



May 7, 2024

The Honorable Buffy Wicks
Chair, Assembly Appropriations Committee
1021 O Street, Suite 8220
Sacramento, CA 95814

**Re: AB-3150 Fire safety: fire hazard severity zones: defensible space: State Fire Marshal –
OPPOSE**

Dear Chair Wicks,

We are writing to express our strong opposition to AB 3150 (Quirk-Silva). The bill allows developers to petition to redesignate very high fire hazard severity zones as a lower classification, which will give them an avenue to avoid complying with building codes and fire regulations designed to protect communities and the environment. AB 3150 also transfers significant oversight and regulatory authority over wildfire risk reduction from the State Board of Forestry and Fire Protection to the State Fire Marshal. At a time when the state should be focused on limiting new large-scale development in fire-prone areas, this bill goes in the opposite direction by streamlining large-scale development in these areas. The state should learn from past mistakes of building in high fire-prone areas, which has resulted in more than 200 deaths, more than 50,000 burned down structures, hundreds of thousands of home evacuations, unhealthy levels of smoke and air pollution for millions of people, and more than \$100 billions spent on emergency fire suppression and economic losses since 2016. This bill is unwise public policy that endangers the lives of all Californians. It does not provide any real solutions to the affordable housing crisis.

I. AB 3150 paves the way for more high-risk development in fire-prone areas.

The bill wrongly assumes that additional large-scale developments in fire-prone areas and the wildland-urban interface is a worthy goal, and purports to be a tool to “address the housing shortage.” Such development is not wise public policy as set forth below; in addition, as

discussed in section III, it does nothing to address the real causes of the affordable housing crisis. Instead, AB 3150 perpetuates the myth that more development in fire-zones is “safe” when in practice such development endangers people, increases fire suppression costs, contributes to poor air quality, and damages ecosystems.

As outlined in the Center for Biological Diversity’s report, *Built to Burn*¹, while some measures can reduce fire risk, they do not make structures or communities fireproof. In an analysis that included more than 40,000 structures exposed to wildfire between 2013 and 2018 in California, many structures deemed “firesafe” were destroyed. And while an analysis conducted in the aftermath of the 2017 Camp Fire showed that new building codes improved home survival, with 51% of homes built to code undamaged compared to 18% of homes built prior to 2008, about half of the homes built to fire-safety codes were still destroyed. AB 3150 provides developers a path to de-designate very high fire hazard severity zones, and thus render it easier to pursue unsafe development without adequate fire safety standards that are normally required in very high fire hazard severity zones.

Increased development in fire zones magnifies the threat of wildfire and puts more people at risk.

This bill would bring more development into fire-prone areas, thereby increasing ignition risk and endangering the lives of new residents and existing communities.

According to a report from Governor Gavin Newsom’s Office, construction of more homes in the wildland-urban interface is one of the main factors that “magnify the wildfire threat and place substantially more people and property at risk than ever before” (Governor Newsom’s Strike Force, 2019). Another 2019 study found that housing and human infrastructure in fire-prone wildlands are the main drivers of fire ignitions and structure loss (Syphard et al., 2019). Sprawl developments extending into habitats that are prone to fire have led to more frequent wildfires caused by human ignitions, like power lines, arson, improperly disposed cigarette butts, debris burning, fireworks, campfires, or sparks from cars or equipment (Alexandre, Stewart, Keuler, et al., 2016; Alexandre, Stewart, Mockrin, et al., 2016; Balch et al., 2017; Bistinas et al., 2013; Keeley et al., 1999; Keeley & Fotheringham, 2003; Keeley & Syphard, 2018; Radeloff et al., 2018; Syphard et al., 2007, 2012, 2019).

Almost all (95-97%) contemporary wildfires in California have been unintentionally caused by people and human infrastructure (Balch et al., 2017; Keeley & Syphard, 2018). For example, the 2017 Thomas Fire, 2017 Tubbs Fire, 2018 Camp Fire, 2018 Woolsey Fire, 2019 Kincade Fire, 2020 Bobcat Fire, 2020 Silverado Fire, and the 2020 Zogg Fire were found to have been caused by electrical transmission lines and electrical equipment. And although many of the

¹ Yap, et al, *Built to Burn: California’s Wildlands Developments Are Playing With Fire* (Feb. 2021), available at <https://www.biologicaldiversity.org/programs/urban/pdfs/Built-to-Burn-California-Wildfire-Report-Center-Biological-Diversity.pdf>.

2020 fires were sparked by a lightning storm, the 2020 Apple Fire was caused by sparks from a vehicle, the 2020 El Dorado Fire was caused by pyrotechnics at a gender-reveal celebration, and the 2020 Blue Ridge Fire was likely caused by a house fire. Allowing the dismissal of fire hazard zoning and placing more homes and people in high fire-prone areas would only increase the potential likelihood of these ignition sources, as has been documented in multiple scientific studies (Balch et al., 2017; Bistinas et al., 2013; Keeley et al., 1999; Keeley & Fotheringham, 2003; Keeley & Syphard, 2018; Radeloff et al., 2018; Syphard et al., 2007, 2012, 2019).

Since 2016 more than 200 people in California have been killed in wildfires, more than 50,000 structures have been burned down, hundreds of thousands have had to evacuate their homes and endure power outages, and millions have been exposed to unhealthy levels of smoke and air pollution (CalFire 2023). Although public utility companies (*i.e.*, PG&E and Southern California Edison) are altering operations in the form of power outages and blackouts during extreme weather conditions (Callahan et al., 2019; Fry, Dolan, et al., 2019; Krishnakumar et al., 2019), wildfires can still spark and spread quickly towards homes, as evidenced by the wildfires in Moraga (Hernández et al., 2019) and Saddleridge/Sylmar (Fry, Miller, et al., 2019). And the power outages themselves disproportionately burden our most vulnerable communities, including the elderly, poor, and disabled (Chabria & Luna, 2019), and can cause traffic jams and collisions (CBS San Francisco, 2019). Michael Wara, Director of the Climate and Energy Policy Program and a senior research scholar at the Stanford Woods Institute for the Environment, estimated that PG&E's power outage in Northern and Central California could have an economic impact of \$2.5 billion in losses, with most of the burden on businesses (Callahan et al., 2019).

Increased development in fire zones disrupts natural fire regimes and harms California's ecosystems and wildlife.

Wildfire is an important ecological process for many ecosystems. For millennia, Indigenous cultural burning and lightning strikes drove ecosystem-specific fire regimes. But the genocide of Native peoples and the criminalization of fire practices, along with 200 years of reckless land-use planning, have altered historical fire regimes (Steel et al., 2018; Williams et al., 2023). This, in combination with climate change causing more extreme fire weather, longer fire seasons, and larger areas burned, has made wildfires more destructive to people and wildlife (Turco et al., 2023).

Development in fire zones can disrupt natural fire regimes and lead to a dangerous feedback loop of deadly fires and habitat destruction. Most destruction to human communities from fire has been caused by human-ignited fires in mixed shrubland habitats (Syphard, 2020). Shrublands are adapted to infrequent (every 30 to 150 years or more), large, high-intensity crown fire regimes (Keeley & Fotheringham, 2001). However, if these regimes are disrupted, the habitats become degraded (Keeley, 2005, 2006; Syphard et al., 2018). When fires occur too frequently in shrubland habitats, type conversion occurs and the native shrublands are replaced

by non-native grasses and forbs that burn more frequently and more easily, ultimately eliminating native habitats and biodiversity while increasing fire threat over time (Keeley, 2005, 2006; Safford & Van de Water, 2014; Syphard et al., 2009, 2018). This could have serious consequences for special-status species like Santa Ana suckers, mountain yellow-legged frogs, and western pond turtles that rely on native habitats for survival and exist in small, isolated patches due to overdevelopment (Sahagun, 2020). In addition, large-scale landscape changes due to vegetation-type conversion from shifts in natural fire regimes could impact wide-ranging species like mountain lions (Blakey et al., 2022; Jennings, 2018), whose populations are already struggling in much of the state due to lack of connectivity and genetic isolation (Benson et al., 2019; Gustafson et al., 2021).

This bill would amplify these harms by increasing unintentional human-driven wildfires that disrupt natural fire regimes, further degrade ecosystems, and threaten California's wildlife.

Unintentional wildfires caused by poorly sited development cause poor air quality and harms people.

As discussed in the Center for Biological Diversity's report, [*The True Cost of Sprawl*](#),² unintentional wildfires due to human activity and ill-placed developments lead to increased occurrences of poor outdoor and indoor air quality from PM_{2.5} from smoke (e.g., Phuleria et al., 2005), which can have both acute and long-term health effects that disproportionately affect vulnerable populations, like children, the elderly, those with underlying chronic disease, low-income communities, and communities of color. Hospital visits for respiratory symptoms (e.g., asthma, acute bronchitis, pneumonia, or chronic obstructive pulmonary disease) and cardiovascular symptoms (e.g., congestive heart failure, ischemic heart disease, and myocardial infarction) have been shown to increase during and/or after fire events (Delfino et al., 2009; Künzli et al., 2006; Liu et al., 2015; Rappold et al., 2012; Reid et al., 2016; Viswanathan et al., 2006). In addition, epidemiologists recently found that increased exposure to wildfire smoke may also be linked to higher rates of dementia (B. Zhang et al., 2023; Z. Zhang et al., 2023). And wildland firefighters are suffering disproportionately high rates of cancer and other serious diseases, likely due to extreme smoke exposure (Hwang et al., 2023; Johnson & Lam, 2023), as well as mental health issues due to extended fire seasons and working extended shifts away from their families (Ashton et al., 2018; Bransford et al., 2018; Del Real & Kang, 2018; Greene, 2018; Gutierrez, 2018; Simon, 2018).

Increases in wildfire also result in higher frequency and toxicity of smoke exposure to communities in the path of and downwind of the fires. This can lead to harmful public health impacts due to increased air pollution not only from burned vegetation, but also from burned homes, commercial buildings, cars, etc. Buildings and structures often contain plastic materials, metals, and various stored chemicals that release toxic chemicals when burned, such as

² Reid-Wainscoat et al. *The True Cost of Sprawl: Bad Planning Harms People, Wildlife, and the Climate* (March 2024). Available at <https://www.biologicaldiversity.org/programs/urban/pdfs/The-True-Cost-of-Sprawl-report.pdf>

pesticides, solvents, paints, and cleaning solutions (Weinhold, 2011). During the 2018 Camp Fire that burned 19,000 structures, the smoke caused dangerously high levels of air pollution in the Sacramento Valley and Bay Area and the California Air Resources Board found that high levels of heavy metals like lead and zinc traveled more than 150 miles (CARB, 2021). AB 3150 will exacerbate these problems.

AB 3150 would increase ignition risk, worsen air quality, and increase disease and sickness throughout the state.

More unintentional ignitions due to development in fire zones increases firefighting costs and strain on firefighters.

More development in fire-prone areas will necessitate significant firefighting costs from both state and local authorities. Cal Fire is primarily responsible for addressing wildfires when they occur, and its costs have continued to increase as wildfires in the wildland-urban interface have grown more destructive. The cost of fire suppression in areas managed by the California Department of Forestry and Fire (Cal Fire) has skyrocketed from \$114 million in the 2000-2001 fiscal year to close to \$3 billion for the 2020-2021 and 2021-2022 fiscal years combined (CalFire 2022). The Legislative Analyst's Office (LAO) reported that CalFire used an estimated \$3.3 billion for wildfire protection and suppression in the 2022-2023 fiscal year (LAO 2023). This does not include the cost of lives lost, property damages, or clean up. As noted above, the vast majority of wildfires in California are unintentionally ignited by people in poorly-planned development in high fire prone areas (Balch et al., 2017; Keeley & Syphard, 2018). More development in high fire hazard areas will increase unintentional ignitions and associated fire suppression costs.

Climate change is increasing extreme weather and fire conditions, which, in combination with poorly planned development, has led to more ignitions and longer fire seasons that are increasing strain on over-burdened firefighters and first responders. According to Captain Michael Feyh of the Sacramento Fire Department, California no longer has a fire season (Simon, 2018); wildfires in California are now year-round because of increased human ignitions in fire-prone areas. Emergency calls to fire departments have tripled since the 1980s (Gutierrez & Cassidy, 2018), and firefighters (and equipment) are being spread thin throughout the state. Firefighters often work 24- to 36-hour shifts for extended periods of time (often weeks at a time), and are being kept away from their homes and families for more and more days out of the year (Ashton et al., 2018; Bransford et al., 2018; Del Real & Kang, 2018; Greene, 2018; Gutierrez, 2018; Simon, 2018). In addition, the firefighting force often must rely on volunteers to battle fires year-round.

The extended fire season is taking a toll on the physical, mental, and emotional health of firefighters, as well as the emotional health of their families (Ashton et al., 2018; Del Real & Kang, 2018; Simon, 2018). As mentioned above, wildland firefighters are suffering

disproportionately high rates of cancer and other serious diseases, likely due to extreme smoke exposure (Hwang et al., 2023; Johnson & Lam, 2023). In addition, the physical and mental fatigue of endlessly fighting fires and experiencing trauma can lead to exhaustion, which can cause mistakes in life-or-death situations while on duty, and the constant worry and aftermath that family members endure when their loved ones are away working in life-threatening conditions can be harrowing (Ashton et al., 2018). According to psychologist Dr. Nancy Bohl-Penrod, the strain of fighting fires without having sufficient breaks can impact firefighters' interactions with their families, their emotions, and their personalities (Bransford et al., 2018). There have also been reports that suicide rates and substance abuse have increased among firefighters (Cart, 2022; Greene, 2018; Simon, 2018).

AB 3150 would facilitate more development in unsafe areas and more unintentional ignitions, which will harm courageous firefighters and first responders and lead to even more unsustainable firefighting costs.

Increased unintentional ignitions caused by development in fire zones has significant economic costs.

There are significant economic impacts of wildfires on all California residents, not just on those with homes or businesses within the fire footprint. One study estimated that damages from California wildfires in 2018 cost \$148.5 billion in capital losses, health costs related to air pollution exposure, and indirect losses due to broader economic disruption cascading along with regional and national supply chains (Wang et al., 2021). Meanwhile the cost of emergency fire suppression and damages in areas managed by Cal Fire continues to skyrocket year after year.

The current system of “build first, deal with the consequences later,” endangers the lives and well-being of all Californians and is financially unsustainable. CalFire has identified high severity fire zones to inform smart land-use planning. Developers should not have an avenue to dismiss these findings. AB 3150 would take the state farther in the wrong direction by allowing developers to avoid taking basic precautions designed to reduce property damage and the spread of wildfires.

II. AB 3150 gives developers an avenue to avoid wildfire risk reduction strategies.

This bill would allow builders to avoid home hardening and defensible space requirements by petitioning to “de-designate” areas that were previously designated as very high fire hazard severity zones. As the Assembly Natural Resource Bill Analysis notes on page 6, home hardening can reduce but not eliminate the risk of wildfire destroying a home. The bill analysis cites an analysis showing that 51% of the 350 single-family homes built after 2008 in the path of the Camp Fire were undamaged. By contrast, only 18% of the 12,100 homes built prior to 2008 escaped damage.

While retrofitting does not eliminate the risk of wildfire damage to homes, retrofitting existing homes is still a wise strategy to reduce a community's risk of ignition and/or improve the chances of structure survival in fires (Syphard et al., 2014, 2017). There are several strategies that reduce risk, like installing ember-resistant vents, fire-resistant roofs, and irrigated defensible space immediately adjacent to structures. Irrigated defensible space within five to 60 feet immediately adjacent to structures helps improve chances of structure survival (Knapp et al., 2021; Syphard et al., 2014) and external sprinklers with an independent water source can reduce flammability of structures (California Chaparral Institute, 2018). Although external sprinklers are not currently required by law, water-protected structures are much less likely to burn compared to dry structures. Similarly, local solar power paired with batteries could reduce power flow (and therefore reduce extreme temperatures) in electricity lines, which would reduce the need for power outages during extreme weather conditions and provide power for communities when outages are necessary (Lee, 2019). Michael Wara argues that solar power and batteries for homes and "microgrids" linking business districts would help make communities in high fire risk areas safer because it would provide backup power for medical devices, refrigerators, and the internet to run while allowing the main power grid to get shut down (Wara, 2018). Home hardening combined with microgrids are important tools to minimize fire risk. To be clear: home hardening is an important tool to minimize the chances of human ignitions and fire spread for homes that already exist in fire zones, but it does not make new development fireproof, nor does it militate in favor of further large-scale development in fire zones.

The fundamental problem with this bill is that it gives developers an avenue to avoid home hardening and other fire-risk reduction strategies for new development. This "head-in-the-sand" approach not only makes new development even less safe, but also jeopardizes existing communities and increases their risk.

III. AB 3150 wrongly assumes that more housing in fire-prone areas is needed.

The bill perpetuates the fiction that more large-scale development in fire-zones is safe and necessary in "meeting the demand for 'housing for all.'" In reality, there are many actual solutions to the affordable housing crisis that do not involve endangering people's lives and building in hazardous areas, or building with even less safeguards than are currently required (as the bill proposes). These solutions include (1) permanently protecting all existing affordable housing; (2) solidifying legally-binding anti-displacement policies; (3) regulating short-term rentals to reduce the conversion of residential units to de-facto hotels; (4) upzoning urban infill areas; and (5) eliminating in-lieu fees for developers to ensure affordable housing is built onsite.

IV. AB 3150 will lead to further development in fire-prone areas without public decision-making processes, environmental review or appropriate mitigation.

AB 3150 would result in the approval of development in fire-prone areas without the procedural and substantive safeguards of the California Environmental Quality Act (CEQA). Recent laws such as SB 423 (Wiener) and AB 1633 (Ting) were designed to generally not apply to projects within very high fire hazard severity zones. AB 3150 would disrupt that balance and provide developers with a path to de-designate the areas they want to develop as very high fire hazard severity zones to streamline development and in some cases avoid the public decision-making process required by CEQA.

CEQA review is a critical component of wise land use planning. CEQA allows cities and counties to closely consider and disclose the risks of development (particularly in hazard zones) to the community, and implement mitigation strategies to reduce the risks to existing communities and the environment. AB 3150 may result in the hasty approval of risky new large-scale developments in fire-prone areas that will put people in harm's way, increase fire suppression costs, and damage ecosystems. Over the last few years, multiple courts have found that developers and cities or counties failed to adopt adequate safeguards as required by CEQA for new large-scale developments in fire-prone areas. The issue has become so pervasive that the Attorney General's office has intervened in multiple cases challenging local decisions that allowed development in fire-prone areas³, and issued guidance in 2022 on analyzing and mitigating wildfire impacts under CEQA.⁴ If this bill advances, an unknown number of projects that previously would have received review and public accountability under CEQA would be able to evade such review and accountability.

V. AB 3150 improperly excludes the State Board of Forestry and Fire Protection from decision-making regarding fire safety standards.

The California Building Industry Association frames AB 3150 as a “good government” measure. In reality, the bill would remove much of the State Board of Forestry and Fire Protection's regulatory authority over fire safety standards and very high fire hazard severity zones, and transfer it to the State Fire Marshal. Members of the State Board of Forestry and Fire Protection are appointed by the Governor and in that way are accountable to the Governor and the electorate. We are unaware of any similar accountability measure for the State Fire Marshal. More importantly, supporters of the bill offer no justification for drastically limiting the State Board of Forestry and Fire Protection's regulatory authority and transferring it to another governmental department.

VI. Conclusion

AB 3150 is an unwise and extremely dangerous bill. It neglects critical scientific knowledge that identifies poorly-planned development in high fire zones as the primary cause of

³ See e.g., Mary Callahan, “Citing inadequate wildfire plans, Lake County judge deals setback to Guenoc Valley resort development,” *Press Democrat* (Jan. 6, 2022), available at <https://www.pressdemocrat.com/article/news/lake-county-judge-rules-against-environmental-review-for-16000-acre-guenoc/>.

⁴ State of California, Office of the Attorney General, *Best Practices for Analyzing and Mitigating Wildfire Impacts of Development Projects Under the California Environmental Quality Act* available at <https://oag.ca.gov/system/files/attachments/press-docs/2022.10.10%20-%20Wildfire%20Guidance.pdf>.

recent destructive wildfires while ignoring the fact that climate change will worsen fire conditions. The bill perpetuates the myth that California can safely continue to build deeper into fire-zones despite the overwhelming health and financial harms recent wildfires have caused to people and communities. The continued construction of new large-scale development in high fire hazard zones without the necessary precautions to minimize ignition risk is incompatible with a safe and climate-resilient future. We are also facing an insurance crisis due in part to unsafe development practices and ignoring the risks of building in high fire-prone areas. California is still stumbling to find its footing after recent wildfires. This bill would make a bad situation worse.

We respectfully oppose AB 3150.

Sincerely,

J.P. Rose
Policy Director, Urban Wildlands
Center for Biological Diversity

References Cited

- Alexandre, P. M., Stewart, S. I., Keuler, N. S., Clayton, M. K., Mockrin, M. H., Bar-Massada, A., Syphard, A. D., & Radeloff, V. C. (2016). Factors related to building loss due to wildfires in the conterminous United States. *Ecological Applications*, 26(7), 2323–2338.
- Alexandre, P. M., Stewart, S. I., Mockrin, M. H., Keuler, N. S., Syphard, A. D., Bar-Massada, A., Clayton, M. K., & Radeloff, V. C. (2016). The relative impacts of vegetation, topography and spatial arrangement on building loss to wildfires in case studies of California and Colorado. *Landscape Ecology*, 31(2), 415–430.
- Ashton, A., Lillis, R., & Ramirez, W. (2018, August). 249 nights away at California fires: Firefighter families cope with a ‘new normal.’ *The Sacramento Bee*.

- Balch, J. K., Bradley, B. A., Abatzoglou, J. T., Nagy, R. C., Fusco, E. J., & Mahood, A. L. (2017). Human-started wildfires expand the fire niche across the United States. *Proceedings of the National Academy of Sciences*, *114*(11), 2946–2951.
- Benson, J. F., Mahoney, P. J., Vickers, T. W., Sikich, J. A., Beier, P., Riley, S. P. D., Ernest, H. B., & Boyce, W. M. (2019). Extinction vortex dynamics of top predators isolated by urbanization. *Ecological Applications*, *29*(3), e01868–e01868.
- Bistinas, I., Oom, D., Sá, A. C. L., Harrison, S. P., Prentice, I. C., & Pereira, J. M. C. (2013). Relationships between human population density and burned area at continental and global scales. *PLoS ONE*, *8*(12), 1–12.
- Blakey, R. V., Sikich, J. A., Blumstein, D. T., & Riley, S. P. D. (2022). Mountain lions avoid burned areas and increase risky behavior after wildfire in a fragmented urban landscape. *Current Biology*, *32*(21), 4762-4768.e5.
- Bransford, S., Medina, J., & Del Real, J. A. (2018, July). Firefighters Reflect on a Job Now ‘Twice as Violent’. *The New York Times*.
- California Chaparral Institute. (2018). *Independent external sprinklers to protect your home during a wildfire*.
- Callahan, M., Rossmann, R., & Schmitt, W. (2019, October 9). Winds pick up as PG&E shutoff enters second day. *Press Democrat*.
- CARB. (2021). *Camp Fire Air Quality Data Analysis*.
- Cart, J. (2022, June 13). Trial by fire: The trauma of fighting California’s wildfires. *Cal Matters*. <https://calmatters.org/series/california-firefighters-trauma-wildfires/>
- CBS San Francisco. (2019, October 9). Power Outage Results In Multiple Crashes , Injuries At Santa Rosa Intersections. *CBS San Francisco*.
- Chabria, A., & Luna, T. (2019). PG&E power outages bring darkness , stress and debt to California’s poor and elderly. *Los Angeles Times*.
- Del Real, J. A., & Kang, I. (2018, July). California Today: The Increasing Strain on State Firefighters. *The New York Times*. <https://www.nytimes.com/2018/07/30/us/california-today-firefighters.html>
- Delfino, R. J., Brummel, S., Wu, J., Stern, H., Ostro, B., Lipsett, M., Winer, A., Street, D. H., Zhang, L., Tjoa, T., & Gillen, D. L. (2009). The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003. *Occupational and Environmental Medicine*, *66*(3), 189–197.
- Fry, H., Dolan, M., Luna, T., & Serna, J. (2019, October 10). Gov. Newsom slams PG&E over ‘unacceptable’ power outages and failure to fix systems. *Los Angeles Times*.
- Fry, H., Miller, L., Ormseth, M., & Serna, J. (2019, October 11). Saddleridge fire explodes to 4 , 700 acres , burns 25 homes in San Fernando Valley. *Los Angeles Times*.
- Governor Newsom’s Strike Force. (2019). *Wildfires and Climate Change: California’s Energy Future*.
- Greene, D. (2018, August). California Firefighters Battle Exhaustion. *National Public Radio*. <https://www.npr.org/2018/08/08/636603563/california-firefighters-battle-exhaustion>
- Gustafson, K. D., Gagne, R. B., Buchalski, M. R., Vickers, T. W., Riley, S. P. D., Sikich, J. A., Rudd, J. L., Dellinger, J. A., LaCava, M. E. F., & Ernest, H. B. (2021). Multi-population

- puma connectivity could restore genomic diversity to at-risk coastal populations in California. *Evolutionary Applications*.
- Gutierrez, M. (2018, July). California blazes tax budgets, firefighters: ‘Fatigue is starting to set in’. *SFChronicle*. <https://www.sfchronicle.com/california-wildfires/article/California-blazes-tax-budgets-firefighters-13121282.php>
- Gutierrez, M., & Cassidy, M. (2018, August 11). As California burns, volunteer firefighters become harder to find. *SFChronicle*.
- Hernández, L., Gafni, M., & Bauman, A. (2019). Moraga blaze 100% contained. *San Francisco Chronicle*.
- Hwang, J., Chong, N.-S., Zhang, M., Agnew, R. J., Xu, C., Li, Z., & Xu, X. (2023). Face-to-face with scorching wildfire: Potential toxicant exposure and the health risks of smoke for wildland firefighters at the wildland-urban interface. *The Lancet Regional Health - Americas*, 21, 100482.
- Jennings, M. (2018). *Effects of Wildfire on Wildlife and Connectivity*.
- Johnson, J., & Lam. (2023, August 29). California’s wildland firefighters are being poisoned by smoke. And we’re doing little to protect them. *San Francisco Chronicle*. <https://www.sfchronicle.com/projects/2023/firefighter-health/>
- Keeley, J. E. (2005). Fire as a threat to biodiversity in fire-type shrublands. In *Planning for biodiversity: Bringing research and management together. USDA Forest Service General Technical Report PSW-GTR-195*.
- Keeley, J. E. (2006). Fire management impacts on invasive plants in the western United States. *Conservation Biology*, 20(2), 375–384. <https://doi.org/10.1111/j.1523-1739.2006.00339.x>
- Keeley, J. E., & Fotheringham, C. J. (2001). Historic fire regime in southern California shrublands. *Conservation Biology*, 15(6), 1536–1548.
- Keeley, J. E., & Fotheringham, C. J. (2003). Impact of Past Present and Future Fire Regimes on North American Mediterranean Shrublands. In *Fire and climatic change in temperate ecosystems of the Western Americas* (pp. 218–262).
- Keeley, J. E., Fotheringham, C. J., & Morais, M. (1999). Reexamining fire suppression impacts on brushland fire regimes. *Science*, 284(5421), 1829–1832.
- Keeley, J. E., & Syphard, A. D. (2018). Historical patterns of wildfire ignition sources in California ecosystems. *International Journal of Wildland Fire*, 27(12), 781.
- Knapp, E. E., Valachovic, Y. S., Quarles, S. L., & Johnson, N. G. (2021). Housing arrangement and vegetation factors associated with single-family home survival in the 2018 Camp Fire, California. *Fire Ecology*, 17.
- Krishnakumar, P., Welsh, B., & Murphy, R. (2019, October 9). Where SoCal Edison may shut off power in California. *Los Angeles Times*.
- Künzli, N., Avol, E., Wu, J., Gauderman, W. J., Rappaport, E., Millstein, J., Bennion, J., McConnell, R., Gilliland, F. D., Berhane, K., Lurmann, F., Winer, A., & Peters, J. M. (2006). Health effects of the 2003 Southern California wildfires on children. *American Journal of Respiratory and Critical Care Medicine*, 174, 1221–1228.
- Lee, A. (2019, February 13). My turn: Here’s how rooftop solar can combat wildfires. *CAL Matters*.

- Liu, J. C., Pereira, G., Uhl, S. A., Bravo, M. A., & Bell, M. L. (2015). A systematic review of the physical health impacts from non- occupational exposure to wildfire smoke. *Environmental Research*, *136*, 120–132. <https://doi.org/10.1016/j.envres.2014.10.015>.A
- Phuleria, H. C., Fine, P. M., Zhu, Y., & Sioutas, C. (2005). Air quality impacts of the October 2003 Southern California wildfires. *Journal of Geophysical Research*, *110*. <https://doi.org/10.1029/2004JD004626>
- Radeloff, V. C., Helmers, D. P., Kramer, H. A., Mockrin, M. H., Alexandre, P. M., Bar-Massada, A., Butsic, V., Hawbaker, T. J., Martinuzzi, S., Syphard, A. D., & Stewart, S. I. (2018). Rapid growth of the US wildland-urban interface raises wildfire risk. *Proceedings of the National Academy of Sciences*, *115*(13), 3314–3319.
- Rappold, A. G., Cascio, W. E., Kilaru, V. J., Stone, S. L., Neas, L. M., Devlin, R. B., & Diaz-Sanchez, D. (2012). Cardio-respiratory outcomes associated with exposure to wildfire smoke are modified by measures of community health. *Environmental Health: A Global Access Science Source*, *11*(71). <https://doi.org/10.1186/1476-069X-11-71>
- Reid, C. E., Brauer, M., Johnston, F. H., Jerrett, M., Balmes, J. R., & Elliott, C. T. (2016). Critical review of health impacts of wildfire smoke. *Environmental Health Perspectives*, *124*(9), 1334–1343.
- Safford, H. D., & Van de Water, K. M. (2014). Using Fire Return Interval Departure (FRID) analysis to map spatial and temporal changes in fire frequency on National Forest lands in California. *Pacific Southwest Research Station - Research Paper PSW-RP-266*, January, 1–59. <https://doi.org/Res.Pap.PSW-RP-266>
- Sahagun, L. (2020, November). Rescue operations underway in the San Gabriel Mountains for rare species marooned by wildfire. *Los Angeles Times*, 2020.
- Simon, S. (2018, August). Constant Wildfires Leave California Firefighters Strained. *National Public Radio*.
- Steel, Z. L., Koontz, M. J., & Safford, H. D. (2018). The changing landscape of wildfire: Burn pattern trends and implications for California’s yellow pine and mixed conifer forests. *Landscape Ecology*, *33*(7), 1159–1176.
- Syphard, A. D. (2020). *A Conversation About Fire Resiliency*. Sierra Club Redwood Chapter Presentation.
- Syphard, A. D., Brennan, T. J., & Keeley, J. E. (2014). The role of defensible space for residential structure protection during wildfires. *International Journal of Wildland Fire*, *23*(8), 1165–1175.
- Syphard, A. D., Brennan, T. J., & Keeley, J. E. (2017). The importance of building construction materials relative to other factors affecting structure survival during wildfire. *International Journal of Disaster Risk Reduction*, *21*, 140–147.
- Syphard, A. D., Brennan, T. J., & Keeley, J. E. (2018). Chaparral Landscape Conversion in Southern California. In *Valuing Chaparral* (pp. 323–346).
- Syphard, A. D., Keeley, J. E., Massada, A. Bar., Brennan, T. J., & Radeloff, V. C. (2012). Housing arrangement and location determine the likelihood of housing loss due to wildfire. *PLoS ONE*, *7*(3), e33954.

- Syphard, A. D., Radeloff, V. C., Hawbaker, T. J., & Stewart, S. I. (2009). Conservation threats due to human-caused increases in fire frequency in mediterranean-climate ecosystems. *Conservation Biology*, 23(3), 758–769.
- Syphard, A. D., Radeloff, V. C., Keeley, J. E., Hawbaker, T. J., Clayton, M. K., Stewart, S. I., Hammer, R. B., Syphard, A. D., Radeloff, V. C., Keeley, J. E., Hawbaker, T. J., Stewart, S. I., & Hammer, R. B. (2007). Human influence on California fire regimes. *Ecological Society of America*, 17(5), 1388–1402.
- Syphard, A. D., Rustigian-romsos, H., Mann, M., Conlisk, E., Moritz, M. A., & Ackerly, D. (2019). The relative influence of climate and housing development on current and projected future fire patterns and structure loss across three California landscapes. *Global Environmental Change*, 56, 41–55.
- Turco, M., Abatzoglou, J. T., Herrera, S., Zhuang, Y., Jerez, S., Lucas, D. D., AghaKouchak, A., & Cvijanovic, I. (2023). Anthropogenic climate change impacts exacerbate summer forest fires in California. *Proceedings of the National Academy of Sciences*, 120(25), e2213815120.
- Viswanathan, S., Eria, L., Diunugala, N., Johnson, J., & Mc Clean, C. (2006). An analysis of effects of San Diego wildfire on ambient air quality. *Journal of the Air and Waste Management Association*, 56(1), 56–67. <https://doi.org/10.1080/10473289.2006.10464439>
- Wang, D., Guan, D., Zhu, S., Kinnon, M. Mac, Geng, G., Zhang, Q., Zheng, H., Lei, T., Shao, S., Gong, P., & Davis, S. J. (2021). Economic footprint of California wildfires in 2018. *Nature Sustainability*, 4, 252–260.
- Wara, M. W. (2018, December 10). Op-Ed: There ’ s a quick way to help prevent wildfires: Shut off the power grid. *Los Angeles Times*.
- Weinhold, B. (2011). Fields and forests in flames: Vegetation smoke and human health. *Environmental Health Perspectives*, 119(9), A386–A393.
- Williams, J. N., Safford, H. D., Enstice, N., Steel, Z. L., & Paulson, A. K. (2023). High-severity burned area and proportion exceed historic conditions in Sierra Nevada, California, and adjacent ranges. *Ecosphere*, 14(1), e4397.
- Zhang, B., Weuve, J., Langa, K. M., D’Souza, J., Szpiro, A., Faul, J., Mendes De Leon, C., Gao, J., Kaufman, J. D., Sheppard, L., Lee, J., Kobayashi, L. C., Hirth, R., & Adar, S. D. (2023). Comparison of Particulate Air Pollution From Different Emission Sources and Incident Dementia in the US. *JAMA Internal Medicine*.
- Zhang, Z., Chen, L., Wang, X., Wang, C., Yang, Y., Li, H., Cai, M., & Lin, H. (2023). Associations of Air Pollution and Genetic Risk With Incident Dementia: A Prospective Cohort Study. *American Journal of Epidemiology*, 192(2), 182–194.