



Drought



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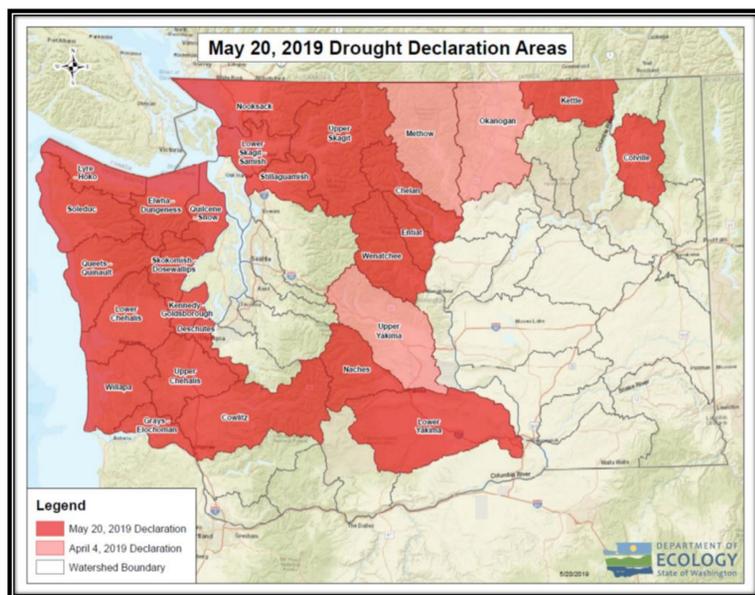
Drought is a prolonged period of dryness severe enough to reduce soil moisture, water, and snow levels below the minimum necessary for sustaining plant, animal, and economic systems. Droughts are a natural part of the climate cycle.

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple of months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered long-term.

It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

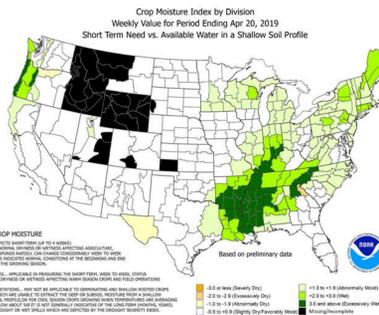
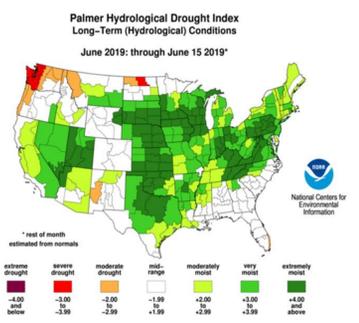
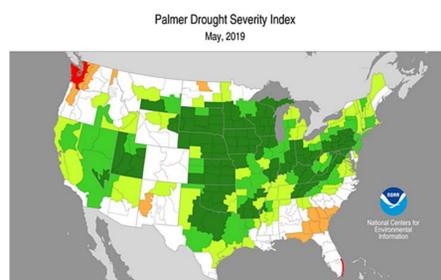
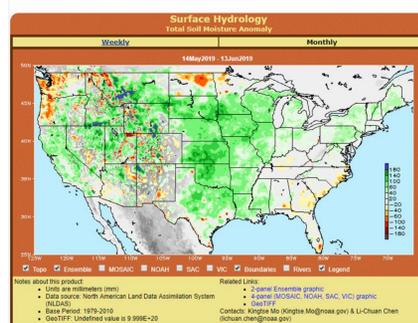
Drought can have a widespread impact on the environment and the economy, depending upon its severity, although it typically does not result in loss of life or damage to property, as do other natural disasters. The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- ❖ **Agricultural**—Drought threatens crops that rely on natural precipitation, while also increasing the potential for infestation.
- ❖ **Water supply**—Drought threatens supplies of water for irrigated crops, for communities and for fish and salmon and other species of wildlife.
- ❖ **Fire hazard**—Drought increases the threat of wildfires from dry conditions in forest and rangelands.



Drought Declarations as of May 2019

Soil moisture indices (below) help establish baselines from which anomalies can be established. Soil moisture is not only important for the agricultural aspect, but also for increased fire danger.



What are the impacts from drought?

On average, the nationwide annual impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between \$6 billion and \$8 billion annually in the United States and occur primarily in the agriculture, transportation, recreation and tourism, forestry, and energy sectors.

How often do droughts occur?

Since 1902, Washington has experienced over 22 drought episodes, including several that lasted for more than a single season—1928 to 1932, 1992 to 1994, and 1996 to 1997. The 1977 drought was the worst on record (with impact from the 2019 drought pending), but the 2001 drought came close to surpassing it in some respects. The table below provides data on how the two droughts affected Washington by late September of their respective years.

Comparison of Impacts of 1977 Drought to 2001 Drought		
Impact	1977 Drought	2001 Drought
Precipitation	Precipitation at most locations ranged from 50 to 75% of normal levels, and in parts of Eastern Washington as low as 42 to 45% of normal.	Precipitation was 56 to 74% of normal. U.S. Bureau of Reclamation – Yakima Project irrigators received only 37% of their normal entitlements. At the end of the irrigation season, the Bureau of Reclamation's five reservoirs stored only 50,000 acre-feet of water compared with 300,000 acre-feet typically in storage.
Wildland Fire	1,319 wildland fires burned 10,800 acres. State fire-fighting activities involved more than 7,000 man-hours and cost more than \$1.5 million.	1,162 wildland fires burned 223,857 acres. Firefighting efforts cost the state \$38 million and various local, regional, and federal agencies another \$100 million.
Fish	In August and September 1977, water levels at the Goldendale and Spokane trout hatcheries were down. Fish had difficulties passing through Kendall Creek, a tributary to the north fork of the Nooksack River in Whatcom County.	A dozen state hatcheries took a series of drought-related measures, including installing equipment at North Toulte and Puyallup hatcheries to address low water flow problems.
Emergency Water Permits	Department of Ecology issued 517 temporary groundwater permits to help farmers and communities drill more wells.	Department of Ecology issued 172 temporary emergency water-right permits and changes to existing water rights.
Economic Impacts	The state's economy lost an estimated \$410 million over a two-year period. The drought hit the aluminum industry hardest. Major losses in agriculture and service industries included a \$5 million loss in the ski industry. 13,000 jobs were lost because of layoffs in the aluminum industry and in agriculture.	The Bonneville Power Administration paid more than \$400 million to electricity-intensive industries to shut down and remain closed for the duration of the drought. Thousands lost their jobs for months, including 2,000-3,000 workers at the Kaiser and Vanalco plants. Federal agencies provided more than \$10.1 million in disaster aid to growers. More than \$7.9 million in state funds paid for drought-related projects; these projects enabled the state to provide irrigation water to farmers with junior water rights and to increase water in fish-bearing streams.

The National Oceanic and Atmospheric Administration (NOAA) (and others) have developed several indices to measure drought impacts and severity and to map their extent and locations.

- The Palmer Drought Severity Index measures the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, so the intensity of drought during a given month is dependent on the current weather patterns plus the cumulative patterns of previous months.
- The Palmer Hydrological Drought Index, another long-term index, was developed to quantify hydrological effects. The Palmer Hydrological Drought Index responds more slowly to changing conditions than the Palmer Drought Index.
- The Palmer Crop Moisture Index measures short-term drought on a weekly scale and is used to quantify drought's impacts on agriculture during the growing season. The figure below represents the Crop Moisture Index for April 2019.

