USDA United States Department of Agriculture

Rocky Mountain Research Station

Science You Can Use *(in 5 minutes)*

SEPTEMBER 2018

Consequences of an Endless Summer: Untangling the Link Between Summer Precipitation and Western Wildfires

Why are Wildfires More Intense?

It's not solely an ignition event, whether a lightning strike or unattended campfire, that causes a wildfire. Fire ecology research over the past three decades has revealed that environmental drivers, such as snow pack, fuels availability, and temperature, also play a role. In particular, warming temperatures are implicated in the increasing number and intensity of wildfires occurring across the western United States. They cause earlier melting of the winter snowpack, resulting in longer fire seasons, and hotter summer temperatures that more thoroughly dry out vegetation and make it more likely to catch fire when ignited.

The increasing number of wildfires in the western United States is attributed to warming temperatures, which result in longer fire seasons and hotter summers. However, researchers with the Northern Region and the Rocky Mountain Research Station also found a connection between declining summer precipitation and wildfire activity (photo courtesy of the National Interagency Fire Council).

However, U.S. Forest Service scientists suspected another weather factor was being overlooked as a contributor to recent trends in wildfire: precipitation, specifically summer precipitation. Zachary Holden, an ecologist with the USFS Northern Region, Charles Luce, a research hydrologist, and Matt Jolly, a research ecologist, both with the Rocky Mountain Research Station anecdotally noticed low summer precipitation was associated with the 1988 Yellowstone fire and the major wildfire season of 2017 in the Pacific Northwest.

It intuitively makes sense why. "Summer dry periods are tightly coupled to how warm and dry the air is during the fire season," Holden said. "Longer windows without rain lead to more surface heating, which dries out woody fuels."

These anecdotes had never been paired with wildfire data to determine their validity, so Holden, Luce, and

KEY FINDINGS

- Understanding the linkage between decreasing wetting rain days and increased risk of wildfires will enable fuels managers and forest managers to better anticipate wildfire severity and where wildfires may occur.
- The number of wetting rain days (WRDs) is expected to decrease throughout the West, which could lead to more burned acres.
- **TopoFire**, a drought and wildfire danger monitoring system for the conterminous United States, now includes a wetting rain day dataset. https://topofire.dbs.umt.edu/topofire_v3/index.php.

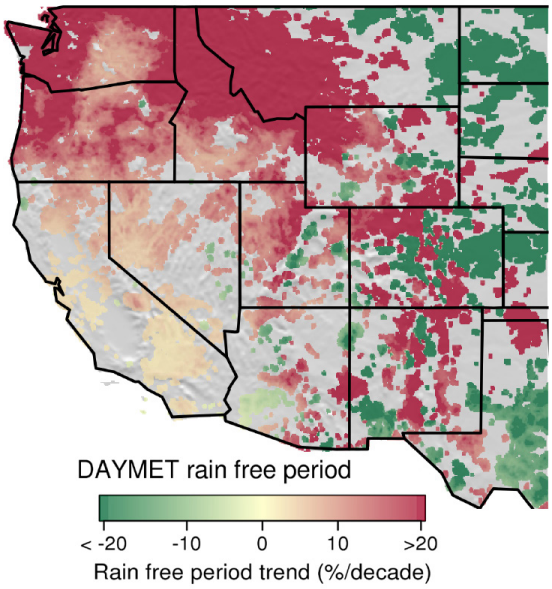
Jolly assembled a team to test the effects of summer precipitation on wildfire.

Visualizing the Missing Rain

Using satellite images of wildfire burned areas in eight western U.S. ecoregions from 1979–2016, they paired the areas with their respective daily temperatures and precipitation, humidity, and snowpack data. A summer day with precipitation greater than 0.10 inches is called a wetting rain day (WRD); 0.10 inches is the lowest volume measured to ensure data quality. Next was an analysis to determine what had the greatest influence upon wildfires during May-September, the historical fire season.

WRDs were found to directly influence wildfires. A decrease in the number of WRDs was associated with 2.5 more times area burned compared to daily temperatures. And WRDs and daily temperatures each had a more significant effect than snowpack. “I was surprised at how strong some of the trends were and the effect was relative to the other effects,” Luce said.

Another surprise: a decline of WRDs across 83–98 percent of the forested area in eight western ecoregions, and an increase of the number of days between WRDs, which was consistent with climate change expectations. According to Luce, this could affect planning for forest adaptation and future firefighting efforts. “These trends have affected high-elevation cold forests and dry forests alike. Fire suppression has not greatly affected cold forests, but the added fuels in dry forests are creating hazardous conditions under increasingly unprecedented periods without rainfall.”



By mapping rates of change in summer precipitation between 1979 and 2016 (37 years), researchers could show the areas of the western United States that are seeing an increase in the length of time between wetting rain days.

To assist fuel managers and forest planners in considering the management impact of these findings, the team created a new WRD dataset for TopoFire, a drought and wildfire danger monitoring system for the conterminous United States. Luce acknowledges more research is needed to explore the link between WRD and wildfire, but “we’re adding to the knowledge that fuel managers and forest planners need as they’re doing their planning.”

FURTHER READING

Holden, Zachary A.; Swanson, Alan; Luce, Charles; Jolly, W. Matt; Maneta, Marco; Oyler, Jared W.; Warren, Dyer A.; Parsons, Russell; Affleck, David. 2018 Decreasing fire season precipitation increased recent western US forest wildfire activity. Proceedings of National Academy of Sciences of the United States of America. www.fs.fed.us/rmrs/publications/decreasing-fire-season-precipitation-increased-recent-western-us-forest-wildfire

Dillon, Gregory K.; Holden, Zachary A.; Morgan, Penelope; Crimmins, Michael A.; Heyerdahl, Emily K.; Luce, Charles. 2011 Both topography and climate affected forest and woodland burn severity in two regions of the western US, 1984 to 2006. Ecosphere. 2(12): 130. www.fs.fed.us/rmrs/publications/both-topography-and-climate-affected-forest-and-woodland-burn-severity-two-regions

Charles Luce is a research hydrologist with the U.S. Forest Service Rocky Mountain Research Station. His research focus is on the effects of climate change and wildfire on streamflows and forest and aquatic ecology. Luce can be contacted at cluce@fs.fed.us.

Zachary Holden is an ecologist with the U.S. Forest Service Northern Region. He studies ecological relationships with microclimates and their relationship with the larger climate. Holden can be contacted at zaholden@fs.fed.us.

W. Matt Jolly is a research ecologist with the U.S. Forest Service Rocky Mountain Research Station. His research focus is on modeling wildfire potential and science delivery of spatial wildland fire potential information. Jolly can be contact at mjolly@fs.fed.us.

Rocky Mountain Research Station researchers work at the forefront of science to improve the health and use of our Nation’s forests and grasslands. More information about Forest Service research in the Rocky Mountain Region can be found here: https://www.fs.fed.us/rmrs/

Subscribe online to future Science You Can Use editions at https://www.fs.fed.us/rmrs/science-you-can-use-bulletin