Received: 2 October 2020 | Accepted: 5 October 2020
DOI: 10.1111/gcb.15388

LETTER TO THE EDITOR

Global Change Biology WILEY

Record-setting climate enabled the extraordinary 2020 fire season in the western United States

The 2020 fire season in the western United States (the West) has been staggering: over 2.5 million ha have burned as of 31 September, including over 1.5 million ha in California (3.7% of the state), in part from five of the six largest fires in state history; over 760,000 ha have burned in Oregon and Washington, most occurring within a few-day period (www.nifc.gov; Figure 1a). The human impacts are unprecedented: millions have endured hazardous air, with estimates of thousands of smoke-related deaths; over 10,000 structures have been damaged or destroyed, and dozens of lives have been lost. While fire is a fundamental natural process in most western ecosystems, these events have distinct human fingerprints—human-caused ignitions, increased human exposure from expansion into flammable landscapes, increased fuel loads due to fire suppression, and increased fuel aridity due to climate change.

This year's widespread burning was clearly enabled by record-setting atmospheric aridity across much of the West, reflected by vapor pressure deficit (VPD; Figure 1b). A dry atmosphere directly increases fuel aridity, and dry fuels facilitate ignitions and catalyze rapid fire spread and fire behavior that resists suppression efforts. Dozens of studies highlight fuel aridity as a dominant control of burned area, particularly where fuel is non-limiting, over interannual, decadal, and millennial timescales (Marlon et al., 2012). Here we show that VPD explains 56% of the variability in burned area since 1984, with 2020 ranking second highest in VPD and burned area (Figure 1c,d).

Anthropogenic climate change is a significant contributor to increased fuel aridity and recent escalating burned area (Figure 1c). In California, an eightfold increase in forested burned area over the last half-century is tightly linked to increased atmospheric aridity (Williams et al., 2019). Across the West, anthropogenic climate change accounts for 45% of total forest burned area from 1984 to 2015 (Abatzoglou & Williams, 2016). With each passing fire season, we are experiencing what dozens of studies have projected and warned of, for decades, as a consequence of a warming climate: increased area burned throughout the 21st century (Bowman et al., 2020; Figure 1c).

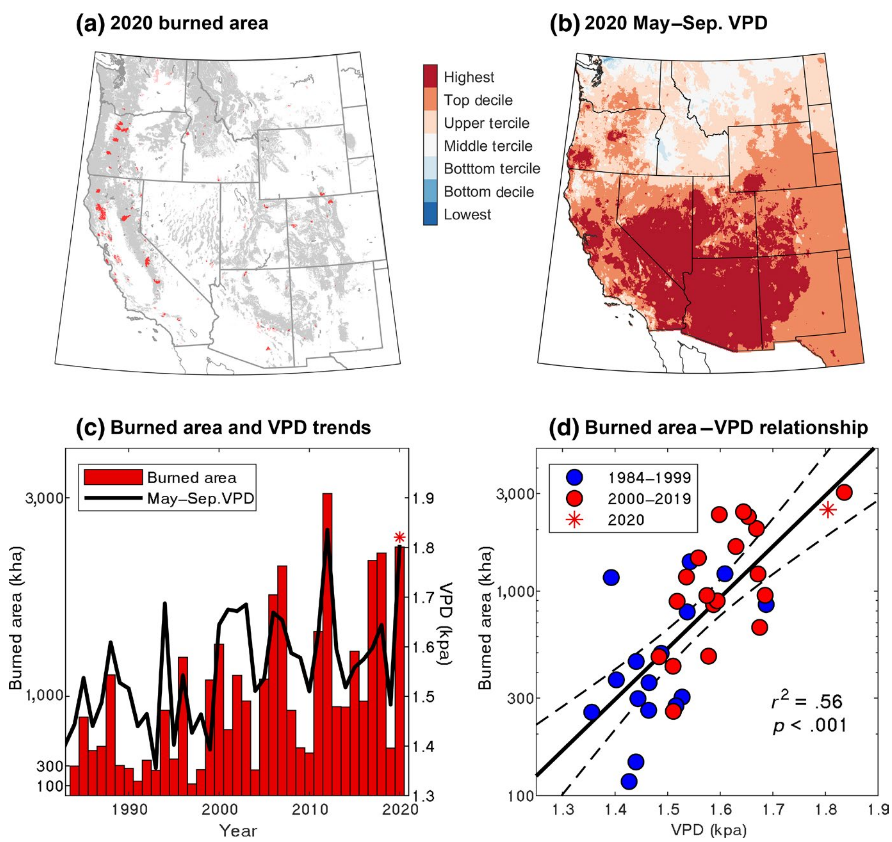

FIGURE 1 Fire and climate in the western United States (West: from 102°W longitude to the coast). (a) Burned area through September 2020 (red polygons; https://www.nifc.gov/nicc/) and forest/woodland vegetation (gray). Approximately 56% of burned area is in forest/woodland vegetation (darker red polygons), about 20% higher than the average since 1984. (b) Average 2020 May–September vapor pressure deficit (VPD) in the West from gridMET (http://www.climatologylab.org/gridmet.html), displayed in percentile bins, based on the 1979–2020 values. (c) Time series of West-wide annual burned area (from https://mtbs.gov, burned pixels; 2020 through September) and average May–September VPD (gridMET). (d) Relationship between VPD and log of burned area, with linear regression and 95% confidence intervals, following Abatzoglou and Williams (2016). Burned area for 2020 is a minimum value, through 31 September

The overarching influence of climate change in enabling widespread burning does not mean that non-climatic factors are unimportant. Drivers of individual wildfires and fire seasons are multifaceted, varying across time scales of seconds to centuries. Humans directly or indirectly start over 95% of fires that threaten homes, and decades of increased development in fire-prone landscapes is leading to more fire disasters (Mietkiewicz et al., 2020). In 2020, the majority of burned area in California and the Pacific Northwest was from human-related ignitions. Over a century of policies that limited Indigenous fire stewardship and focused on fire suppression have increased hazardous fuels and compounded fire risk, particularly in dry forests that historically burned frequently. Finally, short-term weather patterns, such as the easterly foehn wind event that drove extraordinary fire growth in Oregon and Washington this year, can overpower even the most heroic fuel breaks and fire suppression efforts. All of these facets are important contributors to fire activity, but anthropogenic warming significantly increases risk factors linked to all aspects of fire activity, including fire ignition, spread, and intensity (Kirchmeier-Young et al., 2019).

Projected increases in fuel aridity in the coming decades make it unlikely that records from 2020 will stand for long. As a result, fire will increasingly become a driver of global change, catalyzing ecosystem shifts as landscapes adjust to a changing climate, and altering ecosystem services including carbon storage (Coop et al., 2020). Paramount for minimizing the negative human impacts of wildfires is addressing the root causes of anthropogenic climate change. Simultaneously, the 2020 fire season must catalyze rapid, transformative changes in land stewardship, planning, and development, and our collective visions of what it means to be resilient to wildfires in an increasingly fire-prone world (Bowman et al., 2020; McWethy et al., 2019).

ACKNOWLEDGEMENTS

This work was supported by the Joint Fire Science Program through grant 16-3-01-24 and U.S. National Science Foundation (NSF) through grant DEB-1655121 to P.H., and by NSF grant OAI-2019762 to J.A.

DATA AVAILABILITY STATEMENT

Data used are all freely available through the cited sources.

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