

Peering through the Smokescreen of Success with Ecological Fire Use

*A Pilot Study of Three USFS Regions'
2018-2019 Wildfire Seasons*



by

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Firefighters United for Safety, Ethics, & Ecology
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www.fusee.org

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ABOUT FIREFIGHTERS UNITED FOR SAFETY, ETHICS, and ECOLOGY (FUSEE): FUSEE (pronounced FEW-zee) is a national nonprofit organization founded in 2004 that conducts public education and policy advocacy to promote safe, ethical, ecological fire management. FUSEE members include current and former wildland firefighters, fire managers and scientists, fire educators and students, forest conservationists, rural residents and other interested citizens.

Inspired by the great Aldo Leopold's "Land Ethic," FUSEE promotes a new Fire Ethic in fire management policies and practices:

"A thing is right when it contributes to the safety of firefighters and the public, ethical public service and use of taxpayer dollars, environmental protection of fire-affected landscapes, and ecological restoration of fire-dependent ecosystems. It is wrong when it tends otherwise."

FUSEE informs, inspires and empowers firefighters and their citizen supporters to become torchbearers for the new paradigm of Ecological Fire Management.

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Cover photo: The 1995 Mill Creek fire on the Ochoco National Forest, managed as a Prescribed Natural Fire (PNF).

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INTRODUCTION

Ecologists have long been urging land managers to extend the use of fire to restore and maintain resilient fire-adapted landscapes (North et. al 2012). Despite the many benefits of fire use in land management, the barriers to the increased use of prescribed and wildland fire are well known (Black et. al. 2018; Miller et. al. 2020). This paper will focus on the use of fire for resource and ecological benefits through the management of lightning-caused wildfires to re-establish heterogeneous fire-resilient landscapes. It is critical to maintain fire as an ecological process on large swaths of public lands, but the scale of burning needed makes prescribed fire impractical. In certain protected or remote natural areas (e.g. designated wilderness, inventoried roadless, research natural areas, etc.) prescribed fire is also difficult to implement. Consequently, the only other available means of restoring fire is the use of fire in the “emergency” context of unplanned wildfire ignitions.

In the face of climate-enhanced wildfires, the call to enhance protection of rural communities and build resilience into at-risk ecosystems has never been more urgent. There is nothing as effective as fire in reducing surface fuels that most influence fire spread and intensity. Prescribed burning or wildland fire use (WFU) are the *only* ways to get much-needed understory burning done in remote natural areas and rugged terrain where mechanized tools cannot operate [North et. al. 2012]. In this paper when we discuss fires managed for resource benefits we will use the term wildland fire use (WFU).^{*} Prescribed burning is a planned management activity, and must comply with the slow pace of NEPA analyses and inadequate funding from annual budgets. The use of suppression firing operations during wildfires (e.g. backfires or burnouts) are not constrained by these regulations or budgets. This disparity between the two kinds of fire use is not ideal, but both offer opportunities to actively manage fires in ways that mimic natural fire to achieve desired effects that restore or maintain fire-adapted ecosystems. Given that climate change is rapidly altering weather, vegetation, and fuels conditions in ways that are reducing desired prescription burn windows that enable human control over fire behavior, it is critical that managers take advantage of wildfire ignitions to get good fire on the ground at the scale and speed needed before climate change brings environmental conditions that defy our attempts to control fire behavior.

The Federal Wildland Fire Management Policy (1995/2001) gives federal managers unprecedented flexibility and discretion to manage wildfires for resource objectives and restoration goals. In this paper we will investigate how well U.S. Forest Service managers in the Southwest (R-3), Rocky Mountains (R-1) and California (R-5) are using this policy to authorize fire use through the Wildland Fire Decision Support System (WFDSS). WFDSS is an online repository of information about every wildland fire of significance within federal jurisdiction. It replaces old paper-based decision documents that had to be created at the time that a fire escaped initial attack – The Wildland Fire Situation Analysis (WFSA) for wildfire suppression, and the Wildland Fire Implementation Plan (WFIP) for wildland fire use. A WFDSS Decision is maintained and continually revalidated or revised for the duration of a wildfire incident by the responsible Agency Administrator. It includes all risk analyses components and rationale for operational decisions. The WFDSS provides the best documentary evidence of authorizing and applying fire use strategies.

“Given all the social and institutional barriers to prescribed burning, it is critical that managers take advantage of wildfire ignitions to get enough fire on the ground at the scale and speed needed before climate change brings environmental conditions that defy our attempts to safely control fire behavior or achieve good fire effects.”

^{*} *“Wildland Fire Use (WFU) is officially an obsolete term according to the NWCG glossary of fire management. However, WFU remains a current term of use in the official glossary of the National Cohesive Wildland Fire Strategy. This contradiction is an example of the institutional ambiguity and uncertainty over what to call fire use actions. We will use WFU as the traditional term that is most clear to the fire management community, although we recommend calling it “Ecological Fire Use” for actions to manage wildfires for resource benefits.”*

FLAWED METRICS OF “SUCCESS” FOR FIRE MANAGEMENT

Today’s wildland fire managers have an array of metrics to determine the efficacy of their respective programs. An example of a metric used by fire officials is the initial attack success rate. Fire management agencies (some of which are mostly fire suppression organizations) routinely boast about achieving a 95 percent or better rate of “success” in containing fires during initial attack. However, heralding this number of initial attack success rate as a target may be working contrary to other land management objectives such as maintaining ecological integrity of fire-adapted ecosystems and preserving biological diversity of fire-dependent species. If we agree that the application of fire is vital for maintaining these ecosystems and species, then we might want to allow some naturally-occurring wildfires to burn and function as a restorative process on the landscape. This would reduce the initial attack success rate but achieve more success in other land management goals (Calkin et. al. 2015; Shultz, et. al. 2019).

One of the current barriers to managers authorizing more wildland fire use is the lack of ways to quantitatively measure or qualitatively assess the different kinds of resource or ecosystem benefits gained from fire management actions. Another barrier to WFU is that most of the public, elected officials, and the news media enthusiastically support aggressive firefighting efforts but are wary or even antagonistic toward WFU. Consequently, USFS managers who understand the need for beneficial fire have learned how to obscure fire use with a number of abstract, deliberately vague terms (see Fig. 1) collectively expressed as “other-than-full-suppression.” The combination of internal and external barriers to authorizing wildland fire use results in a bureaucratic system that mainly rewards managers for putting fires out rather than putting fires in.

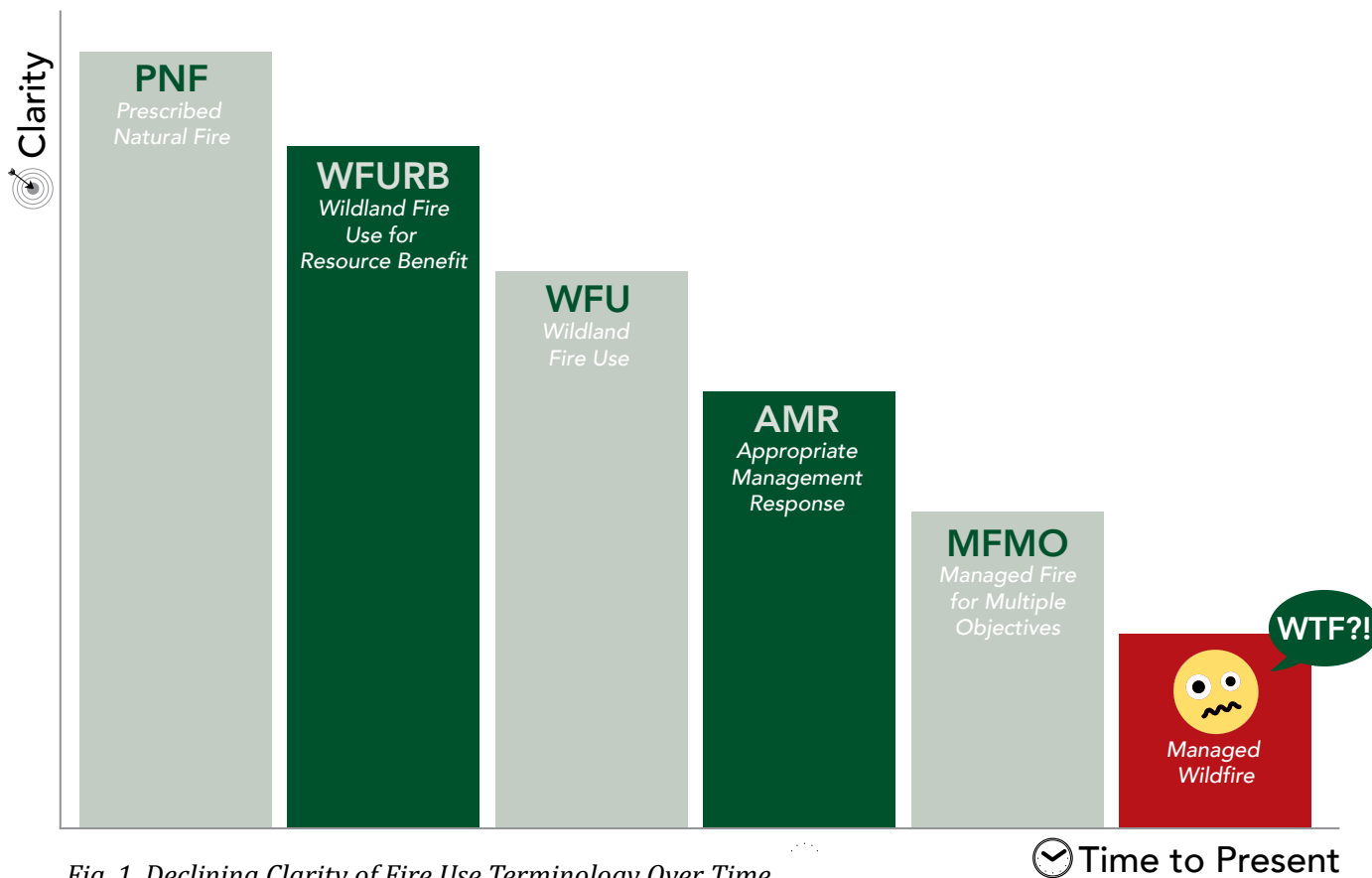


Fig. 1. Declining Clarity of Fire Use Terminology Over Time.

POLICY REFORMS AND PARADIGM SHIFTS

Within the fire management community there has long been talk of a paradigm shift moving agencies away from suppression-dominant wildfire responses. The ability to authorize fire use in the USFS dates back to the 1970s, but these fire use incidents were rare, confined to just a few lightning-caused fires in designated wilderness areas, while aggressive initial attack and full suppression was the sole wildfire response strategy for human-caused fires, and fires burning outside of wilderness areas. In those few incidents where fire use could be considered, managers had 24 hours to make a firm decision to authorize fire use or adopt full suppression. Their decision had to be one or the other, and if conditions changed in ways that compelled taking significant or expensive management action, then their WFU strategy had to be converted to full suppression. The 2009 Guidance for Implementation of Federal Wildland Fire Management Policy (US DOI/USDA, 2009) was an important policy reform to end this bifurcation of wildfire response strategy. The most significant change involved eliminating wildland fire use as a separate class of fires altogether. Over time, policy interpretations had moved toward allowing more active management in wildland fire use instead of the “let burn” approach of passive monitoring. But now, managers could suppress or simply monitor across space and time for the duration of an incident. Indeed, the reforms instituted by the 2009 Policy Guidance represented a major advance towards the paradigm shift of ecological fire management.

The new Policy Guidance divided fire management strategies into two subgroups—protection objectives and resource objectives—and allows wildfires to be actively managed for both protection and resource objectives simultaneously. Even though federal policy mandates that private property and natural resource values on public lands should be weighted equally in designing response strategies, property protection goals usually far outweigh resource benefit goals. Even in areas where the human values-at-risk are relatively low (e.g. it is in a remote, uninhabited area), and the resource benefits of burning may be high (e.g. it is in a fire-dependent ecosystem), protection goals are normally elevated above resource goals and dominate the wildfire response strategy. What is rarely addressed is how fire suppression and fire exclusion for protection goals fail to yield resource benefits, degrades resource and ecosystem values over time, while also increasing risks to property from future fires that may burn through hazardous fuels in extreme conditions. In contrast, fire use for resource benefit goals combines both ecosystem restoration and community protection goals by improving the health of the land and reducing fuel hazards that may threaten private property.

DOCUMENTING DECISIONS FOR “OTHER-THAN-FULL-SUPPRESSION” STRATEGIES

Regarding the management strategy set for the incident, it can be difficult to tease out what may have been the intent of the Incident Commander (IC) and his/her Incident Management Team (IMT) on a day-to-day basis. One document that offers clues is the ICS-209 where a check box is used twice daily to indicate the management objective, be it full suppression or one of the “other-than-full-suppression” variants. Another document source are the WFDSS Decisions that document which objective(s) will guide the management strategy for wildfire response at any given time. While not completed daily, WFDSS Decisions represent the Agency Administrator’s intent for the incident and require his/her routine validation. Anytime conditions or objectives significantly change on the fire, a new WFDSS Decision is generated, and that Decision represents the Agency Administrator’s direction to the IMT that should guide their selection of strategies and tactics for managing the wildfire.

Between 1998 and 2008 when records were kept of wildland fire use (WFU) fires and acres (Fig. 2) the program accounted for, at best, around 400 fires for a half million acres burned, on average, in any given year. If we exclude Alaska, where the vast scale and remoteness of the landscape makes direct suppression across all acreage impractical, around 4% of all fires and 23% of total acres burned in the lower-48 States were the result of lightning-caused fires managed with fire use. (see table below) We will use this 10-year period as a benchmark of WFU accomplishment for comparison with the extent of “wildfire management for resource objectives” over the years 2018 and 2019 (the most recent years statistics are available at the time of this writing). Since the National Wildfire Coordinating Group (NWCG) eliminated the separate category of “*wildland fire use*” in 2009, the only simple way to measure the use of naturally-ignited wildfires managed for resource enhancement has been to document the number and acres of fire being managed under *other-than-full-suppression* strategies.

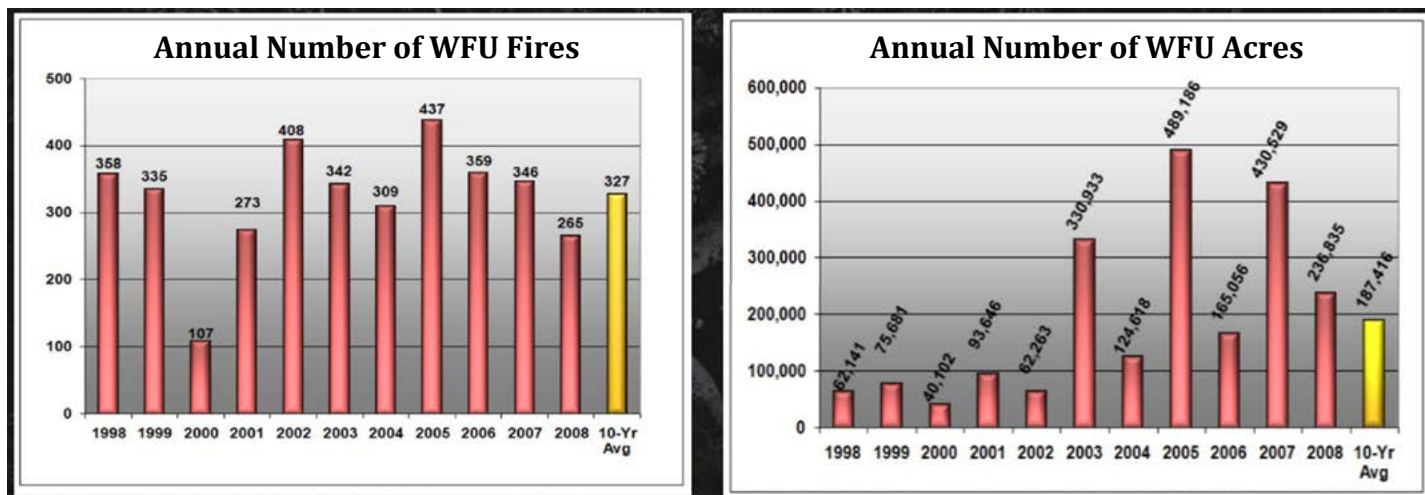


Fig. 2 WFU fires and acres between 1998 and 2008 (NICC).

There are many tactical expressions of an “*other-than-full-suppression*” strategy, such as *confine/control*, *point protection*, *monitoring only*, or *managing for multiple objectives* (i.e. managing for protection and resource objectives on the same fire). Sadly, the latter phrase is sometimes truncated to simply a “managed wildfire” (as if a full suppression incident was not also being managed, somehow). This “othering” of fire use is a term of marginalization that marks the exception to the norm, with full suppression remaining the steadfast dominant default option for wildfire response.

With the 2009 Policy Guidance, managers have the ability to mix and match objectives spatially and temporally throughout the duration of a wildfire incident. What is unclear is if fire managers are taking advantage of this opportunity to authorize more fire use, or has the disappearance of this class of WFU been taken by the rank and file of wildland firefighters as a sign that suppression is always the path of least resistance? Now, without any unique identity, the outcomes from this blending of fire use and fire suppression are taking on a new form, such as “box and burn” strategies (Thompson et. al 2016b, Pyne 2015, Pyne 2020) that involves large-scale “backburning” (a hybrid of backfiring and burnout) initiated after a natural ignition, sometimes conducted within the context of a suppressed fire and sometimes with explicit resource objectives. This strategy has emerged primarily in the Southwest but is gaining acceptance elsewhere. This strategy is predicated on the need to limit smoke duration and minimize resource commitment over the course of the incident, thus crews may be suppressing the fire, but it may also result in additional acres burned with these semi-controlled burns that may yield some resource benefits, intended or not.

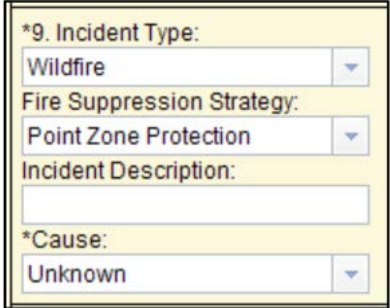
Many of the best and brightest in fire management were attracted to WFU management when it was a special thing, specifically a “good” fire on the landscape (Sielstad 2015). Wildland fire use management teams and fire use modules created, and crafted their own subculture and values in managing fire to benefit the land. With the elimination of fire use as an incident category and the demise of those crews dedicated to fire use that tactic has lost its explicit association with ecological goals and objectives. Nowadays, fire use strategies are authorized, begrudgingly, in the face of insufficient suppression resource availability, the remoteness of the fire, or firefighter safety concerns arising from any attempt to apply a full suppression strategy. Some managers have thus become resigned to “suffering” resource benefits from fire use tactics on suppression incidents. On the other hand, some managers who value fire ecology may be surreptitiously achieving resource and restoration goals under the smokescreen of suppression firing operations. For both reasons, resource benefits “by accident” seem to be gaining preference over the explicit written intent of resource objectives from the WFU era, even in landscapes like designated wilderness areas where this should be optimized. The following study seeks to confirm whether or not wildfires are being managed for resource benefits since the elimination of WFU as a distinct category. Furthermore, we raise the question: could there be unintended consequences of merging wildland fire use with suppression?

Methodology

In this investigation, we analyzed WFDSS and examined Decisions for all fires greater than 10 acres in three geographic areas: the Southwest (USFS Region 3), Northern and Southern California (USFS Region 5), and the Northern Rockies (USFS Region 1). Fires included those burning on Federal jurisdiction with no specificity on point of origin, and should include all fires explicitly managed for resource benefits, since the 2019 Red Book (USDA & USDI 2019) directs managers to complete a WFDSS Decision for all fires that “include both protection and resource management objectives.” Other studies have chosen to look at another suppression operational document, the daily ICS-209 data (Bahr and Young 2019), since code can be written to analyze thousands of these records at a time, effortlessly. The problem with the ICS-209 is that explicit resource management objectives cannot be interpreted from the data. While a strategy of something other-than-full-suppression may be selected, like *confine/contain*, that could be undertaken as part of a suppression-focused protection strategy, rather than being part of a specific resource management objective. In fact, the SIT 209 reporting software has a drop-down menu that forces the user to select a “fire suppression strategy” for all wildfires (Fig. 3). So even if you are only monitoring a natural ignition and have solely resource management objectives, the user is still acquiescing to the dominant suppression paradigm.

We looked at two years of WFDSS Decisions – 2018 and 2019. We selected 2018 as a very active year with National suppression resource shortages, while 2019 represented a much quieter firefighting season, largely because of cooler, moister conditions across the country. While the overall number of wildfires was similar, acres burned in 2019 was roughly half that in 2018. Similarly, the National Preparedness Level never reached 4 or 5 in 2019 (the highest levels), while the National Interagency Coordination Center invoked Levels 4 or 5 a total of 47 days in 2018. Our hypothesis was that managers would be more likely to manage fires for resource benefit during a cooler fire season such as 2019 when there was less competition for suppression resources like aircraft, hotshot crews, and so on. For the two-year period we examined 155 WFDSS Decisions from the Southwest Geographic Area, 67 from the Northern Rockies, and 92 individual WFDSS records for California, combining both its Northern and Southern Areas.

We then looked at each WFDSS decision after eliminating all fires that were human-caused or of unknown origin, because according to current policy only lightning ignitions provide opportunities to specify resource management objectives. We focused on data reported in the Objectives, Rationale and Resource Benefit slider sections of each WFDSS Decision. Sometimes several WFDSS Decisions were prepared for a long-duration event. Specifically, each fire was assigned a management strategy, either full suppression, confine/contain, or resource benefit. Point protection was explicitly stated in WFDSS Decisions so infrequently that we lumped that with confine/contain unless there was a clear resource management objective. We quickly realized, from a language perspective, confine/contain is usually synonymous with resource benefit fires in the Southwest Region, but we still found fires there that had a confine/contain strategy with no clear resource management objectives being articulated. In California and to a lesser degree the Rocky Mountains region, confine/contain implies an indirect suppression strategy. Consequently, we made a distinction between confine/contain and resource benefit even though in some cases the two may have been combined in the minds of managers. To be counted as a fire managed for resource benefits in our analysis of the 2018/2019 fires, a clearly articulated incident objective in the Decision document had to be identified, often directly from the Agency Administrator’s own words in the Objective/Rationale sections. If the fire was managed for resource benefit objectives at any point throughout the fire’s existence, it was categorized as such to be on parity with the old WFU fire classification.



The image shows a screenshot of a software interface for data entry. It features several labeled fields with dropdown menus and one text input field. The labels and their corresponding values are: '*9. Incident Type:' with 'Wildfire', 'Fire Suppression Strategy:' with 'Point Zone Protection', 'Incident Description:' with an empty text box, and '*Cause:' with 'Unknown'. The interface has a yellow background and a thin black border.

Fig. 3 SIT-209 data input screen implies a suppression objective for all wildfires.

RESULTS

Extent to which WFDSS was used to articulate an *other-than-full-suppression* strategy

The vast majority of California wildfires are human-caused. Additionally, since we were looking at the most recent two-year period, many fires were still under investigation, showing as “unknown” in origin. That being said, for all confirmed lightning-caused fires greater than 10 acres with a WFDSS decision, 37% were managed with an other-than-full-suppression strategy in the 2018-2019 period, accounting for only 6% of acres burned that met that criteria. Management strategy as a percentage of *all* fires with a WFDSS Decision for California are shown in Fig. 4.

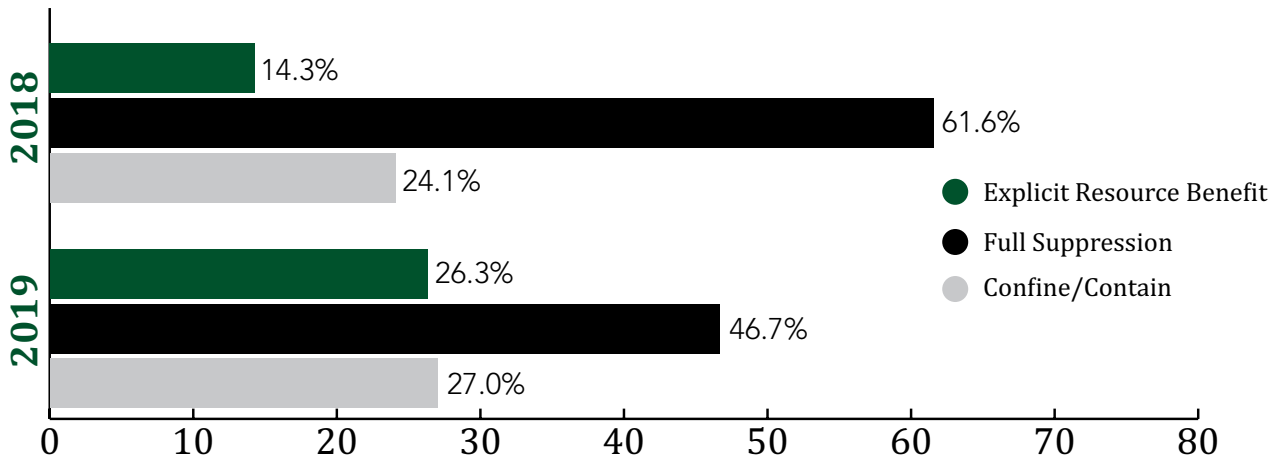


Fig. 4. 2018-2019 Management Strategy for All Fires > 10 ac. with a WFDSS Decision in both Southern and Northern California.

The many destructive fires in California in 2018 pushed managers to select a full suppression response. With so much burning in state and local jurisdiction, no managers wanted to be seen as hoarding scarce firefighting resources when homes are burning. But the data also shows that WFDSS is being used extensively for all significant fires, no matter the cause.

For the two-year period in the Northern Rockies 69% of lightning-caused fires greater than 10 acres were managed with an other-than-full-suppression strategy accounting for 72% of these lightning-caused acres with a WFDSS Decision. Management strategy as a percentage of all fires with a WFDSS Decision for the Northern Rockies are shown in Fig. 5.

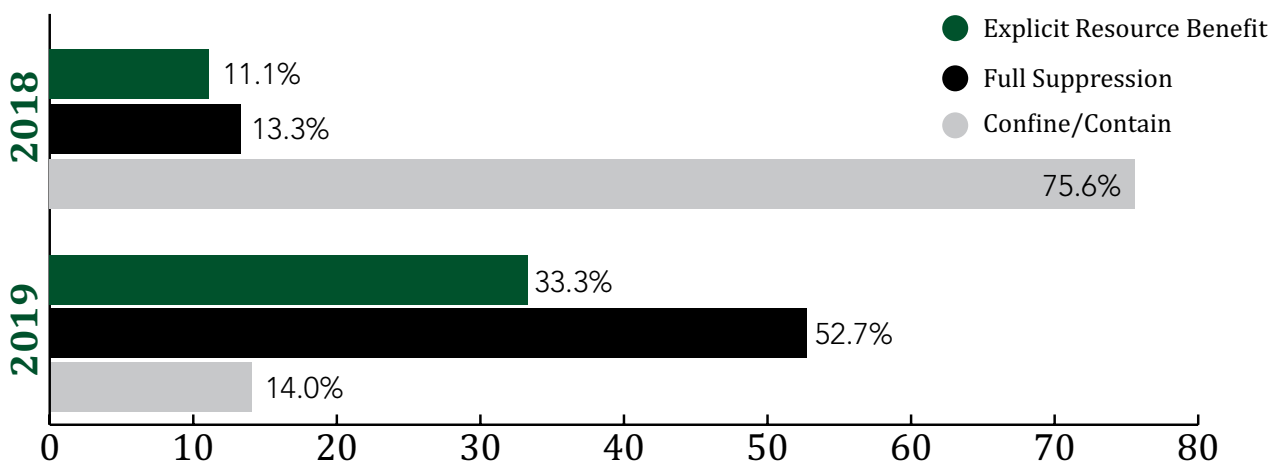


Fig 5. 2018-19 Management Strategy for All Fires > 10 ac. with a WFDSS Decision in the Northern Rockies Geographic Area.

Most impressive was in the Southwest Region, where 78% of lightning-caused fires greater than 10 acres having a WFDSS Decision were managed under an other-than-full-suppression strategy, accounting for 67% of acres. In 2019 96% of all acres reporting having been burned by lightning had a WFDSS Decision. So, at least in the Northern Rockies and Southwest Regions a majority of larger lightning-caused wildfires are not receiving full suppression as a default. Management strategy as a percentage of all fires with a WFDSS Decision for the Southwest Region are shown in Fig. 6.

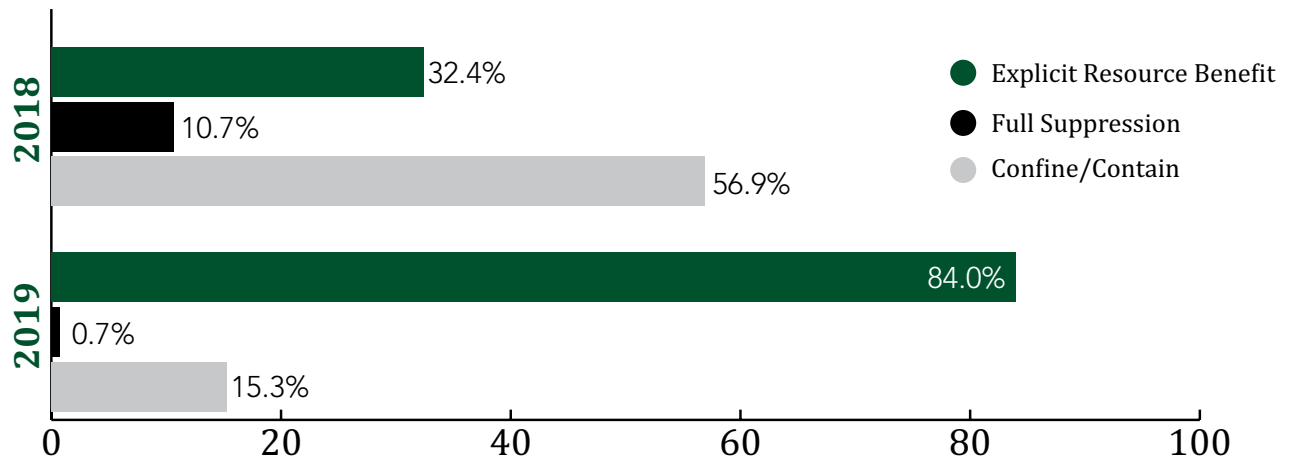


Fig. 6. 2018-19 Management Strategy for All Fires >10 ac. with a WFDSS Decision in the Southwest Geographic Area.

Extent of fires managed explicitly for resource benefit

In the fourth column for each Region in Table 1 (below) are statistics provided by the National Interagency Coordination Center used to develop the nationwide data shown earlier in Fig. 2. This is ten-year average (1999-2008) WFU data for separate Geographic Areas, so direct comparisons of the fires managed for resource benefit in 2018-2019 are found in the second and third column and can be compared Region-by-Region.

<i>Northern Rockies</i>	2018	2019	'99-'08 Average	<i>Southwest</i>	2018	2019	'99-'08 Average	<i>California</i>	2018	2019	'99-'08 Average
Resource Benefit (#Fires)	6	9	75	Resource Benefit (#Fires)	22	55	32	Resource Benefit (#Fires)	6	6	204
Resource Benefit (#Acres)	10,278	4,494	34,881	Resource Benefit (#Acres)	53,394	196,956	46,691	Resource Benefit (#Acres)	15,393	7,440	15,152
Confine/Contain (#Fires)	17	6		Confine/Contain (#Fires)	17	15		Confine/Contain (#Fires)	6	7	
Confine/Contain (#Acres)	69,671	10,734		Confine/Contain (#Acres)	93,803	35,835		Confine/Contain (#Acres)	9,187	7,651	

Table 1. ¹NICC data on WFU accomplishments (right) and #fire/acre data from WFDSS decisions (left) with either a resource benefit or confine/contain suppression strategy.

The data show that only in the Southwest Region are both numbers and acres of fire managed for resource benefits continuing to rise. The other regions not only showed much less acreage of wildfires that were managed explicitly for resource benefits, but this amount was greatly reduced in 2019 when wildfire activity was low, and conditions were more favorable for WFU.

Analysis

The only way to make direct comparisons of recent *other-than-full-suppression* responses to the accomplishments of wildfires managed for resource benefits under the retired WFU program are to find contemporary wildfires where explicit resource management objectives are built into the guiding documents. The only management strategies available for selection on the ICS-209 input through the SIT 209 program (Fig. 3) are shown below in Fig. 7.

- **Monitor** is the systematic process of observing, collecting, and recording of fire-related data, particularly with regards to fuels, topography, weather, fire behavior, fire effects, smoke, and fire location. This may be done onsite from a nearby or distant vantage point in person or using a sensor, or through remote sensing (aircraft or satellite).
- **Confine** is to restrict a wildfire to a defined area using a combination of natural and constructed barriers that will stop the spread of the fire under the prevailing and forecasted weather conditions until out. This means “some action is or has been taken” (line construction, bucket drops, etc.) to suppress portions of the fire perimeter.
- **Point to Zone Protection** involves protecting specific points from the fire while not actively trying to line the entire fire edge. Points being protected may be communities, individual homes, communication sites, areas of high resource value, etc.
- **Full Suppression** implies a strategy to “put the fire out” as efficiently as possible, while providing for firefighter and public safety. To complete a fireline around a fire to halt fire spread, and cool down all hot spots that are an immediate threat to control line or outside the perimeter, until the lines can reasonably be expected to hold under foreseeable conditions. Full Suppression is synonymous with “Full Perimeter Containment and Control.”

Fig. 7. Possible selections for completing the ICS-209 Question #9 regarding incident strategy.

Since none of these options expresses a natural resource management objective, alone, they cannot serve as a surrogate to determine if earlier efforts to manage for those objectives are continuing today, so noting trends in ICS-209 data and equating management of fire by anything other than full suppression, from the categories above, does not address whether or not progress is being made on the reintroduction of fire to fire-dependent landscapes.

Clearly, there was variation in how WFDSS was utilized, depending on the Geographic Area of reporting. Just the sheer number of WFDSS Decisions in the Southwest indicated a greater willingness to go through the process. Managing for resource benefit seems so accepted in the Southwest Geographic Area; that complex analysis and decision support is less utilized compared to other Regions. This is unlike California where we found widespread usage of WFDSS and its suite of decision-making tools used on all fire types. 2019 was an unusually cool and short season for the Northern Rockies, driving numbers down, while 2018 was very active. In the Southwest, despite *confine/contain* usually being synonymous with fires managed for resource benefit, in 2018 more fires were managed *confine/contain* as a suppression strategy without any mention of resource benefit. They were constrained by what was going on nationally, especially in California, but they clearly had excellent conditions in 2019 to really expand their burning for resource benefits.

The number of fires reported as being for resource benefit is down in all regions from the WFU era, but that is likely due to the tiny fires surrounded by rocks that are not included in our analysis that only looked at fires greater than 10 acres. There does seem to be a difference today in that those “goat rock” fires, though they didn’t amount to any acreage, that were being actively designated as WFU back in that era. But without the WFU designation today, many of those fires will get a heli-rappel or smokejumper response with the associated unnecessary firefighter risk exposure when these fires could be simply monitored periodically by ground or air.

California is under-utilizing natural ignitions as a management tool, due likely to 1) triggering Title 17 California AQ rules that allow local air districts to be in a regulatory position to approve daily acres burned and be in receipt of per acre fees, and 2) stave off the allegations of insufficiently aggressive firefighting from uninformed local/state/county cooperators. The number of acres didn’t show any increase from the WFU program days, and the number of incidents is down since the smallest fires aren’t receiving resource management objectives and weren’t included in

our analysis of WFDSS Decisions. Arguably, these remote fires may be of limited ecological significance due to their small size. Overall, there appears to be a general aversion to conceding resource benefit objectives in California, particularly if there is any concern for nearby private land/property liability. Clearly, with the slow pace of official investigations into the cause of fires, there is no rush or sense of urgency to declare a wildfire as being lightning-caused, the very most important piece of information needed to allow a fire for resource benefit to move forward.

California also suffers from local incident management teams consisting of a minority of current agency employees, ceding many positions to local and state cooperators, as well as recent annuitants. Since managing for resource benefit is restricted to agencies having a land base, state and local officials have no buy-in or understanding of such goals. Many of these team members are in key operational roles, where clear leader's intent is so important for outcomes. Sadly, this has led to local/county/state cooperators, and by extension law enforcement and other civic leaders to claim "the Feds don't fight fire aggressively anymore," and conflicts arise among different agencies on fires managed under a unified incident command.

Conclusion: Whither the new paradigm?

This paper represents an initial exploration into current levels of application of wildland fire use for resource and ecological benefits. This study was limited by its focus on just two years of fires in Federal jurisdiction across three Forest Service regions. More robust studies should follow looking at other data sources and examining other USFS regions. Different methods for data analysis, particularly using machine learning to process more suppression records such as ICS-209s and Incident Action Plans, could be employed, although the WFDSS documents may yield the best data. The real discovery from this pilot study is that there may be more to see than meets the eye: more ecological fire use may be occurring on the ground even if the various euphemisms, e.g. "other-than-full-suppression" and lack of official documentation obscures it.

Progress since the end of the wildland fire use era (and the end of WFU as an officially recognized category for analysis) can be seen as either a glass half-empty or a glass half-full. On the one hand, the understanding of the ecological necessity of managing wildfires for resource benefits, and the confidence by fire managers and commitment by agency decisionmakers to implement fire use seems to be waning, leaving a glass half-emptied. On the other hand, the risk assessment and fire behavior predictive tools that are being used to manage long-term wildfire events, along with the use of confine/contain, "box-and-burn," and other less-than-full-clarity suppression strategies reveals that land and fire managers are taking opportunities to increase the amount of fire on the ground despite the lack of explicit resource management goals. Most encouraging in our research results is the discovery that resource benefit objectives are frequently and explicitly stated in the WFDSS Decisions in the Southwest Region, indicating that a cultural shift favoring more ecological fire use is happening in that region, giving a glass that is half-filled.

Current language around management of natural ignitions lacks clarity and continues to favor a suppression response, a feature exploited and exported from California. If we continue to suppress the easy fires during the shoulder seasons (spring/fall), preferring instead to apply resource benefit objectives by benign neglect at the peak of wildfire season when attempted full suppression fails, then we are certainly not optimizing our management for beneficial fire effects. Having explicit resource benefit objectives would facilitate and even legitimize raising the number of acres being burned by *intent* rather than by accident. This would require more involvement by 'ologists' in fire management, and more input by resource specialists in designing wildfire response strategies. And above all, it would require more courage among administrators and decisionmakers demonstrated by a willingness to explain themselves more fully to the public, and expose themselves to potential negative press or public reaction, and opposition from affected private landowners, especially timber companies. Fortunately, ecological fire use enjoys substantial scientific support along with economic rationale and justifications framed by firefighter safety concerns. Such courage to authorize more fire use may force some managers to step out front and lead but they won't be out on a limb.

With annual wildfire losses exceeding \$10 billion for the first time in three of the past four years (2017 to 2020), the danger exists that managers will become even more risk-adverse to managing wildfires, and double down

on the fire suppression paradigm despite its short-term failures and long-term futility. This would be a mistake. During the most extreme fires in 2020 there was only *one thing* tempering fire spread and intensity: the mosaic of recent nearby burned patches from wildfires. During the pivotal wind events that led to the most rapid rates of spread, when no human intervention in the moment tempered fire growth, recent fire history did. Timber harvest and other mechanical fuels treatments do nothing to reduce surface fuels. Only broadcast burning eliminates the connective tissue of wildfires: the surface fuels. Increasing ecological fire use when conditions permit good consumption of surface fine fuels can be viewed as investments in future suppression success when conditions may yield extreme fire behavior or unwanted severe fire effects.

What we are seeing now is what fire ecologists have long observed. Over time, a fire mosaic can be created across a landscape, such that fire size becomes self-limiting (van Wagtenonk 2004, Collins 2009, Scholl, 2010, Haire 2013), but this is occurring with a speed and amount of change that is straining social acceptance. For example, the southern half of the Mendocino National Forest burned during the 2018 Mendocino Complex. That was the largest wildfire in recorded California history, until 2020, when the remainder of the Mendocino National Forest burned during the August Complex. But, even as these behemoths churned away, they met resistance and slowed in the Yolly Bolly Wilderness, where past fires had been managed for resource benefit. Other recent wildfires around the periphery of these two giants either stopped or slowed the spread of the August Complex during conditions when suppression actions were ineffective. There is a need to investigate the effects of wildfires that burned over the last 15 years, especially those few that were managed for resource benefits, on the rates and patterns of fire spread and ecological effects of the 2020 California wildfires.

Obviously, society would prefer that wildfire remain in wildlands, and not burn near communities or threaten any lives or property. Ecological fire use in remote wildlands is too often viewed as exclusively an environmental benefit, with no recognition of how this can also be a social benefit. Indeed, the only practical and economical way to reduce hazardous fuels at the scale of Federal wildlands that require it involves the application of fire--much more fire. For a number of reasons, prescribed burning will not be able to provide the needed amount of ignitions, so a shift in social acceptance of managing naturally-ignited wildfires to function like prescribed fires, as is occurring in the USFS Southwestern Region, needs to happen across the western U.S. Greater use of spring season lightning fires combined with allowing more late-season fires to burn until their season-ending weather event are both critically needed. This expanded fire use for the purpose of landscape-scale fuels reduction will reduce the probability of high-intensity wildfires migrating toward communities, and if the wildlands are good with fire, this will enable managers to focus on reducing vulnerability of communities to wildfire ignitions. Consequently, there is a beneficial effect of ecological fire use in enhancing community wildfire protection goals, but the way to accomplish these goals is counterintuitively with more fire, not less.

There is a growing number of land and fire managers who fully understand the social and ecological need for and benefits of managing wildfires for resource objectives. Within the USFS there should be deliberate efforts to integrate fire use in the agency's "multiple-use" philosophy, acknowledging fire use as both management inputs and outputs. Progressive managers using the best available science and most advanced technology to safely manage fire spread and behavior for desired effects should be able to document and share their successes, and be rewarded for them. These successes are happening, rarely in the California Region while more frequently in the Southwestern and Northern Rockies Regions.

In June of 2020 with COVID concerns running high, USFS Chief, Vicki Christiansen, issued direction emphasizing "rapid containment" of wildfires during the 2020 season. That did not deter managers on the Bighorn Fire outside of Tuscon in June from including explicit resource management objectives in their WFDSS Decision documents. As long as the agency masks its management actions and intentions with vague terminology that avoids admitting to the resource and ecological benefits of fire use, this will hold back the amount of success the agency can achieve. So let's not be tolerant of "suffering resource benefits" by default when their first resort to suppression resources are unavailable. Managers should call it what it is and be "loud and proud" of their professional knowledge and skills in safely using wildland fire for social and ecological benefits. With commitment by their agency leaders, the rest of society can and will support their success.

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