the impacts of drought;
- iv). Developing drought management and mitigation plans;
- v). How feasible to build an early flood warning system;
- vi). How to assess the socio-economic impacts;
- vii). Monitoring drought progression on both temporal and spatial scales.

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What is the role of remote sensing?

- Satellites that use optical, thermal and microwave sensors, and synthetic aperture radar (SAR) are good.
- Platforms such as GPM, GOES-T, GRACE, MODIS, SMAP and SWOT have a role, but do not measure drought directly.
- They can be used in conjunction with other types of data analysis and ground observations to give drought indicators.
- Combining multiple datasets is advantageous.
- The challenge is how to produce and synthesize data in a format that can be readily used by people on the ground.



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Thank You



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