Drought Hazard

Causes and Characteristics of Droughts

A drought is a period of drier than normal conditions that results in water-related problems. Droughts are generally defined as Short-Term or Long-Term. Short-Term droughts last less than six-months and generally impact agriculture and grassland resources; Long-Term droughts have a duration longer than six-months and can impact larger hydrologic or ecologic systems. Drought occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. Drought is a temporary condition; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate. Droughts are categorized on the following scale:

Table DR-1: Drought intensity Categories

Drought Category	Drought Intensity
D0	Abnormally Dry (pre- or post-drought condition)
D1	Moderate Drought
D2	Severe Drought
D3	Extreme Drought
D4	Exceptional Drought

Source: U.S. Drought Monitor, http://droughtmonitor.unl.edu/

The National Drought Mitigation Center and the National Center for Atmospheric Research defines drought by categorizing it according 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.

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.

National Drought Status 2012

More of the United States is in moderate drought or worse than at any other time in the history of the U.S. Drought Monitor, with 46.84 percent of the nation's land area in various stages of drought on the map dated July 3, 2012. Looking only at the 48 contiguous states, 55.96 percent of the country's land area is in moderate drought or worse -also the highest percentage on record.[1]

Risk Assessment

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.

History of Drought in Clackamas County Area

Clackamas County experiences annual dry conditions typically during the summer months from July through September. Dates for significant regional drought events that affected Clackamas County include the following:

[1] Source: National Drought Mitigation Center, University of Nebraska, Lincoln http://drought.unl.edu/

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 five-year 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.

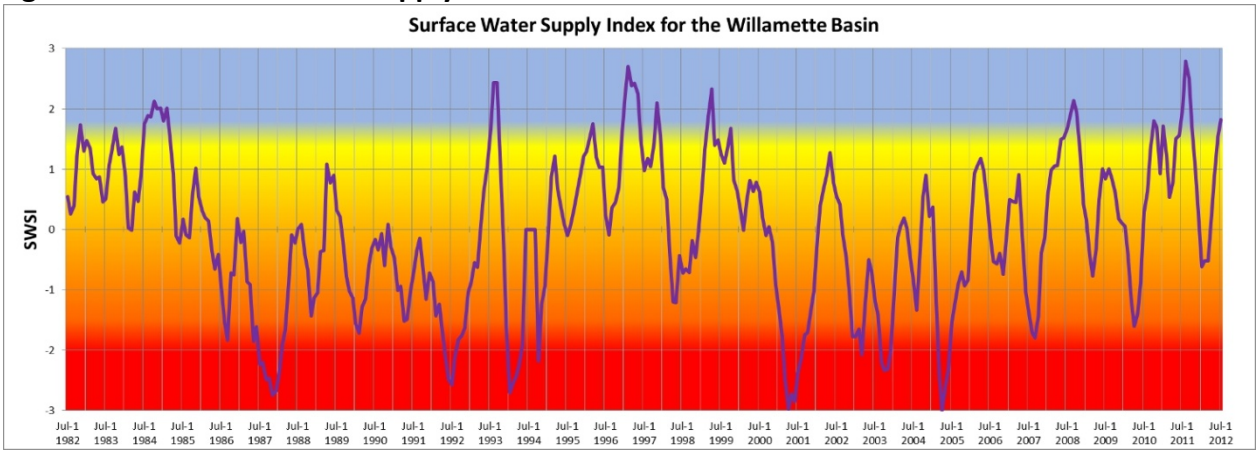
1985-1994

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.

2005

February 2005 was the driest February on record since 1977, surpassing 2001's conditions.88 The Governor'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.

Figure DR-1: Surface Water Supply Index for the Willamette Basin



Surface Water Supply Index (SWSI) for the Willamette Basin. SWSI was developed by the Natural Resources Conservation Service. Values below -1.5 are considered "abnormally dry" and would be a reasonable indicator of drought. Provided by National Weather Service -Portland Weather Forecast Office.

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 2007 the Clackamas County Hazard Analysis did not address the drought hazard. Given the average recurrence interval for severe droughts in Oregon and Clackamas County's drought history, the steering committee determined that there is a high probability Clackamas County will experience severe extended drought conditions, meaning that one drought event is likely to occur within the next ten to 35 years.

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 chronic drought that hit western North America from 2000 to 2004 left dying forests and depleted river basins in its wake and was the strongest in 800 years, scientists have concluded, but they say those conditions will become the "new normal" for most of the coming century."

http://www.homelandsecuritynewswire.com/dr20120730-chronic-20004-u-s-drought-worst-in-800¬-years-may-be-the-new-normal

The 2006 Clackamas County Hazard Analysis did not address the drought hazard. Due to the nature of droughts and their extensive effects, the Clackamas County steering committee determined that Clackamas 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 Clackamas County has not been completed at this time. However, given the county's high vulnerability to the drought hazard, a risk analysis is recommended.

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. Clackamas County has a large agricultural economy which would suffer significantly during an extended drought.

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.

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.

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.

Implementing Drought Hazard Mitigation

The Clackamas Soil and Water Conservation District suggests the following drought mitigation measures:

- Education to residents to encourage residential installation of a rainwater harvesting system (for water storage and conservation) as well as rain gardens for groundwater infiltration (preventive measure to mitigate groundwater withdrawal).
- Installation of potable rainwater harvesting systems and rain gardens if possible at county emergency facilities and other facilities that use large quantities of water. Three examples to start with are:
- Clackamas Events Center – designated emergency center for animals
- Clackamas County Dog Service – managers have expressed interest in a system for conservation as well as emergency disaster conditions such as drought and earthquakes
- Other emergency shelter throughout the county such as fire stations and schools. The fire station could use the system for immediate supply of water in case of disaster

Drought Mitigation Action Items

Drought actions are listed in Section 3 Mitigation Strategy. For detailed information regarding each action, please refer to Appendix A – Action Items.

Resources:

Oregon Water Resources Department – Drought Watch

http://cms.oregon.egov.com/owrd/pages/wr/drought.aspx

National Integrated Drought Information System

www.drought.gov

US Drought Monitor – University of Nebraska, Lincoln

http://droughtmonitor.unl.edu/

National Weather Service, Portland Bureau, (February 2002)

http://www.wrh.noaa.gov/Portland.