National Drought Mitigation Center

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Spotting Drought Before It's Too Late

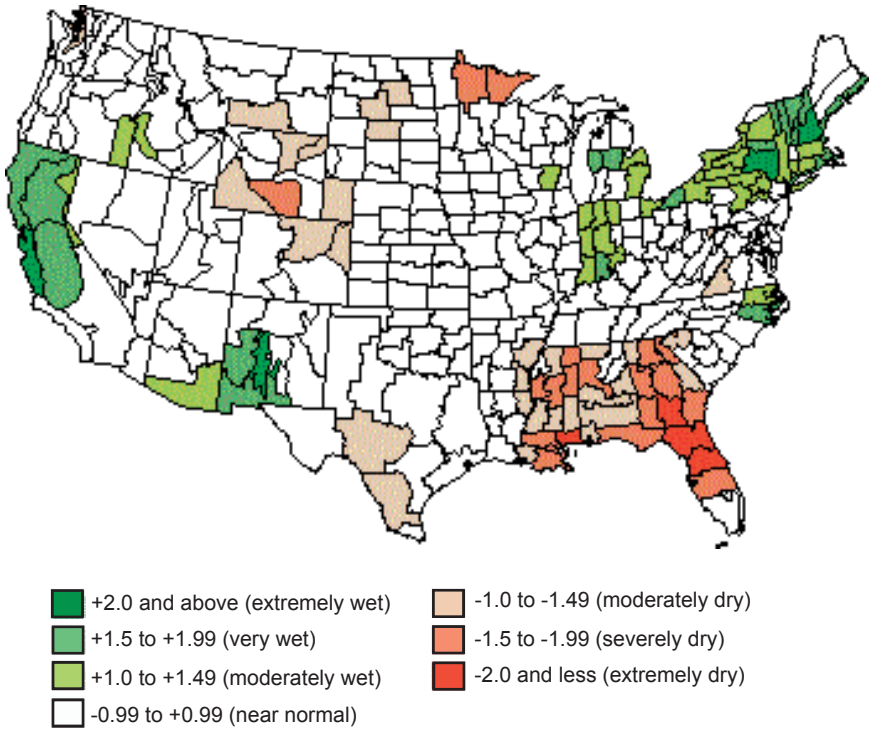
Drought is slow, but its costs and indirect effects add up to devastation that rivals that of hurricanes or floods. As with other disasters, early warning and preparedness saves lives and livelihoods. Unlike other disasters, caused by too much energy unleashed, drought is what isn't — when the atmosphere fails to deliver anticipated water supplies.

General definition: Drought is when a shortfall in precipitation creates a shortage of water, whether it's for crops, utilities, municipal water supplies, recreation, wildlife, or other purposes.

It takes more than a general definition to spot a drought in time to prevent its worst effects.

Drought planning usually involves picking or creating an index to identify and quantify departures from normal. Drought indices assimilate thousands of bits of data on rainfall, snowpack, streamflow, and other water supply indicators into a comprehensible big picture that is far more useful than raw data for decision making. A drought index value is typically a single number associated with a description, such as "moderately dry."

6-month Standardized Precipitation Index through August 2006



The Standardized Precipitation Index, based on precipitation values from more than 500 monitoring stations around the country, is computed monthly for a variety of time frames. For example, the SPI above compares precipitation values from March 2006 hrough August 2006 with all other recorded March through August data.

For resource managers concerned with meeting specific water supply needs, drought planning links a working definition of drought (sometimes based on an index) to triggers.

For example, Denver Water has created its own index. Drought declarations depend on its total predicted or actual reservoir storage on July 1. If that value falls below 80%, a Stage 1 Drought is triggered, and Denver Water initiates actions designed to yield a 10% reduction in water use. At a value of 65%, a Stage 2 Drought is triggered, and the water use reduction target is 30%, with mandatory water restrictions enacted. A value of 40% triggers a Stage 3 Drought, with prohibitions on most lawn watering and a water use reduction target of 50%. A Stage 4 Drought is triggered at 25%, with a goal of a 66% reduction in water use.

Disciplinary Perspectives

How you measure drought depends on where you're coming from and what you're interested in. Traditionally, drought scholars have identified three main physical ways to measure drought:

meteorological: Meteorological drought is usually based on precipitation's departure from normal over some period of time. These definitions are usually region-specific, and presumably based on a thorough understanding of regional climatology. Normally, meteorological measurements are the first indicators of drought.

hydrological: Hydrological drought refers to deficiencies in surface and subsurface water supplies. It is measured as streamflow, and as lake, reservoir, and groundwater levels. There is a time lag between lack of rain or snow and less water in streams, rivers, lakes, and reservoirs, so hydrological measurements are not the earliest indicators of drought. When precipitation is reduced or deficient for a long time, this storage is reflected in declining surface and subsurface water levels.

agricultural: Agricultural drought occurs when there isn't enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought is typically evident after meteorological drought but before a hydrological drought.

But drought's effects are widespread, and other people quantify drought by other measures and other effects. Economists, politicians, ecologists and social workers, among others, can each measure different effects of drought that result from the imbalance of water supply and demand.

Key Concepts

Drought is a normal part of virtually every climate on Earth. Drought isn't what we picture as "normal" weather, but history shows that droughts and floods are both part of the normal continuum of weather patterns.

Each place needs its own working definition of drought. Twenty inches of rain in a year would be slightly wetter than normal in Lubbock, Texas, but would be a severe drought in Nashville, Tennessee.

Weather isn't the only cause of drought. Drought results from both natural events, such as a long dry spell, and from human activities that increase demand for water. Expanding population, irrigation, and environmental awareness all put pressure on water supplies and increase vulnerability to drought.

Drought differs from aridity. Drought is a temporary deviation from normal. Aridity is a permanent feature of climates that receive little rain.

One rain doesn't necessarily end a drought. It can take months of below-normal precipitation to create a drought, and it often takes more than one good rainfall to catch up.

Drought is not the same as desertification, although some researchers speculate that the two are linked. Desertification is a long-term ecosystem change. The Food & Agriculture Organization of the United Nations describes desertification as "the sum of the geological, climatic, biological and human factors which lead to the degradation of the physical, chemical and biological potential of lands in arid and semi-arid zones, and endanger biodiversity and the survival of human communities."