California Building Resilience Against Climate Effects (CalBRACE) Project

Short Title: Current drought risk
Full Title: Palmer Drought Severity Index

CalBRACE Domain: Environmental Exposures

Why is this important to health?

Increasing temperatures and changes in precipitation may lead to longer, more severe droughts. Even in non-drought conditions, increases in air temperature can lead to unusual and excessive drying of soil and vegetation, exacerbating drought conditions. Higher temperatures also cause earlier snowmelt and less snowpack.[1] By 2050 California is projected to have a loss of at least 25 percent of the Sierra snowpack, an important source of urban, agricultural, and environmental water.[2] The public health impacts of drought are many, including deterioration of the quality and quantity of drinking water and food, reduction of the air quality due to increased wildfires and dust storms, and diminished living conditions due to scarce energy, sanitation, and increased incidence in disease and illness.[1] Decreased water access can lead to less hand washing and other personal hygiene practices, which can increase the risk of infections.[3, 4] As water flow decreases due to shortages, the concentration of pollutants and contaminants in water may increase.[3] Drought decreases crop yields causing both food shortages and price increases to food and water.[4] Higher food prices can lead to food insecurity, obesity, and malnutrition in households with low income.[4, 5] The economic hardship associated with increased food prices and lack of adequate water for operations can cause psychological distress and other negative behavioral impacts.[1, 4] Those impacted most by the health impacts of drought may include the elderly, children, individuals of low socioeconomic status, rural communities, populations living in nursing homes, hospitalized patients, those who rely on electrical equipment to survive, farmers, and agricultural workers.[3-5]

Summary of Evidence for Climate and Health

Dust storms associated with drought conditions have been associated with increased incidence of San Joaquin Valley Fever, a fungal disease.[4] Climate change alters the range, biogeography, and growth of microbes and the vectors of food, water, and vector-borne illnesses.[1, 4] Changes in aquatic environments could increase harmful algal blooms and lead to increases in foodborne and waterborne illnesses.

Key References:

1. 2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008: California Natural Resources Agency; 2009.
2. Climate Change in California: California Department of Water Resources; 2007.
3. U.S. Environmental Protection Agency Centers for Disease Control and Prevention, National Oceanic and Atmospheric Agency, and American Water Works Association. When every drop counts: protecting public health during drought conditions— a guide for public health professionals. Atlanta, GA: U.S. Department of Health and Human Services; 2010.

4. Stanke C, Kerac M, Prudhomme C, et al. Health Effects of Drought: a Systematic Review of the Evidence. *PLOS Currents Disasters.* 2013; 1.
5. Friel S, Berry H, Dinh H, et al. The impact of drought on the association between food security and mental health in a nationally representative Australian sample. *BMC Public Health.* 2014; 14.

What is the indicator?

Detailed Definition

- Indicator (index) = Palmer Drought Severity Index
- Interpretation: Vulnerable communities will have higher level of current drought risk

Data Description and Methodology

- Data were downloaded from the WestWide Drought Tracker http://www.wrcc.dri.edu/wwdt/index.php .
  - Years available: monthly, 2014 data was downloaded
  - Geographies available: United States

Palmer Drought Severity Index (PDSI) uses temperature and precipitation data to determine the accumulated water excess or deficit; it considers water supply (precipitation), demand (evapotranspiration driven by temperature) and loss (runoff). Fixed soil characteristics are supplied independently by incorporating the available water holding capacity of the top 250 cm of the soil acquired from the State Soil Geographic Data Base. Values are referenced to the local climate so that PDSI in different climates can be more readily compared. Palmer Drought Severity Index (PDSI) raster data were obtained from the WestWide Drought Tracker project, University of Idaho Desert Research Institute, which utilizes data from the PRISM Climate Mapping Program, Oregon State University. PRISM (Parameter-elevation Regressions on Independent Slopes Model) is an analytical tool that uses point data, a digital elevation model, and other spatial data sets to generate fine scale (4-km, 2.5 arc-minutes) grid-based estimates of monthly precipitation and temperature from 1895-present. PRISM uses point measurements of climate data and a digital elevation model of terrain and is constantly updated to map climate in the most difficult situations, including high mountains, rain shadows, temperature inversions, coastal regions, and associated complex meso-scale climate processes. WestWide Drought Tracker project utilizes the AN81m and AN81d PRISM datasets (*http://www.prism.oregonstate.edu/).*

Limitations

Only monthly estimates of regionally calibrated PDSI values are available. August 2014 was chosen to provide the best time window snapshot to account for interannual variability as it both accounts for the precipitation that fell in the previous winter season and the impacts of warming in the spring and summer season. The August 2014 PDSI values only reflect the drought risk within August 2014 and areas of greatest impact may geographicaly vary across drought events. PDSI values may lag emerging droughts by several months are are well suited for mountainous land or areas of frequent climatic extremes. PDSI values have an unspecified built-in time scale that can be misleading. Snow and its effects are not represented in this analysis. (http:// drought.unl.edu/Planning/Monitoring/ComparisonofIndicesIntro/PDSI.aspx)

Acknowledgement and Disclaimer

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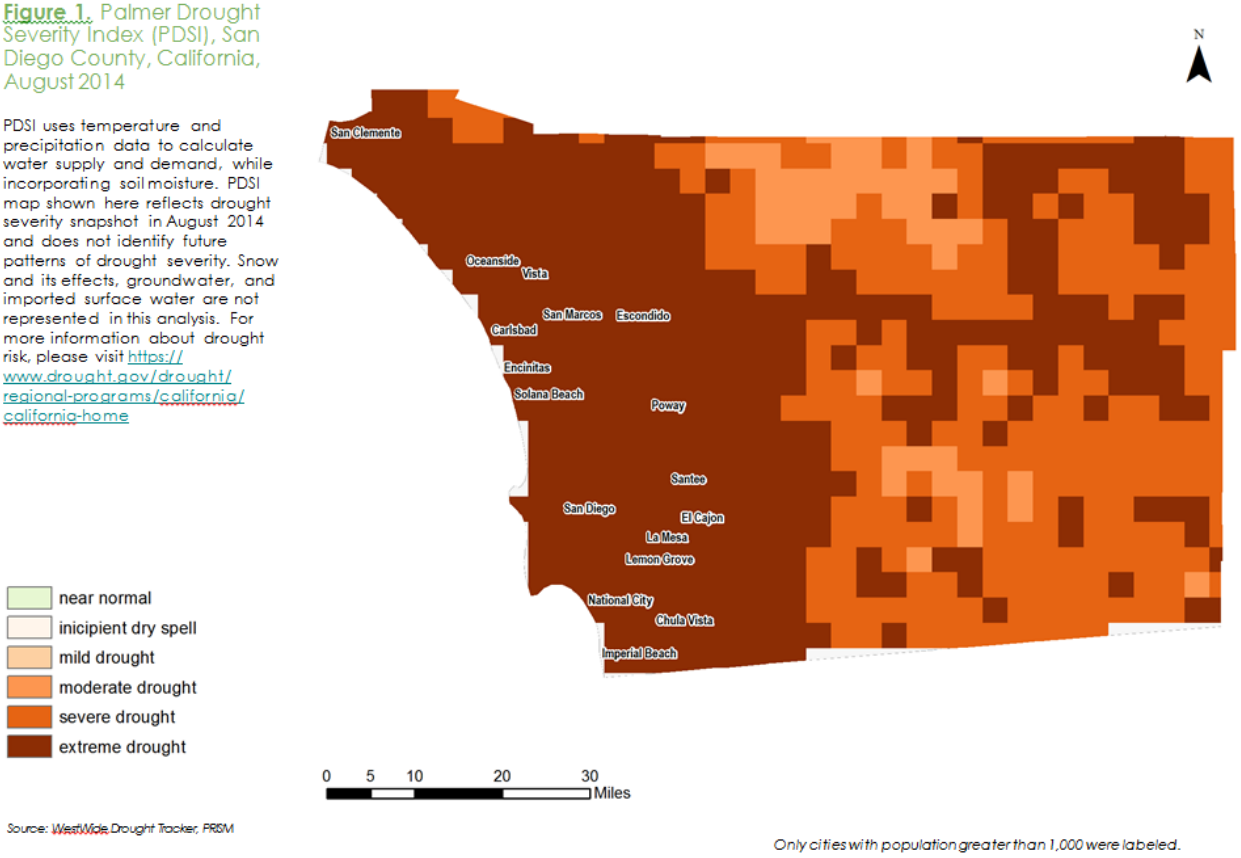
Examples of Maps, Figures, and Tables:

Figure 1. Palmer Drought Severity Index (PDSI), San Diego County, California, August 2014

PDSI uses temperature and precipitation data to calculate water supply and demand, while incorporating soil moisture. PDSI map shown here reflects drought severity snapshot in August 2014 and does not identify future patterns of drought severity. Snow and its effects, groundwater, and imported surface water are not represented in this analysis. For more information about drought risk, please visit https://www.drought.gov/drought/regional-programs/california/california-home



Source: WestWide Drought Tracker, PRISM

Only cities with population greater than 1,000 were labeled.