Ecological Fire Use for Ecological Fire Management: Managing Large Wildfires by Design

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Abstract—*Past fire exclusion policies and fire suppression actions have led to a historic "fire deficit" on public wildlands. These sociocultural actions have led to unprecedented environmental changes that have created conditions conducive to more frequent large-scale wildfires. Politicians, the newsmedia, and agency officials portray large wildland fires as catastrophes and unnatural disasters, but these fires could actually provide fire managers unique opportunities to recover fire-dependent species and restore fire-adapted ecosystems that have been adversely affected by the fire deficit. This paper will describe a vision of utilizing wildland fires in a way that holistically synthesizes the principles and practices of prescribed burning, suppression firing operations, and wildland fire use as part of a land stewardship philosophy to be called Ecological Fire Management (EFM). Under EFM, preplanned ecosystem restoration goals will guide management actions—including suppression actions—on every large wildfire. However, suppression will be redefined from its current frame of "aggressively fighting" to limit large fire size, to one of "actively managing" to mitigate uncharacteristic fire severity. Fire use will be a major tool in EFM, actively applied to steer, slow down, or speed up rather than simply stop fire spread. With increased fire use for ecological restoration goals, future wildfires may become large by managerial design.*

Introduction

Every year the newsmedia blares sensationalist stories about "wildfires burning out of control" somewhere in the United States (KHBS/KHOG TV). This has become an acceptable, almost hackneyed, media frame that never seems to lose its dramatic appeal, and rarely gets critically examined by journalists who attempt to outdo each other with hyperbolic stories about so-called "megafires" or "the worst fire season ever." Journalists typically focus on scenes showing the most extreme fire behavior like crown fires or homes fully engulfed in flames, or focus on areas with the most severe fire effects like fire-killed trees or "moonscapes" that often result from burned clearcut timber plantations. Readers or viewers of these news stories are left with the false impression that every acre of a wildfire burned catastrophically, and if not for the heroic efforts of brave firefighters, the size of the catastrophe would have been even greater. This overused media frame promoting hype and hysteria of wildfire events is contributing to a widespread belief among the public that all large wildfires are unnatural and entirely destructive events, and that we suffer from an over-abundance of wildfire.

In some ecosystems large wildfires were a natural part of the historic fire regime, There is accumulating scientific evidence that large wildfires and megafires are becoming more frequent in the western U.S. (Dennison and others 2014; Littell and other 2009; Westerling and others 2006). Depending on the given region, the increasing size of wildfires can be attributed to the following factors: (1) the effects of ongoing climate change that are producing weather and fuel conditions more conducive to ease of wildfire ignition; (2) rapid fire spread and/or extreme fire behavior; (3) sprawling housing development in fire-prone rural areas that produce more human-caused ignitions and/or divert firefighters away from managing fires in wildlands to prioritize structure protection; and (4) the accumulation of excess fuel loads resulting from past logging, grazing, and firefighting actions and fire exclusion policies.

Although some wildfires are getting bigger in size, there is an oft-stated assumption that they are also getting hotter, i.e., more severe in effects. Indeed, there is healthy scientific debate and conflicting evidence concerning increasing fire severity. Some studies conclude that the frequency and extent of high-severity fire is increasing in some regions (Miller and Safford 2012), while other studies claim that there is no demonstrated increase in severity (USDA Forest Service 2012). In ecosystems that are characterized by infrequent fire return intervals and high-severity fire regimes, severe fire effects may still be within their historic range of variability. In ecosystems with frequent fire return intervals and low-severity fire regimes, recent large wildfires do appear to be uncharacteristically large or severe. However, some fire history studies reveal that, in the pre-settlement era, some low-severity fire regimes had some extremely large-scale wildfire events that included patches of high-severity fire, so questions remain whether or not recent large-scale or high-severity fires are truly "uncharacteristic" events in these ecosystems (Odion and others 2014; Williams and Baker 2012). Regardless, when the scale of wildfire phenomena is limited to the last few decades, the trend is clear that the frequency of large wildfires and the number of acres burned by the largest wildfires is increasing dramatically.

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Decades of sensationalist media coverage coupled with Smokey Bear anti-fire propaganda have conditioned most people to fear and loath wildfires, and there is almost unquestioning support by the public and elected officials for any or all efforts to prevent or suppress wildfires. Understandably, when flames encroach upon homes and communities, people want firefighters to put those blazes dead out. Paradoxically the fear of fire extends ever outward into the hinterlands so even when fires burn in remote wildlands or designated wilderness areas far away from human communities, there still exists a popular desire to aggressively suppress those fires. In fact, the U.S. Forest Service (USFS) boasts that it is successful in suppressing 98% of all wildfire ignitions during initial attack operations (Tidwell 2014). This success rate further contributes to the perception that large wildfires are unnatural events. Ironically, successful initial attack fire suppression is a primary factor contributing to the growing frequency of large-scale wildfires that burn through areas that would have burned if not for prior suppression efforts. Dead and live fuels continue to accumulate in the absence of fire increasing the intensity of the next fire incident. Agencies have acknowledged that past fire suppression has contributed to excess hazardous fuel loads that feed larger wildfires, but there is nothing "past" about this. Systematic fire suppression is still ongoing, and the still-rare but increasing frequency of large-scale, long-duration, uncontrollable wildfires are entirely natural outcomes of fighting fires near and far from human communities.

The Minority View: The Land Needs More Fire

Despite the widespread belief among the public, politicians, and the press that there is an overabundance of wildfire on the landscape, fire ecologists hold a minority viewpoint that in actuality many fire-adapted ecosystems and fire-dependent species have been adversely altered or are in decline due to a lack of fire. In fact, just in terms of total acres, there is an historic fire deficit of burned acres that has accumulated since the industrial area and in particular over the most recent 60 years (Leenhouts 1998). Table 1 reveals the dramatic decrease in burned acres in the U.S. since the 1940s. According to one study, in the eleven western states of the U.S., the amount of acres that needs to burn to maintain historical fire regimes, compared to the amount that actually burns, comes to a deficit averaging 10 to 12 million acres per year (Medler 2006). This fire deficit continues to grow every year with each wildfire that is contained at the smallest size feasible by fire suppression crews. The annual fire deficit could be reduced over time if the fire-fighting agencies would stop suppressing nearly all fires and allow more fires, especially those in remote settings, to spread larger and burn longer. Even if that were to happen, natural ignitions alone probably would not provide sufficient amounts or the right kinds of fire to recover from the huge fire deficit that has grown to date. Consequently, many fire ecologists believe that, for the sake of ecological restoration and biodiversity preservation, it will require active fire reintroduction on a landscape scale. This is currently impractical politically given the public's perception that we have too much rather than too little fire on the land.

Table 1—Average number of wildfires and acres burned by decade in the U.S.

Years	Average number of fires	Average acres burned
1919-1929	97,599	26,004,567
1930-1939	167,277	39,143,195
1940-1949	162,050	22,919,898
1950-1959	125,946	9,415,796
1960-1969	119,772	4,571,255
1970-1979	115,112	3,194,421
1980-1989	163,329	4,236,229
1990-1999	106,306	3,647,597
2000-2009	70,771	6,612,363

Source: National Interagency Fire Center

There is another contrarian viewpoint that is gaining more credence among fire ecologists: the number of "acres burned" is the wrong metric for analyzing the effects of wildfire or the effectiveness of fire management. Given current attitudes, a large wildfire is seen as a natural disaster, while a fire that is kept small due to aggressive suppression efforts is considered a management success. But is a large wildfire that reduces accumulated dead fuels, rejuvenates wildlife habitat, and regenerates fire-dependent species a "natural disaster" or "catastrophe"? Is a small fire that required extensive money, crews, toxic chemicals, and heavy equipment to keep it small a "management success" in terms of ecological land stewardship? An emerging vision of land stewardship that I call Ecological Fire Management (EFM) advocates that the proper focus of fire managers should be mitigating extreme fire behavior and uncharacteristic severity, not limiting fire size. Managers should be addressing what Pyne (1995) calls the "maldistribution" of fire: too much of the wrong kinds of fire burning in the wrong places and conditions, and too little of the right kinds of fire burning in the right places and conditions. In this new perspective, managers must combine the tasks and missions of fire prevention and fire promotion, fire suppression and fire restoration, and a qualitative assessment of ecological integrity should become the new measure for management success rather than the quantity of acres burned or ignitions successfully attacked.

Even though the newsmedia typically portrays wildfires as "catastrophic," in fact, most large fires burn with a range of severities resulting in a landscape "fire mosaic." High-severity fire is generally a smaller proportion of the total acres burned in large wildfires compared to moderate and low severity areas, and there can be significant unburned islands located within wildfire perimeters that are often overlooked in mapping efforts (Kolden and others 2012; Kolden 2010; Kolden and Weisberg 2007). Even incidents of rapid fire spread or large fire "runs" rarely uniformly burn with high severity, rather, they burn unevenly leaving a mosaic of effects (Donovan and others 2014). Regardless, the

dominant cultural bias against wildfires is especially strong in its antipathy to high-severity fire. However, from an ecological standpoint, high-severity fire is not necessarily bad or undesirable given that many species depend on it for various habitat needs including natural regeneration.

Despite or because of the historic fire deficit, there is accumulating scientific evidence that large wildfires are becoming more frequent under the influence of ongoing climate change, an abundance of surface and ladder fuels, and human communities sprawling into fire-prone environments. Even though large wildfires are becoming more frequent, they are still relatively rare events due to the agencies' success rate with initial attack fire suppression. Much more fire on the landscape is needed to restore fire-adapted ecosystems, preserve fire-dependent species, and protect rural communities located in fire-prone places. As an alternative to the dominant cultural and management view of large wildland fires as a problem, they could be reframed as a possible solution to a number of land management challenges. The key will be for fire managers to de-emphasize the significance of fire size, and focus instead on more critical issues such as fire severity and whether the severity level is likely to be beneficial to ecosystem integrity, natural resource values, and other social values for the particular region, fire regime, and ecotype of any given wildfire.

Future wildfires that destroy property or harm people may legitimately be viewed as disasters, but in the emerging vision of EFM, future megafires that burn within the historical range of variability for fire severity may be used as opportunities for landscape-level fuels reduction and ecosystem restoration. Toward that vision, agencies will be actively managing wildfires in backcountry and wilderness areas in ways that mitigate uncharacteristic fire behavior or effects, and maximize the social, ecological, and resource benefits of the burns. In so doing, managers will be using large fires intentionally—by design and with desire—to achieve land management goals for ecological restoration and community protection.

Evolution of Fire Use Terminology

Fire use has been a wildfire management technique for several decades, with one of its first applications by the U.S. Forest Service on the Bad Luck Creek Fire in the Selway-Bitterroot Wilderness Area as part of the White Cap Fire Plan in 1972 (Mutch, unpublished data). The practice has undergone several name changes over the years. The first term for fire use was "prescribed natural fires" (PNFs) and was a fairly descriptive label for using lightning ignitions for prescribed burning. Early practitioners had a philosophy that restricted management actions mainly to monitoring the natural spread of PNFs, particularly in designated wilderness areas. The ideal PNF in their view was a fire that "started and stopped on its own, with minimal management interventions" (Campbell, personal communication). In fact, if fire behavior or spread threatened to exceed managers' prescriptions, then the only way to take management actions on the fire was to declare it a wildfire and then commit to total suppression. Unfortunately, PNFs were dubbed with the phrase, "let it burn," and this passive non-interventionist approach to fire use generated opposition by the public and most agency line officers. This opposition had the effect of making PNFs rarely authorized, and only viable in the largest, most remote areas of designated wilderness or national parks. PNFs were even more restricted following the 1988 Yellowstone Fires (Parsons and Landres 1998).

With the creation of the 1995 Federal Wildland Fire Management Policy, official fire management terminology went through a significant revision, and PNF was replaced by the term, "Wildland Fire Use for Resource Benefits" (WFURBs, sometimes called "furbees" by firefighters) that was later shortened to "Wildland Fire Use" (WFU, pronounced "woo-foo" by fire crews). WFU was elevated from a fire management tactic to become a strategy that defined its own kind of wildland fire that was distinct from wildfire which, by definition, had to be totally suppressed. In practice, WFUs allowed more management actions to keep fire spread or behavior within prescribed parameters, but in 2003 the Bush Administration issued new guidance for implementation of the Federal Wildland Fire Policy that had the effect of inhibiting authorization of WFU even more.

At the outset of the Obama Administration in 2009, new guidance for implementing federal fire policy was issued again, and this time it was made explicit that multiple objectives such as protection and restoration could be combined on a single fire. Thus, crews could implement both fire suppression and fire use actions on different portions or different times on the same wildfire. This was a remarkably progressive policy change that greatly facilitates a shift to ecological fire management and restorationist fire use, but part of this policy change involved the National Wildfire Coordinating Committee eliminating the term "wildland fire use" from the official glossary of fire management, leaving only two kinds of wildland fire: prescribed fire and wildfire. The reason behind the glossary change by the NWCG was that they did not want managers to view fire use as a type of fire (e.g., "Fire Use fires"), but rather, as a tactic or tool to be considered on any wildfire. The intention was to expand opportunities for fire use as much as possible, but given the cultural baggage of a century of demonizing and attacking wildfire, most of the public and politicians believe wildfires are something to fear and fight, never to "use." Consequently, wildland fire use continues to be rarely authorized or applied, and when it is applied, fire managers prefer to euphemistically call it "managed fire for multiple objectives" in an attempt to avoid controversy over the term fire use.

The Three Kinds of Fire Use

In the goal to encourage more use of wildfires to achieve fire reintroduction and ecosystem restoration goals, it is important to rearticulate fire use as something besides or beyond a passive "let it burn" approach. This is important to gain more public support and line officer approval for it,

but also to maximize its potential usefulness in fire management. One way to do this is to recognize and integrate all three kinds of fire use that are already widely practiced as the staples of fire management methodology: prescribed fire use, suppression fire use, and wildland fire use. The public understands and largely accepts the first two kinds, and from that basis, can come to support the third kind of fire use that, in my opinion, should be renamed as ecological fire use and become the primary focus if not major means of implementing wildland fire management on federal lands.

Prescribed Fire Use

Prescribed fire is the most preferred form of fire use for managers because it offers them the most control over desired fire behavior and fire effects. However, paradoxically a number of social, administrative, and fiscal factors make this most desirable form the least utilized of all. First, there is opposition to prescribed burning from people who fail to understand the necessity and inevitability of fire in fire-adapted ecosystems, and believe that we can and should prevent all forest fires. Second, there is the ever-present risk that controlled burns may escape or exceed their prescriptions, and become uncontrolled wildfires. Indeed, there have been huge wildfire disasters that were initiated by escaped prescribed fires. It only takes one of these accidents to end a manager's career in fire, and set back a local burn program for years. Barely one percent of all prescribed fires escape, and of these, just a fraction cause any property damage or human casualties; nevertheless, these are the fires that make the headlines and get burned into the public's psyche, reinforcing other contemporary political themes about government incompetence or mismanagement. The perceived risk of escaped fires has become greater given the sprawl of homes into wildlands. The other 99 percent of prescribed fires that are safely and successfully implemented largely go unreported and unacknowledged.

Smoke emissions are becoming a key constraint on the use of prescribed fire due to air quality regulations that unfairly lump smoke from burning for fuels reduction or ecosystem restoration in the same category as "agricultural" burning of farming or logging wastes. Indeed, prescribed fire use must compete with agricultural and industrial burners for smoke allowances, and even when these are within legal limits, smoke from controlled burns can trigger public nuisance complaints that can provoke air regulators into shutting down the burns. However, along with the fire deficit there has been an historic "smoke deficit" from wildfires! One study concluded that ten times more landscape should be burning annually, consuming eight times more biomass, and producing seven times more smoke emissions (Leenhouts 1998). Nevertheless, the effect of the wildfire smoke deficit has been masked by the air pollutants emitted from urban, industrial, and agricultural sources. Unlike the largely invisible emissions from auto tailpipes or industrial smokestacks, the smoke plume from a prescribed burn is a visible target for public complaints and the ire of air regulators.

Lastly, funds for prescribed burning and other fuels treatments must come from budgets that are fixed by annual appropriations, and are getting smaller due to Congressional budget cuts to federal agencies. Wildfire suppression enjoys near limitless funding through large budgets, "fire transfers" from other non-suppression accounts, and emergency supplemental appropriations. At the time of this writing there are bills in both houses of Congress that would allow wildfire suppression to access FEMA disaster funds, too. But funding for prescribed fire use that would mitigate some of the damages and costs of wildfires is becoming more limited each year. For all the above reasons and more, even though prescribed burning is the most preferred kind of fire use from the standpoint of managers, it is the least utilized and most unlikely means of implementing the vast scale of burning needed to reduce fuels, restore ecosystems, and recover landscapes from the historic fire deficit.

Suppression Fire Use

Fire use is commonly considered the opposite tactic from fire suppression, but in fact, fire is used extensively if not systematically in wildfire suppression, especially on large wildfires. Indeed, suppression firing operations implement a longstanding practice of "fighting fire with fire." The two forms of suppression fire use are called backfires and burnouts. Backfires are largely uncontrolled high-intensity fires ignited to eliminate all burnable fuels in advance of wildfires, and to apply force to change the direction of wildfire spread. They are normally ignited in conditions or locations that cause high-severity effects. On steep slopes or rugged terrain with dense fuels and severe fire weather conditions, backfiring is often the safest method for firefighters to attempt wildfire containment. Burnouts, on the other hand, are typically low-intensity fires ignited adjacent to fire containment lines, and are intended to eliminate surface fuels and therefore strengthen the firelines. Burnouts are ignited on almost every fire of any significant size as a routine practice. In recent years large-scale backfires and burnouts have started resembling each other, creating a hybridized firing operation dubbed "backburning" by the newsmedia. Most people do not associate fire-lighting with fire fighting, but suppression fire use is arguably occurring on a scale that far exceeds any other kind of fire use, thus, challenging the conventional assumption that fire suppression equates with fire exclusion. It is an open question whether extensive backburning is a cause or consequence of large-scale wildfires.

The dominant objective of wildfire suppression is to contain fire spread—to keep fires as small as feasible and limit the number of acres burned. The great paradox of suppression firing operations is that they objectively spread fire and add to the number of acres burned while at the same time they are intended to limit even greater potential spread and size of a wildfire. There has been no systematic tracking of suppression firing locations, so the size or severity of these fires individually or cumulatively is currently unknown. Anecdotally, though, two case studies revealed that suppression fire use was conducted on a very large scale, such as the

1999 Megram and the 2002 Biscuit fires that were the largest (and most expensive) wildfires in the U.S. during those years. Backfires and burnouts were ignited considerable distances away from the wildfires' edges, adding tens of thousands of acres cumulatively to each wildfire's perimeter, and much of this acreage also burned with high severity (Ingalsbee, unpublished paper; Ambrose, unpublished data).

Given the need to reintroduce fire on a landscape scale, the fact that suppression fire use is partly accomplishing this goal should be celebrated, however, it is not known if the places, patterns, sizes and severities of firing operations are ecologically appropriate, or instead are creating uncharacteristic fire effects. Again, suppression actions generally have one objective in mind—to contain fire spread—and the ecological effects of firefighting actions have until recently rarely been considered in suppression operational planning. But speculating that backburning is the dominant form of human-caused fire reintroduction, there is an urgent need for systematic research and critical analysis of the ecological effects of suppression fire use. In those incidents where backburns are ignited in places or conditions certain to cause large high-severity patches, it begs the questions: is that a desirable outcome, and if so, how does that constitute "suppression" of a wildfire?

Because backfires are uncontrolled high-intensity blazes, they used to be ignited as a kind of last resort when conditions did not permit safe or effective fireline containment, but it appears that backfiring is becoming more prevalent, especially on large wildfires or fire complexes with indirect attack strategies. Sometimes backfires can literally backfire on crews by changing direction and failing to merge with the main wildfire, and thus, its own separate wildfire, or by vastly increasing the intensity or rate of spread of the main wildfire. Some notorious examples include the 2000 Cerro Grande fire that started as a prescribed burn slopover that was eventually contained at 30 acres, but then when crews ignited a large burnout, the fire surged out of the area and eventually spread across 44,000 acres, destroying hundreds of homes in Los Alamos, New Mexico in the process. On the 2009 Station Fire, backfires helped save homes in the community of La Crescenta, but two firefighters were killed while fleeing a backfire they ignited and burned back toward them. Backfires and burnouts thus may represent a greater risk of adverse impacts on firefighters and ecosystems than are commonly perceived, but without systematic tracking or long-term monitoring or analysis, the overall effects of backburns are currently unknown.

There is inherent risk in managing fire, and even the most carefully planned and implemented prescribed burn has the potential to escape control given the dynamics of fire and all the environmental variables that influence its behavior. Backburns, on the other hand, are by definition emergency actions that enjoy the "suppression exemption" from many laws and regulations governing normal agency operations. They are ignited with minimal planning, no prior environmental impact analysis, and often under less than ideal conditions for controlling fire behavior or effects. However, there is a double standard when it comes to the professional and public consequences of escaped prescribed fire use versus uncontrolled suppression fire use: managers face formal reviews, negative sanctions, and are publicly vilified as incompetents for the former, but are unquestioned and even heralded as heroes for the latter. This double-standard creates additional disincentives for prescribed burning, while making suppression firing almost risk-free with barely any legal, regulatory, or fiscal limits on its use, even when backfires damage private property (Backfire 2000 v. U.S. 2006). It is easy to understand, therefore, why suppression firing may be the dominant form of fire use today. While it might be getting fire on the ground and helping to compensate for some of the fire deficit, if it is creating uncharacteristic patch sizes, patterns, or locations of high-severity fire, then it would be further contributing to Pyne's concept of the maldistribution of fire.

Ecological Fire Use

Progressive fire managers have been implementing fire use for ecosystem restoration and resource benefit objectives for several decades. It has been called many names and acronyms over the years, most recently it has been called "wildland fire use" but may soon be called "managed wildfire." Fire use specifically for ecosystem restoration purposes is currently the rarest form because it suffers from a few misperceptions and overly restrictive management regulations that constrain opportunities and options to apply it. This paper argues that wildland fire use needs to be re-envisioned and re-articulated as an active form of ecological fire management that should become a principal way that fire management is defined and practiced in the future. For that reason, I propose that we start calling it "ecological fire use."

There are a number of institutional biases against ecological fire use that explain its rarity. First, the agency imposes several extra planning requirements and restrictions upon fire use for resource benefits, especially compared to suppression fire use that has almost no prior restrictions placed upon it. Ecological fire use is not permitted unless an approved Fire Management Plan and Forest Plan authorizes it. However, many National Forests have forest plans that are outdated, and have obsolete or non-existent fire management plans. This functions as a form of prior restraint that prevents fire use from being considered as an option at all. Second, many "old-school" foresters view wildfire as a threat to natural resources, especially commodity timber values, and thus exclude fire use from most "General Forest" areas committed to multiple-use resource management. Third, State forestry agencies have suppression-only policies, and some in federal agencies fear that they might face legal or financial liability if their fire use actions on federal lands spread wildfires onto State or private lands.

These institutional biases stem from a misperception shared by much of the public that views fire use narrowly and simplistically as "let it burn," a passive or laissez faire approach that seems almost "anti-management" in its essence. In a recent survey measuring homeowners' attitudes about wildfire and fire management in Central Oregon, researchers

came to a surprising finding: people opposed fire use more than they opposed wildfire! Examining the survey questions explained the basis for this attitude: the concept of wildfire was defined in a way that assumed it would automatically be suppressed while fire use was defined as "let burn" (Olsen 2014, 2012). Despite the insistence of Fire Use managers that monitoring is a kind of management action, most of the public and too many agency officials believe that wildland fire use really means "unmanaged" wildfire. Consequently, this kind of fire use is the rarest management response because when a wildfire ignites the public demands that land managers do something to control it.

In contrast to the view of ecological fire use as a passive, hands-off response, it needs to be rearticulated as a hands-on fire management tactic and a proactive strategy for reintroducing fire, reducing fuels, and restoring ecosystems. Many progressive land managers have used such tactics and strategies for years, but it's time to enhance the practice and promote it. As a strategy, ecological fire use would employ all of the tools and techniques of fire management to manage wildfire spread in ways that serve pre-planned ecosystem restoration goals. Instead of contain and control strategies with tactics that aim to stop fire spread, more confinement strategies and related tactics could be used to start and steer fires into areas that planners want to burn, and away from areas like human communities that should not burn. Fewer fires would be suppressed with perimeter control strategies in favor of point or zonal protection strategies that would allow wildfires to grow larger and burn longer. Utilizing the best available technology for monitoring, mapping, and modeling fire spread, fire crews might be asked to slow down fire spread one day but then speed it up the next, depending on changes in current and expected conditions, in order to accomplish desired fire behavior and effects. Management actions would occur on strategic locations deemed the safest, most effective, least damaging places to take action, and crews would likely do much more firing and much less fireline cutting than they currently do. In essence, crews would be utilizing wildfire ignitions as triggers for managing, applying, and using fire in an active, hands-on approach to reintroducing fire on a landscape scale.

Ecological Fire Use as the Means For Implementing Wildland Fire Management

In this future vision of ecological fire use, "let it burn" will be rearticulated as "make it burn," and wildfires will be managed to become large-scale by design, both in the sense that behavior and effects will be prescribed with preplanning, and in the sense that fire patterns and perimeters will be larger by desire. Natural ignitions will start the process, but management ignitions and other actions will sustain wildland fire events and processes as long as conditions permit the accomplishment of ecological restoration goals. The goal of this redefinition and greatly expanded application of fire use is ultimately to support safer, more ethically and ecologically sound fire management. This may take some protracted messaging campaign to persuade the public, the press, elected and administrative officials about fire ecology and the necessity, inevitability, and desirability of large wildfires burning on the landscape. This campaign could be challenging, but not impossible, if the other two forms of fire use that already enjoy public acceptance—prescribed and suppression fire use—are incorporated into the new definition of ecological fire use. In fact, the three kinds will essentially be holistically synthesized into one form with one simple term: fire use. Ecological goals will be considered on every wildfire incident and in every management action, and fire will be used as much as possible to fulfill both protection and restoration objectives.

At the same time that fire use is redefined and rearticulated, fire suppression will need to be re-conceptualized, ending its single-objective focus on limiting wildfire spread to keep fire size small, and more concerned with mitigating uncharacteristic fire intensity or severity. In the context of unfolding climate change that will likely make future conditions more prone to extreme fire behavior or severe fire effects across broad regions, this may require fire managers to take a long-range view and permit wildfires to burn at higher intensities in the short-term in order to mitigate fuel conditions for future wildfires. Employing more fire use will also allow agencies to be more flexible, strategic, and selective in where they dispatch scarce or costly suppression resources. Overcoming the historic fire deficit and preparing landscapes for future climate change will require getting as much ecologically appropriate fire on the ground as soon as possible, so fire use will continue to be a major suppression tool. But again, suppressing fire severity, not limiting fire size, will be done for the sake of pre-planned ecological restoration goals, not out of generalized fear of fire, or as a default mode of risk-adverse managers compensating for a lack of prior fire planning.

The Ecological Fire Management Vision

The words that agencies use matter in terms of conveying to the public what is or should be happening on the ground, and also to guide management actions in the first place. The traditional suppression-centric focus of federal fire management has been dominated by the pervasive use of military metaphors, e.g., "fire fighting," and these kinds of words and the mindsets that they impose will need to be changed to reflect a new restorationist mission and ecological ethos. For example, instead of fighting against fire, crews will be working with fire; instead of conducting initial "attack," crews will be taking initial action, instead of preventing large wildfires, crews may actually be promoting them! The mission of fire management will be redefined from mainly fire fighting to one resembling fire guiding. Given the qualitative change in mission and terminology used to explain new pro-fire use policies and

practices, it would be anachronistic to call crews "fire fighters." Consequently, a term like fire rangers might be a more accurate if not more inspiring identity for crews doing Ecological Fire Management. In a future restorationist paradigm, fire "control" efforts will be newly applied to fire use rather than suppression actions; indeed, suppression itself will be redefined and practiced in a new way: mitigating uncharacteristic fire severity not containing fire spread or limiting fire size.

Although incidents might not have been called "fire use for ecological restoration" and the policy was not called "Ecological Fire Management," a good argument could be made that these were the unspoken objectives and underlying philosophy of progressive fire managers over the last 40 years, beginning with the pioneering work of wilderness fire managers implementing Prescribed Natural Fires, to the recently terminated Fire Use Modules and Fire Use Management Teams. Indeed, anecdotal examples can be culled from past incidents to bring concrete working models to bear on the seemingly abstract, "pyrotopian" visions of ecological fire use and EFM described in this paper. Progress toward that vision is happening slowly but surely. Consideration of resource benefits is gradually becoming more systematized in suppression operational plans as part of the Wildland Fire Decision Support System (WFDSS). A broader range of management strategies are being employed on most large fires, from full suppression on one end of the spectrum through point/zone protection, confinement, and monitoring actions on the other end. Fire managers are taking more advantage of the flexibility of the Federal Wildland Fire Policy to manage fires for simultaneous multiple objectives such as community protection, resource benefits, and ecosystem restoration. This is all progress worth celebrating.

Indirect suppression strategies that "back off and burn out" for the sake of firefighter safety are likely significantly expanding the number of acres burned, so the accumulated fire deficit may be incrementally shrinking through increased suppression fire use. The public seems to accept large-scale backburning when it is implemented reactively in a state of emergency, but the task ahead is to build public support for its use as a pre-planned proactive method for managing wildfires not as crises or potential catastrophes, but as opportunities for sustainable land stewardship. As a public education strategy needed to build more stakeholder support for restorationist fire use in ecological fire management, it is important to clearly call it what it is and fully explain what the many roles and benefits of fire use are to achieving the multiple objectives of promoting firefighter safety, ensuring ethical and economical use of taxpayer resources, protecting rural communities, and restoring fire-adapted ecosystems. Given the assumption that large wildfires are natural, essential, inevitable phenomena, and will become more so in the future as climate change continues to affect our pyrogenic planet, the wildland fire community must embrace and articulate the role and benefits of ecological fire use in managing large wildfires safely, ethically, and ecologically by design.

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