

Volume II: Hazard Annex

Drought

Causes and Characteristics of Droughts

A drought is a period of drier than normal conditions that results in water-related problems.⁸¹ Drought occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another.⁸² Drought is a temporary condition; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate.⁸³

The National Drought Mitigation Center and the National Center for Atmospheric Research define drought by categorizing it according to the “type of drought.” These types include the following:

Meteorological or Climatological Droughts

Meteorological droughts are defined in terms of the departure from a normal precipitation pattern and the duration of the event. These droughts are a slow-onset phenomenon that can take at least three months to develop and may last for several seasons or years.

Agricultural Droughts

Agricultural droughts link the various characteristics of meteorological drought to agricultural impacts. The focus is on precipitation shortages and soil-water deficits. Agricultural drought is largely the result of a deficit of soil moisture. A plant's demand for water is dependent on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.

Hydrological Droughts

Hydrological droughts refer to deficiencies in surface water and sub-surface water supplies. It is measured as stream flow, and as lake, reservoir, and ground water levels. Hydrological measurements are not the earliest indicators of drought. When precipitation is reduced or deficient over an extended period of time, the shortage will be reflected in declining surface and sub-surface water levels.

⁸¹ Moreland, A. 1993. Open-File Report 93-642. USGS.

⁸² National Drought Mitigation Center. 2007. What is Drought? <http://www.drought.unl.edu/whatis/what.htm>, accessed May 28, 2010.

⁸³ National Drought Mitigation Center. 2006. What is Drought?: Understanding and Defining Drought. <http://www.drought.unl.edu/whatis/concept.htm>, accessed May 28, 2010.

Socioeconomic Droughts

Socioeconomic droughts occur when physical water shortage begins to affect people, individually and collectively. Most socioeconomic definitions of drought associate it with supply, demand, and economic good. One could argue that a physical water shortage with no socio-economic impacts is a policy success.

Drought is typically measured in terms of water availability in a defined geographical area. It is common to express drought with a numerical index that ranks severity. The Oregon Drought Severity Index is the most commonly used drought measurement in the state because it incorporates both local conditions and mountain snow pack. The Oregon Drought Severity Index categorizes droughts as mild, moderate, severe, and extreme.

History of Drought in Marion County

Marion County experiences dry conditions annually during the summer months from June to September. The Drought Severity Index shows episodes of drought within the past five years occurring during the summer through the fall.⁸⁴ Periodically, Marion County experiences more significant drought conditions that affect the region or the state. Dates for significant drought events that affected Marion County include the following:

1928-1941

A significant drought affected all of Oregon from 1928 to 1941. The prolonged statewide drought created significant problems for the agriculture industry. The first of the three Tillamook Forest burns occurred during this drought in 1933.⁸⁵

1976-1981

During this drought period in western Oregon, low stream flows prevailed. The period between 1976 and 1977 was the single driest year of the century. The Portland Airport received only 7.19 inches of rain between October 1976 and February 1977.¹¹ In the twelve-month period from September, 1976 through August, 1977, Corvallis received only 22.2 inches of precipitation, 52 percent of the "normal" of 42.7 inches.⁸⁶ During the winter of that year, airborne dry ice seeding was used in Polk County as a means of enhancing winter precipitation for agricultural use.

⁸⁴ National Weather Service Climate Prediction Center. Drought Severity Index by Division (Long-Term Palmer) Archive.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring, accessed February 17, 2010.

⁸⁵ Taylor, George H. and Chris Hannan. 1999. *The Oregon Weather Book*. Corvallis, OR: Oregon State University Press.

⁸⁶ Taylor, George. "Weather Matters." *Mid-Valley Sunday*: January 9, 2000.

1985-1994

A dry period lasting from 1985 to 1994 caused significant problems statewide. The peak year was 1992, when the state declared a drought emergency. In the seven-year period from 1986-1992, Medford received only five years' worth of precipitation and other areas of southern Oregon were also significantly affected. Forests throughout Oregon suffered from a lack of moisture with fires common and insect pests flourishing.⁸⁷

2005

February 2005 was the driest February on record since 1977, surpassing 2001's conditions.⁸⁸ Governor Ted Kulongoski's Office posted a State of Oregon Drought and Fire Web page. This page features weekly updates, drought and fire information, and agency links. Above normal temperatures contributed to decreased water availability for the summer. Stream and river levels dropped significantly and watermasters regulated live flow use by irrigators. Drought conditions also led to the use of stored water, when it was available. However, water availability in the Willamette Valley was not as severely affected as with other parts of the state.⁸⁹

Risk Assessment

How are Hazard Areas Identified?

The extent of the drought depends upon the degree of moisture deficiency, and the duration and size of the affected area. Typically, droughts occur as regional events and often affect more than one county. In severe droughts, environmental and economic consequences can be significant.

Probability of Future Occurrence

Droughts are not uncommon in Oregon, nor are they just an "east of the mountains" phenomenon. They occur in all parts of the state, in both summer and winter. Oregon's drought history reveals many short-term and a few long-term events. The average recurrence interval for severe droughts in Oregon is somewhere between 8 and 12 years.

The 2006 Marion County Hazard Analysis did not address the drought hazard. Given the average recurrence interval for severe droughts in Oregon and Marion County's drought history, the steering committee determined that there is a **high** probability Marion County will experience severe extended drought conditions, meaning that one drought event is likely to occur within the next ten to 35 years.

⁸⁷ Taylor, George H. and Chris Hannan. 1999. *The Oregon Weather Book*. Corvallis, OR: Oregon State University Press.

⁸⁸ "Willamette Valley Reservoirs Succumb to Dry Weather." US Army Corps of Engineers Press Release. March 9, 2005. KATU 2 News. <http://www.katu.com/printstory.asp?ID=7552>, accessed March 9, 2005

⁸⁹ Governor Ted Kulongoski. 2005. 2005 Monthly Update - Drought Conditions <http://governor.oregon.gov/Gov/fd/daugust.shtml>

Vulnerability Assessment

The severity of a drought occurrence poses a risk for agricultural and timber losses, property damage, and disruption of water supplies and availability in urban and rural areas. Factors used to assess drought risk include agricultural practices, such as crop types and varieties grown, soil types, topography, and water storage capacity.

The 2006 Marion County Hazard Analysis did not address the drought hazard. Due to the nature of droughts and their extensive effects, the Marion County steering committee determined that Marion County has a **high** vulnerability to drought, meaning over ten percent of the county's population or regional assets would be affected.

Risk Analysis

A risk analysis estimating the potential loss of life and property for the drought hazard in Marion County has not been completed at this time. However, given the county's high vulnerability to the drought hazard, a risk analysis should be completed when data is available (see Multi-Hazard Action # 8).

Community Hazard Issues

What is susceptible to damage during a hazard event?

Drought is frequently an "incremental" hazard, meaning both the onset and end are often difficult to determine. Also, its effects may accumulate slowly over a considerable period of time and may linger for years after the termination of the event.

Droughts are not just a summer-time phenomenon; winter droughts can have a profound impact on agriculture, particularly east of the Cascade Mountains. Also, below average snowfall in higher elevations has a far-reaching effect, especially in terms of hydro-electric power, irrigation, recreational opportunities and a variety of industrial uses. Marion County has a large agricultural economy which would suffer significantly during an extended drought. During the exceptionally dry years between 2000 and 2001, the city of Detroit's recreation economy suffered hardships when the Detroit Reservoir's water levels were too low to support normal summer activities.

Drought can affect all segments of a jurisdiction's population, particularly those employed in water-dependent activities (e.g., agriculture, hydroelectric generation, recreation, etc.). Also, domestic water-users may be subject to stringent conservation measures (e.g., rationing) and could be faced with significant increases in electricity rates. In addition, water-borne transportation systems, such as the ferry in Buena Vista, could be impacted by periods of low water.

There also are environmental consequences to drought. A prolonged drought in forests promotes an increase of insect pests, which in turn,

damage trees already weakened by a lack of water. The incidence of forest and range fires increases substantially during extended droughts, which in turn places both human and wildlife populations at higher levels of risk.⁹⁰

Some environmental effects of drought are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. Many species, however, will eventually recover from this temporary aberration. Oregon has several fish species listed as threatened or endangered pursuant to the Endangered Species Act (ESA) of 1973. Some of these species have habitat requirements that often conflict with the needs or desires of the human environment. For example, in times of scarcity, the amount of water necessary to maintain certain fish species may conflict with the needs of the local agricultural community. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity of the landscape.⁹¹

Existing Hazard Mitigation Activities

In 2000 Marion County completed a Water Resources Management Plan that discusses issues surrounding groundwater and surface water availability and quality in Marion County. Data in the Water Resources Management Plan is used to define the role that population growth, economic development, and related land uses play in analyzing local and regional water quality problems. Data in the Water Resources Management Plan is also used to help on-going and anticipated facility planning efforts into an area wide planning philosophy to achieve cost effective solutions to local and regional water quality problems.

Drought Mitigation Action Items

The following actions have been identified by the Marion County steering committee, and are recommended for mitigating the potential effects of droughts in Marion County. Please see full action item worksheets in Appendix A.

DR1: Connect local farmers and ranchers with organizations such as the local Soil and Water Conservation District, Oregon Department of Agriculture, and the USDA to educate them on water conservation methods they can implement to reduce the impact of droughts.

⁹⁰ National Drought Mitigation Center. 2006. Understanding Your Risk and Impacts: Impacts of Drought. <http://www.drought.unl.edu/risk/impacts.htm>, accessed May 28, 2010.

⁹¹ National Drought Mitigation Center. 2006. Understanding Your Risk and Impacts: Impacts of Drought. <http://www.drought.unl.edu/risk/impacts.htm>, accessed May 28, 2010.

DR2: Partner with EarthWISE and local schools to implement water conservation strategies to maximize water use in schools and educate students about water conservation.

DR3: Continue implementing the 'Marion County Water Resource Management Plan' (portion of the Marion County Comprehensive Plan).

