



Extreme Events 101: Drought, Dust Storms, and Wildfire

Periods of higher temperatures and a lack of precipitation can lead to drought conditions, which increase the potential for dust storms and wildfires. Reduced visibility and road closures during dust storms pose problems for drivers. Wildfires also cause road closures, compromise air quality, and reduce visibility. Fires damage infrastructure directly, while burned areas often become more susceptible to erosion and flash flooding. Without vegetation, slopes are often less stable and more runoff will accompany heavy rain. Both of these effects can raise landslide risk, potentially damaging roads, posing risks to drivers, and clogging drainage systems (see Extreme Events 101: Heavy Rainfall and Flooding).

REGIONAL TRENDS

At the national and regional scales, droughts have occurred periodically over the 20th century. About 80% of the contiguous U.S. experienced drought in the peak Dust Bowl period of the 1930s, and 50-60% of the contiguous U.S. experienced drought during much of the 1950s.¹ While there have been severe droughts in several regions recently (Texas in 2011; much of the Midwest and Great Plains in 2012; California and parts of the Southwest in 2013 and 2014), the proportion of the U.S. land area experiencing has varied considerably from year to year (see Fig. 1).² Drought conditions were particularly severe in 2012, with more than 50% of the country experiencing drought.

Although historical records of dust storms have been studied in specific locations, the potential changes in their frequency or intensity across the country are less studied. Ongoing research and improvements in monitoring should provide more insights into how the characteristics of dust storms may have changed over time.

Warmer and drier conditions have helped increase the number and extent of large wildfires in western U.S. forests since the 1970s. Many of the periods of large wildfires have coincided with some of the warmest years on record nationwide.³

REGIONAL PROJECTIONS

Under higher emissions scenarios, many regions are likely to experience more rainfall coming in fewer events, and longer periods of time between rain events (see Fig. 2).⁴ Exacerbating these longer dry spells, warmer temperatures are likely to increase water demands, and increase the rate of evaporation from soils. While these changes are likely to vary in magnitude from region to region, the Southwest is anticipated to be hit especially hard.

A warmer climate is likely to increase risks for wildfire; larger and more frequent fires would lead to substantial increases in the area burned (see Fig. 3). As people and development continue to expand further into wildland areas, wildfires will increasingly threaten communities and infrastructure.

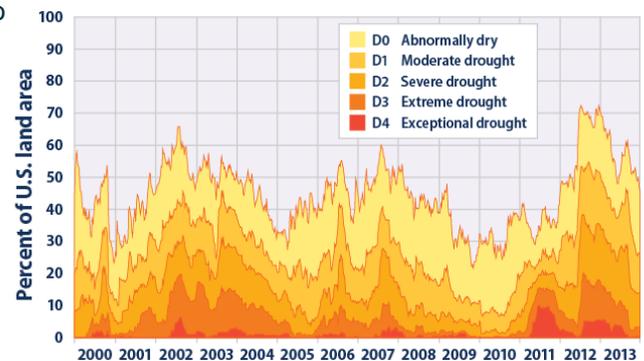


Fig. 1. The percentage of U.S. lands classified under drought conditions from 2000 through 2013. Source: EPA Climate Change Indicators in the United States

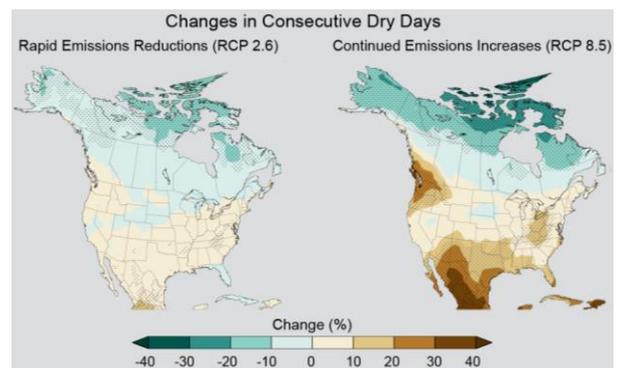


Fig. 2. Projected changes in the annual maximum number of consecutive dry days (days receiving less than 0.04 inches (1 mm) of precipitation) under two scenarios. Source: 2014 National Climate Assessment

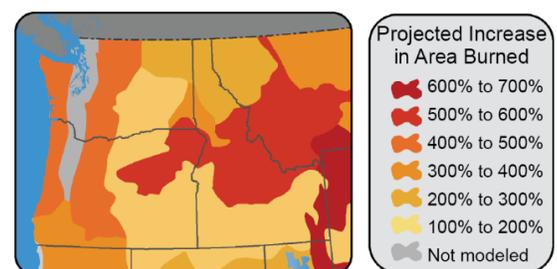


Fig. 3. Increases in area burned that would result from the regional temperature and precipitation changes associated with a 2.2°F global warming. Although not included in this map, other regions in the West exhibit similar types of increases. Source: 2014 National Climate Assessment

¹ <http://www.ncdc.noaa.gov/sotc/service/drought/wetdry/bar-mod-110-00/190001-201408.gif>

² <http://www.epa.gov/climatechange/science/indicators/weather-climate/drought.html>

³ 2014 National Climate Assessment, p. 771

⁴ The "rapid emissions reductions" (RCP 2.6) pathway assumes immediate reductions in emissions and would limit globally-averaged warming to about 2.5°F during this century. The "continued emissions increases" (RCP 8.5) pathway is projected to lead to more than 8°F globally-averaged warming by 2100, with a high-end possibility of more than 11°F. (National Climate Assessment, p. 26)

AASHTO EXTREME WEATHER & THE TRANSPORTATION SYSTEM



RESPONSES

State departments of transportation (DOTs) and local governments are addressing the risks of drought, dust storms, and wildfire through various activities. Examples include:

- As one of the Federal Highway Administration's (FHWA) Climate Resilience Pilot Projects, **Arizona DOT** conducted a study on climate adaptation for transportation infrastructure. The state currently experiences periods of drought, dust storms, and wildfires, and examined ways to better manage impacts from these events. Arizona DOT has developed driver awareness and safety campaigns for dust storms, and is examining whether additional road weather information system stations are needed across the state to warn drivers about dust storms.⁵
- **Caltrans** is exploring ways to prepare for and cope with wildfires and subsequent landslides. These include deploying landslide mitigation measures and increasing monitoring of slope stability for projects in vulnerable areas.⁶
- **Washington State DOT** conducted a vulnerability assessment of state-owned transportation infrastructure to various climate impacts, including drought, dust storms and wildfire. The assessment found several areas within the state are vulnerable to landslides resulting from wildfires that decrease the erosion protection that mature vegetation provides.⁷



Image: July 2011 dust storm in Arizona. Source: National Weather Service (<http://www.wrh.noaa.gov/psr/pns/2011/July/DustStorm.php>)

RESOURCES

- **AASHTO Extreme Weather Events Symposium:** This site provides presentations and a summary white paper from the May 2013 national symposium on the implications of extreme weather events on transportation. <http://climatechange.transportation.org/symposium/>
- **FHWA Tools for Adaptation:** FHWA has developed various reports and tools that can be used by transportation planners and engineers, including guidance about regional climate impacts, vulnerability assessments, and case studies. http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/summary/index.cfm
- **Transportation Research Board Special Report 90: Potential Impacts of Climate Change on U.S. Transportation:** This report summarizes current and future climate changes on U.S. transportation infrastructure and operations, and identifies potential adaptation options. <http://onlinepubs.trb.org/onlinepubs/sr/sr290.pdf>
- **Third National Climate Assessment, Climate Change Impacts in the United States:** This report assesses the impacts of climate change across the country, including impacts for various sectors (including transportation) and regions, as well as potential responses to these impacts. <http://nca2014.globalchange.gov/>
- **National Oceanic and Atmospheric Administration (NOAA) Technical Reports on Regional Climate Trends and Scenarios:** These reports describe the observed climate trends and future climate scenarios for the various regions of the United States. This work helped inform the National Climate Assessment, but the NOAA reports provide greater detail for each region. http://www.nesdis.noaa.gov/technical_reports/142_Climate_Scenarios.html

CONTACTS

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⁵ <http://www.camsys.com/pubs/AZ696.pdf>

⁶ http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/Caltrans_ClimateChangeRprt-Final_April_2013.pdf

⁷ <http://www.wsdot.wa.gov/NR/rdonlyres/B290651B-24FD-40EC-BEC3-EE5097ED0618/0/WSDOTClimateImpactsVulnerabilityAssessmentforFHWAFinal.pdf>