The Honorable Governor Gavin Newsom
State Capitol Building
Sacramento, CA 95814

Re: Saving Lives and Property from Wildfire January 11, 2019

Dear Governor Newsom,

Encouraged by the spirit of hope that your new administration brings to Sacramento, we urge you to take the lead in creating a new wildfire policy based on science rather than tradition.

Why? Because the traditional approach to wildfire protection is backward. It focuses on vegetation rather than what we want to protect – our homes and families.

Homes burn because they are flammable and are built on fire-prone landscapes. Most structures ignite during wildfires **because of flying embers** that can travel a mile or more from the fire front. This is why so many families have lost their homes even though they have complied with defensible space regulations – their homes were still vulnerable to embers. This is why communities far from wildland areas, like Coffey Park in Santa Rosa, have been destroyed during wildfire and why entire neighborhoods have burned to the ground while the trees around them have not (Fig.1). This is why fuel breaks, twelve-lane highways, and even large bodies of water fail to protect our homes during wind-driven wildfires.

However, there is hope. While wildfire is inevitable, the destruction of our communities is not.

Jack Cohen, a former lead fire scientist with the U.S. Forest Service, has demonstrated this through decades of research. To stop wildfire disasters in our communities we must accept some basic principles based on science, especially with climate change and increasing numbers of people living next to wildlands. First among them is that **the wildfire problem is a home ignition problem, not a wildfire control problem.**

Focusing on forests and dead trees far from our communities most at risk or habitat clearance projects that have little value during wind-driven fires will only guarantee more of the same – continued catastrophic losses.

To stop the destruction of our communities by wildfire we must focus on strategies that will work in our rapidly changing environment: **reduce the flammability of existing communities and prevent new ones from being built in very high fire hazard severity zones.**

Figure 1. Camp Fire, showing the devastation of homes in the Kilcrease Circle community of Paradise. Note the surrounding green, mature forest with little or no scorching. The homes were not burned by a high-intensity crown fire, but were ignited by embers, followed by home-to-home ignitions. Photo: Digital Globe, a Maxar company via Reuters, 11/17/2018.

With your leadership, we can break free from the traditional and nearly exclusive focus on habitat clearance and logging that fails to address why our communities are burning.

The current focus on forests and dead trees is especially misguided because the vast majority of lives and homes lost to wildfire in California had little to nothing to do with vegetation in forests (Fig. 2). And while it is reasonable to remove hazard trees immediately adjacent to roads and homes and to thin forests immediately around communities, thinning projects in the forest away from communities do nothing to protect houses and lives, while costing a fortune and often damaging forest ecosystems.

The traditional focus incorrectly sees nature only as “fuel.” Eliminate the “fuel,” the thinking goes, and we can control the fires. This misguided emphasis on fuel has become so powerful that some mistakenly view *all* of our forests, native shrublands, and even grasslands as “overgrown” tangles ready to ignite, instead of valuable natural resources.

This focus is failing us. We must look at the problem from the house outward, rather than from the wildland in. The state must take a larger role in regulating development to prevent local agencies from ignoring known wildfire risks as the city of Santa Rosa ignored with their approval of the Fountaingrove community in the 1990s (Fig. 3). The state should follow the lead of communities like Idyllwild and Big Bear and support retrofitting homes with proven safety features that reduce flammability – ember-resistant vents, fire-resistant roofing and siding, and exterior sprinklers – and focus vegetation management on the immediate 100 feet surrounding homes.

We must address the conditions that are the cause of so many lost lives and communities: wind-driven wildfires and the embers they produce that ignite flammable structures placed in harm's way. We have provided a list of recommendations below that will help us do so.

As we incorporate this new way of thinking into our wildfire response, we must also endeavor to implement the changes we seek. We have had difficulty doing so in the past as many of the recommendations made after previous fire storms have never been realized.

We urge you to break with the conventions that have led to the crisis and focus fire risk reduction efforts where it matters most – directly on our homes and communities, and *where* we build them. This will allow us to tailor fire policy to the needs of our families most at risk.

Sincerely,

Richard W. Halsey
Director
California Chaparral Institute
rwh@californiachaparral.org
760-822-0029

Doug Bevington
Forest Director
California Program
Leonardo DiCaprio Foundation
dbevington@ldcfoundation.org

Chad Hanson
Director
John Muir Project
Earth Island Institute
cthanson1@gmail.com
530-273-9290

Brian Nowicki
CA Climate Policy Director
Center for Biological Diversity
bnowicki@biologicaldiveristy.org

Kathryn Phillips
Director
Sierra Club California
kathryn.phillips@sierraclub.org

An online version of this letter with active links to the cited references is available at this web address: http://www.californiachaparral.com/bprotectingyourhome.html

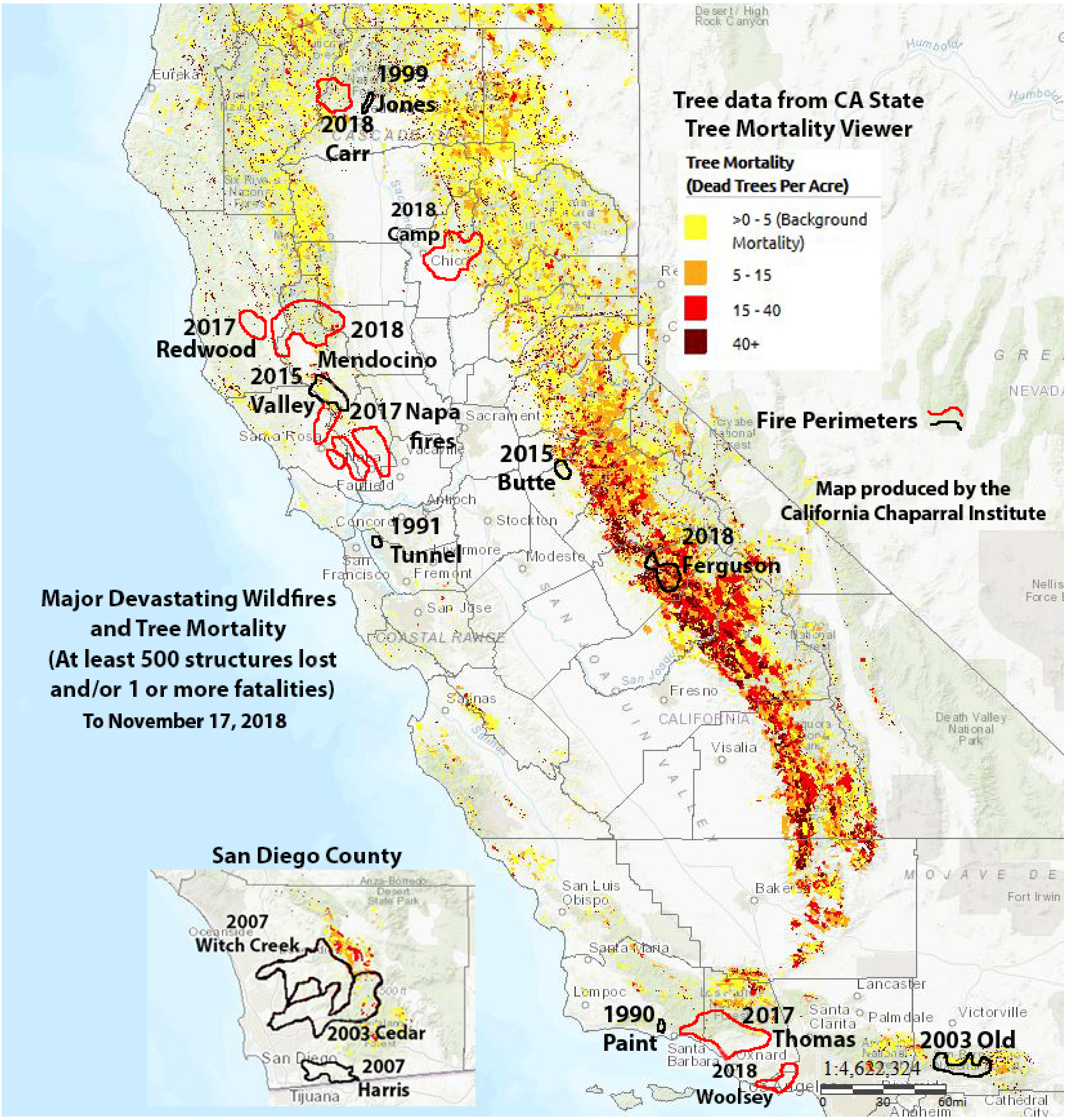


Figure 2. Overlay of California's most devastating wildfires with dead tree distribution. With the exception of the 2018 Ferguson Fire, concentrations of dead trees did not play a role in the state's most devasting wildfires as per [Cal Fire's official list](). In addition, the majority of California's most devasting wildfires have not involved forests.

12 Recommendations

1. Shift the focus to saving lives, property, and natural habitats rather than trying to control wildfires. These are two different goals with two radically different solutions. This new focus can help existing communities withstand wind-driven wildfires, and improve alerts and evacuation procedures and programs, instead of continually pouring resources into modifying a natural environment that continually grows back and will always be subject to wildfire (Moritz et al. 2014).

2. Quantify all the risks, statewide. Conduct a comprehensive examination of fire and debris flow hazards across the state. Require the use of fire hazard maps, post-fire debris flow maps, and local expertise to play a significant role in planning/development/zoning decisions. One of the primary objectives in land use planning should be to prevent developers and local planning departments from putting people in harm's way.

3. Start at the structure first when developing local plans to protect homes. Develop action plans in Community Wildfire Protection Plans (CWPPs), similar in scope and detail to those traditionally developed for vegetation treatments, that address the wildfire protection issue from the house outward, rather than from the wildland in. Require that Fire Safe Councils include structure and community retrofits as a significant portion of their activities. This approach has been endorsed by a strong consensus of fire scientists and **is illustrated well in this National Fire Protection Association video with Dr. Jack Cohen: (https://youtu.be/vL_syp1ZScM)**.

4. Encourage retrofits. Promote legislation on the state and local level to assist existing neighborhoods-at-risk in retrofitting homes with known safety features (e.g., *exterior* sprinklers, ember-resistant vents, replacing flammable roofing and siding with fire-resistant Class A material, etc.). Establish a tax rebate program, similar to the one used to promote the installation of solar panels, to encourage homeowners to install such fire safety features. Provide incentives to roofing companies to develop and provide *exterior* sprinkler systems for homes.

The effectiveness of exterior sprinklers was proved during the 2007 wind-driven Ham Lake fire in Cook County, Minn., where they had been installed on 188 properties. All of those properties survived; more than 100 neighboring properties didn't. Federal Emergency Management Agency (FEMA) hazard mitigation grants had covered the majority of the cost of the sprinklers.

5. Identify all flammability risks. Create and promote a fire safety checklist that encourages the complete evaluation of a home's vulnerability to wildfire. Beyond structure flammability, it is imperative that this list cover flammable conditions around the home, such as the presence of dangerous ornamental vegetation, under-eave wooden fences/yard debris, and flammable weeds.

6. Help with grants. Promote legislation on the state and local level to assist community Fire Safe Councils in acquiring FEMA pre-disaster grants to assist homeowners in retrofitting their homes to reduce their flammability.

7. Comprehensive evacuation plans. Promote the development of clear evacuation/response plans that all communities can understand. Promote programs that will dedicate a regular time each year for communities to practice their evacuation plans.

8. Incentives to prevent building in very high fire hazard zones. Beyond restricting development in very high fire/flood hazard areas, the state could also internalize the costs of fire protection so developers assume the responsibility for possible losses caused by future wildfires and post-fire debris flows. Creating incentives to reduce or prevent development in very high fire/flood hazard areas like the Fountaingrove area in Santa Rosa is an achievable goal (Fig. 3).

The City of Monrovia implemented another creative approach – creating a wider urban-wildland buffer by purchasing parcels in high fire hazard zones.

> *Because the city's hillside acreage was both publicly and privately owned, the City Council decided to seek voter approval for two measures. The first designated city-owned foothill land as wilderness or recreational space and limited development on the private property. The other was a $10-million bond, the revenues from which would be used to purchase building sites from willing sellers. Both passed by a wide margin. In the end, Monrovia spent $24 million for 1,416 acres, paying off the bonds with parcel taxes and gaining an added benefit: a deeper urban-wildland buffer. (Miller 2018)*

Figure 3. The devastation of the Fountaingrove II community in Santa Rosa during the 2017 Tubbs Fire was predictable. The city was warned this area was too dangerous to place homes. The area had burned in a wind-driven fire in 1964. In 2001, the city's planning division issued a report concluding the development did not properly follow the city's general plan's goals and policies (Regalia et al. 2001).

9. Science-based defensible space guidelines. Expand defensible space guidelines so treatment and distances are based on science and recognize the physical impact of bare ground on ember movement, increased flammability due to the spread of invasive weeds, and increased erosion and sediment movement in watersheds. The research has clearly indicated that defensible space distances beyond 100 feet can be counterproductive.

10. Peer-reviewed Vegetation Treatment Program. Require Cal Fire to submit its latest Vegetation Treatment Program Environmental Impact Report (EIR) to an outside, independent, science-based, peer-review process prior to its public release for public comment. Such a review was required by the state legislature for the 2012 version. Require Cal Fire to follow the recommendations offered by the independent review committee in both the EIR's supporting background information and proposed action plan.

11. Establish an interdisciplinary, statewide Fire Preparedness Task Force (FPTF) versed in Catastrophic Risk Management (CRM) to evaluate our response to wildfire hazard. CRM is successful because it helps managers in high-risk organizations make better decisions by reducing their tendency to "normalize deviance," engendering a focus on positive data about operations while ignoring contrary data or small signs of trouble. Airlines use CRM to objectively analyze plane crashes, thereby creating safer planes. Without CRM, small deviations from standard operating procedures are often tolerated until disasters, such as the Deepwater Horizon offshore oil platform blow out, the Challenger Space Shuttle explosion, or unprecedented losses caused by the 2017 wildfires expose an organization's failures. Ensure that a majority of task force members can speak freely, enabling them to offer creative solutions, and that half of the membership is outside the fire profession.

12. Reduce human-caused ignitions. Since nearly all of California's devasting wildfires are human-caused, significant resources should be dedicated to reducing such ignitions. One of the objectives of the **FPTF** should be to develop a statewide action plan, in collaboration with land management agencies, Cal Trans (since many ignitions occur along roads), Cal Fire, and public utilities (since many of the largest fires have been caused by electrical transmission lines and equipment), to reduce the potential for human-caused ignitions. The following should be considered: underground placement of electrical lines, replacement of uninsulated wire, placement of roadside barriers to reduce vehicle-caused sparks/ignition sources, closure of public lands during periods of extreme fire danger, and increasing the number of enforcement personnel to monitor illegal access, campfire, gun use, etc. on public lands.

Additional Information:

1. A thorough analysis of Cal Fire's Vegetation Management Program:
http://www.californiachaparral.com/threatstochaparral/helpcalfireeir.html

2. Detailed research and proven strategies on how to protect communities from wildfire:
http://www.californiachaparral.com/bprotectingyourhome.html

3. Successful grant programs that help communities retrofit structures to reduce flammability:
http://www.californiachaparral.com/fire/apleaitstheembers.html

4. Detailed analysis on assumptions concerning the 2017 Napa/Sonoma wildfires.
https://californiachaparralblog.wordpress.com/2018/01/17/how-we-think-about-nature-and-fire/

Resources:

Diane Vaughan (dv2146@columbia.edu)
Dept. of Sociology, Columbia University, specializing in how high-risk industries are prone to "normalizing deviance," whereby managers focus on positive data about their operations and tune out contrary data/signs of trouble until disasters necessitate a change in thinking (e.g. Deepwater Horizon offshore oil rig, Challenger Space Shuttle, 2018 wildfires)

Karlene Roberts (karlene@haas.berkeley.edu)
Center for Catastrophic Risk Management, UC Berkeley, specializing in the design and management of high reliability organizations.

Gregory L. Simon (gregory.simon@ucdenver.edu)
Dept. of Geography & Environmental Sciences, University of Colorado, Denver, specializing in human-environment relations, environmental policy and governance, and how the Wildland-Urban-Interface as a concept fails to reveal the forces behind its own creation.

Brian Fennessy
Fire Chief, Orange County Fire Authority, specializing in developing and managing quality municipal fire organizations.

Jack Cohen
Retired, Research Physical Scientist, Missoula Fire Sciences Lab, US Forest Service, specializing in how wildland-urban fire disasters occur and how homes ignite.

Max Moritz (mmoritz@ucsb.edu)
College of Natural Resources, UC Berkeley, specializing in understanding the dynamics of fire regimes at relatively broad scales and applying this research to ecosystem management.

Alexandra Syphard (asyphard@consbio.org)
Senior Research Scientist, Conservation Biology Institute, specializing in landscape change that results from the interplay between human and natural disturbances, especially wildfire, climate, and urban growth, and with extensive focus on understanding fire risk to communities.

Jon E. Keeley (jon_keeley@usgs.gov)
Senior Scientist, USGS, specializing in the ecological impacts of wildfires.

Carla D'Antonio (carla.dantonio@lifesci.ucsb.edu)
Professor, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, specializing in understanding controls over variation in plant community change and how the invasion of species affects ecosystem composition, structure, and functioning.

Marti Witter (Marti_Witter@nps.gov)
Fire ecologist for the National Park Service and central and southern California coordinator for the California Fire Science Consortium, specializing in chaparral fire response and fire plans.

A Primer on Wildland Fire in California

1. Fuel treatments are often ineffective in stopping wind-driven fires and can create more flammable conditions by type-converting native chaparral shrublands to highly-flammable, non-native weedy grasslands.

There are dozens of anecdotal stories about fires stopping at previous fire scars. There is no doubt that happens. However, when assessing the use of scarce resources, government agencies must consider the cost/benefit of every action to ensure they are not spending money on efforts that are less effective than others.

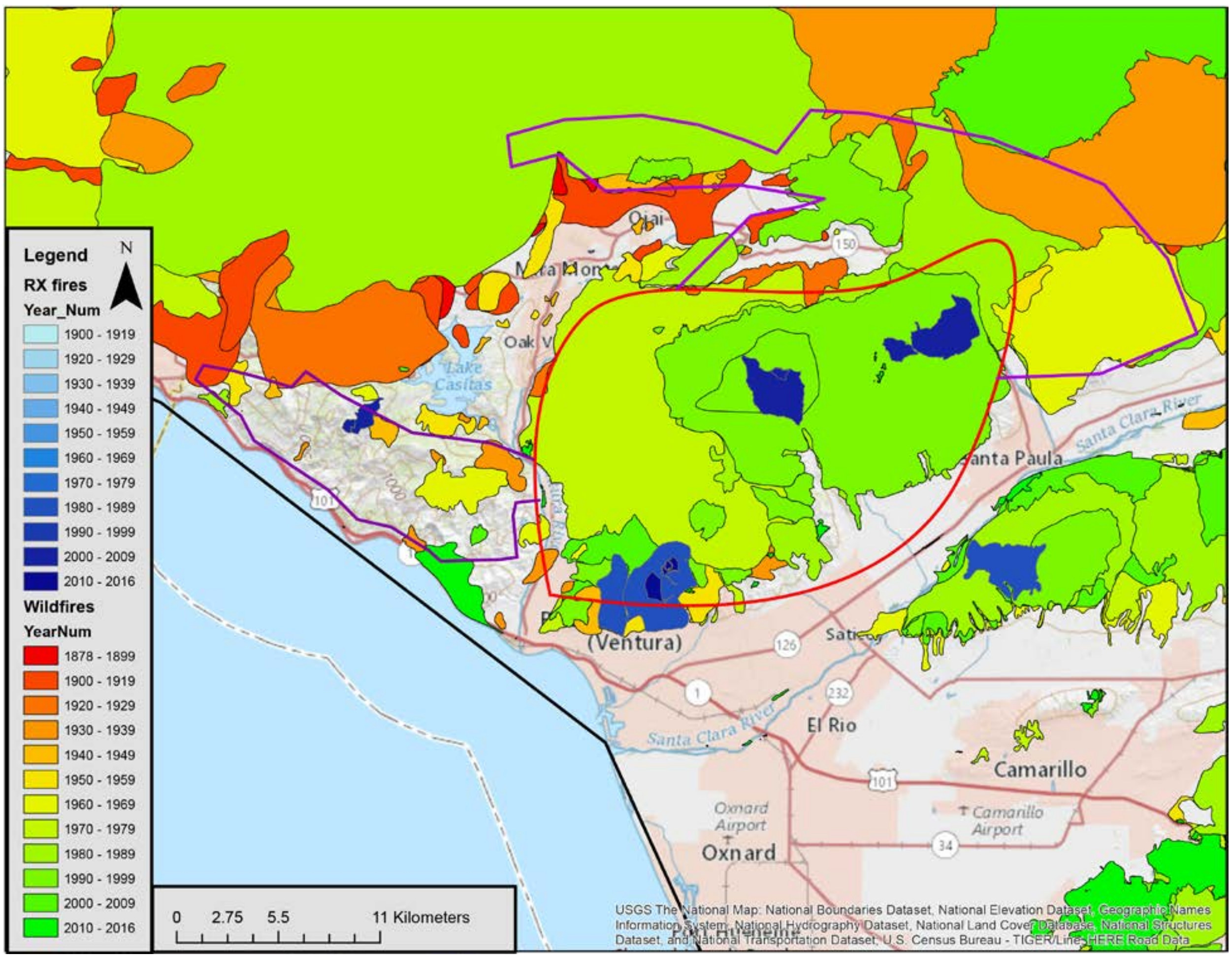


Figure 4. Prescribed Burns Within the Thomas Fire. The blue polygons show recent prescribed burns conducted by the Ventura County Fire Department. The red outline shows the rough perimeter of the 2017 Thomas Fire during its first hours. Source: USGS.

As evidenced in Fig. 4, recent prescribed burn treatments (shown in blue) were not helpful in preventing the spread of the 2017 Thomas Fire.

The easternmost prescribed burn in Fig. 4 is off Salt Marsh Road, downwind of the probable origin of the Thomas Fire. The middle burn is in Aliso Canyon. Neither of these appear to have provided anchor points for fire suppression activities.

The burns near the southern edge of the fire, in Hall, Barlow, and Sexton Canyons, have existed for many years and were intended to create opportunities for controlling a fire; however, they did little to stem fire spread.

Initially, the head fire spread 14 miles from its origin outside of Santa Paula to downtown Ventura in about five hours, with spot fires ignited by embers along the entire way. This kind of fire behavior would likely defeat any fuel break.

Further research is needed to determine all the factors involved in the Thomas Fire's spread, but the consequences are clear from the damage assessment shown in Fig. 5 below. The prescribed burns did little to protect the community. This is especially the case for the southernmost prescribed burn just above the northern edge of Ventura.

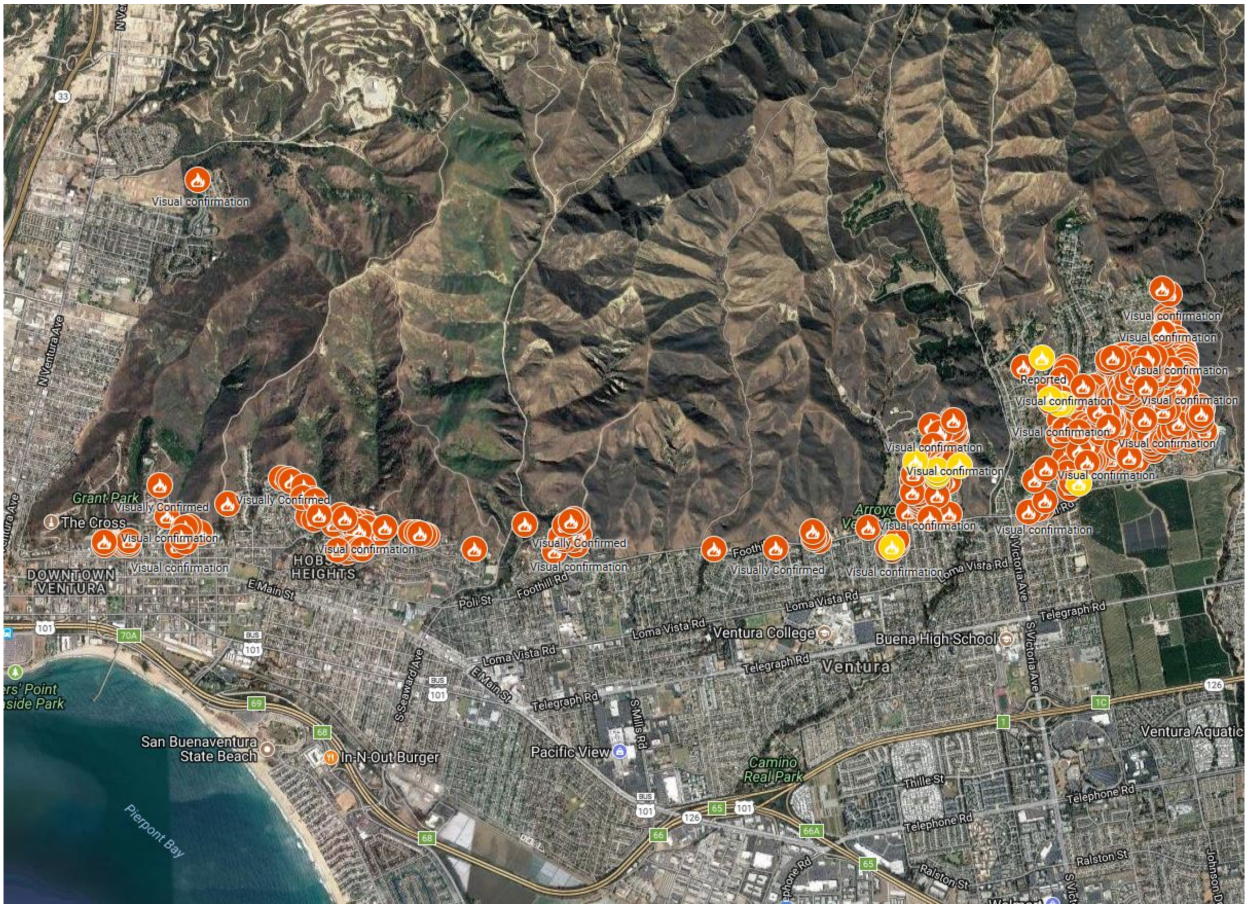
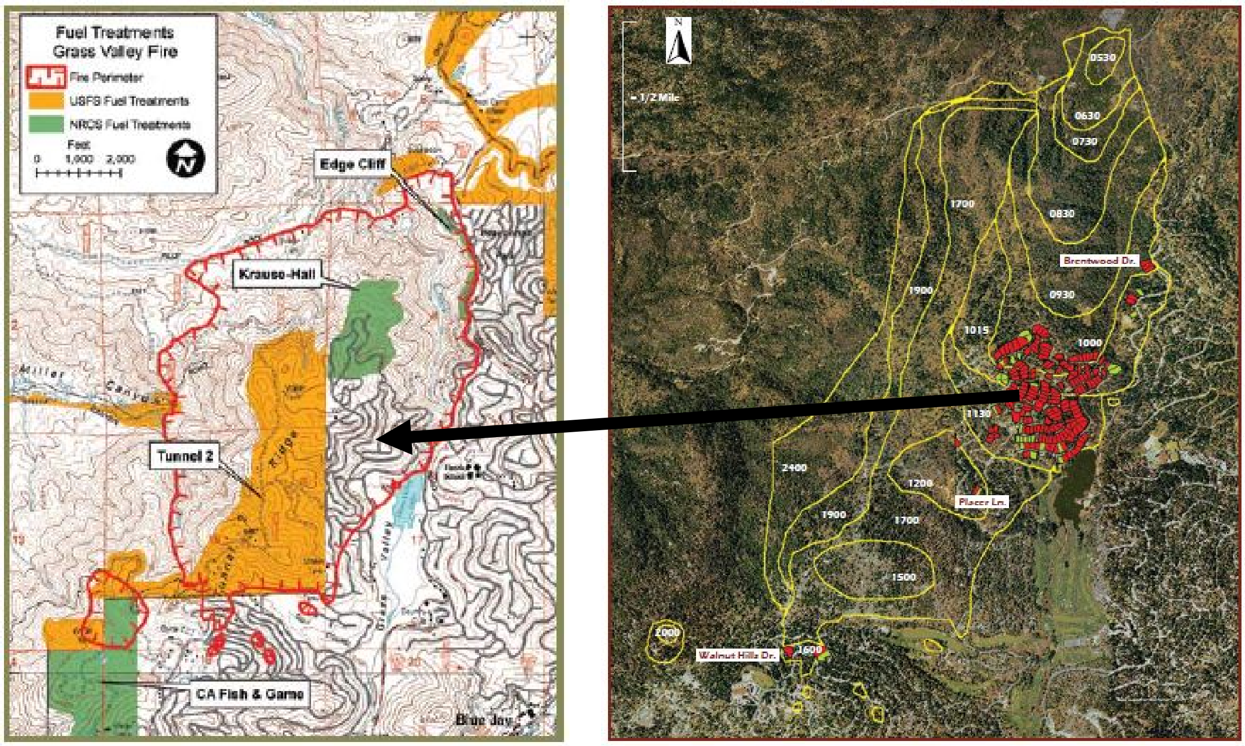


Figure 5. Home Losses from the Thomas Fire, Ventura. Burned homes are indicated by orange dots. A prescribed burn was conducted just above the burned homes in the center middle of the image. Based on visual confirmation as of 12/8/2017: https://www.google.com/maps/d/viewer?mid=10S-m7mBzbjvG1rjiJ8wFAlbeG-F5VoKS&ll=34.2989948363656%2C-119.20525410881879

In the 2007 Grass Valley Fire, the US Forest Service and the Natural Resource Conservation Service had created several fuel treatments in the forest (e.g., thinning trees, clearing understory shrubs) around the community of Lake Arrowhead (Fig. 6). Reportedly, the fuel treatments performed as expected by allowing firefighters to engage the fire directly and reducing the rate of spread and intensity (Rogers et al. 2008). However, the end result for the community was much less positive: <u>174 homes were lost</u>, the majority of structures in the hillside neighborhood of about 90 acres (Fig. 7).



Figures 6 and 7. The 2007 Grass Valley Fire, Lake Arrowhead, California. Map on the left shows forest fuel treatments as orange and green polygons (Rogers et al. 2008). Map on the right shows location of 174 homes burned in the fire (Cohen and Stratton 2008).

The comprehensive analysis of the Grass Valley Fire by US Forest Service scientists (Cohen and Stratton 2008) concluded that,

> Our post-burn examination revealed that most of the destroyed homes had green or unconsumed vegetation bordering the area of destruction. Often the area of home destruction involved more than one house. This indicates that <u>home ignitions did not result from high intensity fire spread through vegetation that engulfed homes</u>. The home ignitions primarily occurred within the HIZ (*Home Ignition Zone*) due to surface fire contacting the home, firebrands accumulating on the home, or an adjacent burning structure.

Home ignitions due to the wildfire were primarily from firebrands igniting homes directly and producing spot fires across roads in vegetation that could subsequently spread to homes.

The 2013 Silver Fire near Banning, California (Fig. 8) challenged the fundamental assumption of that treating older vegetation is an effective way to prevent devastating wildfires. Most of the fire burned through invasive weeds and young, desert chaparral that was recovering from the deadly 2006 Esperanza Fire that killed five US Forest Service firefighters. **Twenty-six homes were lost in the 2013 fire that was fueled by seven-year-old vegetation.**

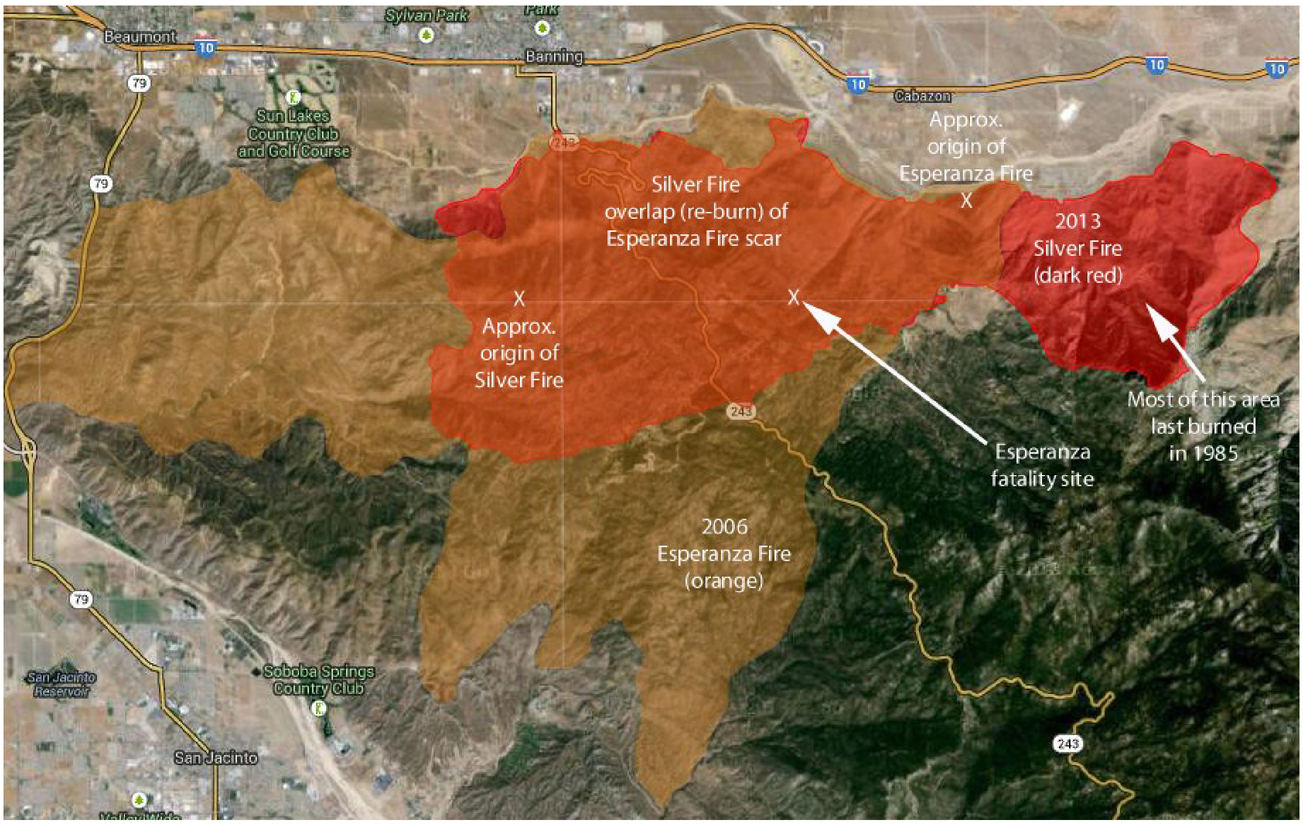


Figure 8. Reburned After Seven Years. The 2013 Silver Fire reburned almost entirely within the deadly 2006 Esperanza Fire scar near Banning, California.

The 2018 Camp Fire that devastated the town of Paradise provides another example of how younger fuels typically fail to stop fire spread or assist fire suppression efforts during wind-driven wildfires. Before reaching Paradise, the Camp Fire had to burn through more than 30,000 acres that had burned ten years before during the 2008 Butte Fire (Fig. 9). In addition, much of the area burned in 2008 had been salvaged logged, a strategy that many have incorrectly claimed is necessary to reduce fire risk. Again, the primary reason for the devastation was wind-driven embers that can travel a mile or more ahead of the fire front.

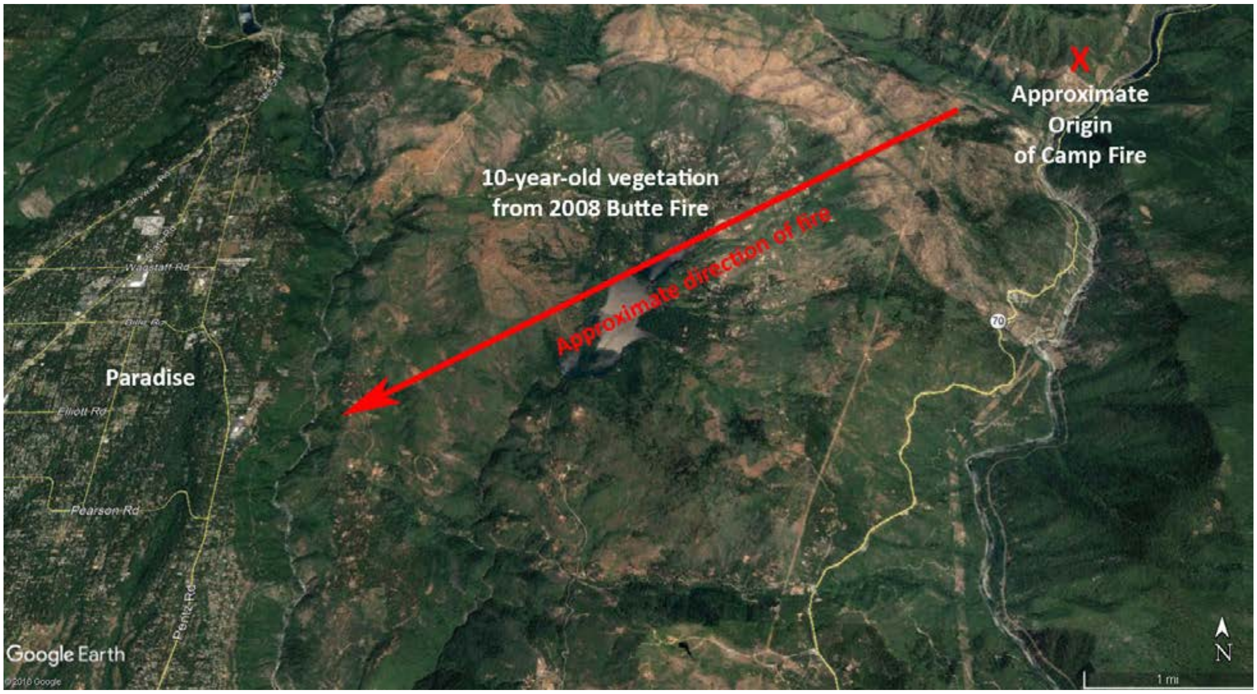


Figure 9. The wind-driven 2018 Camp Fire had to move through approximately seven miles of 10-year-old fuels plus fuel management zones before igniting Paradise with a rain of embers.

There are numerous other examples and a number of solid research papers explaining why and how homes burn. Cohen and Stratton (2008) summarized their study of multiple wildfires by writing:

> These incidents remind us to focus attention on the principal factors that contribute to a wildland-urban fire disaster—the home ignition zone.

We are not arguing whether fuel modification can be a tool that can help control non-wind-driven wildfires. Under non-extreme fire weather conditions, fuel treatments can assist fire suppression efforts. But again, these are not the fires that cause the most damage to our communities. The nearly exclusive financial and time focus on fuel modification is failing us. How else can we account for the loss of so many lives and homes in the 2017 and 2018 wildfires?

2. Exterior Sprinklers

Exterior sprinklers have been proven to play a significant role in reducing home loss during wildfires (Mitchell 2005) (Fig. 10).

Exterior sprinklers, coupled with an independent water supply (swimming pool or water tank) and an independent power source should be required for all homes within very high fire hazard zones. Clusters of homes could be served by a community water tank and should be a required retrofit for communities already built in fire-prone areas. Each house should also be required to maintain a gas-powered pump to support the sprinkler system when regional power systems fail.

Figure 10. Exterior Sprinklers. As a wildfire approaches, exterior sprinklers wet the structure at risk, the surrounding environment, and increase humidity to prevent ignition. Photo: Platypus Fire Pty Ltd.

Some California residents have retrofitted their homes with exterior sprinkler systems to protective effect. For example, under-eave misters on the Conniry/Beasley home played a critical role in allowing the structure to survive the 2003 Cedar Fire in San Diego County. The home was located in a canyon where many homes and lives were lost (Halsey 2008).

The effectiveness of exterior fire sprinklers was proven during the 2007 wind-driven Ham Lake Fire in Cook County, Minnesota. In 2001, exterior sprinklers had been installed on 188 properties, including homes and a number of resorts. **All 188 properties survived.** More than 100 neighboring properties were destroyed.

The cost of the Cook County program was covered by a FEMA hazard mitigation grant. The program was finished on time and on budget by Wildfire Protection Systems (WPS), costing $764,255. Minnesota U.S. Senator Amy Klobuchar credited the program with saving over $42 million in property value. The grant paid 75% of the cost of the sprinklers. Individual property owners covered the balance.

The sprinklers were so successful that a $3 million FEMA pre-disaster mitigation grant was awarded in 2008 to install additional wildfire sprinkler systems throughout Cook County. In 2013, another grant was awarded to install the systems in two additional counties, including properties with low-water resources. FEMA pre-disaster grants have also been used in Big Bear and Idyllwild, California to retrofit homes with non-flammable roofing and ember-resistant attic vents.

Canadians have successfully utilized exterior sprinklers too, with the implementation of portable sprinkler kits placed in the path of wildfires. The kits can tap into nearby water sources, pools, or local water tanks. These kits have protected over $2 billion in property value over the past 20 years in Canada, according to Morris Douglas, a retired advisor to various Ministries of Natural Resources.

Exterior sprinklers work by creating an environment that extinguishes embers (spotting firebrands) that are the primary cause of building ignition. The sprinklers do this by 1) **hydrating potential fuels**, thus making them less susceptible to ignition, 2) **increasing humidity**, and 3) **creating a cooler microclimate** around the home.

3. FEMA Pre-disaster Grants

Mountain communities can use federal grants to install ember-resistant vents and eliminate wood roofs, vital to reducing home loss during wildfires

In 2013, David Yegge, a fire official with the Big Bear Fire Department, submitted his fourth grant proposal to the FEMA pre-disaster mitigation grant program to pay up to 70% of the cost of re-roofing homes with fire-safe materials in the Big Bear area of San Bernardino County. Yegge also has assisted Idyllwild and Lake Tahoe in applying for grants, including the costs of installing ember-resistant attic vents.

Yegge’s first $1.3 million grant in 2008 retrofitted all but 67 of 525 wooden-roofed homes needing retrofits in Big Bear Lake. A forward-thinking, “no-shake-roof” ordinance passed by the Big Bear City Council in 2008 required roofing retrofits for all homes by this year. San Bernardino County passed a similar ordinance in 2009 for all mountain communities, with compliance required by next year. Such “future effect clause” ordinances can be models for other local governments that have jurisdiction over high fire hazard areas.

To qualify for a FEMA grant, a cost/benefit analysis must be completed. “Our analysis indicated that $9.68 million would be saved in property loss for every $1 million awarded in grant funds,” Yegge said. “FEMA couldn’t believe the numbers until they saw the research conducted by then Cal Fire Assistant Chief Ethan Foote in the 1990s. There’s a 51% reduction in risk by removing wooden roofs.”

“The FEMA application process is challenging, but well worth it,” said Edwina Scott, Executive Director of the Idyllwild Mountain Communities Fire Safe Council. “More than 120 Idyllwild homes are now safer because of the re-roofing program.”

Additional Information

In California, the state agency that manages the grants is the Governor’s Office of Emergency Services (Cal OES), Hazard Mitigation Grants Division. Cal OES is the administrative agency and decides what grant proposals are funded based on priorities established by the State Hazard Mitigation Plan.

The Mountain Area Safety Taskforce re-roofing program:
http://www.thinisin.org/shake/

The San Bernardino County re-roofing ordinance:
http://www.thinisin.org/shake/images/DOWNLOADS/ORDINANCES/ord_4059.pdf

FEMA grant program:
http://www.fema.gov/pre-disaster-mitigation-grant-program

4. The Impact of Improper Vegetation Treatments/Clearance Activities

Creating large areas of clearance with little or no vegetation creates a **"bowling alley" for embers** (Fig. 11). Without the interference of thinned, lightly irrigated vegetation, the house becomes the perfect ember catcher. To make matters worse, when a fire front hits a bare fuel break or clearance area, a shower of embers is often released (Koo et al. 2012).

After investigating why homes burn in wildfires, research scientists Syphard et al. (2012) concluded, "We're finding that geography is most important – where is the house located and where are houses placed on the landscape."

Syphard and her coauthors gathered data on 700,000 addresses in the Santa Monica Mountains and part of San Diego County. They then mapped the structures that had burned in those areas between 2001 and 2010, a time of devastating wildfires in the region.

Figure 11. Three-hundred Feet of Clearance. Such bare ground can create a potential "bowling alley" effect, directing embers directly at the structure.

Buildings on steep slopes, in Santa Ana/sundowner wind corridors, and in low-density developments intermingled with wild lands had the highest probability of burning. **Nearby vegetation was not an important factor in home destruction.**

The authors also concluded that **the exotic grasses that often sprout in areas cleared of native habitat like chaparral could be more of a fire hazard than the shrubs.** "We ironically found that homes that were surrounded mostly by grass actually ended up burning more than homes with higher fuel volumes like shrubs," Syphard said.

5. Excessive Fuel Treatments Can Destroy Native Habitats and Create More Flammable Landscapes

As shown in Fig. 12 below, a rich, old-growth stand of chaparral has been systematically compromised by clearance activities funded by a local Fire Safe chapter in the community of Painted Cave, Santa Barbara County. The foreground represents the impact of mastication, showing significant soil disturbance. In the background, the longer-term impact of earlier treatments shows the invasion and spread of highly flammable, non-native weeds and grasses. This process has increased the ignitability of this area with the addition of flashy fuels. Since the focus of wildfire risk reduction has been on the surrounding landscape, comparably little has been done to reduce the flammability of the Painted Cave community itself. In a recently proposed Community Wildfire Protection Plan for the area, the only attempt to address home ignition is the suggested production of an educational brochure.

Figure 12. The invasion of non-native weeds resulting from significant soil disturbance caused by an improper vegetation treatment project above the community of Painted Cave, Santa Barbara County.

6. Native Chaparral Shrublands Are Threatened by Too Much Fire

Chaparral is California's most extensive native plant community. However, its continued existence in many areas is threatened by the increasing number of fires. Fire frequency greater than the chaparral's natural fire return interval of 30 to 150 years or more can type convert chaparral to highly-flammable, non-native grasslands (Fig. 13). Such grasslands played a significant role in spreading the 2017 Tubbs, Nuns, Atlas, and Thomas fires.

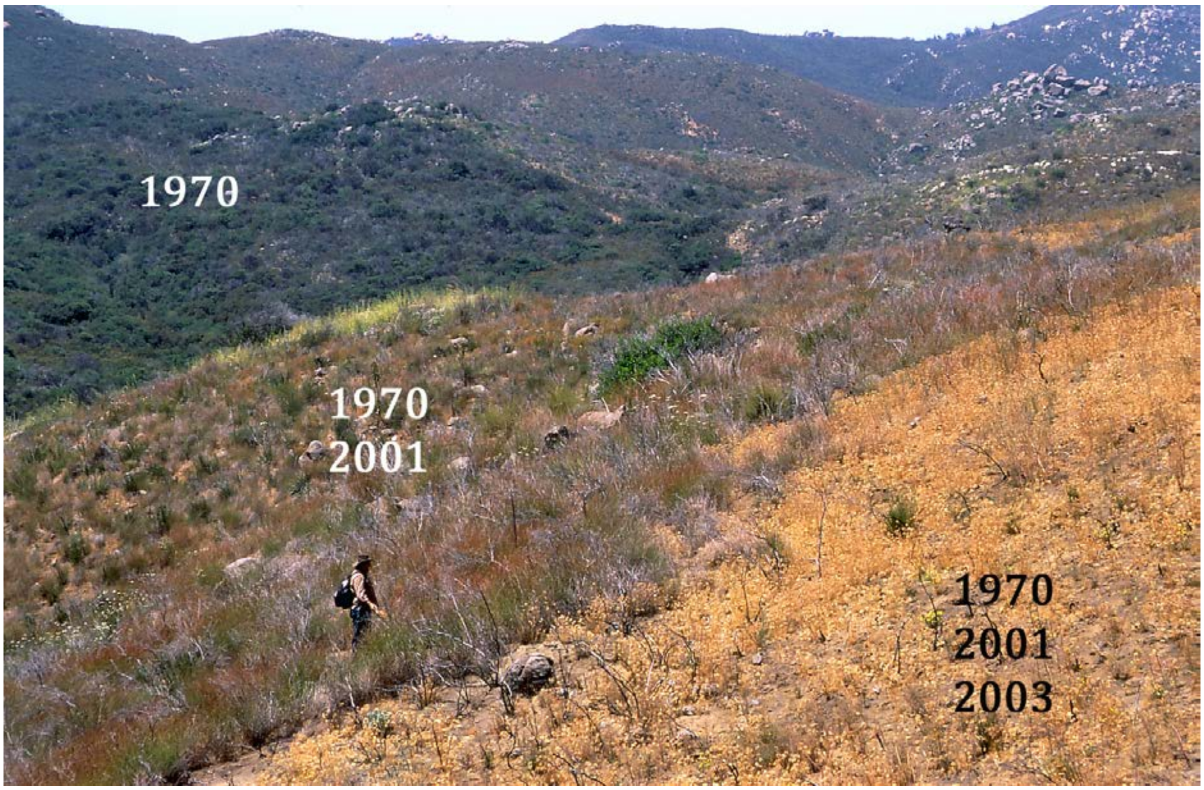


Figure 13. The Impact of Excessive Fire on Chaparral. This area has been subjected to three wildfires. The first, the 1970 Laguna Fire, burned the entire area shown in the photograph. The far left shows mature chaparral that has grown since 1970. The middle area is recovering after being burned again in the 2001 Viejas Fire. It is composed primarily of native shrubs such as chamise, deerweed, and several other species. To the right is a portion that was burned a third time during the 2003 Cedar Fire. The interval between the 2001 and 2003 fires was too short for the chaparral to properly recover. Consequently, the majority of the resprouting shrubs were killed and the area was overwhelmed by non-native grasses. Since this photo was taken (2004), the area has been restudied in 2018. It remains compromised by non-native grasses, with significant areas of bare ground and lower biodiversity compared to the adjacent area burned in 2001. Location: east of Alpine off Interstate 8, San Diego County. From Halsey and Syphard (2015).

The threat of excessive fire to native shrublands is statewide but is especially extreme in the southern portion (Fig. 14). As shown in the map below, most of the plant communities within the four national forests of southern California are threatened by too much fire (shown in red to yellow colors).

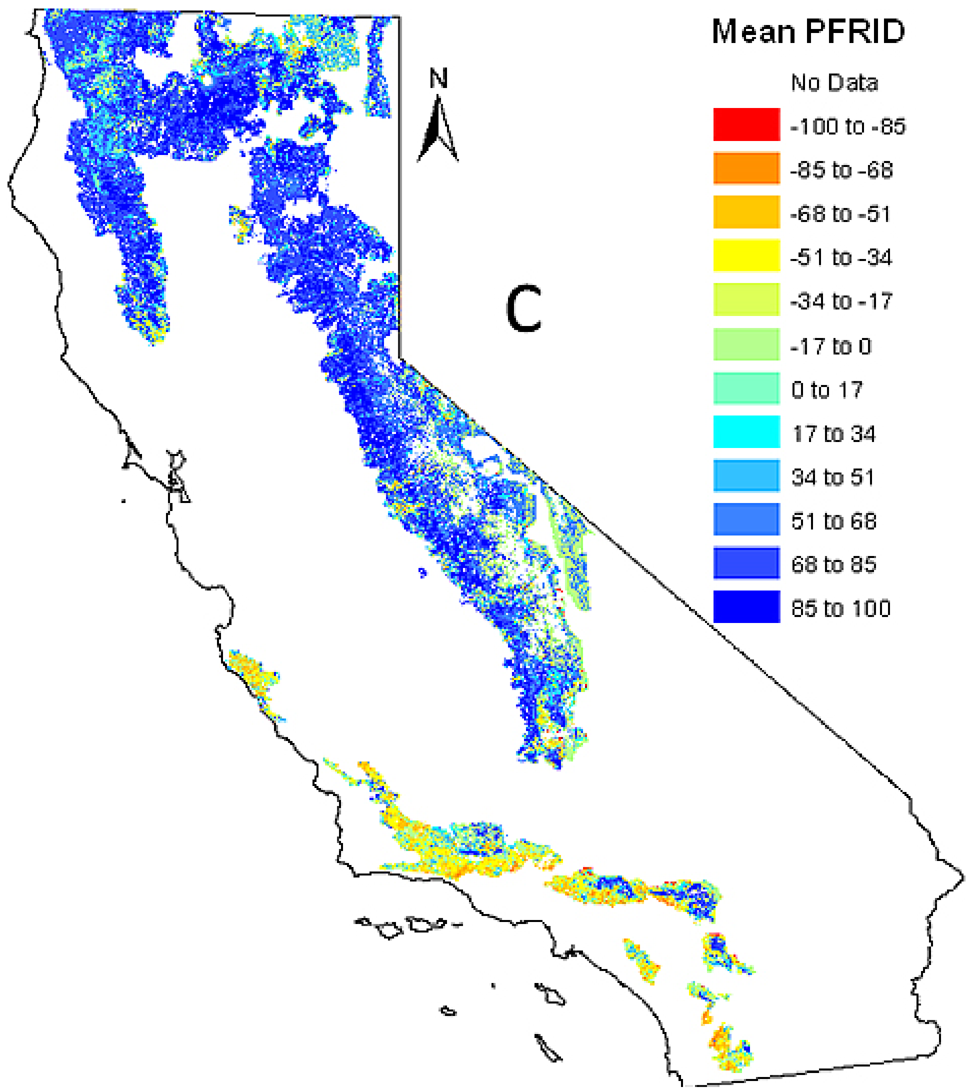


Figure 14. A Tale of Two Californias. Most chaparral in California is threatened by too much fire as shown by the map's color variations representing the Fire Return Interval Departure percentages (PFRID) for national forest lands in California. Note the color differences between the southern California national forests which are dominated by chaparral (yellows), and the conifer dominated forests in the Sierra Nevada (blues). The warm colors identify areas where the current fire return interval is shorter than pre-European settlement (negative PFRID), threatening native plant communities. Cool colors represent current fire return intervals that are longer than pre-European settlement (positive PFRID), indicating a fire deficit in higher elevation forests. From Safford and Van de Water (2014).

As climate change continues to impact California, it is predicted that the loss of chaparral will accelerate in the southern and central parts of the state. The ecosystem will also begin to lose ground further north (Fig. 15). Some regions may become more suitable for chaparral, but considering the speed at which the climate is changing, it is difficult to predict what vegetation communities will ultimately develop in those areas. Such changes need to be considered when developing fire and development plans. Unfortunately, the current draft of the California Board of Forestry's (and Cal Fire's) Vegetation Treatment Program fails to properly account for these predicted changes and calls for "treatment" of chaparral in northern California for "ecological purposes." Rather than "treating" chaparral, the Board of Forestry should develop strategies to protect its further loss.

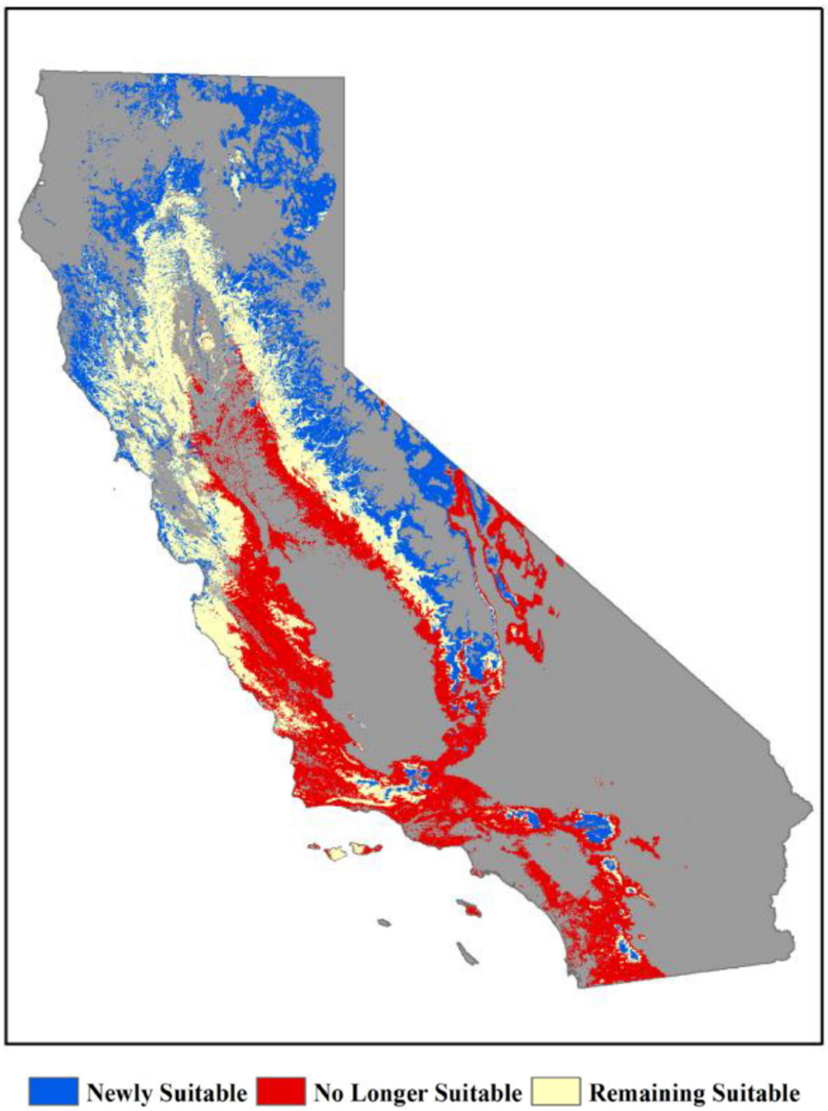


Figure 15. Potential Loss of Chaparral. Predicted end-of-century chaparral distribution change under a continued high carbon emissions and hot/dry climate change scenario. From Thorne et al. (2016).

The US Forest Service has recognized the natural resource value of chaparral (Fig. 16) and the important ecological services it provides us as well as the threat fire now poses to the system in their new Region 5 Ecological Restoration Leadership Intent (USFS 2015). The document can serve as a model for how California views chaparral as well, the state's most characteristic and extensive ecosystem.

Figure 16. Mixed chaparral in the Santa Monica Mountains. The natural fire return interval for chaparral is 30 to 150 years or more. Increasing fire frequencies either through prescribed burning or accidental wildfire leads to the eventual elimination of chaparral, California's most extensive ecosystem.

8. Common Misconceptions about Forests and Fire in California

Do "Thinning" Logging Operations Stop or Slow Wildland Fires? No. "Thinning" is just a euphemism for intensive commercial logging, which kills and removes most of the trees in a stand, including many mature and old-growth trees. With fewer trees, winds, and fire, can spread faster through the forest. In fact, extensive research shows that commercial logging, conducted under the guise of "thinning", not only makes wildland fires spread *faster*, but in most cases also *increases* fire intensity, in terms of the percentage of trees killed (Cruz et al. 2008, 2014).

Does Reducing Environmental Protections, and Increasing Logging, Curb Forest Fires? No, based on the largest analysis ever conducted, this approach increases fire intensity (Bradley et al. 2016). Logging reduces the cooling shade of the forest canopy, creating hotter and drier conditions, leaves behind kindling-like "slash" debris, and spreads combustible invasive weeds like cheatgrass.

Do "Thinning" Logging Operations Improve Forest Carbon Storage? No. In fact, this type of logging results in a large overall net *reduction* in forest carbon storage, and an *increase* in carbon emissions, relative to wildland fire alone (no logging), while protecting forests from logging maximizes carbon storage and removes more CO2 from the atmosphere (Campbell et al. 2012, Law et al. 2018). To mitigate climate change, we must protect our forests.

Do Large High-Intensity Fire Patches Destroy Wildlife Habitat or Prevent Forest Regeneration? No. Hundreds of peer-reviewed scientific studies find that patches of high-intensity fire create "snag forest habitat", which is comparable to old-growth forest in terms of native biodiversity and wildlife abundance (Fig. 17) (summarized in DellaSala and Hanson 2015). In fact, more plant, animal, and insect species in the forest are associated with this habitat type than any other (Swanson et al. 2014). Forests naturally regenerate in heterogeneous, ecologically beneficial ways in large high-intensity fire patches (DellaSala and Hanson 2015, Hanson 2018).

Figure 17. Trees killed in high-severity fire patches provide extremely important habitat for a wide array of plants and animals. Photo: Sierra Nevada post fire forest habitat by Chad Hanson.

Do Forests with More Dead Trees Burn More Intensely? Small-scale studies are mixed within 1-2 years after trees die, i.e., the "red phase" (Bond et al. 2009, Stephens et al. 2018), but the largest analysis, spanning the entire western U.S., found no effect (Hart et al. 2015). Later, after needles and twigs fall and quickly decay into soil, and after many snags have fallen, such areas have similar or *lower* fire intensity (Hart et al. 2015, Meigs et al. 2016).

Are Our Forests Unnaturally Dense and "Overstocked", and Do Denser Forests Necessarily Burn More Intensely? No. We currently have slightly more small trees than we had historically in California, but have fewer medium/large trees, and less overall biomass. Our forests are actually less dense, due to decades of logging (McIntyre et al. 2015). Historical forests were variable in density, with both open and very dense forests (Baker et al. 2018). Wildland fire is driven mostly by weather, while forest density is a "poor predictor" (Zald and Dunn 2018).

Do We Currently Have an Unnatural Excess of Fire in our Forests? No. The is a broad consensus among fire ecologists that we currently have far less fire in western US forests than we did historically, prior to fire suppression (Hanson et al. 2015). For example, currently, we have about 200,000 acres of fire in California's forests per year on average, and 500,000 to 900,000 in the very biggest years. Historically, before fire suppression, an average year would see 1-2 million acres in California's forests (Stephens et al. 2007, Baker 2017). We also have less high-intensity fire now (Stephens et al. 2007, Mallek et al. 2013, Baker et al. 2018).

Did the Rim Fire Emit Carbon Equal to Over 2 Million Cars? No. This is based on the false assumption that fire-killed trees are largely vaporized, and that no post-fire regrowth occurs to pull CO2 out of the atmosphere. Field studies of large fires find only about 11% of forest carbon is consumed, and only 3% of the carbon in trees (Campbell et al. 2007), and vigorous post-fire regrowth returns forests to carbon sinks within several years (Meigs et al. 2009).

Are Recent Large Fires Unprecedented? No. Fires similar in size to the Rim fire and Rough fire, or larger, occurred in the 1800s, such as in 1829, 1864, and 1889 (Bekker and Taylor 2010, Caprio 2016). Forest fires hundreds of thousands of acres in size are not unprecedented

Do Occasional Cycles of Drought and Native Bark Beetles Make Forests "Unhealthy"? Actually, it's the opposite. During droughts, native bark beetles selectively kill the weakest and least climate-adapted trees, leaving the stronger and more climate-resilient trees to survive and reproduce (Six et al. 2018). In areas with many new snags from drought and native bark beetles, most bird and small mammal species *increase* in numbers in such areas, because snags provide such excellent wildlife habitat (Stone 1995).

Is Climate Change a Factor in Recent Large Fires? Yes. Human-caused climate change increases temperatures, which influences wildland fire. Some mistakenly assume this means we must have too much fire but, due to fire suppression, we still have a substantial fire deficit in our forests. For example, historically, snag forest habitat, from high-intensity fire and patches of snag recruitment due to drought and native bark beetles, comprised 14% to 30% of the forests in the Sierra Nevada (Show and Kotok 1925, Safford 2013, Baker 2014, Baker et al. 2018). Currently, based on federal Forest Inventory and Analysis data, it comprises less than 8% of Sierra Nevada forests.

Do Current Fires Burn Mostly at High-Intensity Due to Fire Suppression? Current fire is mostly low/moderate-intensity in western US forests, including the largest fires (Mallek et al. 2013, Baker et al. 2018). The most long-unburned forests experience mostly low/moderate-intensity fire (Odion and Hanson 2008, Miller et al. 2012, van Wagtendonk et al. 2012). Older forests self-thin their understories (Zachmann et al. 2018).

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