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Key Points:
- Synchronous fire danger days across western US forests are interannually correlated with strain on national fire suppression resources
- A 25-day increase in the annual number of days with synchronous fire danger was observed during 1979–2020
- A doubling in the number of synchronous fire danger days is projected by 2051–2080

Supporting Information:
- Supporting Information S1

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Increasing Synchronous Fire Danger in Forests of the Western United States

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Abstract Widespread fire activity taxes suppression resources and can compound wildfire hazards. We examine the geographic synchronicity of fire danger across western United States forests as a proxy for the strain on fire suppression resource availability. Interannual variability in the number of days with synchronous fire danger, defined as fire weather indices exceeding the local 90th percentile across ≥40% of forested land, was strongly correlated ($r = 0.85$) with the number of days with high strain on national fire management resources. A 25-day increase in the annual number of days with synchronous fire danger was observed during 1979–2020. Climate projections show a doubling of such days by 2051–2080. Such changes will escalate the likelihood of years with extended periods of synchronous fire danger that have historically strained suppression efforts and contributed to additional burned area, therein requiring additional management strategies for coping with anticipated surges in fire suppression demands.

Plain Language Summary The amount of area burned per year in forests across the western United States has been increasing over the past half-century alongside warmer and drier weather conditions in the summer months of the western United States, called the “fire season.” These conditions lead to a number of impacts on ecosystems and society with mounting challenges for fire suppression. The occurrence of widespread fire danger and fire activity during active fire seasons has overwhelmed fire suppression resource capacity, limiting the effectiveness of managing fires and potentially increasing fire impacts. We find a strong link between fire danger days across western US forests and the number of days with high strain on national fire suppression resources. We show a 25-day increase in the annual number of days of regionally widespread connected fire danger-fire resource strain over the past 4 decades, and a doubling of such days by the mid-21st century. These findings suggest that, if fuel availability, ignition patterns, and land management approaches do not substantially change over time, climate change may continue to overburden fire management efforts across the region, requiring careful strategy when fire resources are strained in future dangerous, prolonged fire seasons.

1. Introduction

Wildland fire can impact society, particularly in inhabited fire-prone regions where vegetation, human settlement, and favorable atmospheric conditions for fuel drying and fire spread co-exist (Krawchuk et al., 2009). Fire suppression attempts to limit fire spread and extreme fire behavior, particularly where infrastructure, communities, or natural resources are threatened. While suppression is largely successful at containing most fire ignitions, suppression efficacy is reduced under unfavorable environmental factors such as high fire danger or heavy fuel loading (Arienti et al., 2006; Stavros et al., 2014) or when logistical challenges associated with fire suppression resource allocation arise, including a high number of new ignitions requiring simultaneous initial attack response and numerous ongoing fire incidents requiring extended attack response (Cumming, 2005; Finney et al., 2009). The costs of fire suppression in the United States (US) have escalated in recent decades due to more frequent elevated fire danger, drier fuels, and longer fire seasons (Abatzoglou & Williams, 2016; Jolly et al., 2015; Westerling, 2016), increased fuel abundance in lower-elevation forests (North et al., 2015), and increased human settlement in fire-prone lands (Radeloff et al., 2018), prompting suggestions of new strategies for living in fire-prone environments (Schoennagel et al., 2017; Smith et al., 2016).

Spatiotemporal patterns of fire activity and underlying factors of vegetation, weather, and both lightning and human-caused ignitions provide a context for modern fire management in terms of where and when fire suppression resources (e.g., personnel, equipment) are needed, as well as opportunities for using managed and prescribed fire. This pyrogeography is used to allocate and share US fire suppression resources (Belval et al., 2017; Corringham et al., 2008). The National Wildfire Coordinating Group at the National Interagency Fire Center (NIFC) coordinates all interagency wildland fire resources nationally, both assigning nationally coordinated fire resources to top priority wildfires and filling resource sharing orders from different subregional Geographic Area Coordination Centers where heightened fire activity (e.g., multiple large fires) exceeds the capacity of regional fire suppression resources. The extent, or geographic synchronicity, of fire activity and high fire potential across a given region is thus hypothesized to have direct implications for suppression capacity (e.g., limited resources for newly ignited fires) as suppression resources become scarce.

Synchronous fire seasons with widespread large fires occurring across the western US in both the paleo and modern record have been linked to large-scale climate anomalies (e.g., Kitzberger et al., 2007; Trouet et al., 2010; Westerling & Swetnam, 2003). Synchronous fire activity during such seasons is a byproduct of an abundance of new ignitions or uncontained fires, coincident with fire weather extremes that arise due to a combination of antecedent drying of fuels and meteorological conditions that promote fire spread (e.g., Balch et al., 2018). In recent summers during periods of synchronous fire activity, up to 26,000 personnel were deployed in fire management activities at a given time, along with associated equipment (e.g., engines and aircraft). Even with this massive deployment of national suppression resources, supplemented by resources from other countries such as Australia and Canada, periods of synchronous fire activity limit the effectiveness of suppression resources (Cumming, 2005) and are hypothesized to amplify fire impacts (e.g., burned area and suppression costs).

Many environmental phenomena exhibit geographically synchronous conditions through top-down atmospheric drivers (Anderson et al., 2019; Walter et al., 2017). The broad spatial scales of Rossby waves are directly responsible for synchronous meteorological and climatic extremes (e.g., Coumou et al., 2014), including in the fire-environment, such as extremes in fire weather indices (e.g., Crimmins, 2006). While recent efforts have begun to examine changes in compound climate extremes (e.g., AghaKouchak et al., 2014), fewer studies have examined changes in the spatial character of fire-related climate extremes (Fischer & Knutti, 2014; Vogel et al., 2019). We argue that there is value in assessing the geographic synchronicity of meteorological and climatological extremes that directly impact resource management of systems across broad geographic scales, including those associated with fire, given the challenges faced in fire suppression and the far-reaching air quality concerns during periods of synchronous fire activity.

The increased fire potentials projected for a changing climate will further compromise current capacities for managing fire (Podur & Wotton, 2010). Such changes, absent adoption of adaptation or mitigation approaches for wildland fire, will lead to large increases in the population exposed to fire impacts and fire suppression costs. This study seeks to understand recent and projected changes in synchronous fire danger across western US forests that can confound fire suppression. First, we examine interannual relationships between fire weather conditions and fire suppression resources across forested regions of the western US to develop a working definition of synchronous fire danger. Second, we document trends in synchronous fire danger over the past 4 decades and how such conditions are projected to change throughout the remainder of the 21st century, showing the potential for additional strain on fire suppression efforts.

2. Data and Methods

This study focuses on the western contiguous US (west of 103°W), as this region commandeers the majority of US fire suppression resources and costs (e.g., Gebert et al., 2007). We restrict our focus to areas that are primarily forested given the relatively high resource expense tied to forest fires (e.g., Gebert et al., 2007), prioritization of suppression resources to fires in the wildland-urban interface often comprised of forests (Bayham & Yoder, 2020), strong links between fire danger metrics and burned area in forested lands (Abatzoglou et al., 2018), and regional air-quality impacts from fires in biomass rich environments. We delineated forested lands at a 1/24th-degree geographic resolution using the 30-m Environmental Site Potential (ESP) product of LANDFIRE (Rollins, 2009). We defined a 1/24th-degree grid cell as forested if the majority of 30-m ESP grid cells within were classified as “forest” or “woodland” (Abatzoglou & Williams, 2016).

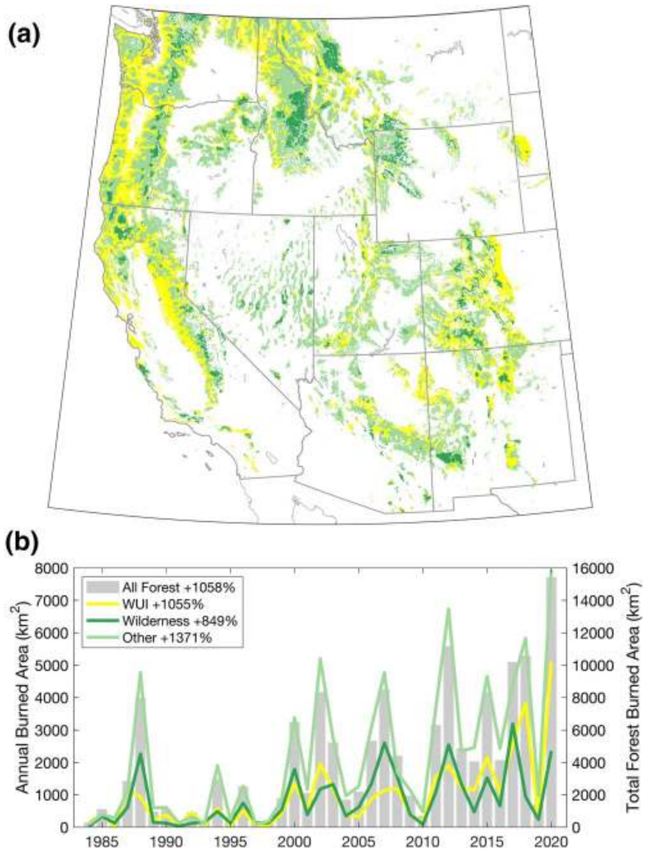

Figure 1. (a) Study area map delineating forested lands in the WUI (yellow), forested lands in a designated Wilderness area (dark green), and other forested lands (light green). (b) Time series of 1984–2020 annual burned area in forested WUI (yellow), forested wilderness lands (green), other forested lands (light green), and all forested land (gray bars). Trends in annual burned area denoted in the legend were computed using the nonparametric Theil-Sen estimator of the base-10 logarithm of burned area as the estimate for 2020 relative to that of 1984 following Williams et al. (2019). Trends were all significant at $p < 0.05$. WUI, Wildland-Urban Interface.

Daily data on US National Preparedness Levels (PL) from 1990 to 2020 were acquired from National Interagency Coordination Center Incident Management Situation Report records (https://www.nifc.gov/PIO_bb/Background/PreparednessLevels.xlsx). The PL is a categorical value from 1 to 5 assigned daily throughout the year by NIFC to reflect the relative availability of national fire suppression resources. PL 1 refers to minimal fire activity and limited commitment of national resources, whereas PL 5 refers to multiple regions experiencing large fires with national suppression resources fully committed. The PL changes incrementally over the fire season based on a variety of factors, including existing resources assigned to incidents, geographic diversity in incidents that constrains local and regional efforts, and projected fire potentials. The PL is ultimately a subjective value based on expert guidance of fire management and is subject to changes in policies, fire management strategies, and available resources. Herein we constrain our focus to high resource demand days when the PL ≥ 4 (PL4+), as NIFC specifically defines PL 4 and PL 5 as the two categories when there is significant wildfire activity in multiple Geographic Areas and suppression resources are being mobilized and translocated across all Geographic Areas (Cullen et al., 2020).

Fire weather conditions were evaluated using the Fire Weather Index (FWI) from the Canadian Forest Fire Danger Rating system (Van Wagner, 1987). We chose FWI given its widespread use globally, strong empirical links to interannual burned area, and association with extreme fire events across diverse ecosystems including those in the western US (Bowman et al., 2017; Goss et al., 2020). The FWI is a daily hybrid climate-weather index that incorporates both fuel aridity and potential fire spread rates (e.g., wind speed) and serves as a proxy of potential fire intensity. FWI was calculated from gridMET at a 1/24th degree spatial resolution during 1979–2020 (Abatzoglou, 2013). Following prior studies (e.g., Goss et al., 2020), we calculate FWI using a modified approach that includes daily mean wind speed, accumulated precipitation, maximum temperature, and minimum relative humidity, rather than the standard procedure that uses local noon observations. We also calculated FWI for a library of climate simulations from the fifth phase of the Coupled Model Intercomparison Project (Taylor et al., 2012). The simulations were produced by 18 climate models (first ensemble member; Table S1). We considered simulations forced by historical anthropogenic and natural sources during 1950–2005 and by projected future anthropogenic forcings over 2006–2099, using both a moderate (RCP4.5) and an extreme (RCP8.5) emissions scenario (van Vuuren et al., 2011). The climate simulation data were statistically downscaled to 1/24th degree following Abatzoglou and Brown (2012).

Days with high fire danger were defined on the basis of FWI exceeding locally defined percentiles (90th, 95th, and 97th). Percentiles were defined using data pooled over the calendar year during 1979–2020 in the observational record, and model years 1979–2020 for each climate model. These thresholds were used to quantify the geographic extent of forested lands with FWI exceeding varied thresholds per day. We defined thresholds based on local percentiles rather than absolute thresholds given the adherence to practices used in climate extremes (e.g., Vogel et al., 2019) and results from previous studies showing that large fire growth occurs preferentially under such local extremes (e.g., Barbero et al., 2014).

We considered the geographic extent of fire danger across varied FWI severities (i.e., 90th, 95th, and 97th FWI percentiles) and land provenances. For the latter we used four aggregations of forested land: (i) all forested land, (ii) forested land in the Wildland-Urban Interface (WUI), (iii) forested land in Wilderness areas, and (iv) forested land excluding that designated as Wilderness or in the WUI (Figure 1a). Lands were

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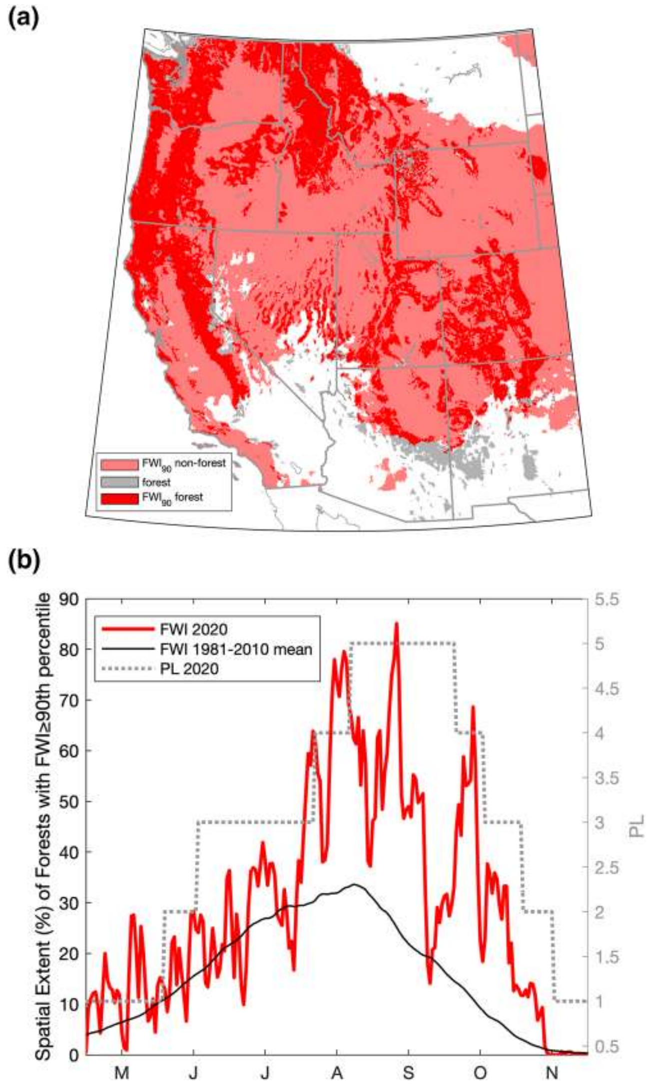

Figure 2. (a) Example of the geographic coverage of Fire Weather Index (FWI) exceeding the local 90th percentile threshold (red) on September 6, 2020. Nonforested lands with FWI exceeding the 90th percentile are shown in pink and all other forested lands shown in gray. (b) Spatial extent of forested land with daily FWI exceeding the 90th percentile during 2020 (red), smoothed 21-day moving average climatology during 1981–2010 (black), and the National Preparedness Level during 2020 (dashed gray).

classified as in the WUI from Schoennagel et al. (2017) and in Wilderness from the administrative boundaries of National Wilderness areas as of 2015 ("https://data.fs.usda.gov/geodata/edw/edw_resources/meta/S_USA.Wilderness.xml"). We hypothesized that the heightened values at risk in the WUI would usurp more suppression resources, whereas fire use policies (e.g., limited fire suppression) in wilderness lands contribute less to national resource strain.

Annual forested burned area was tabulated for all land provenances to contextualize variability and trends. Geospatial burned area data were acquired from Monitoring Trends in Burn Severity (MTBS) during 1984–2017 (Eidenshink et al., 2007), version 6 MODIS burned area dataset during 2001–2019 (Giglio et al., 2018), and mapped fire perimeters from the NIFC as of December 1, 2020 for the year 2020. Fires from MTBS were limited to those ≥404 ha and excluded areas in the unburned-to-low burn severity class. Burned area estimates for 2018–2019 were obtained using a linear model between MODIS and MTBS estimated using the overlapping 2001–2017 period (e.g., Williams et al., 2015). We approximated burned area for 2020 by assuming that 20% of the area inside mapped fire perimeters was unburned (Meddens et al., 2016).

We examined daily concurrent fire danger by combining the spatial extent of forested lands that exceed locally defined FWI thresholds. For example, Vogel et al. (2019) defined daily concurrent temperature extremes as the extent of northern hemisphere lands with daily temperatures exceeding the 90th percentile. Building on this concept, and to provide a metric meaningful to national fire suppression resource strain, we tabulated counts of daily concurrent fire danger exceeding varied geographic extents. This was done for combinations of FWI severity (exceeding the 90th, 95th, and 97th percentiles) and geographic extents (≥15% to ≥55%) across four forested land classes. Interannual Spearman's rank correlations were calculated between the number of June-September PL4+ days and the number of June–September days exceeding combinations of FWI severity and spatial extent thresholds across land provenances during 1990–2020. We herein defined synchronous fire danger by the optimal correlation among these combinations. Using this definition, we calculated linear trends in synchronous fire danger during the observational period 1979–2020 as well as projected changes throughout the 21st century. Trends were calculated using Sen-Theil slope and considered significant at $p < 0.05$ based on a two-tailed Mann-Kendall trend test. Projected changes were considered significant at $p < 0.05$ using a t-test between a given 30-year period and the 1951–1980 period.

3. Results

While the distribution of forested lands by land provenance varies across the western US, we find significant interannual co-variance in burned area among WUI, Wilderness, and non-WUI/non-Wilderness forested land (Figure 1b). Moreover, forested WUI, forested Wilderness, and all other forested lands showed significant increases in burned area during 1984–2020 of 1,055%, 849%, and 1,371%, respectively. These results highlight the interannual coherence of forested burned area among land provenances and the similarity of changes in burned area extent among land provenances over the past 4 decades, suggestive of common broad-scale climate factors, rather than bottom-up factors associated with human-settlement.

An example of widespread fire danger, examined here as FWI exceeding the local 90th percentile, is shown for September 6, 2020 (Figure 2a). Such FWI extremes covered 85% of forested lands on September 6, 2020

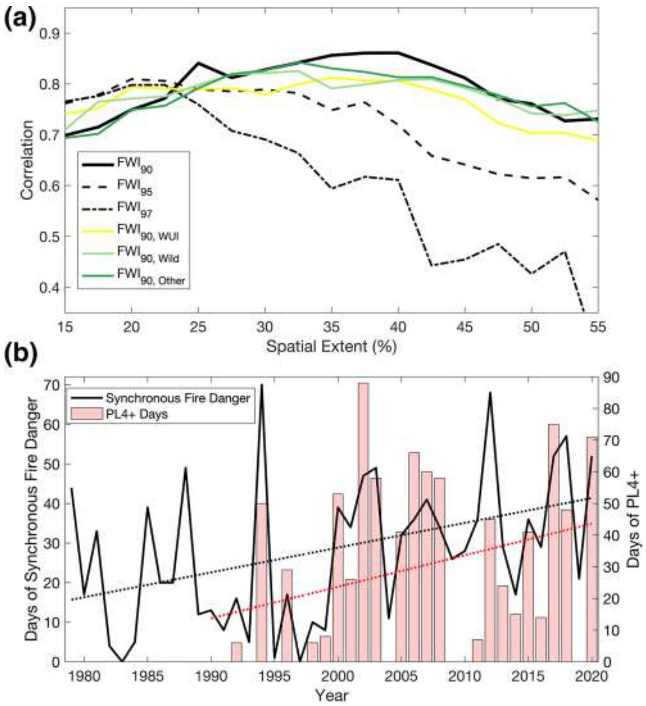

Figure 3. (a) Spearman rank correlation coefficients by the spatial extent (%) of forested land experiencing Fire Weather Index (FWI) extremes. Correlations were made between the number of June–September days with National Preparedness Levels at or above 4 (PL4+) and number of days of FWI extremes defined using local 90th (solid), 95th (dashed), and 97th (dot-dashed) thresholds exceeding varied spatial extents across all western United States forests, and for the 90th percentile for forested land in the Wildland-Urban Interface (WUI, yellow), forested land in wilderness area (dark green), and all other forested land (light green). (b) Annual time series of the number of days with synchronous fire danger, defined as days where FWI exceeds the 90th percentile across >40% forested land (lines, 1979–2020, linear trend shown by dotted black line), and number of days with PL4+ (bars, 1990–2020, linear trend shown by dotted red line).

with high geographic coverage broadly from early August through late September, coincident with anomalously warm, dry conditions across the western US (Figure 2b). For comparison, a climatology (1981–2010) of the extent of forested lands exceeding the 90th percentile FWI shows a seasonal cycle congruent with resolved fire seasonality (e.g., Westerling et al., 2003). The period of chronic widespread fire danger in 2020 coincided with a prolonged 44-day spell of days with the national PL of 5, including the largest fires in the modern records for both California and Colorado (Higuera & Abatzoglou, 2020). We additionally demonstrate a strong statistical relationship between the daily probability of PL4+ and the spatial extent of concurrent FWI extremes during 1990–2020 (Figure S1). For example, approximately 50% of days had PL4+ when concurrent FWI extremes covered at least 40% of forested lands, well in excess of a null model that preserves the seasonality of FWI extremes (Figure S1a). Further, concurrent widespread FWI extremes appear to be a leading indicator of PL4+ as the fraction of days at PL4+ rises for a week following widespread FWI extremes (Figure S1b), suggestive of a lag between widespread fire danger extremes and subsequent effects on suppression response capacity.

Significant interannual correlations were seen between the number of PL4+ days and days with concurrent fire danger across western US forests. Correlations varied as a function of FWI severity, spatial extent of FWI extremes, and land provenance, with the highest correlations seen for moderate extremes (FWI exceeding the 90th percentile) compared with more stringent thresholds (Figure 3a). We found limited overall differences when stratifying by land provenance, with maximum correlations ($r = 0.85$) obtained when defining days with where FWI exceeds the 90th percentile across at least 40% of forested area. Correlations were similar using spatial extents of 30%–40% among forested land provenance. Additionally, correlations between PL4+ and synchronous fire danger were stronger than correlations between PL4+ and May-September FWI averaged over western US forests, suggesting slightly more explanatory power using a daily measure of widespread fire danger. We posit that the strong coherence in interannual burned area among different land classes (Figure 1b) and the top-down effect of meteorology on fire danger supersede bottom-up factors such as heterogeneous forest types and land provenance (Figure 1a) from the perspective of national resource strain. Using these findings, we herein define synchronous fire danger as days when at least 40% of western US forest areas experience moderate FWI extremes (90th percentile).

An average of 25 days per year of synchronous fire danger occurred over western US forests during 1979–2020 (Figure 3c), with 72% of these days occurring in July and August. From 1979 to 2020, the annual frequency of synchronous fire-danger increased by 25 days (+160%) (Figure 3b). Years with the highest frequencies of synchronous fire danger days occurred in 1994, 2003, 2012, 2018, and 2020, coinciding with some of the most active fire seasons in the past 40 years in terms of annual burned areas. Moreover, we find that years with at least 40 days of synchronous fire danger averaged 62 days of PL4+. In comparison, years with fewer than 20 days of synchronous fire danger averaged only 5 PL4+ days. We also document a nonsignificant ($p = 0.06$) 26-day increase in PL4+ days during the period 1990–2020 (Figure 3b). Note that nonbiophysical factors including increased human settlement in the WUI, increased resources for fire suppression, and changes in fire policies may exert their own influences on PL trends independent of biophysical factors. The strong interannual correlation between synchronous fire danger days and PL4+ days provides evidence that the increase in synchronous fire danger days played an important role with recent increases in PL4+ days.

Climate models project an increase in the occurrence of synchronous fire danger across the western US throughout the 21st century when forced with the moderate RCP4.5 emissions scenario (Figure 4a). The

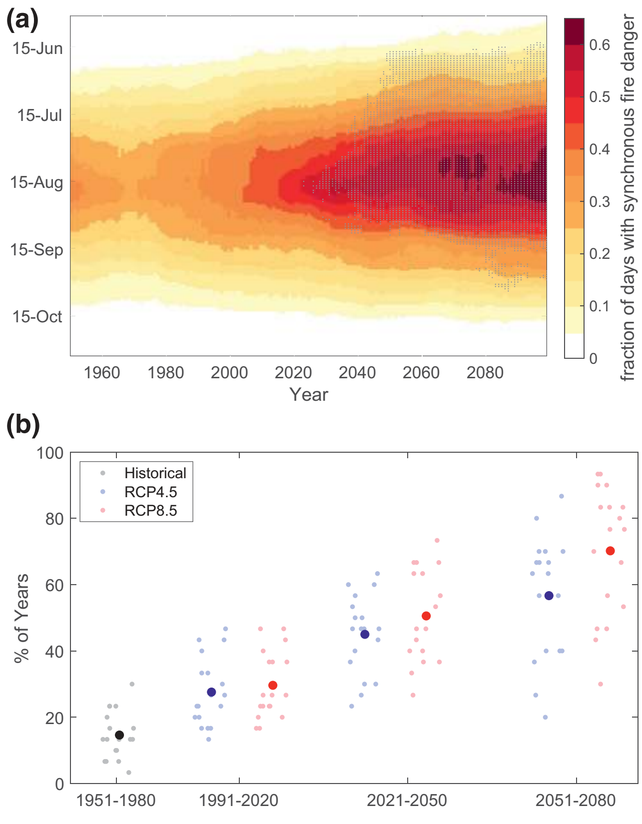

Figure 4. (a) 18-model mean fraction of days with synchronous fire danger over the western US forests from 1950 to 2005 (historical forcing) and extended through 2099 with RCP4.5 forcing. Plotted data are smoothed using a 11-day centered moving window and 21-year centered moving window. Stippling denotes periods where at least 12 of the 18 models showed a significant increase compared to the base period of 1951–1980 per a t-test. (b) The fraction of years where synchronous fire danger ≥40 days in a given year for 1951–1980, 1991–2020, 2021–2050, and 2051–2080. Results for each individual model are plotted as small dots; large dots indicate the 18-model mean.

largest increases were during the core of the fire season in July-August, but projected aridification trends drive an expansion of synchronous fire danger into June and mid-September as well. The number of annual days of synchronous fire danger increases from 20 days during 1951–1980 to a multimodel median of 28.5 days/year (25.6–31.0 days/year, interquartile range) during the contemporary era (1991–2020) and 47 days/year (35.6–50.6 days/year) by 2051–2080 with RCP4.5 forcing. Notably, these model-projected increases in frequency of synchronous fire danger are slower than those observed over the past 4 decades.

Complementary to increased synchronous fire danger with climate change is an increase in the occurrence of years with ≥40 days of synchronous fire danger. Whereas models show ∼16% of years meeting such criteria during 1951–1980, comparable to the observational record, the multimodel median increases to 28% of years by 1991–2020, 47% of years by 2021–2050, and 59% of years by 2051–2080 for RCP4.5, with slightly larger increases for RCP8.5 (Figure 4b). These results are largely consistent with projected warming and increased vapor pressure deficits across the region (e.g., Williams et al., 2019), as well as slight decreases in summer precipitation in the Northwestern US that collectively act to hasten the widespread drying of fuels reflected in higher FWI (e.g., Rupp et al., 2016).

Finally, we provide a simple estimate of the additional region-wide forested burned area imposed by prolonged periods of synchronous fire danger not accounted for by regional fuel aridity. This was accomplished by first removing the direct influence of fuel aridity on burned area as expressed through May-September FWI averaged over forested lands. FWI during May-September explained 67% of the interannual variability in the logarithm of burned area, similar to previous fuel aridity measures (Abatzoglou & Williams, 2016). We performed a simple linear regression between the annual burned area residuals and May-September synchronous fire danger days, constraining the relationship to years with at least 30 days of synchronous fire danger when resource strain is reasoned to be more important. Results show a significant linear relationship of +160 km^2 burned area per synchronous fire danger day (+30 to +280 km^2/day, 95% CI; Figure S2), with additive effects above 50 synchronous fire danger days.

4. Discussion and Conclusions

Increased fire activity across western US forests in recent decades has been heavily enabled by warmer and drier conditions in summer that have increased fuel aridity (Abatzoglou & Williams, 2016; Holden et al., 2018; Westerling, 2016; Williams et al., 2019). Complementary to these overall changes, we document a 25-day increase in the number of synchronous fire danger days over the past 4 decades. Climate projections show continued increases in the occurrence of synchronous fire danger through the 21st century, congruent with regional increases in fire weather indices (Abatzoglou et al., 2019; Flannigan et al., 2013). Moreover, these increases in synchronous fire danger are consistent with other studies showing increases in geographically concurrent meteorological extremes due to anthropogenic climate change (e.g., Vogel et al., 2019). Yet, similar to previous studies, we show that observed increases in synchronous fire danger during 1979–2020 outpaced model projections, suggesting a significant role for internal climate variability (Abatzoglou & Williams, 2016; Williams et al., 2020). Indeed, the past couple of decades have been predominantly locked in the cold-phase of the naturally occurring Pacific Decadal Oscillation, which promotes aridity across much of the western US (e.g., Lehner et al., 2018).

We demonstrate strong interannual and in-season empirical relationships between synchronous fire danger and national fire suppression resource strain. Additionally, other factors are likely to interact nonlinearly with synchronous fire danger to influence resource strain and burned area, including the location and number of ongoing fire events (Cullen et al., 2020), the occurrence of widespread dry lightning that can promote hundreds of new ignitions, and widespread hazardous fuels including those from drought- and beetle-driven tree mortality (Stephens et al., 2018). Continued efforts are needed to understand potential nonlinear interactions arising from compound societal-biophysical extremes for fire activity that include meteorological, vegetation, and societal factors in the context of fire management (Raymond et al., 2020)

Our study provides potentially useful insight for ongoing efforts to model fire activity, as well as implications for the management of future wildland fires. First, we suggest there is value in incorporating a measure of direct (e.g., PL, number of active fires) or indirect (e.g., synchronous fire danger) resource strain in empirical and process-based fire models in areas where fire suppression is widely used (Podur & Martell, 2007). Most current approaches do not directly incorporate proxies for resource strain from competing fires regionally or nationally that might alter local fire suppression efficacy and produce positive feedbacks to fire size. For example, while large fire probability has been expressed as a function of local fire weather conditions that supersede fire suppression efforts (e.g., Barbero et al., 2014), reduced suppression resources coincident with synchronous fire danger likely modulates these relationships allowing for large fires under more benign environmental conditions in geographic areas distant from the locus of extreme fire danger. Our simple analysis shows the potential additional strain imposed during chronic periods of synchronous fire danger (+160 km^2 burned area per added day of synchronous fire danger exceeding 50 days). Additional efforts to incorporate resource strain on fire activity patterns and burned area are needed to better resolve and quantify the added-value of such measures.

Our results support previous studies that suggest climate change will confound fire management efforts at multiple geographic scales (Flannigan et al., 2009; Podur & Wotton, 2010) absent wholesale changes in ignitions, values at risk, and fire management approaches. Limiting human-ignited fire can be beneficial in many regions where fire and people are co-located (Balch et al., 2017), which may alleviate resource strain tied to the abundance of human ignitions. Conversely, increased WUI development and allocation of suppression resources to property protection are likely to continue for the foreseeable future. Improved subseasonal to seasonal forecasts of fire potential may aid pre-emptive allocation of suppression resources geographically, as well as mobilization of resources from other countries. Finally, projected increases in synchronous fire danger will continue to require more informed decision making on fire management, including policies that allow managed wildfire for meeting ecological objectives (e.g., in wilderness areas) under strategies other than full suppression when resources are strained (Young et al., 2020), as well as pre-emptive efforts such as prescribed fire (Kolden, 2019) and Indigenous cultural burning practices (Lake et al., 2017) to reduce fire impacts.

Data Availability Statement

Summarized data sets on daily synchronous fire danger extent across western US forests and daily gridded FWI during 1979–2020 are available at https://climate.northwestknowledge.net/ACSL/GRL/

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