

CHAPTER 12. DROUGHT RISK ASSESSMENT

12.1 DROUGHT DEFINED

Drought is a function of the cumulative impacts of several dry years on water users. It can include deficiencies in surface and subsurface water supplies and generally impacts the health, well being, and quality of life.

12.2 BACKGROUND

Although Humboldt County has abundant water resources as groundwater and surface water supplied by high levels of rainfall with several major rivers, the County faces water-related challenges that impact water supply and demand, cultural values, and economic, social and environmental conditions. California's North Coast region contributes 26 percent of California's water supply (Guivetchi, 2001). The largest portions of the Klamath and Eel Rivers, California's second and third largest rivers, flow through Humboldt County; both have major diversion projects outside the county, but have economic, social, cultural and ecological impacts affecting the state as a whole.

Humboldt County's potential drought impacts include, but aren't limited to, hydrological, environmental, and socioeconomic impacts. The County has large rural, agricultural, timber, cultural, sand and gravel extraction, and fisheries interests that all rely on the abundant water supply. Humboldt County's urban majority is concentrated around Humboldt Bay. Lack of sufficient water supply would affect not only residents and businesses that rely on water for their daily household, employee, and industrial needs, but also an economy and culture that rely on the replenishment of rivers, creeks, and groundwater to grow trees and grass/grain for livestock and to support healthy fish populations.

12.2.1 Water Supply Goals and Standards

The Water Resources Element of the Humboldt County General Plan uses a comprehensive approach to ensure water reliability for customers. The County has a diverse set of water supply options, including surface water and groundwater wells to ensure that even after a period of dry years, a combination of water supplies and water conservation measures will ensure that the community has adequate water. The Humboldt County General Plan Update presents two principle goals in respect to Humboldt County's water supply:

- Maintain or enhance the quality of the County's water resources and the fish and wildlife habitat using those resources,
- Maintain a dependable water supply, sufficient to meet existing and future domestic, agricultural, industrial needs and to ensure that new development is consistent with the limitations of the local water supply.

12.2.2 Water Facilities

Many facilities in Humboldt County depend on an adequate and abundant supply of water. Any stress or reduction of the water supply could have harmful effects on how the facilities described below are maintained and operated.

According to the County's General Plan, the major purveyor of domestic and industrial water in Humboldt County is the Humboldt Bay Municipal Water District. This district supplies water to the cities of Eureka, Arcata and Blue Lake, and to the community of Fairhaven, the Samoa Pulp Mills, and various special districts in the Humboldt Bay area. The Humboldt Bay Municipal Water District is currently operating near its 75 million gallon per day capacity; however, the district can redistribute its industrial and domestic allotments to meet future demands.

The County's inland and southern special districts, with few exceptions, have sufficient water supply to meet present needs. The districts in Willow Creek, Jacoby Creek, Hydesville, Miranda, Redway, Orick, Alderpoint, and Orleans appear to have adequate water supply and capacity. Water supply or capacity is questionable in Weott and Shelter Cove.

Wastewater treatment and disposal services are provided to some of the more densely populated areas of Humboldt County. Six of the County's incorporated cities have wastewater systems (Arcata, Eureka, Blue Lake, Ferndale, Fortuna, and Rio Dell). Six of the special districts also have such systems (the Humboldt, McKinleyville, and Redway community services districts, the Garberville and Loleta Sanitary Districts, and the Shelter Cove Resort Improvement District). The remainder of the County relies on septic systems to dispose of wastewater. The average home generates about 40 to 50 gallons of wastewater per day (not including outside uses such as lawn watering). The County Health Department and Regional Water Quality Control Board have control over design, construction, operation, and maintenance of wastewater treatment systems within their jurisdictions.

12.2.3 Water Supply

Surface Water

Surface water in Humboldt County varies with the time of year and the amount of rainfall. Insufficient summer flows are experienced in many areas of the county due to the hot dry conditions typically seen in the County just 5 miles inland of the coastal fog belt and because of the seasonal disparity of rainfall and flow conditions. The hydraulic basins in Humboldt County provide very large surface water volumes. Mean annual runoff in Humboldt County from the major rivers and streams is approximately 23 million acre-feet. In comparison, total groundwater yield of the entire County is approximately 100,000 acre-feet. The largest drainage area of the County is that of the Eel River and its tributaries. The contributory surface area is over 763,000 acres, more than a third of the surface area of the County.

The total average annual runoff of the rivers running through the County reflects almost 30 percent of the total runoff of the State of California, but there is an extreme variation in river flows. The Mattole River has a maximum recorded winter discharge in excess of 90,000 cubic feet per second and a minimum summer flow of under 20 cubic feet per second, highlighting the seasonal extremes. The majority of water usage in the County is needed during the lowest flow regimes, further reinforcing the need for drought preparedness and planning. Insufficient summer flows could create problems in the future.

The flows of all of the rivers in the County except the Trinity and Klamath Rivers are directly related to rainfall within the County, and over 80 percent of the flows of these streams occur from November through March. A 1975 Winzler and Kelly report concluded that the major rivers and their perennial tributaries should meet the future domestic water demand of the rural communities. Updated population projections are well within those used in the report. However, facilities to distribute this supply are in many cases inadequate to meet the projected demand and unprepared for drought conditions as experienced presently in the counties immediately south and east.

Groundwater

Humboldt County is in the North Coast Hydrologic Area and has four principle groundwater basins: Hoopa Valley, Mad River Valley, Eureka Plain, and Eel River Valley (see Table 12-1). The Eureka Valley Basins, comprising the Mad River Valley, the Eureka Plain, and the Eel River Valley, are a part of the Coastal Basins.

Groundwater Basin	Tributaries	Size (sq. mi.)	Average Well Yield (gallons/minute)	Maximum Well Yield (gallons/minute)	Storage Capacity (acre-feet)
Eel River Valley	Eel and Van Duzen Rivers	120	400	1,200	136,000
Eureka Plain	Freshwater, Salmon, and Jacoby Creeks and the Elk River	60	400	1,200	n/a
Mad River Valley	Mad River	60	400	n/a	60,000
Hoopa Valley	Lower Trinity and Lower Klamath Rivers	5	300	n/a	19,000

Groundwater development in the rural area of Humboldt County has generally been directed only to individual domestic requirements or to the irrigation demands of the more extensively farmed areas of the Eel River delta and Mad River delta areas.

The prime source of groundwater, by quantity, is in the Eel River and Van Duzen delta. Though the storage capacity is about 136,000 acre-feet, the usable yield of this groundwater storage is estimated to be 40,000 to 60,000 acre-feet annually. A little more than 10,000 acre-feet of groundwater is currently being pumped from the basin for agricultural uses (Winzler and Kelly, 1970). The Mad River basin has been reported to have a yield of about 45,000 acre-feet annually (Baruth and Yoder, 1971). Other groundwater basin areas include: Hoopa Valley, Prairie Creek, Big Lagoon, Mattole River Valley, Honeydew, Pepperwood, Weott, Garberville, Larabee Valley, and Dinsmore.

More wells each year are being drilled to serve new development, yet little is known about the location or capacity of the groundwater aquifers. Better estimates of groundwater availability is needed so that development will not surpass the capacity and for planning and modeling of potential drought conditions.

12.3 DROUGHT HAZARD PROFILE

12.3.1 Location and Extent

Droughts typically occur after two or three consecutive years of below average rainfall for the period between November and March when about 75 percent of California’s average annual precipitation falls. December, January, and February are usually when approximately 50 percent of the rainfall occurs in the State of California.

Droughts can be localized to a particular watershed, may affect only a part of the state, or can affect the entire state, depending on weather patterns. Droughts in Northern California, the source of 70 percent of the state’s rainfall and much of the developed water supply, rarely last longer than three years.

12.3.2 Drought Event History

State of California

According to the California Department of Water Resources website, the state has measured hydrologic data back to the early 1900s. Data prior to the 19th century are very limited and in some cases have only been discovered through scientific research such as the study of tree rings (<http://watersupplyconditions.water.ca.gov>). The State's hydrologic data shows multi-year droughts from 1912 to 1913, 1918 to 1920 and 1922 to 1924. Since the early 1920s, the following prolonged periods of drought occurred in California:

- *1929 to 1934 Drought*—The 1929 to 1934 drought established the criteria for designing the supply and yield of many large Northern California reservoirs. The Sacramento Valley runoff during this drought was 55 percent of the 1901-1996 average—about 9.8 million acre-feet.
- *1975 to 1977 Drought*—The State of California had one of its most severe droughts due to lack of rainfall during the winters of 1976 and 1977. The year of 1977 was the driest period on record in California with the previous winter recorded as the fourth driest in California's hydrological history. The cumulative impact led to widespread water shortages and severe water conservation measures throughout the state. Only 37 percent of the average Sacramento Valley runoff was received (6.6 million acre-feet). Over \$2.6 billion in crop damage was recorded in 31 counties. A federal disaster declaration was declared in numerous counties.
- *1987-1992 Drought*—The State of California received precipitation well below average levels for four consecutive years. While the Central Coast was most affected by the lack of rainfall and low run-off, the Sierra Nevada in Northern California as well as the Central Valley counties were also affected. During this drought, only 56 percent of average runoff for the Sacramento Valley was received (10 million acre-feet). By February 1991, all 58 counties in California were suffering from drought conditions.
- *Present*—Data is being processed and collected now to determine the extent of the present persistent drought in the state. Figure 12-1 shows current conditions nationwide. Note that the line for drought conditions starts just south and east of Humboldt County. This has drastic implications for the Eel, Trinity Rivers, and Klamath Rivers despite the fact that Humboldt is not in a present drought.

Humboldt County

The 1977 extreme California drought conditions affected water supplies for civilian and industrial interests throughout Humboldt County and were some of the worst in the County's history. Not only were water supplies compromised for the County's usage, but the drought forced neighboring counties to petition for additional drawdown of water resources allotted from Humboldt County. Over 70 percent of the Trinity River is dammed and diverted for central valley agricultural projects. Flows from the Klamath River are also diverted for agricultural uses. Significant percentages of the Eel River are diverted to the three moderately drought-stricken and rapidly developing counties south (Mendocino, Sonoma, Marin) serving over 350,000 people plus agricultural interest. If Humboldt County were to experience a drought like that of 1975-77 season, the economic, cultural, environmental, and social impact could be devastating not only to Humboldt County but also to counties and state projects that depend on water received from Humboldt County.

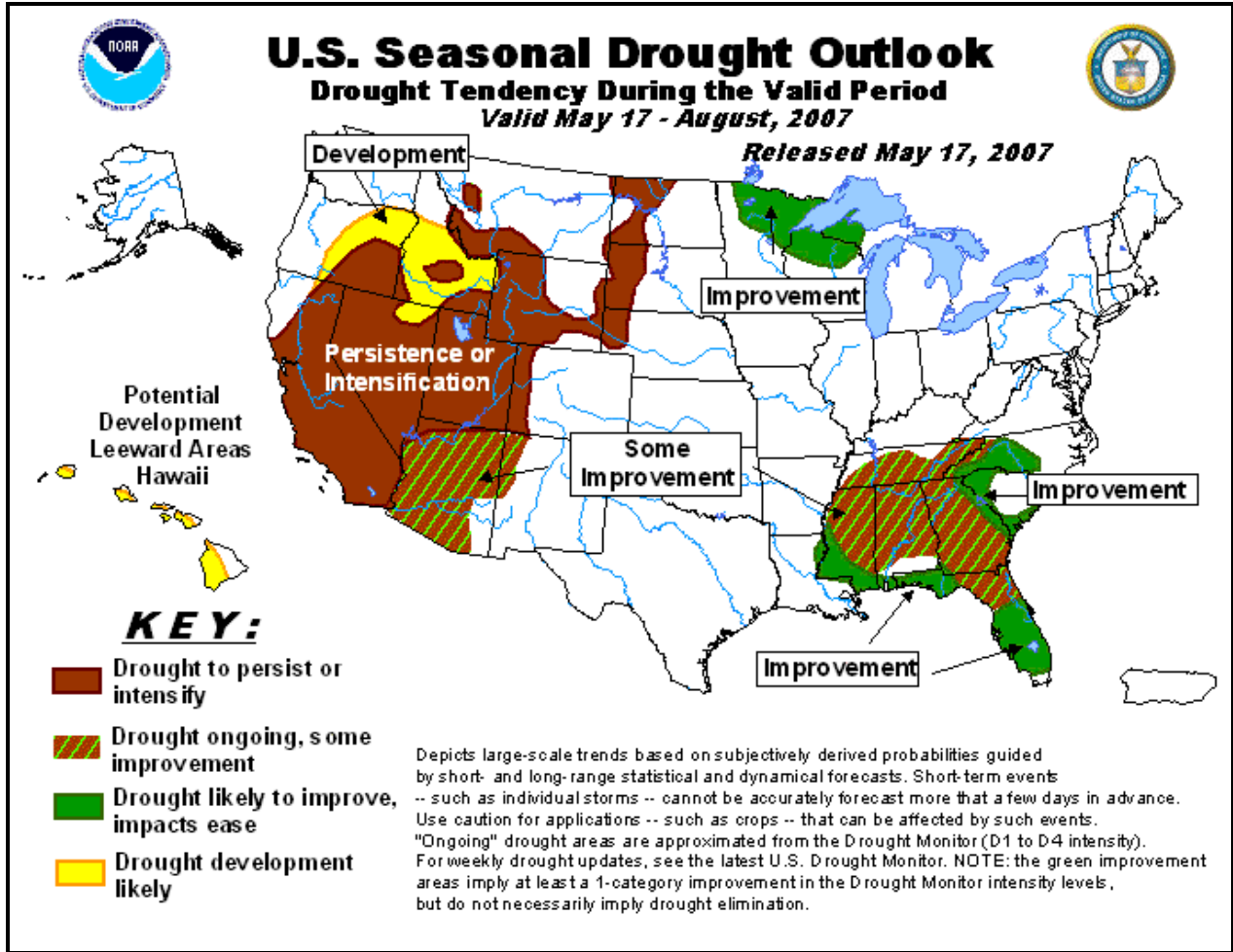


Figure 12-1: U.S. Drought conditions projected for 2007

12.3.3 Location

Eastern and southern Humboldt County are generally affected most when low amounts of rainfall is received in conjunction with hot, dry conditions. Every part of the County is exposed to drought. As indicated in Figure 12-1, Humboldt County does not fall within NOAA’s US Seasonal Drought Outlook for 2007.

12.3.4 Frequency

With the exception of the 1940s through the 1960s, California’s drought history indicates that there have been multiyear droughts every decade between 1900 and 2000, all of which had mild to serious effects in Humboldt County. Conservatively speaking, Humboldt County can experience the direct effects of drought at least once every decade. This does not include the effects that would result from droughts impacting water dependent counties that rely on Humboldt County water. No data are available regarding how much of an effect the present and 2001 drought has had on the County. With this said, it should be noted that although short-term conditions indicate the County is in the “mid-range” between “extreme moist” and “extreme drought” (Figure 12-2), the long-term hydrological conditions indicate the county is in a “moderate drought” (Figure 12- 3).

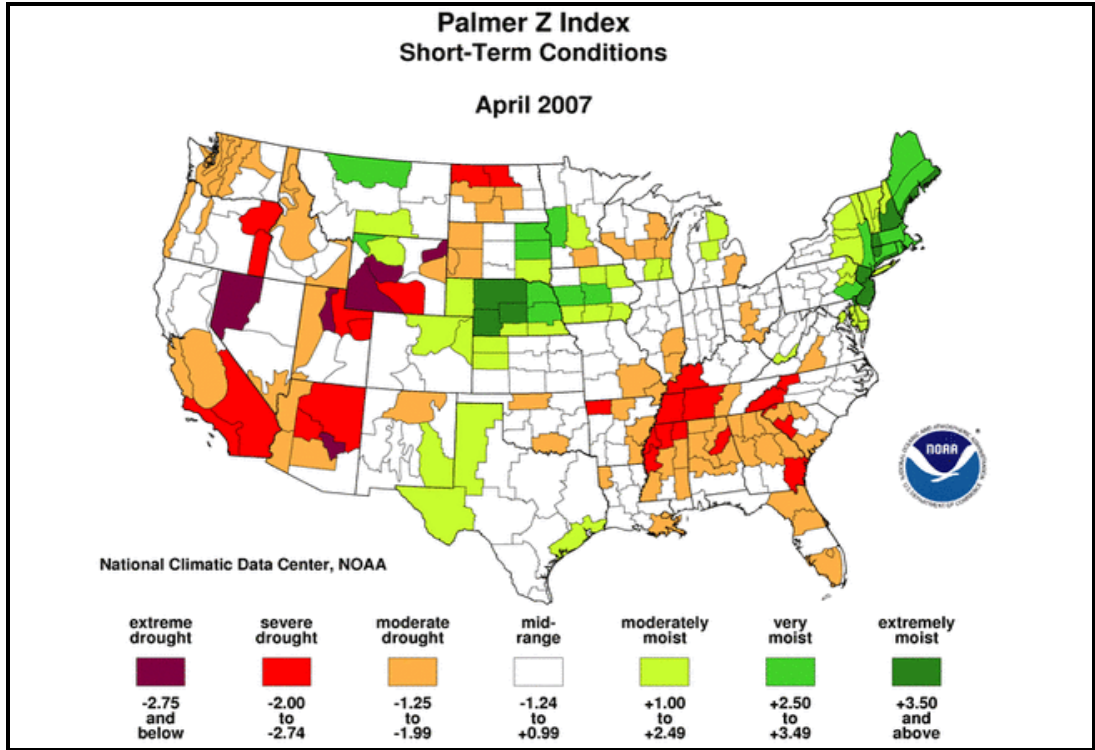


Figure 12-2: Short-term drought conditions.

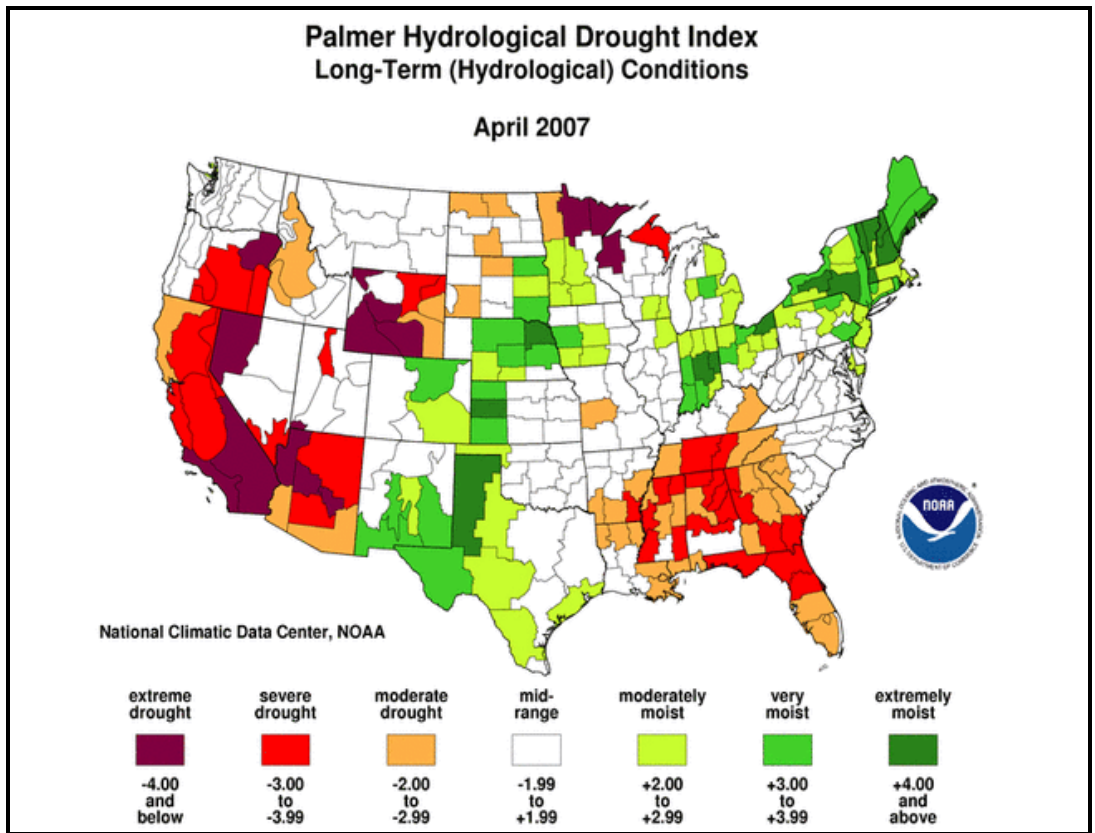


Figure 12-3: Long-term drought conditions

12.3.5 Severity

Thus far Humboldt County has only experienced mild to moderate drought conditions. Due to its dry farming practices and reliance on generally abundant groundwater and surface water resources, Humboldt County does not experience the severity of drought experienced in the central and southern parts of the state that have large irrigation and urban demands.

12.3.6 Warning Time

Droughts are climatic patterns that occur over long periods of time so that only very generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

12.3.7 Other Assets at Risk

Natural Resources

Natural resources are highly valued by residents of Humboldt County for their contribution to the local quality of life, and as an economic development asset that attracts tourist-related expenditures.

Agricultural and Timber Resources

Agricultural resources include rangelands, timberlands, cultivated farmlands, and dairy lands. Agricultural lands are an important element of the Humboldt County identity and economy. Any shortage of water supply would have significant economic impacts. In addition, drought conditions greatly increase the likelihood of wildfires, the major threat to timber resources.

Cultural Resources

The Humboldt County General Plan Cultural Resources Section provides an overview of culturally sensitive resources in the county:

Before European settlement, the Humboldt County area was one of the most culturally diverse regions of California, being home to nearly a dozen distinct peoples. In large part, Native American tribes occupied distinct areas conforming largely to the natural watershed basins. Culturally sensitive areas are sites and regions of special importance to Native Americans, primarily coastlines and riverbanks with outstanding religious or resource-producing importance. Over 32,000 acres of land in Humboldt County are designated as culturally sensitive, with notable concentrations along the Lower Klamath, the Lower Trinity, lower end and North Fork of the Mad, and the Van Duzen Rivers, and the eastern shore of Humboldt Bay (Humboldt County, 1984).

Culturally sensitive areas exist on both public and private lands. While some locations are publicly identified, others are held as confidential information by Native American governments or cultural leaders. The North Coast Information Center at the Yurok Tribe maintains records for approximately 2,040 cultural resource sites, including cemeteries, villages, and lithic scatters (surface-visible concentrations of stone chips, flakes, and tools). Three-quarters of these resources are located along rivers and major tributaries; the remainder is located in flat mountainous areas or prairies. High-density sites (villages, cemeteries, and ceremonial and gathering areas) are concentrated in the Hoopa, Yurok reservations, Karuk tribal lands and riverine areas. Ridgelines along rivers and creeks, where traveling between villages likely occurred, and lithic scatters around Trinidad, Humboldt Bay, the Eel delta, and Shelter Cove are considered medium-density resource sites. Water shortages and severe drought

conditions would have a significant impact on those cultures' way of life in fishing and farming subsistence.

Scenic Resources

There are a broad range of scenic resources in Humboldt County, including the coastline and Pacific Ocean, mountains, hills, ridgelines, inland water features, forests, agricultural features, and distinctive rural communities. Many of these resources are vulnerable to drought as well as the increased likelihood of wildfires associated with droughts.

Coastal Views

Humboldt County's varied and extensive coastline allows for a wide range of scenic vistas from State Highway 101 and from beaches, state parks and coastal access points. The County's Local Coastal Program includes a technical study on visual resources. The study includes a detailed inventory of local visual resources along the coastline and identifies areas as "highly scenic" and "visually degraded areas" (Humboldt County, 1979). A more recent discussion of Humboldt County's existing scenic resources, viewshed evaluation and policy discussion is contained in the *Natural Resources and Hazards* Discussion Paper document prepared for use in the General Plan Update (Dyett and Bhatia, 2002). Drought could visually impact these views.

Forests

Forestlands define much of the visual landscape of Humboldt County. Redwood National Park, Six Rivers National Forest, Redwoods State Park, and Kings Range National Conservation Area are all significant, protected forests within the County. Forestland is abundant well beyond these protected areas. The scenic value of these natural resources, viewed both from within or from outside, is of great importance. Drying up or dying off of any of these forests could reduce ecological and eco-tourist values.

12.4 EXPOSURE

Although Humboldt County is one of the least vulnerable counties in California the entire County would be exposed in moderate to extreme drought conditions. Timber production and residential areas in the south and east County that already have low groundwater summer conditions would be affected the most.

12.5 VULNERABILITY

The most vulnerable areas of the County are the timberlands and rural residential areas. The timber industry relies on a relatively long and wet winter to provide the necessary conditions for fast, vigorous new growth of harvested lands. Any shortfall of rain for a period of time would not only reduce productivity, but also greatly increase the risk of fire.

Rural residences located on ridge tops, higher elevations, or in the south and east of the County are also vulnerable to drought conditions. They depend on adequate winter rains to replenish their ground and surface water supplies. Due to the nature of the hot dry summers, steep topography, and the low to moderate groundwater potential, a period of extreme drought conditions could potentially render those areas uninhabitable.

12.5.1 Impact of Drought on Life, Safety and Health

Humboldt County, regional water purveyors, and the Regional Water Quality Control Board have spent considerable time and effort to protect life, safety and health in regards to water supply and quality. The

County has the ability to minimize any impacts on residents and water consumers. No significant life or health impacts are anticipated as a result of drought in the County.

12.5.2 Impact of Drought on Critical Facilities Inventory

Critical facilities will continue to be operational during a drought. Although critical facility elements such as landscaping may not be maintained due to limited resources, the risk to the critical facilities inventory will be largely aesthetic. These aesthetic impacts are not considered significant.

12.5.3 Structures

No structures will be directly affected by drought conditions in Humboldt County, though many structures are vulnerable to wildfires, which are more likely following years of drought.

12.5.4 Economic Impact

Economic impact will be largely associated with industries that depend on water for their business. For example, landscaping businesses were affected in the droughts of the past as the demand for service significantly declined because landscaping was not watered. The County's water conservation programs works to ensure that businesses whose product relies on water receive their allotments to continue operating. The timber, gravel and sand, and agricultural industries will also be affected by drought.

12.6 FUTURE TRENDS IN DEVELOPMENT

Humboldt County has experienced relatively low growth in past years (less than 1 percent per year). Considering these historical trends and future population projections produced by the state, anticipated development trends for the planning area are considered low, consisting primarily of residential development with the exception of the Eureka and Fortuna areas. Higher rates of growth tend to increase demand for new development. It is assumed that development/redevelopment trends in Humboldt County are not such that there is major risk to development from drought. However, increased development or increased water demand from out-of-county sources may have detrimental impacts in a drought.

12.7 SCENARIO

An extreme multiyear drought more intense than the 1977 drought could impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years, threatening agricultural operations, fisheries, and timber production. Intensified by such conditions, extreme wildfires could break out throughout the County, increasing the need for water. Surrounding counties, also in drought conditions, could increase their demand for Humboldt County water, causing social and political conflicts. If such conditions persisted for several years, the agricultural, fisheries, gravel and sand, and timber industries would experience major setbacks, with significant levels of unemployment and potential property damage.

12.8 ISSUES

The planning team has identified the following drought-related issues:

- There are existing residences in drought-prone areas in south and east Humboldt County that normally experience water shortages.
- Drought in the County could increase and expand fire-prone areas and adversely affect the timber economy.
- The degree of planning for future development in drought-prone areas.

- Counties to the south and east are in a persistent drought and are, at differing levels, dependent on Humboldt County water. The future water demand for those counties if the drought intensifies is presently unknown.
- The diverse fisheries stock is dependent on abundant water availability, any drop in fisheries productivity due to drought conditions would have immediate and long-term consequences for the economy, culture, and ecological structure.
- More study needs to be done regarding overall county water usage and how it relates to the economy to prepare for a worst case scenario drought.
- With the possibility of climate change, drought may become a larger issue due to warming trends and wider fluctuations in rainfall patterns.