Perceived Policy Challenges and Opportunities for Prescribed Burns in California

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Abstract
The catastrophic wildfires that have devastated California in recent years have prompted new policy proposals to increase the use of prescribed burns as a wildfire reduction treatment. Here we recognize the policy-based challenges to implementing more prescribed burns in California and identify opportunities and solutions. Drawing on interviews with state policy makers and implementers, we show that fear-related challenges (public perceptions, liability, and inadequate knowledge or experience) limit prescribed burns and XXXX-related challenges (funding, environmental regulations, weather conditions, and crew availability) prevent more prescribed burns. While recent policies have addressed the former, the latter remains an obstacle. These findings offer policy recommendations for how California can reach its state and federal fuel treatment goals. The combination of climate change and overabundant fuel loads make increasing the use of fuel treatments like prescribed burns more critical in order to decrease the incidence of future catastrophic wildfires in the state.

Introduction

The incidence of catastrophic wildfire has increased in the Western United States in recent years, and particularly in California.[1] These fires stem from a combination of climate change which has heightened hot and dry conditions, historic fire suppression policies which have enabled nearly a century of fuel accumulation, and insufficient fuel treatments which have removed too little of the accumulated fuels from the landscape.[2,3,4] Fuel treatments are activities intended to reduce the incidence or severity of wildfires. 20 million acres of forestland, or nearly 20% of California, would benefit from fuel treatments.[5]

Fuel treatments primarily take the form of prescribed burns, mechanical thinning, and managed wildfire. Prescribed burns are fires purposefully set under controlled conditions to clear ground fuels. Mechanical thinning relies on machines to remove trees and large biomass. Managed wildfire, or wildland fire use, occurs when federal landowners allow natural ignitions to burn in remote areas, mimicking the effects of a wildfire with less danger to the public. Prior studies have examined the efficacy of these fuel treatments; prescribed burns are more effective in removing fuels than mechanical thinning alone, but their combination is most effective.[6,7,8] This study is predicated on the assumption that prescribed burns and mechanical thinning reduce wildfire risks.[9,10,11]

Between 2012 and 2017, wildfires burned an average of 770,000 acres (0.74% of the state's total acreage) per year in California in comparison to an annual average of 46,000 acres (0.04%) of prescribed burns.[12] The state government has a goal of increasing fuel treatments (mechanical thinning or prescribed fire) on nonfederal lands from 17,500 acres on average per

year to 35,000 acres per year by 2020 and 60,000 acres by 2030. The U.S. Forest Service, the largest landowner in California with 20.7 million acres, intends to double its fuel treatment goal from 250,000 acres per year to 500,000 acres by 2020.[13] Increasing the use of prescribed burns will be critical to reaching these fuel treatment goals. After the catastrophic 2017 and 2018 wildfire seasons, the California legislative and executive branches responded with policy changes designed to implement more prescribed burns.

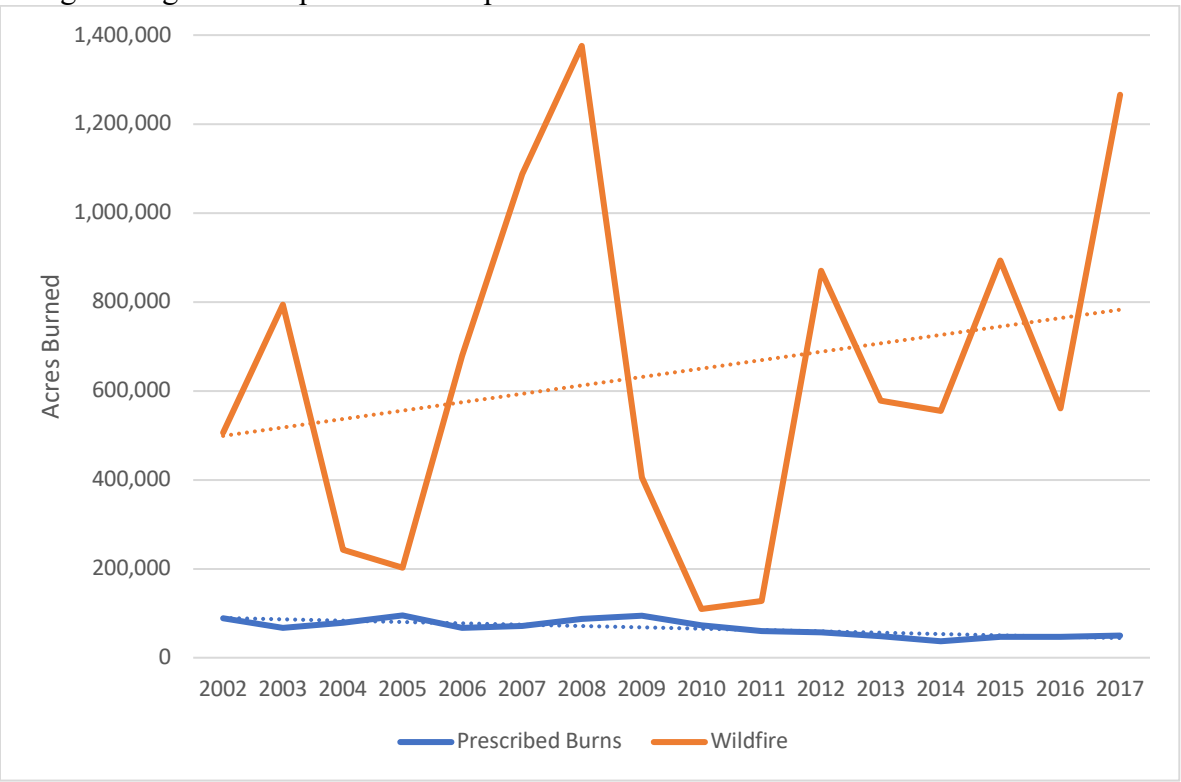

Figure 1: Acres Burned by Prescribed Burn and Wildfire in California, 2002-2017
Source: National Interagency Fire Center

Here, we investigate the policy challenges and opportunities to increasing the use of prescribed burns as perceived by policy makers and implementers in California based on expert interviews. As policy makers have the ability to institute new policies, their interest in using more prescribed burns and beliefs as to what barriers restrict prescribed burns may indicate future policy directions. We are not aware of previous studies that investigate how policy makers or implementers view fuel treatments. In this study, we identify perceptions of different fuel treatments and the challenges and opportunities to implementing more prescribed burns in California among prescribed burn experts and policy makers.

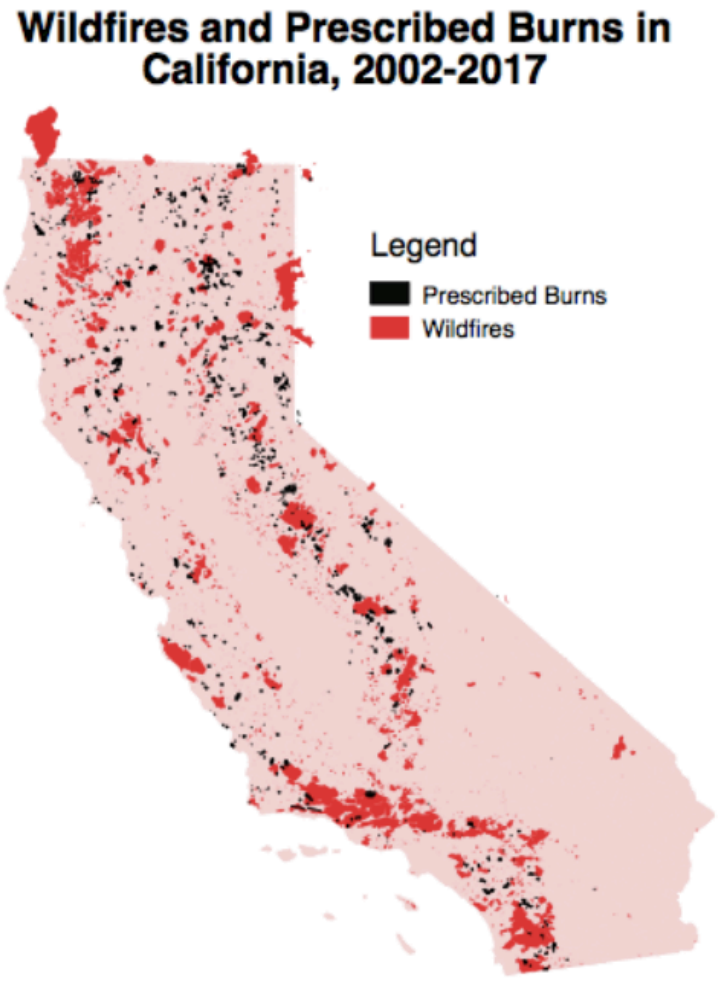

Figure 2: Map of wildfires and prescribed burns in California, 2002-2017

Results

Politicians propose more policies following catastrophic wildfire seasons. Wildfire-related bills experienced peaks during the 2007-2008 and 2017-2018 legislative sessions; 2008, 2017, and 2018 were record-setting years for wildfires. Legislators propose more bills during legislative sessions with catastrophic wildfires due to increased attention. Worse wildfire seasons (as measured by acres burned per year) generate a statistically-significant increase in wildfire bills during their legislative sessions ($p < 0.001$). This correlation is not present for fuel treatment bills related to bills related to prescribed burns or thinning. Worse wildfire seasons are also a statistically-significant indicator of chaptered wildfire-related bills ($p < 0.001$) and chaptered and appropriated wildfire bills ($p < 0.001$). Policies designed to prevent or mitigate the effects of future natural disasters often need funding for effective implementation. Chaptered and appropriated bills serve as a proxy for policies that may prevent or mitigate future disasters. This correlation is not present for fuel treatment bills. The correlation between worse wildfire seasons and wildfire-related bills (including chaptered and appropriated) was less significant with a time lag. Legislators respond more to immediate or current crises rather than crises that have already passed.

Figure 3: Wildfire-, Prescribed Burn-, and Thinning-Relevant Bills Proposed in Legislative Sessions, 1999-2000 – 2017-2018

Although acres burned were not statistically significant predictors of thinning or prescribed burn bills, prescribed burn bills peaked during the 2017-2018 legislative session with twelve bills. Six were chaptered and appropriated, more than in any other session. Based on interviews, a combination of a severe wildfire season and prior efforts to increase attention on prescribed burns internally within the legislature may have been responsible for the rise in new prescribed burn legislation. Interviewees emphasized the critical role of the 2017 wildfires in generating policy proposals within the 2017-2018 legislative session, particularly for prescribed burn bills. The severity of the fires created a policy opening through which legislators could introduce bills that then became laws. Many of these bills emerged from a decade of conversations with legislators on solutions to the drought and tree mortality crisis from the early 2010s. These conversations, often with representatives from non-profit organizations, focused attention on the role of fuel treatments in improving forest health. By 2017, legislators had enough familiarity with the challenges to conducting more prescribed burns identified by non-profit organizations that legislators could propose bills designed to address these issues. The 2017 wildfires galvanized policy action on wildfires and fuel treatments.

Interviewees expressed concern that a relatively light wildfire season following the 2017 wildfires could reduce pressure on legislators to respond to the wildfire crisis. A return to an average wildfire season could give legislators license to focus on other priorities. Interviewees stressed the importance of maintaining pressure and attention on wildfire issues, since they could not be entirely resolved within a single legislative session. As interviews were conducted during the summer of 2018, interviewees did not know that the most destructive wildfire in California's history would occur later that year (Camp Fire). Given the severity of the 2018 wildfires, particularly toward the end of the year, it is likely that legislators will continue to focus on wildfire policies through the 2019-2020 legislative session. Within the first three months of the

legislative session, 54 bills have been proposed related to wildfires, 2 to thinning, and 5 to prescribed burns, suggesting that the focus has shifted from fuel treatment policies to other wildfire-related challenges (such as emergency response and public utility responsibility).

Policy makers and implementers support the use of more fuel treatments. All interview groups considered all types of fuel treatments to be necessary to reduce the risk of wildfires and desired an overall increase in their use. Interviewees agreed that prescribed burns support critical ecosystem functions, but addressing California's fire deficit would require a significant increase in the pace and scale of their use. 99% of prescribed burns begin on federal lands, which make up 46% of the state.[14] Federal employees expressed pride that they were responsible for most of the prescribed burns in California, but also recognized that the majority of lands needing fuel treatments were federally-owned. State government employees noted the public benefits associated with prescribed burns and emphasized the state's role in burning on state and private lands. Academics and non-profit representatives stressed the importance of choosing treatments based on the amount of fuel and ecosystem type in each treatment area. The perspectives of non-profit representatives fed into those of the state legislative staff and analysts, who expressed support for prescribed burns but cautioned that their knowledge base stemmed from prior conversations with constituents and non-profit representatives (which interviewees also described regarding the crafting of bills in the 2017-2018 legislative session).

All interviewees agreed that prescribed burns generate positive ecological benefits and reduce the risk of wildfires, a higher proportion than the general public.[15,16] Interviewees believed that (1) the public feared prescribed burns because of smoke and the possibility of escapes, but education could convince them of their utility, and (2) rural populations supported prescribed burns more than urban populations. First, interviewees cited examples of prescribed burns that could not occur because of public complaints, as well as cases when firefighters invited skeptical local residents to attend a prescribed burn whereupon they became proponents. Second, interviewees recognized that rural populations had greater familiarity with and appreciation for the role of fuel treatments like prescribed burns than urban populations given their greater physical and experiential distance. These themes have been previously described and indicate that experts and policy makers are familiar with the public's concerns with prescribed burns.[17,18,19] Interviewees viewed themselves as distinct from the general public on beliefs around prescribed burns, but they also understood the public's broad concerns and the need to alleviate them.

Interviewees similarly believed that mechanical thinning reduced fuel loads (and to a greater extent when combined with prescribed burns) and offered profit potential (unlike prescribed burns). Academics warned that the financial incentives offered by mechanical thinning may be elusive, as lumber volume targets may require timber clearing that is too expensive to generate profit. Legislative staff and analysts criticized the model of removing large-diameter, valuable trees and leaving the smaller, less valuable, and more flammable biomass. However, they expressed uncertainty as to what policy proposals or solutions could incentivize fuel treatments that would encourage mechanical thinning while also removing the smaller biomass (such as with additional prescribed burns). Other interview groups cautioned against relying exclusively on mechanical thinning or viewing it as the default fuel treatment unless it is used as a pre-treatment in areas too dense for an initial prescribed burn.

As managed wildfire is currently legal only on federal property where it is included within national plans, interviewees recognized that societal and political restrictions prohibit its

wider use. Managed wildfire is still wildfire and involves more smoke, potential damages, and need for monitoring and planning than prescribed burns. However, so long as the negative effects do not impact the public, interviewees believed that fires on remote federal lands should not be immediately suppressed but instead allowed to burn and clear fuels naturally. Interviewees across non-state groups embraced managed wildfire as natural, cost-effective, and necessary for clearing some of the millions of acres in California in need of fuel treatments. State legislative staff and analysts recognized that the state firefighting agency (California Department of Forestry and Fire Protection) is legally mandated to extinguish rather than enable wildfires, but some implied that this state-level restriction may change in the future with more research on managed wildfire. Finally, and in contrast to other interview groups, state government employees expressed skepticism over the safety and practicality of using managed wildfire. Though heralded as the future of fuel treatments, it remains unlikely that state and private lands will experience managed wildfire in the near future. This underscores the importance of expanding the use of prescribed burns throughout California and particularly on state and private lands to achieve the ecological benefits of fire.

SOMETHING creates a gap between acres planned for burns and actually burned. Our results indicate an increasing difference between the acres planned and approved for prescribed burns each year and the acres then burned. Some of this increase may be accounted for by the Prescribed Fire Information Reporting System (PFIRS), which collects prescribed burn permit data. Since the system's inception in 2012, the number of active participants has risen from 11 local air districts to 22 of the 35 air districts in California. While PFIRS does not collect data on all prescribed burns in California, it provides data on planned acres burned and actual acres burned on the burns registered within its system. On average, nearly 11,700 acres are planned for burning but are not burned each year, with greater differences over time (5,056 in 2012, 17,793 in 2018). During this period, the number of acres planned for burning rose by a factor of 3.48 (11,127 to 38,798 acres), and the number of acres burned rose by a factor of 3.46 (6,070 to 21,005 acres). However, a growing gap exists between burned acres and planned acres.

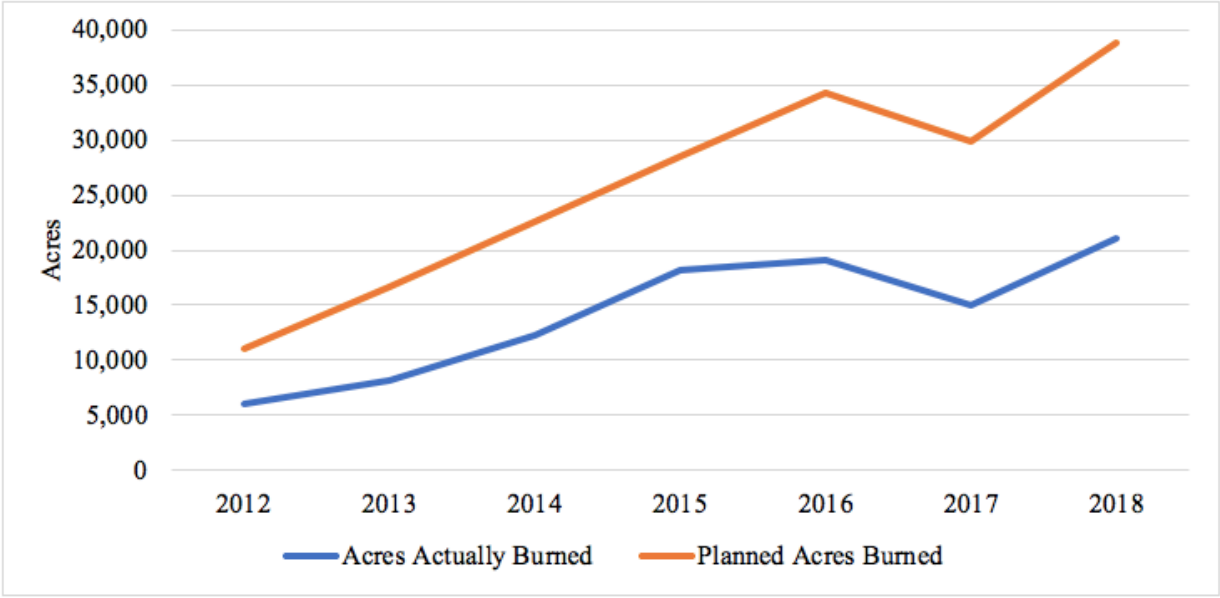

Figure 4: Acres Burned and Planned to be Burned by Prescribed Burn, as recorded in PFIRS, 2012-2018

Of the 67,211 acres that were planned but not burned (and for whom the burner is known), 62,462 (92.9%) were burns planned by a federal government agency, and 60,347 (96.6%) of these were burns planned by the U.S. Forest Service. With large, uninterrupted swaths of land, a dedicated federal fire crew, and prescribed burns incorporated into National Forest Plans, the U.S. Forest Service has the potential to burn hundreds of thousands of acres every year. Based on interviews, two challenges prohibit the U.S. Forest Service from burning more planned acres. First, federal wildfire prevention funding is often diverted to support immediate wildfire suppression. Inconsistent funding for fuel treatments and an emphasis on private mechanical thinning (particularly on national timberlands) limits the reliance on prescribed burns. Many National Forests are also so overgrown that prescribed burns cannot occur without mechanical thinning pre-treatments, though mechanical thinning may occur without follow-up prescribed burns due to financial constraints. Second, local weather conditions may narrow burn windows, restricting when or how many acres federal agencies can burn. Changing weather conditions may result in less burning than planned because burns cannot continue over consecutive days due to concerns of escapes. Though many interviewees blamed burn permit restrictions from local air boards, others recognized that air boards offer more burn days than are used, placing the responsibility for fewer burns on the burners themselves.

While state and private burners represented only 7.1% (4,748 acres) of the acres planned but not burned, these burners face two distinct challenges that prevent them from burning planned acres. First, burners must undergo extensive environmental reviews like the California Environmental Quality Act (CEQA) or the National Environmental Protection Act (NEPA), which slowed the burning process. If burn managers miss the window allowed by these expensive and time-consuming reviews, then they need to undertake the process again. Interviewees complained that CEQA and NEPA, which are intended for determining environmental impacts of major projects or action, were not designed for prescribed burns, which should recur on a regular basis. One interviewee claimed that he needed to complete more NEPA paperwork for a burn than British Petroleum did for Deepwater Horizon. Finally, limited prescribed fire burn crew availability restricts when and where prescribed burns can occur on state property or on private lands where landowners have partnered with the California Department of Forestry and Fire Protection through the Vegetation Management Program. The Vegetation Management Program enables private landowners to contract with the state to conduct prescribed burns under sliding-scale costs. Many state burn crews are seasonal, rather than full-time, employees who are often diverted from conducting planned burns to extinguishing wildfires in other areas in the state. Seasonal employees are hired during the worst wildfire months as opposed to the best prescribed burn months.

Fear prevents potential burners from beginning the prescribed burning process. Based on interviews, personal and public fears around prescribed burns reduce the likelihood that landowners – particularly private landowners – will conduct a prescribed burn. First, liability laws place financial and legal responsibility for any escapes on the burners, resulting in a risk-averse culture. Private landowners afraid of potential bankruptcy thus avoid burning on their property. Within the federal government, interviewees described an absence of praise or reward for managers who used prescribed burns, but punishment for any escapes. Second, potential burners may lack the experience or knowledge necessary to burn safely. Active federal burn programs have ended when a single experienced prescribed burn manager has retired. In addition, prior to 2018, California did not have an official state prescribed burn training or

certification program. Private landowners therefore had limited opportunities to gain the confidence or skills to conduct prescribed burns safely, exacerbating their fears of escapes and legal liability. Finally, while public opinion has recently shifted in favor of prescribed burns recently, strong negative opinions remain and hinder their use. Public tolerance for smoke or potential escapes is limited, and avoiding prescribed burns entirely is one way to avoid persistent complaints.

Each of these challenges has been addressed in either legislation introduced in the 2017-2018 session or in a May 2018 executive order. Private landowners can now enroll in a newly-established certification and training program. Those who enroll or can prove they took appropriate precautions before starting the burn will no longer be held personally and financially liable for any escapes (SB 1260).[20] New education programs intended to teach the public about and improve opinions of prescribed burns have been appropriated (Executive Order B-52-18).[21] As these policies are implemented, more prescribed burns may occur in the next several years, particularly on private lands.

Political support and infrequent escapes create opportunities for more prescribed burns. Interviewees identified three strategies that contributed to a rise in prescribed burn use: political collaborations, strong leadership, and infrequent escapes. First, collaborations across non-profit organizations and state legislators enabled conversations that improved policy makers' perceptions of prescribed burns. These conversations then fostered some of the prescribed burn legislation proposed in the 2017-2018 legislative session. In addition, non-profit organizations, the state government, and several federal agencies signed a Memorandum of Understanding for the Purpose of Increasing the Use of Fire to Meet Ecological and Other Management Objectives in 2015. The Memorandum served to remind signatories of their commitment to return fire, whether prescribed or managed, to California's landscape. Second, political support from powerful government officials enabled policy and culture shifts in favor of prescribed burns. Interviewees identified Jerry Brown (former governor of California) and Ken Pimlott (former director of the California Department of Forestry and Fire Protection) as instrumental in encouraging more prescribed burns on state or private lands. However, interviewees recognized that high-level policy directives can be slow to trickle down to lower levels. They hoped that future administrations would maintain the policy and political enthusiasm for prescribed burns that the Brown Administration had.

Finally, infrequent escapes demonstrated the safety of using prescribed burns to reduce the likelihood of wildfires. Of the 7,188 prescribed burns registered in PFIRS with data on both planned and burned acres, 147 (2.0%) burns were escapes in which the acres burned exceeded the acres planned. On average, an escaped burn exceeded its plan by 0.51 acres. Escaped burns are rare, and burns are unlikely to extend far beyond their planned confines. Interviewees also noted the benefits that prescribed burns offered in creating fuel breaks that paused the spread of wildfires and aided firefighting efforts.

Discussion

Our results indicate that catastrophic wildfires induce politicians in California to propose new wildfire-related policies. Policy makers and implementers interpreted fuel treatments as a critical component in addressing the wildfire problem. Recent support from politicians and the infrequency of escapes have improved perceptions and use of prescribed burns. The 2017 wildfires served as a catalyst for new prescribed burn policies after years of prior conversations

between legislators and prescribed burn experts. These policies were intended to address public fears through education and personal concerns of liability through training and certification programs. Addressing these challenges may increase the number of prescribed burns conducted on state and private lands. Politicians have not addressed the remaining challenges, which on federal lands are funding fluctuations and short burn windows, and on state and private lands are environmental regulations and limited burn crew availability. These remaining challenges create a gap between the acres burned and those intended to be burned (Table 1).

Federal funding fluctuations could be prevented through policies designed to protect fuel treatment funding from being diverted to fire suppression. Changes in how smoke emissions are calculated nationally may incentivize more prescribed burns. The smoke from prescribed burns counts toward anthropogenic emissions, whereas wildfires can be excluded from air quality standards as natural emissions.[22] More standardization across the different air districts may establish greater consistency in when and where burns can take place, particularly in larger areas that cross multiple jurisdictions. Some air districts keep only minimal records of prescribed burns; the adoption of PFIRS by all 35 air districts would also improve data on prescribed burns throughout the state. Though interviewees complained about environmental regulations, they did not want to change them because such changes could create an opportunity to lessen overall environmental protections. Limited firefighter availability could be addressed by either a dedicated prescribed burn crew or staggering seasonal fire crew hiring so some crews are available during prescribed burn seasons.

This study extends prior research by focusing on the perceptions of policy makers and implementers on prescribed burns. Previous studies have examined perceptions of the general public, but policy makers' and implementers' perceptions of the challenges and opportunities may indicate future policy directions because they hold political power and influence. This research also incorporates proposed state legislation, emphasizing the role that legislators play in enabling fuel treatments. In addition, we have not identified other studies that have used PFIRS data to analyze the use of prescribed burns across different landowners and air districts in California.

Climate change exacerbates warm and dry conditions in California, increasing the risk of catastrophic wildfires. In the wake of the disastrous 2017 and 2018 wildfire seasons, it is critical to implement fuel treatments like prescribed burns. Removing the barriers to prescribed burns will help reach the state and federal goals of 535,000 acres treated annually by 2020. Treating these fuels and addressing the challenges remaining that prohibit prescribed burns is essential to responding to the growing threat of climate change-induced wildfires and to protecting lives and property in California.

	Challenge	Count (n=40)	Sample Quote	Potential Solution
SOMETHING (Limiting)	Environmental regulations	11 (28%)	NEPA and CEQA "weren't meant to account for something like prescribed fire…. You have to [do] CEQA for prescribed fire, which unfortunately means maybe you're burning every five to ten years, but that's about the time that your NEPA or CEQA document ends. And then you have to do it again."	• No recommendation suggested
	Limited funding	22 (55%)	"If we could have taken the amount of money that the recent Ferguson Fire cost and applied that to prescribed fires or managing wildfires, there would have been a cost saving."	• Consistent funding for fire prevention
	Inadequate firefighter availability	20 (55%)	"Are there ways to keep dedicated, prescribed fire crews when you've got this constant demand for wildland fires?"	• Dedicated prescribed burn crews • Staggered seasonal prescribed burn crews
	Short burn windows; air quality standards	29 (73%)	"It is easy to scapegoat the air boards…. We are given more burn days than we use."; "Wildfire smoke gets a pass, but we regulate prescribed burning because we light the match. That's silly. Smoke is smoke, and prescribed burning smoke saves a ton of $PM_{2.5}$ emissions."	• Standardization across air districts • Reassessment of smoke from wildfires and prescribed burns in air quality standards • Consistent adoption of PFIRS
Fear (Preventative)	Liability laws	26 (65%)	The mentality is "about avoidance of risk rather than taking risks. You continue to get your paycheck whether or not you get a burn off or not…. [We need individuals] who are visionary, who are bold, and who get things done, and they're willing to take those risks."	• Certified burners who undertake preventative efforts free from liability
	Limited training or certification programs	12 (30%)	"I've seen really active, prescribed fire, managed wildfire programs pretty much dry up overnight when someone retires."	• Training or certification program
	Negative public opinion	20 (50%)	"I think the real issue around prescribed fire is an attitude issue and the culture."	• Education programs

Table 1: Challenges and potential solutions identified by interviewees

Methods

Prescribed burn permits. To examine statewide trends in prescribed burn permits and use throughout California, we reviewed data from the Prescribed Fire Information Reporting System (PFIRS) between 2012 and 2018. The California Air Resources Board (CARB) collects data on planned and conducted prescribed burns for 22 of California's 35 local air pollution control districts (APCDs) or air quality control districts (AQCDs). PFIRS includes data from Butte County, Calaveras County, Colusa County, Eastern Kern, El Dorado County, Feather River, Glenn County, Great Basin Unified, Lake County, Mariposa County, Monterey Bay Unified,

Northern Sierra, Northern Sonoma County, Placer, Sacramento Metro, San Joaquin Valley, Santa Barbara County, Shasta County, Siskiyou County, Tehama County, Tuolumne County, and Yolo-Solano. Data were not available from the remaining 13 APCDs and AQCDs in a comparable format to PFIRS.

Data on burn dates, acres planned and actually burned, managing agency, county, air district, and air basin were obtained from PFIRS. The PFIRS database included 7,593 individual burns after deduplication, though not all burns in the database included all types of information. We identified escaped burns as those in which the acres burned exceeded the acres planned. 7,188 prescribed burns included information on acres planned and burned; as described in the text, the acres burned exceeded those planned in 147 cases (2.0%).

Trends in prescribed burn permit data were analyzed using both summary statistics and linear regression models. We used pivot tables to determine changes in acres burned and planned over time and frequency of burns by managing agency and location. Logistic regression and ANOVA were used to identify a statistically significant relationship between the number of acres burned and other variables within the dataset. A combination of acres planned, managing agency, county, air district, and air basin produced the best fit model for a 13.9% adjusted-R^2 model fit with a p-value less than 0.001 (p-value = $2.2e^{-16}$).

Wildfire-related legislation. To determine changes in wildfire-related legislation over time, we examined proposed legislation from the California State Legislature between the 2003-2004 and 2017-2018 legislative sessions. We identified all bills with the keywords "wildfire," "prescribed/controlled burn/fire," and "thinning." We reviewed all bills with keywords to ensure relevance, identified all relevant and chaptered bills, and all relevant, chaptered, and appropriated bills. Chaptered bills have passed through the state legislature (and the governor, if applicable) to enter the state's legal code. Appropriated bills have passed through either the Assembly or Senate Appropriations Committee and serve as a proxy for funded proposals. The amount of money identified was not included because of uncertainty or broad ranges within Committee assessments as to necessary funding.

Logistic regression was used to identify a statistically significant relationship between the severity of wildfire seasons and the number of relevant, chaptered, and/or appropriated bills related to wildfires or fuel treatments. Severity of wildfire seasons was determined based on the total acres burned in California during each of the two-year legislative sessions based on data reported by the National Interagency Fire Center.

Expert interviews. To understand the challenges and opportunities to increase the use of prescribed burns in California, we conducted expert 40 semi-structured stakeholder interviews. We interviewed forty-five individuals between June and October 2018. Interviews lasted between forty-five and sixty minutes. The study included 10 interviews with federal government employees (25%), 12 with non-profit representatives (30%), 7 with state government employees (18%), 4 with academic researchers or affiliates (10%), and 7 with legislative staff or analysts (18%). Interviews were conducted either in person or by telephone. Initial interviewees were identified based on either association with California's prescribed burn policies, with additional participants identified through snowball sampling. Interviewees responded to questions on their opinions of different fuel treatment techniques, proposed prescribed burn policies, the influence of the 2017 and 2018 wildfire seasons on the policies, the challenges in implementing prescribed burns in California, and opportunities to increase their use.

At in-person interview meetings or before telephone interviews via email, interviewees received the Stanford IRB Informed Consent for Non-Medical Research letter to read and review as a copy for their own records. Signed consent was not required as the Stanford IRB determined that the interview protocols were exempt. Interviews were conducted under conditions of anonymity beyond identification as a member of an interview group (e.g. non-profit organization, federal government).

All interviews were recorded, transcribed, and coded for analysis using grounded theory based on themes identified during data analysis. These themes included challenges (liability, air quality, burn windows, funding, firefighter availability, training need, public opinion, and other); personal opinions (prescribed burns, mechanical thinning, managed wildfire); scientific research (remaining questions); public opinion; collaboration; successes; the role of individuals; climate change; the 2017 wildfire season, the 2018 wildfire season; and changes (sudden v. gradual, future changes, executive actions, legislative actions, and Memorandum of Understanding for the Purpose of Increasing the Use of Fire to Meet Ecological and Other Management Objectives).

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