

## DEFINITION OF DROUGHT

Drought is a weather-related natural disaster. It affects vast regions for months or years. It has an impact on food production and it reduces life expectancy and the economic performance of large regions or entire countries.

Drought is a recurrent feature of the climate. It occurs in virtually all climatic zones, and its characteristics vary significantly among regions. Drought differs from aridity in that drought is temporary; aridity is a permanent characteristic of regions with low rainfall.

Drought is an insidious hazard of nature. It is related to a deficiency of precipitation over an extended period of time, usually for a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought is also related to the timing of precipitation. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with drought.

Drought is more than a physical phenomenon or natural event. Its impact results from the relation between a natural event and demands on the water supply, and it is often exacerbated by human activities. The experience from droughts has underscored the vulnerability of human societies to this natural hazard.

Drought definitions are of two types: (1) conceptual, and (2) operational. Conceptual definitions help understand the meaning of drought and its effects. For example, drought is a protracted period of deficient precipitation which causes extensive damage to crops, resulting in loss of yield.

Operational definitions help identify the drought's beginning, end, and degree of severity. To determine the beginning of drought, operational definitions specify the degree of departure from the precipitation average over some time period. This is usually accomplished by comparing the current situation with the historical average. The threshold identified as the beginning of a drought (e.g., 75% of average precipitation over a specified time period) is usually established somewhat arbitrarily.

An operational definition for agriculture may compare daily precipitation to evapotranspiration to determine the rate of soil-moisture depletion, and express these relationships in terms of drought effects on plant behavior. Operational definitions are used to analyze drought frequency, severity, and duration for a given historical period. Such definitions, however, require weather data on hourly, daily, monthly, or other time scales and, possibly, impact data (e.g., crop yield). A climatology of drought for a given region provides a greater understanding of its characteristics and the probability of recurrence at various levels of severity. Information of this type is beneficial in the formulation of mitigation strategies.

The various types of droughts are listed below.

- **Meteorological drought**

Meteorological drought is defined on the basis of the degree of dryness, in comparison to a normal or average amount, and the duration of the dry period. Definitions of meteorological drought must be region-specific, since the atmospheric conditions that result in deficiencies of precipitation are highly region-specific.

The variety of meteorological definitions in different countries illustrates why it is not possible to apply a definition of drought developed in one part of the world to another. For instance, the following definitions of drought have been reported:

- United States (1942): Less than 2.5 mm of rainfall in 48 hours.
- Great Britain (1936): Fifteen consecutive days with daily precipitation less than 0.25 mm.
- Libya (1964): When annual rainfall is less than 180 mm.
- Bali (1964): A period of six days without rain.

Data sets required to assess meteorological drought are daily rainfall information, temperature, humidity, wind velocity and pressure, and evaporation.

- **Agricultural drought**

Agricultural drought links various characteristics of meteorological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil-water deficits, reduced groundwater or reservoir levels, and so on. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil. A good definition of agricultural drought should account for the susceptibility of crops during different stages of crop development. Deficient topsoil moisture at planting may hinder germination, leading to low plant populations per hectare and a reduction of yield.

Data sets required to assess agricultural drought are soil texture, fertility and soil moisture, crop type and area, crop water requirements, pests and climate.

- **Hydrological drought**

Hydrological drought refers to a persistently low discharge and/or volume of water in streams and reservoirs, lasting months or years. Hydrological drought is a natural phenomenon, but it may be exacerbated by human activities. Hydrological droughts are usually related to meteorological droughts, and their recurrence interval varies accordingly. Changes in land use and land degradation can

affect the magnitude and frequency of hydrological droughts.

Data sets required to assess hydrological drought are surface-water area and volume, surface runoff, streamflow measurements, infiltration, water-table fluctuations, and aquifer parameters.

- **Socioeconomic drought**

Socioeconomic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. It differs from the other types of drought in that its occurrence depends on the processes of supply and demand. The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on the weather. Due to the natural variability of climate, water supply is ample in some years, but insufficient to meet human and environmental needs in other years.

Socioeconomic drought occurs when the demand for an economic good exceeds the supply as a result of a weather-related shortfall in water supply. The drought may result in significantly reduced hydroelectric power production because power plants were dependent on streamflow rather than storage for power generation. Reducing hydroelectric power production may require the government to convert to more expensive petroleum alternatives, and to commit to stringent energy conservation measures to meet its power needs.

The demand for economic goods is increasing as a result of population growth and economic development. The supply may also increase because of improved production efficiency, technology, or the construction of reservoirs. When both supply and demand increase, the critical factor is their relative rate of change. Socioeconomic drought is promoted when the demand for water for economic activities far exceeds the supply.

Data sets required to assess socioeconomic drought are human and animal population and growth rate, water and fodder requirements, severity of crop failure, and industry type and water requirements.