Incendiary Rhetoric: Climate Change, Wildfire, and Ecological Fire Management

The first rule when talking about wildfire in a warming world is to stop blowing hot air.

by
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Firefighters United for Safety, Ethics, & Ecology
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FIREFIGHTERS UNITED FOR SAFETY, ETHICS & ECOLOGY

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.

For more information or to receive printed copies of
Incendiary Rhetoric: Climate Change, Wildfire, and Ecological Fire Management

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Cover photo: Firefighter cooling the edge of a firing operation on the Ferguson Fire. Photo courtesy of Kari Greer/USDA-Forest Service

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INTRODUCTION

In response to the horrifying images of the urban firestorms in California in 2017 and 2018, the newsmedia made a huge shift in framing their coverage of wildfires: for the first time they blamed climate change instead of hazardous fuels or forest health as the driving force of the firestorms. This climate change frame has been even more pronounced in the newsmedia's coverage of the wildfires in Australia in 2020. Climate activists have taken this opportunity to further rouse public awareness and alarm over climate change with various slogans and images symbolizing that the "Earth is on fire." Consequently, adding to decades-old anti-fire Smokey Bear propaganda we now have people fearing wildfires even more in the era of climate change. The specter of deadly, destructive, uncontrollable wildfires reducing homes and communities to ashes has now become the dominant symbol of the climate crisis in the western U.S.

While images of urban wildfire disasters have been aiding the organizing efforts of climate activists, there is a danger that an amplified fear of fire might undermine the efforts of forest activists to protect forests from destructive logging and firefighting. Proponents of commercial logging and conventional firefighting are using anti-fire propaganda to frame wildfire prevention and suppression as a means of combating climate change by limiting forest carbon emissions. But attempts to fire-proof the forest through landscape-scale logging or mechanized firefighting are essentially *geoengineering* schemes that would fundamentally alter forest ecosystems, ultimately to put them at greater risk of destruction, and to further accelerate global heating. Both forest and climate activists must not fall into the opportunist trap of scaring people even more intensely about wildfire to the point that the public will accept grandiose logging and firefighting schemes as a means of "saving" the forest or "stopping" climate change.

In December 2018 the Trump Administration issued an Executive Order mandating a major increase in logging on federal lands, blaming a "lack of active forest management" as the cause of recent California firestorms. While forest activists are challenging phony "fuels reduction" logging schemes, they generally lack an effective response to false claims that forest preservation raises the risk of "catastrophic wildfires." While climate activists are effectively using grim images of recent wildfire disasters to generate public alarm over climate change, they generally lack an effective counter to false claims that forest fires are a major source of carbon emissions, or that preventing wildfires is a viable means of protecting forests and forestalling climate change. Both forest and climate activists are rallying around the slogan that "forest defense is climate defense," but what is missing from activists' rhetoric is an understanding of the potential role that fire management could play in forest and climate defense.

It is not the lack of active forest management, but rather, the relative lack of active fire management in the U.S. that is a major source of the problems affecting forests and climate recovery. The legacy of *overactive logging, reactive firefighting, and hyperactive fossil fuel burning* are the major threats to forests and climate, and are the underlying sources of recent wildfire disasters in the western U.S. The wise use of fire in a new paradigm of Ecological Fire Management could become a major part of the solution for protecting rural communities, restoring forest ecosystems, and recovering climate stability.

This guide is intended to help forest and climate activists talk to broad audiences about wildfire in the era of climate change, in ways that are grounded in the best available fire and climate science and progressive fire management policy. It's not just what you say, but how you say it that matters in terms of countering propaganda from special interests and allied government agencies, and persuading big shifts in public attitudes and behaviors regarding wildland fire. By informing ourselves with more of the latest research findings and scientific facts, overcoming media sensationalism and dominant myths about logging and firefighting, and utilizing some of the messaging tips provided in this guide, forest and climate activists can advance their joint goals of defending forests and solving the climate crisis.

Inconvenient Truths: Climate Change and Wildfire

There is scientific consensus that human-caused greenhouse gas emissions from burning fossil fuels are causing major physical, chemical, and ecological changes to the planet, including altering the climate in ways that are increasing wildfire activity and affecting fire behavior. The science is clear that a substantial portion of the increased wildfire activity in the western U.S. over the past few decades is being driven by human-caused climate change.[1] Some of the changes in wildfire activity include:

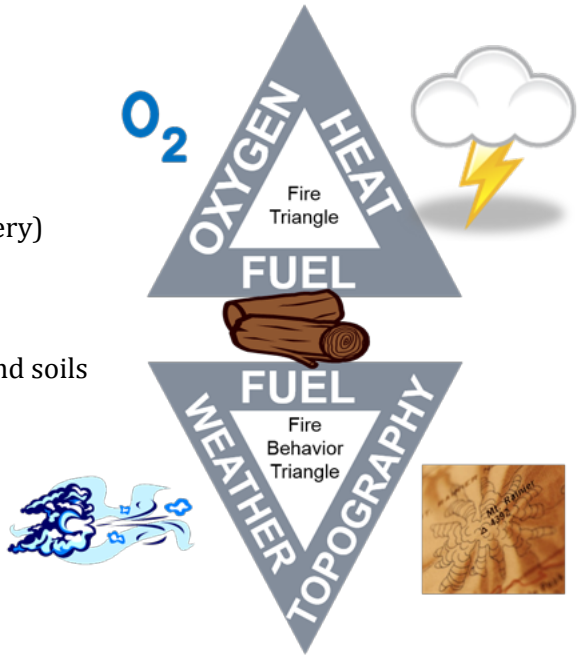
- an increased number of large wildfires and total area burned
- fires burning with higher intensities and faster rates of spread
- more frequent episodes of extreme or erratic fire behavior
- lengthier fire seasons.

These changes in fire behavior are the result of ongoing changes in two of the three components that make up the Fire Environment: weather and fuels.

Climate influences on wildfire

Weather:
- Increased temperatures
- Decreased relative humidity (reduced nighttime recovery)
- Winds: speed and direction
- Precipitation: rain vs. snow
- Storms: lightning; hurricanes, ice storms
- Droughts: affects live vegetation, dead downed fuels, and soils

Fuels:
- Fuel aridity
- Fuel availability
- Live vs. dead



Climate change is influencing weather and fuels in ways that are increasing wildfire activity.

Weather is a critical component of the fire environment that influences the ignition, spread, and behavior of wildfires, and weather conditions from climate change are the dominant drivers of the changing fire activity in the western U.S.[2] The weather factors that affect fire behavior include temperature, relative humidity, wind, storms (especially lightning), and precipitation (amounts and types, including droughts). In particular, hot, dry, windy conditions produce severe fire weather situations that can lead to extreme fire behavior.[3] Over the last 40 years there has been a measurable increase in episodes of severe fire weather conditions, and 96% of disastrous urban wildfire events have occurred during severe fire weather conditions.[4]

Temperature

Global warming is causing average air temperatures to rise worldwide, and along with that, an increase in wildfire activity across many regions, including the western U.S. and especially Alaska.[5] Warmer air temperature reduces moisture in the air, soils, and live and dead vegetation, making fuels more combustible so fires start easier, spread faster, and burn more intensely. During periods of high temperature and low relative humidity, forest fuels can be drier than sawmill kiln-dried lumber.

Wind

Warmer, drier conditions are also producing more frequent periods of strong and erratic winds. High winds can push wildfires through sparse or moist fuels that otherwise would slow or stop fire spread. High winds can also send burning embers across firelines, and ignite spotfires significant distances ahead of a flame front. Even more dangerous than high winds are gusting and erratic winds that can suddenly shift speed or direction, putting firefighters and communities at high risk of entrapment.

Seasonality of Fire

Climate change is also lengthening the wildfire season in the western U.S. and across the planet.[6] Warmer temperatures are occurring in all seasons, and this causes more precipitation to fall as rain rather than snow in higher elevations, resulting in shallower snowpacks. Snow is also melting sooner in spring and falling later in the fall.[4] A longer snow-free period makes fuels on the ground surface available to ignite and burn, and the fire season has lengthened an average of 78 days (over two months) in the western U.S. since the late 1980s.[8] Globally, fire weather seasons have lengthened on over 25% of the Earth's vegetated surface, accounting for a doubling of area burned across the planet.[9]

Precipitation

A more critical factor than snowpack is rainfall, especially during the summer fire season.[10] There has been a significant decline in summer rain events from 1979-2016 across a third to a half of the forested areas in the western U.S.[11] Summer rain directly wets soils and vegetation, and increases air humidity, making fuels more difficult to ignite. Rain can sometimes extinguish some small fires, but rarely can they put out large wildfires. But more significantly rainfall can cleanse the sky, giving some respite to people who may be located far from flames but are suffering from smoky air. Less summer rain events as well as increased wildfire activity are part of the increase in prolonged, widespread smoke events in recent years.

Drought

Along with periods of hot, dry, windy weather, climate change is producing prolonged drought periods that also impact the quantity and flammability of fuels. Drought causes stress on living plants, causing some to die, fall to the ground, and thereby become more combustible. Drought can also cause large dead fuels (e.g. downed logs) to lose their internal moisture reserves, and can make deeper layers of duff dry out. Periodic and recurring seasonal droughts are a natural phenomenon, but human-caused global warming is magnifying the effects of drought on wildfire activity.

Fuels

The significance of rising temperatures and other weather changes influenced by global warming is that it accelerates the drying of both live vegetation and dead fuels, which makes them easier to ignite, burn more intensely, and spread flames at a faster rate.[12] Periods of extremely dry fuels are prone to very active wildfire spread and large wildfires.[13] Increasing fuel aridity from human-caused climate change is the primary driver of increased wildfire activity in the western U.S. over the past few decades, and is projected to continue increasing wildfire activity in the future.[14]

Summary

Rising temperatures are creating drier conditions, stronger and shifting winds, changing precipitation patterns, lengthening fire seasons, and producing more frequent episodes of severe fire weather. All of these climate-driven changes in weather are increasing the ignitability and flammability of both live vegetation and dead fuels in ways that are increasing wildfire activity across broad regions of the planet. The best available science attributes the bulk of these changes in the fire environment and resulting wildfire activity to fossil-fueled climate change. Forest and climate activists with command of these scientific facts can confidently warn people that climate change is a real and present danger manifested not only in rising seas, melting glaciers, or fierce hurricanes in far-off places, but also in the rising risk of wildfire burning places near and dear to people across the U.S.

While the trend in number and frequency of large wildfires is growing, these wildfires are generally not a problem in remote wildlands. Most forest and grassland ecosystems in the western U.S. are fire-adapted with fire-dependent species inhabiting them, and they need recurring fires to maintain their biological health and ecological integrity. In the face of an historic deficit of beneficial fire that has been accumulating since World War II, the recent rise in wildfire activity is partially compensating for this lack of fire in wildlands. But for people living in flammable homes in rural communities who are unprepared for fire, increased wildfire activity has become a serious social problem. It is also a problem for wildland firefighters who are tasked with protecting people and property at risk from climate-fueled weather-driven wildfires.

Wildfire has become the dominant specter of global warming in the western U.S.

A Conspiracy of Optimism: The Fallacy of Fire Prevention and Suppression

In response to increased wildfire activity, some people might think a logical response would be to intensify fire prevention and suppression efforts everywhere. But withholding fire degrades and destabilizes fire-adapted ecosystems, and imperils fire-dependent species. Systematic fire suppression does not preserve or protect wildlands—it ultimately alters them in ways that sacrifices many of the social and ecological values that people cherish in public lands.

Human-caused fires are the majority of wildfires in the U.S., and they are often ignited in times, places, or conditions that create high-intensity fires that threaten people and property, so it is valid to try to prevent unwanted human-caused fires. Much more should be done to prevent industrial and arson fires. However, preventing *all* wildfires is not possible since lightning will strike, and accidents will happen. Absolute fire prevention is not even desirable because many ecosystems require recurring fires to maintain biological diversity and ecological integrity. Moreover, Indigenous peoples have historically been a vital source of beneficial fire that helped maintain fire-adapted habitats and species.

Given that absolute fire prevention is impossible, society has invested heavily in wildfire suppression. The U.S. has the largest, most technologically-advanced, most expensive firefighting forces in the world. Taxpayers pay over $3 billion dollars annually on federal fire suppression programs.[15] Congress, the newsmedia, and a majority of the public strongly support firefighting efforts, believing that they are both essential and effective—and assume that *there is no alternative* to fighting forest fires. On the contrary, for the vast majority of our species' existence, human beings intentionally ignited fires on the land—were fire *lighters*, not fire fighters—in order to enjoy the multiple benefits of fire's natural recycling and regenerative powers. It is only within the last 100 years that people have converted to fearing and fighting all wildland fires, and this must change.

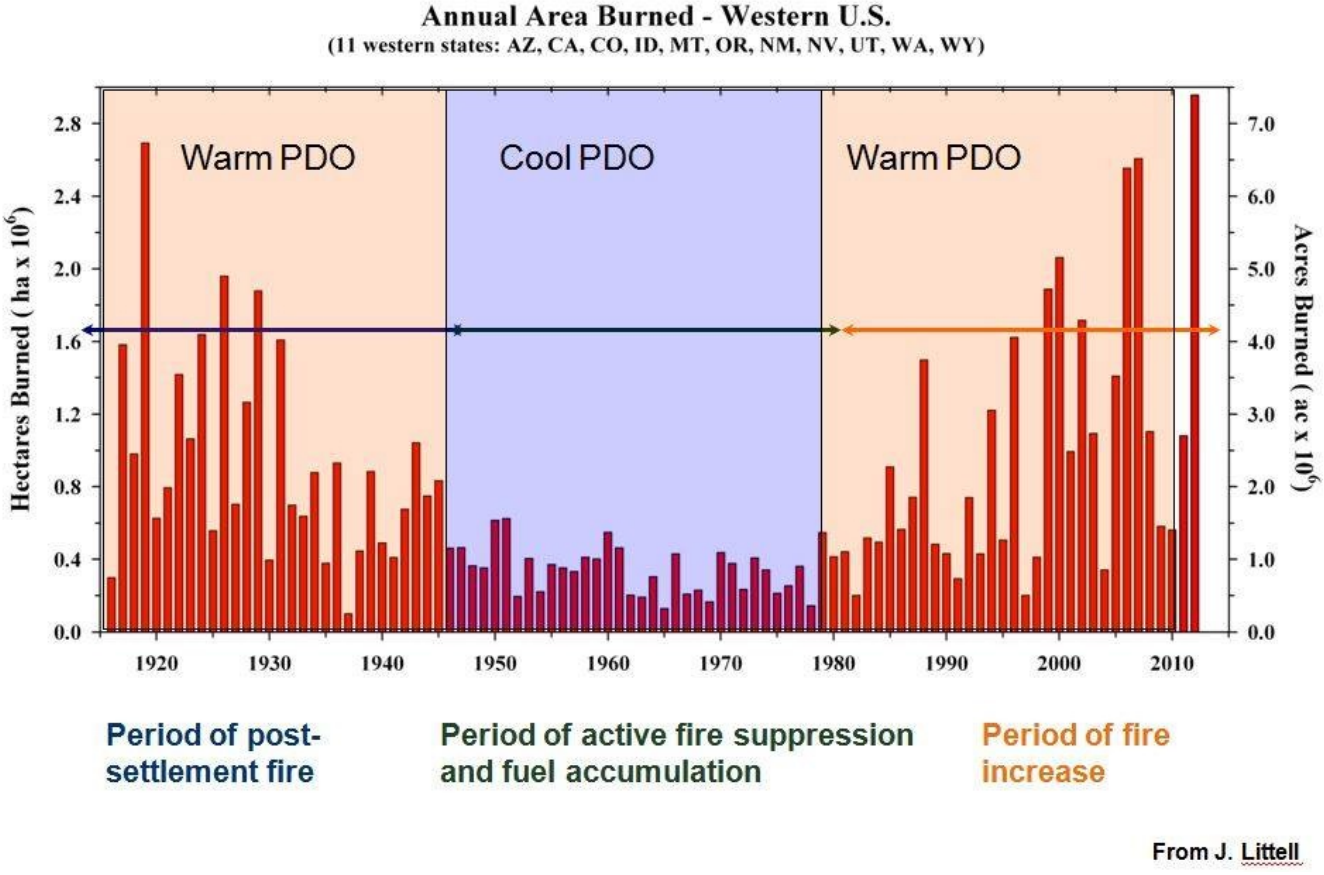
Federal agencies such as the U.S. Forest Service began fighting fires in 1905, but with minimal effectiveness due to the large expanse of undeveloped wildlands, the limited size of its workforce, and primitive suppression technology. This changed in the post-World War II period with an influx of military surplus vehicles and equipment, incorporation of scientific research in combustion physics, and the advent of mechanized fire suppression.[16] Cutting firelines with large crews and mechanized equipment such as bulldozers, engines, and airtankers brought the extent of annual burned area crashing to an historic low. This has caused significant ecological degradation across broad landscapes.

Mechanized firefighting using post-World War II military surplus vehicles and equipment increased the reach of fire suppression into backcountry wildlands.

At the same time that mechanized firefighting was pushing deeper into backcountry wildlands and containing most wildfires at a small size, natural climate variability produced a prolonged cool, wet period. This natural dynamic called the Pacific Decadal Oscillation (PDO) greatly aided firefighters' efforts in stopping wildfire spread. [17] The combination of a cooler, moister climate and aggressive mechanized firefighting created an unprecedented shortage of fire on the landscape during the 1950s and 60s. During this post-war period with its anomalously and artificially low level of wildfire activity, people developed a distorted perception of wildfires as absolutely bad along with a false sense of security that firefighters could put them all out. [18] Alongside this new anti-fire/pro-suppression attitude began the post-WWII migration of people to the western U.S., resulting in suburban sprawl into naturally fire-prone wildlands.

When that cool, wet PDO cycle ended and was replaced by warmer and drier conditions, this natural cyclical climate shift was being amplified by the unnatural global heating caused by fossil-fuel emissions. Prolonged droughts punctuated by frequent severe fire weather conditions are now driving fast-moving wildfires that are overwhelming firefighters' ability to contain or control them. But even this recent surge in wildfire activity and large fires masks the fact that there is still much less fire on the landscape than is necessary for the maintenance of many fire-adapted forest ecosystems. However, the presence of flammable homes located in fire-prone areas has placed firefighters in an awful paradox: at the same time that aggressive suppression has become more imperative for unprepared, vulnerable rural communities, firefighting has become more dangerous for firefighters, more costly to taxpayers, more damaging in wildlands, but much less effective. In short, fighting fires has become more futile and fatal in the era of climate change.

Area burned in 11 Western states, 1916-2012



Cooler, moister climatic conditions, not the expansion of logging and road-building, made suppression more effective from the 1950s to 1980s. Global warming will prevent those conditions from reoccurring for a long, long time.

The 20th century belief that human beings with their machines, science and technology could effectively extinguish all wildfires and even extirpate them from the landscape has been revealed to be a grand illusion in a 21st century climate. Conventional firefighting tactics of dumping fire retardant chemicals, cutting fire containment lines, and lighting high-intensity backfires or large-scale burnouts in aggressive "perimeter-control" strategies increasingly cannot stop today's fast-spreading blazes. Wind-blown flames easily loft firebrands into the sky, jumping over firelines, roads, and even rivers. Hot embers landing on dry fuels or flammable rooftops miles away from a wildfire's flaming front start new fires. Firefighters are simply overwhelmed by the rapid speed of fire spread and amount of wildfire activity in this era of climate change.[19] Relying on fire suppression or prevention to protect people and property is a failing strategy—there must be an alternative to an endless, escalating, unwinnable "war" on wildfire.

False Solutions: Countering Wildfire and Logging Myths

Beginning in the early 1990s, greater restrictions on clearcutting of old-growth forests were imposed on the national forests. This was in response to a biodiversity crisis from decades of logging that was pushing several wildlife species to the brink of extinction. This increase in regulation happened to coincide with the time that scientists announced that human-caused climate change was a reality, marked in part by a sudden change in the number and frequency of large-scale, long-duration wildfires. The U.S. Forest Service and commercial logging proponents immediately declared that a "forest health crisis" existed due to an excess of "dead and dying trees" and "dense, overstocked forests" that were fueling "catastrophic wildfires." The agency suddenly repackaged its commercial timber sale program into alleged "hazardous fuels reduction" projects and other euphemisms while still keeping its focus on extracting large commercially-valuable trees.

For the last three decades, logging proponents, most recently parroted by Donald Trump, have falsely claimed that a lack of "active forest management" (a.k.a. commercial logging) due to forest protection measures is what underlies the current spate of large wildfires. This claim rests on several stubborn myths that are manufactured by the timber industry and its allies in Congress and the Administration. These myths have been routinely and uncritically propagated by the newsmedia. Countering false and misleading claims about wildfire and logging is vital if forests are to be genuinely protected over the long-term to serve as one of nature's most vital climate stabilization organs.

Myth #1: Forests are being destroyed by "catastrophic wildfire"

Advances in the science of fire ecology over the last 50 years have demonstrated that rather than being destroyed, most forests are fire-adapted and are renewed by fire. Warm, dry forest ecosystems depend on fire to recycle dead downed needles and limbs into soil nutrients, and cool, moist forest ecosystems depend on fire to regenerate certain tree species (e.g. lodgepole pine) and allow understory native plants to grow in the bursts of sunlight that follow fire. Although some plants and animals are killed by fire, forest ecosystems and wildlife populations are rejuvenated by fire. The newsmedia is quick to showcase blackened trees and ash-covered slopes, and this reinforces the myth of destruction, but rarely do journalists return later to witness surviving trees and animals and the abundant new plant growth that is the hallmark of burned forests. In fact, the best available science has discovered that even the most severely burned forests are hotspots of native biodiversity and rich wildlife habitats.[20] It is clear that fire destroys homes and other human structures, and fire can dramatically change the natural scenery of a place, but in backcountry wildlands and other natural areas fire mostly plays a life-enhancing role that benefits biological diversity and ecological integrity.

Myth #2: We are experiencing an unprecedented, unnatural excess of fire

The newsmedia are quick to claim that the recent increase in wildfire activity and number of burned acres is "record-breaking" and "unprecedented," but this is factually untrue. Up through the 1940s, an average of 30 to 40 million acres burned annually across the U.S., but this crashed to barely 3 million acres in that brief post-WWII period when fire suppression was aided by a cooler climate. Since the late 1980s the amount of burned areas has been generally increasing, but it has not come close to the historic norm. Journalists and policymakers who use the baseline of the mid 20th century to measure the recent increase in wildfire amount paint a deceptive picture. Wildfires in the mid 19th century burned millions of acres in the continental U.S., and many of the beautiful wild forests that people enjoy today were born in those fires.

Journalists' claims about "record-breaking" wildfires ignore the tens of millions of acres that burned annually in the U.S. up until the 1950s, as this 1949 Smokey Bear poster reveals.

The problem is not that there is an unnatural excess of wildfire, but rather, that we are still facing an ongoing deficit of fire measured since the 1950s. We can argue that the fire deficit goes back even earlier than historical records reveal as a consequence of the elimination of Indigenous burning. Annual wildfire amounts are highly variable and shift from year to year across different regions. While climate change is fueling more fire than in the 1980s, this does not mean that we have too much fire, and in fact, for fire-dependent species and fire-adapted ecosystems, we have much less fire than is needed. The real problem is not the number of wildfires or amount of burned acres, it is more the *maldistribution* of fire in that too many fires are burning in times, places, and conditions that are adversely affecting human communities, while not enough fires are burning in the times, places, and conditions that could positively benefit native ecosystems.[21]

Myth #3: Logging reduces fire risks and fuel hazards

It was more than coincidental that the U.S. Forest Service discovered a forest health crisis at the same time that legal restrictions against commercial logging occurred—it was an opportunistic invention. In order to overcome public opposition to commercial logging and clearcutting, the agency employs various euphemisms such as "thinning," "hazardous fuels reduction," and "fuelbreak construction." Some form of these techniques theoretically could be justified as a means of creating fire management infrastructure to facilitate safely managing wildfire on a landscape-scale, but the bulk of actual fuels reduction projects are intended to do the opposite: continue fire exclusion by facilitating fire suppression and prevention objectives.[22] Again and again, purported thinning or fuels reduction projects target larger commercially-valuable trees for removal, even while these trees have the least influence on wildfire spread, and actually mitigate fire behavior and effects. The fuels most influencing fire spread and severity are small-diameter surface and ladder fuels, especially downed needles and limbs, grasses and shrubs, tree saplings and poles. These kinds of fuel present the highest fire hazards but have the least commodity value, and thus, provide little incentive for the agency or logging interests to deal with them.

Commodity-grade tree removal cannot be called hazardous fuels reduction because it removes the *least* flammable portion of a tree—its trunk—while dumping on the ground the *most* flammable portions—its needles and branches—where these fuels become available and ignitable by the tiniest ember in hot, dry weather conditions. And these conditions become more prevalent when the overstory tree canopy that formerly provided shade from the heating and drying effects of the sun and wind is removed. Forest activists should rightly call these logging projects fuels "*relocation*," not "reduction" projects, and where canopy fuels are relocated to the ground surface this greatly raises their potential fire hazard.

The legacy of clearcut logging followed by industrial tree planting has made the general forest landscape vastly more flammable than the original forest cover, and when fires burn through those industrial tree farms that are laden with big stumps, logging slash, invasive weeds, grasses and shrubs, and devoid of shade from large trees or logs—the resulting fire effects are truly catastrophic. Indeed, the proverbial "moonscape" that journalists often claim are left in the wake of wildfires occurs in burned clearcut plantations where the dense thickets of young conifer trees are incinerated, fires smolder for days in the old slash and stumps, and eventually the stump roots are consumed, leaving lifeless, ash-filled craters scattered across the ground.

This is a far different scene than even the most severely burned native forest where large fire-killed trees and logs remain after the flames die out; these snags and logs become some of the most prized habitats for wildlife who thrive in burned forests. These large fire-killed trees and logs anchor soil on steep slopes, retain moisture, and shelter tree seedlings from the harsh drying effects of sun and wind. Commercial logging by whatever name does not prevent "catastrophic wildfires" or even mitigate fire or fuel hazards—just the opposite. Fuels reduction projects centered on logging as the first and most important aspect of those projects are clearly designed to get the cut out while falsely promising they will help put the fires out.

Clearcuts and young timber plantations burn catastrophically, leaving proverbial "moonscapes" that, in contrast to burned forests, lack any biological legacy for the next forest. Photo Courtesy of Country Media, Inc.

Myth #4: Firefighting is Safe and Effective in Protecting Communities and Ecosystems

The great fallacy of fire suppression effectiveness has been discussed above, but it needs emphasis because there are too few critics even among forest conservationists who are willing to challenge this myth. First, the flames of every wildfire eventually and inevitably go out. In the case of small fires burning under low or moderate intensity, this occurs when firefighters encircle the blaze with firelines that stop flames from spreading. When all combustible matter has been separated from flames or burned off, the flames ultimately go extinct.

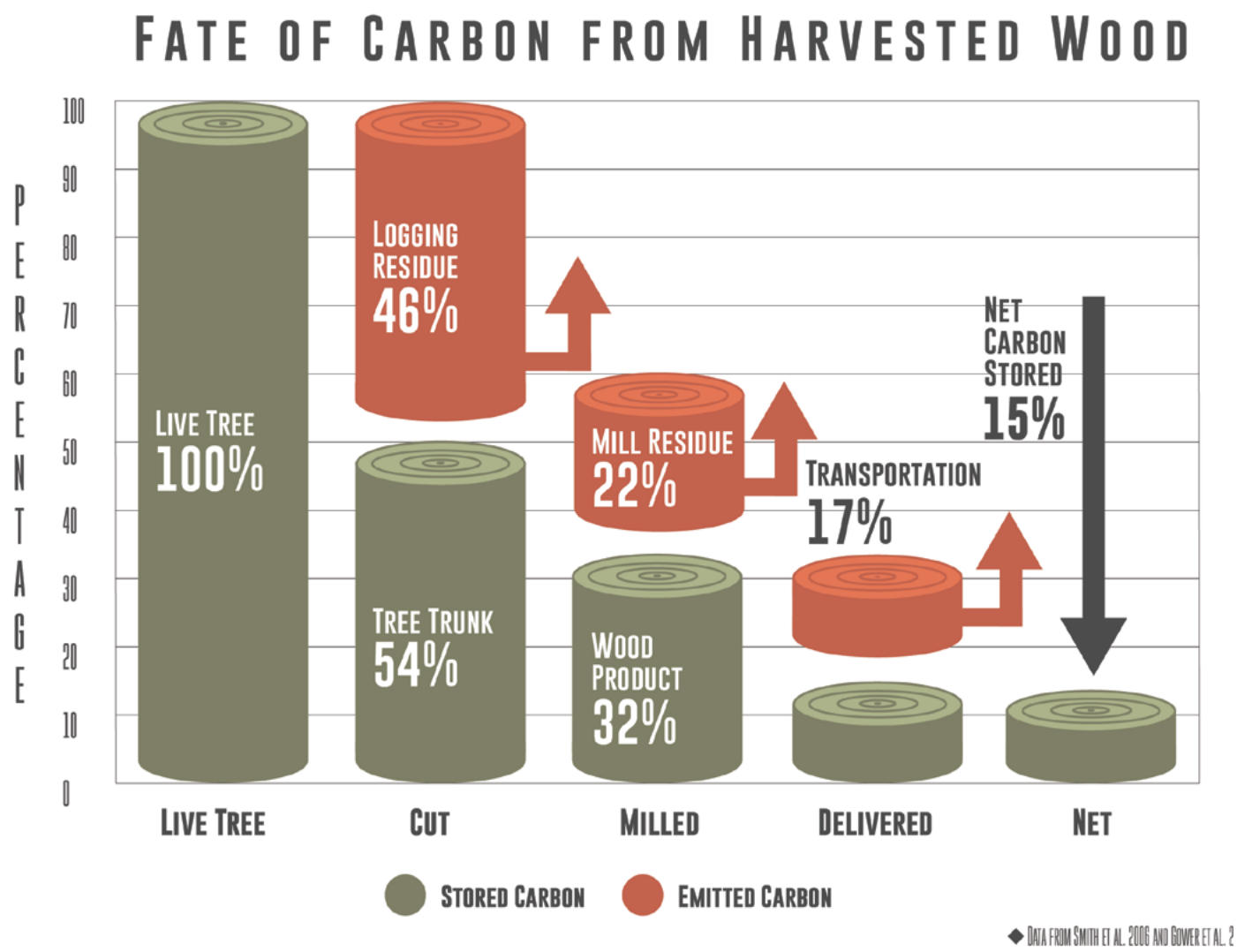
In the case of large fires or high-intensity fires burning under more severe conditions, the efforts of firefighters are largely irrelevant in containing or controlling fire. Given the extremely rapid spread that many wildfires are exhibiting in this era of climate change, firefighters are often forced to back off and burn out far away from the fire's edge in an indirect attack strategy dubbed "box and burn." It is only when the weather changes that crews can safely directly engage the fire to stop its spread. Many large wildfires will continue to smolder in their interiors until winter rains or snow finally put them out. But firefighters will get all the credit for successfully suppressing these fires, even if their efforts are analogous to the Lilliputians successfully "capturing" Gulliver—after he had laid down and fallen asleep! While firefighters may claim individual victories in battles over blazes, they are ultimately losing an unwinnable war against wildfire.

The real paradox with suppression is that firefighters are most effective in containing and controlling small low-intensity fires that they shouldn't suppress (but do), and are largely ineffective in controlling large high-intensity fires that they should suppress (but can't). In general, it is the area closest to communities where the legacy of industrial logging and fire exclusion has been longest and strongest compared to more remote backcountry areas, and these frontcountry areas pose the greatest fire risks and fuel hazards as well as the most negative impacts on people. Society is placing an impossible expectation on firefighters, and the hope of every rural homeowner to have crews come to their rescue is misplaced faith. Given the weather and fuel conditions primed for wildfire by climate change, the strategy for community protection based on reactive wildfire suppression is failing, and the list of urban wildfire disasters defined by futility and fatalities continues to grow. The myth that more firefighting resources and suppression spending will ultimately lead to success in protecting communities or forests must end. Alternatives to fighting fires must be developed and implemented.

Myth #5: Logging and Firefighting Preserve the Most Forest Carbon to Fight Climate Change

Logging and private firefighting interests have launched a new myth in response to growing public interest in preserving forest carbon to mitigate climate change. Logging interests advocate that carbon should be preserved in wood products while replanting fast-growing young trees that will absorb more atmospheric carbon compared to slower-growing big, old trees. Yet it takes many decades or longer for younger trees to compensate for the carbon that is taken after logging bigger, older trees. Only approximately 15% of the total carbon from a tree is preserved in wood products (some of which, like paper, are short-term stores before entering the waste stream), while the rest of a tree's carbon soon enters the atmosphere from the waste generated by logging and milling processes.[23] Indeed, far more carbon is emitted from the effects of logging and milling (including the fossil fuels used to transport and manufacture trees into wood products), than from the effects of wildfire.

Private firefighting interests claim that preventing and suppressing fires will save more forest carbon from being emitted into the atmosphere by wildfire smoke and fire-killed trees. The majority of carbon in a forest is stored in large trees and organic soil, and even the most severe wildfires do not completely consume large tree boles or deeper layers of organic soil. Fire-killed trees may stop sequestering atmospheric carbon, but they may take several decades or even centuries to decompose (depending on their species and forest type), slowly emitting to the atmosphere their stored carbon over that time. This is far different than logging and milling waste that rapidly releases its carbon into the atmosphere soon after logging. Moreover, charred wood material can retain its carbon for an extremely long time, especially if it is buried in soil. While fire-killed large snags and logs are slowly losing



Just 15% of the carbon in a tree is preserved in lumber, while the rest is emitted to the atmosphere to further global warming. Graphic courtesy of Oregon Wild.

their carbon stores, they provide vital habitat structures and ecosystem services. Meanwhile, new plant growth following fires are rapidly sequestering atmospheric carbon. The combination of large dead trees and logs with rapidly-growing new plants is partly why native forests are tremendous carbon sinks, and are one of the planet's vital climate stabilizing forces.

The belief that firefighting can successfully create or maintain a fire-free forest and prevent all carbon loss is as much a fantasy as it is a myth, but if it were possible to keep all fires out of forests, this would fundamentally alter those ecosystems, harm the many species that rely on recurring fires for their habitat needs, and degrade some of the values that people cherish in wild forests. The reality is that climate change is increasing wildfire activity beyond human capability to control it (and way beyond the ability to eliminate it). Forests will burn, and some of their stored carbon will become gaseous and seep into the sky, but that same carbon will be sequestered by live plants essentially feeding off the carbon emitted by dead plants. This simplified rendition of the carbon cycle where there is no net gain of carbon in the atmosphere is far different than fossil fuel emissions which are exhumed from below the biosphere and are pouring into the air in amounts that are literally altering the chemistry of the atmosphere and oceans, putting the planet in peril. We need to keep this fossilized carbon under the ground, and keep living carbon in the forest.

Myth #6: Prescribed Fire Alone Can Reduce or Replace Wildfires

While many people oppose prescribed burning because they fear the burn could escape control and become a wildfire, or they don't like the smoke, or they are concerned about the environmental impacts of spring burning, there is growing evidence from public opinion surveys that more people actually support the use of prescribed burning specifically for fuels reduction.[23] Forest conservationists who are leery of "mechanical fuels treatments" that emphasize commercial thinning also tend to favor prescribed burning if projects don't involve logging big trees. Too often, mechanical treatments are used to supplant the use of fire and/or to continue fire exclusion goals, or to get commodity timber outputs under the guise of fuels reduction rather than genuine ecological restoration. Consequently, when given a choice, forest conservationists tend to be more supportive of using prescribed fire treatments, preferring the use of fire alone without additional mechanical methods.

The adverse effects of fire exclusion go beyond causing hazardous fuels accumulations: ecosystems, habitats, and species that require recurring fire have all been impacted by the historic fire deficit. There is no mechanical, chemical, or biological substitute for the necessary thermal effects of fire in ecosystems, and only fire *inclusion* can fully compensate for the adverse effects of fire exclusion. With the use of controlled burning (a.k.a. prescribed fire), the social benefits of fuels reduction and the ecological benefits of fire restoration occur simultaneously. But, depending on site-specific conditions, management goals, or ecosystem needs, prescribed fire alone may not be able to accomplish needed ecological restoration and fuels reductions objectives. There are some places where vegetation growth or fuels accumulation from past fire exclusion may have become so great that applying fire alone would likely result in higher-intensity or higher-severity fires than desired, increasing the risk of an escaped fire or loss of desired habitat features

Controlled burning is necessary but insufficient in many areas to compensate for the historic fire deficit without wildfires also supplying needed fire on the ground.

such as large live trees and dense multi-storied canopy. Some manual or mechanical *pre-treatments* of surface and ladder fuels may be necessary to prepare the ground for safe, controllable application of fire. The key phrase is that these initial actions are pre-treatments, and projects are not fully completed unless and until fire is applied.

Another reason that management-ignited prescribed burning alone may not suffice is that there are numerous social obstacles to controlled burning that severely limit its current application. Prescribed burns can be prohibitively costly to complete, requiring environmental analysis and planning, site preparation, and assembling crews and equipment for ignition. And unlike fire suppression that is often paid by off-budget "emergency" accounts, all prescribed fire activities must be funded by fixed annual budgets. After all the work is done to prepare projects and assemble all necessary personnel and resources, at the last minute the conditions for burning may not appear, and the burn can be called off. Indeed, climate change is shrinking the number and duration of prescription burn windows available. Prescribed fires must also get approval from air regulators, and even then, opposition from local communities annoyed by smoke can stop planned burns if they raise enough complaints with air regulators. Finally, burn projects must get approval from agency administrators who are increasingly risk-averse when it comes to the use of fire. Thus, relying on prescribed burns as the only socially-acceptable means of getting fire on the ground is not working given the many challenges, small scale, and slow pace of controlled burning projects across the country.

Considering all of the technical, logistical, financial, regulatory, sociopolitical, and ecological challenges, prescribed burning alone will likely not be able to provide sufficient ignitions or scale of burning for restoration or even maintenance of fire-adapted ecosystems that have been impacted by past fire exclusion. That is why agencies and society must accept the greater use of *wildfire* to get more landscape burned for social and ecological objectives. Wildfires provide fire at sufficient frequency, size, seasonality, scale, and mixed severity to match the ecological need for fire on the land. The future of progressive fire management will involve opportunistically managing wildfires with pre-planned ecological objectives as if they were management-ignited prescribed fires.

Prescribed burning has to tread carefully through numerous social obstacles; consequently, wildfire will be the main source for generating the amount of fire needed on the land.

Fireside Chats: Talking About Climate, Wildfire, and Fire Management

Demonizing the enemy is a tried and true tactic for mobilizing the masses for war, and the war on wildfire is no exception. Decades of anti-fire propaganda from government agencies and the timber industry, and sensationalist newsmedia coverage that vilifies all wildfires, have all helped to socially-condition a majority of the public to fear and hate wildland fire. Smokey Bear is widely acknowledged as one of the world's most successful advertising campaigns, but that success has come at the great expense of a relationship with wildland fire that is grounded in scientific facts, economic rationality, and ecological reality. Consequently, to publicly advocate for the expanded use of fire on the landscape in this era of so-called "megafires" is to come across as a raving "radical" environmentalist.

But throughout our species' evolution fire has been at the center of our homes and habitats, and human civilization would not—could not—exist without our special relationship with fire. It has only been over the last century that human beings in advanced industrial societies, especially settler-colonialist countries, have rejected humanity's longstanding relationship with fire and our ecological role as fire-tenders. Thus, to speak approvingly of fire's place in the ecosystem, to accept its ecological necessity and inevitability, and to advocate for managing fire to provide benefits to people is actually a *conservative* position; to argue that humans must fear and fight all fires with the goal of eliminating it from the land is a highly *radical* proposition.

Fortunately, despite all the anti-fire propaganda coming from the newsmedia, logging and firefighting industries, and government agencies, public opinion polls show that people are more fire literate and understanding of the benefits of fire than many fire professionals or experts assume.[25] People's attitudes about forest fires have been shifting, they are open to learning more about fire ecology, and are more accepting of alternatives to fighting fires. But much depends on having the right messages from the right messengers. The following section offers some advice for talking about wildfire, fire management, and their connections to climate change in ways that should foster greater public support for forest protection and climate action.

Tip #1: Talk about *human safety* and *community protection* before talking about fire ecology or forest restoration.

While scientific evidence abounds on the social and ecological benefits of fire in forest ecosystems, people tend to have emotional reactions to wildfires based on fears of uncontrolled fire, associating it with danger and potential destruction. Even fires in remote wilderness areas that do not threaten any people or property can stoke fear if people think of those fires as uncontrolled (and uncontrollable) blazes that could eventually spread to their community. Messages strategically need to prioritize concern for the safety of people and property first. Consequently, advocating for policies that prepare homes and communities to be more firewise and less ignitable is the topmost priority for forest activists. Houses are *fuel* for fires and their construction design and materials often make them more flammable than adjacent trees or surrounding forests! Once people feel safer from fire threatening their homes and communities, this will open up more options and opportunities for ecological fire use elsewhere. All public outreach that leads with safety messages greatly opens up people to hearing additional messages about ecological fire management.

Example message: *"The sooner we prepare rural communities to be safe from fire, the sooner we can restore forest ecosystems with fire."*

Tip #2: Talk about *controlled burns* rather than "prescribed fires" or "managed wildfires."

Relatedly, the most direct way to allay people's fears of *uncontrolled* wildfires is to talk about controlled burns or *controlled* burning. Polling data shows that the term controlled burn is much more preferable than the conventional term of *prescribed fire* (which sounds like an abstraction) or the new term of *managed wildfire* (which sounds like an oxymoron). Talking about controlled burning or controlled burns resonates with people's association of safety with control.

Example message: *"Fire crews carefully use controlled burns to help protect rural communities from uncontrolled wildfire, and reintroduce fire into fire-dependent forest ecosystems."*

Tip #3: Talk about the *social benefits of burning* before talking about the ecological benefits of fire.

Messages should prioritize the *social benefits to human communities* from using fire before emphasizing the ecological benefits to wildlands and natural areas. For many forest activists who are motivated by biocentric values to defend forests and their non-human natural inhabitants, this may challenge one's personal philosophy and priority concern, but this is a matter of strategic messaging to achieve success in shifting people's attitudes and behavior. More people will support progressive forest protection policies if they feel that your proposals will better protect their safety, health, and well-being than conventional forest or fire management policies. In fact, protection of wildlands and all the ecological services they provide can be directly linked to human or community benefits, but your messaging must convey that policy proposals are first and foremost going to improve the safety and quality of human life.

Example message: *"Proactive controlled burning and ecological fire use are the most effective means of managing smoke emissions to reduce health impacts on smoke-sensitive people."*

Tip #4: Do not talk about "letting" fires burn or even mention "let it burn"!

One of the worst phrases to ever enter fire management terminology was "let it burn." In fact, this was a media-created phrase that has no basis in fire management policies or practices. Pro-fire advocates must continuously emphasize that no fires will be allowed to "let burn" unfettered or completely unmanaged without any human response. Every wildland fire on public land, in fact, receives some kind of management action and human engagement, even if this is nothing more than aerial monitoring. Fire managers are always actively monitoring fire behavior with crews standing by ready to take additional actions, if necessary, to avoid fires burning uncontrollably in ways that might threaten communities. Again, people fear the notion of unmanaged, uncontrolled wildfires, so emphasizing that all wildfire ignitions receive some kind of management response is an absolute must. Any messages extolling ecological fire use instead of suppression should stress that some form of monitoring will occur to ensure that the fire will not burn out of control and harm people or communities.

Example message: *"Every wildfire should be carefully managed to maximize the social and ecological benefits of burning while mitigating the safety risks and minimizing the economic costs and environmental impacts of management actions."*

Tip #5: Talk about tree *cutting* or *pruning* instead of "thinning" or logging.

Thinning is extremely controversial within the forest defense movement because the term has consistently been misused by agencies as a smokescreen for commercial logging. Efforts to set restrictions on the age or size of trees to be thinned, or calling it "understory thinning," or "thinning-from-below," have been used by activists to try to prevent thinning projects from being misused for logging, with mixed success in some national forests. The aftermath of so-called fuels reduction projects that involve logging often *increases* fire and fuel hazards by generating flammable logging slash, and exposing logged sites to increased sun and wind. Consequently, some forest activists strongly oppose any fuels projects that involve thinning because that term has been so abused by agencies.

For some forests with naturally long intervals between fire events, they are naturally dense with heavy fuel loads, and high-severity fire is a normal part of their life cycle. In fact, high-severity fire is a vital ecosystem component and valuable habitat source for some species, and efforts to prevent all high-severity fire would degrade those forest ecosystems and drive some species to extinction. However, in some specific sites (e.g. the last remaining old-growth groves in a drainage that has depleted old-growth forest from past clearcutting) a stand-replacing fire might not be a desired outcome in those stands even if it is a natural process. In this case, site-specific ecological goals might include protecting large live trees from fire-caused mortality by thinning and burning timber plantations surrounding the old-growth groves. Low-intensity controlled burning might be the preferred entry burn in some stands where fire has long been excluded. Without proper preparation of the fuel profile, though, fire use can be extremely difficult to manage without risking unwanted impacts or the fire burning out of control.

For initial entries into stands where fire is naturally frequent but has been excluded for some time, site-specific conditions might not allow the safe, controlled use of fire alone without some cutting or pruning to prepare for broadcast surface burning. These kinds of fuels treatments might be tempting to call "thinning," however, forest activists should clearly explain the difference between thinning that is based on *cutting* small-diameter trees or *pruning* lower limbs versus logging larger-diameter trees to extract for commercial wood products. While cutting and pruning can be done using handheld tools (like chainsaws or polesaws), logging must be done with heavy equipment that greatly increases the costs and environmental impacts. However, cutting alone does not perform all of the valuable ecological functions that fire does, so every cutting must include burning to make that fuel treatment complete. Thus, when discussing the use of thinning in fuels treatments, activists should make clear distinctions between non-commercial "*cutting*" versus commercial *logging*. Cutting should be clearly framed as a manual *pre-treatment* to prepare for controlled burning versus logging as a mechanical treatment that is almost always intended to continue to exclude fire from the landscape.

Example message: *"Careful cutting, pruning, and controlled burning can better prepare forest sites near communities for future wildfires while avoiding the costs and impacts of logging that typically increase fire risks and fuel hazards."*

Tip #6: Talk about fire *reintroduction*, *restoration*, or *resilience* rather than wildfire prevention or suppression.

So-called fuels reduction projects that claim to aid wildfire prevention or suppression goals across the landscape or in backcountry wildlands are part of the obsolescent, unsustainable fire exclusion paradigm. Ultimately, these projects will throw more good money after bad, will accelerate climate chaos from loss of forest carbon stores, and will put communities at greater risk from future wildfires burning in extreme weather conditions. Given the enormous deficit of burning in fire-adapted forests, fuels reduction projects must be designed with fire *inclusion* as part of their treatment design to compensate for past fire exclusion, and restoring fire processes must be a clearly stated objective. The purpose of fuels reduction projects should not be to enhance wildfire prevention or suppression in backcountry wildlands. Rather, the outcome of fuels management projects should be creating stand conditions where fire can be safely used to restore resilience to climate change in fire-adapted ecosystems. Forest activists should demand that every fuels management project, especially those that involve manual or mechanical thinning, have explicit objectives and outcomes to reintroduce and restore fire processes rather than further suppress and exclude fire.

Example message: *"The primary reason to manage fuels is to manage fire, not make it easier to continue suppressing and excluding fire. Fire reintroduction can restore resilience in forests facing the adverse impacts of climate change."*

Tip #7: Talk about fuels *recycling* and fuels *management* rather than "fuels reduction" or "biomass removal."

So-called fuels reduction projects that involve logging are more aptly called fuels *relocation* projects in which the least flammable portion of a tree—its main trunk—is turned into a log and removed from the ecosystem, while the most flammable portion of a tree—its mass of small limbs and needles or leaves—are dumped on the ground. High up above the ground, it is a rare and extreme event that would cause the tree canopy to ignite and burn on its own, but relocating canopy fuels down to the ground surface allows logging slash to ignite from a single spark or ember landing in nearby grass or brush. The result of fuels treatments using commercial logging is that fuels are relocated in ways that fire hazards *increase*, not reduce, fire risks and fuel hazards. What is needed, particularly in dry forest ecosystems where decay processes are naturally slow, is for fire to recycle the nutrients locked up in downed dead needles and limbs, convert them into fertile soil, and become available for fast-growing plants.

Relatedly, too many mechanical fuels reduction projects are billed as aggressive "one and done" treatments to reduce or remove fuels and thereby eliminate the occurrence of fire. But the longevity of these treatments rarely lasts a decade before new vegetation growth and fuels accumulation negate the effects of the earlier treatment. However, when logging is used to fund fuels projects, there is no economic incentive to return to cutover sites after the commodity timber has been extracted, and these sites have been systematically neglected, resembling a classic "cut and run" logging scheme. Logging further depletes the forest of its large stores of carbon, its most valuable habitat structures, and all the ecosystem services that big old trees provide. Consequently, what is more appropriate is surface fuels *management* with the objective of long-term maintenance primarily with fire. Rather than physical removal from the ecosystem, biomass should be *recycled* with fire into soil nutrients to replenish future generations of plants that will sequester and store carbon and provide wildlife habitat.

Example message: *"Mechanical fuels reduction or removal damages soils and depletes forests of nutrients and carbon. Fire can recycle excess biomass into fertile soil to nourish new fast-growing plants that sequester and store carbon."*

Tip #8: Talk about *rural intermix* fires or *urban interface* fires that burn isolated homes or suburban neighborhoods, and distinguish these from "*wild*fires" that burn in remote, backcountry *wild*lands.

Unfortunately, people have conflated fires that burn forests in backcountry wildlands with fires that burn homes in frontcountry communities, and call them both "wildfires." Indeed, the newsmedia showcases scenes of burning homes and incinerated neighborhoods as its dominant image of "wildfires," however, these are *rural* or *urban* fires, not *wild* fires that burn in *wild* lands. Forest and climate activists should make distinctions between the two qualitatively different kinds of fires. People fearing the destruction of their homes and communities are projecting that fear onto forests in wildlands, but the effects of the two different kinds of fire are vastly different, and require different management strategies in response.

Example message: *"Fires burning rural homes or communities are destructive, but are avoidable through firewise practices. However, fires burning forested wildlands are regenerative and inevitable. We need to keep fire out of homes, but keep it in the forest."*

Tip #9: Talk about the need for *fire preparation* rather than "wildfire prevention."

While it is true that 84% of all wildfire ignitions are human-caused, and everyone should be careful to avoid starting an accidental fire, a strategy based on absolute prevention of all wildfires is doomed to fail. Accidents will happen, arsonists continue to commit their crimes, and we cannot stop lightning from striking. But when prevention fails, then too many people become utterly dependent on fire suppression to protect them, and increasingly this is also a failing strategy. Our rapidly-changing 21st century climate is making conventional 20th century firefighting tactics increasingly ineffective in stopping wildfires.

In fire-prone environments, the science is clear that the most practical, economical, and effective means of keeping people and property safe from wildfires transitioning into urban fires is to reduce the ignitability of built structures and the area immediately surrounding structures. Unlike fire prevention or suppression that makes individuals dependent on government agencies to do something, everyone has a role and can take action to prepare their homes and communities for the inevitable eventuality of fire in their area. Thus, homes and communities must be *prepared* for fire, including controlled burns that can provide extra security to homes from encroaching wildfires. If every home has reduced ignitability, then communities can safely co-exist with wildfires in a fire-permeable landscape.

Example message: *"We cannot prevent all wildfires, but we can and must be prepared for every fire, and the time to do that is long before the first whiff of smoke. Rural residents in fire-prone areas must prepare their homes and communities for fires from any source and for every situation because suppression alone cannot protect all people or properties at risk of ignition."*

Tip #10: Talk about *managing* fires rather than "fighting" fires. Talk about initial *action* rather than initial "attack" on wildfires. Talk about *active* fire management rather than reactive fire suppression.

The war metaphor in fire management is a serious impediment to changing policies and practices that would enable people to live safely and sustainably with fire on the land. Fire is not an "enemy" to fight or an alien to extirpate from the land; it is a vital natural process that nurtures native biodiversity and forest ecosystem integrity. Making warfare on wildfire is essentially an endless, escalating, unwinnable war on Mother Nature. As difficult as it is to change the language we use for wildland fire, we must abandon use of the war metaphor and replace it with terminology that conveys active management for land stewardship.

Example message: *"We should not fight another fire—we should manage every fire so we can mitigate the safety risks and health hazards to people, minimize the economic costs to taxpayers, and maximize the ecological benefits of burning on wildlands."*

Fire crews managing wildfires can simultaneously safely protect rural communities while effectively reducing surface fuel loads and restoring ecosystem fire processes.

CONCLUSION

In solving the climate crisis, it will not be enough just to eliminate fossil fuel burning. The excess atmospheric carbon that has been accumulating for the past three centuries of industrial society must be drawn back out of the sky and put into the ground. Forests are one of the planet's most effective means of sequestering atmospheric carbon and storing it for the long-term. Native, unlogged forests are far more superior at sequestering and *storing* carbon compared to industrial tree farms. Young timber plantations take decades to replenish the amount of carbon that was depleted by the initial logging. The timber industry's opportunistic, false claims that "active forest management" in the guise of commercial logging and industrial tree planting are climate-friendly solutions must be countered. While proforestation strategies hold some promise for improving atmospheric carbon drawdown, first there is an urgent need to stop logging old forests worldwide, and then all tree planting programs must account for future wildfire activity.

Given how global warming is increasing wildfire activity, many forest and climate activists are understandably concerned that wildfires may turn forests into sources instead of sinks for carbon. But it is important to know that even in the most severe fires that kill 100% of the trees in a given forest stand, the majority of tree carbon is still retained after a wildfire, and it takes decades and even centuries for large snags and logs to decay and release carbon back into the atmosphere. Charred wood or "biochar" actually retards decay, and can lock up carbon for an extremely long time. Meanwhile, the flush of new tree seedlings and shrubs that sprout up after a fire will start sequestering carbon immediately. Importantly, many plant and animal species evolved with the need for recurring pulses of dead trees or bare soils after wildfires. Consequently, high severity fire is not a "catastrophe" or a "disaster" from the standpoint of either carbon or habitat, but instead, it is a vital stage in forest life that many species depend upon.

In pursuit of goals to maximize the survival of big, old trees and organic soil matter where the majority of carbon is stored in forests, what can or should be done to prepare those stands for wildfires that, given the effects of past fire exclusion and future climate change, might be uncharacteristically severe? The answer is *not* logging trees before or after they burn, and *not* doubling down on fire exclusion or suppression. Rather, the solution lies in facilitating *more fire, not less,* as the means of stabilizing forests, enhancing resilience, and storing the most carbon over the long term.

The most natural, economical, and effective way to facilitate more beneficial burning is to end the folly of fire exclusion predicated on mechanical fuels reduction and aggressive wildfire suppression, and to practice Ecological Fire Management (EFM). In contrast to conventional suppression where the goal is to contain and control fires at their smallest size and duration, EFM involves maximizing the socioecological benefits of burning while mitigating the risks and minimizing the costs and impacts of fire management actions to the best extent possible. Fire use is the most viable means of compensating for the historic fire deficit, recycling excess accumulations of downed and dead surface fuels, thinning overly-dense patches of tree saplings and shrubs, and adapting forests to a rapidly changing climate where water may become more scarce and future fires more plentiful. In responding to wildfires, crews would steer flames away from towns that cannot burn, and steer flames into natural areas that need to burn in accordance with pre-fire scientific assessments and management plans. EFM thus *works with wildfire* rather than fights against it, and *actively* manages fires to burn across a greater landscape area.

This guide has presented some of the science needed to understand the relationship between climate change and wildfire, various arguments for countering the myths and false solutions pitched by logging and firefighting special interests, and some strategic rhetorical advice for avoiding the loaded terminology that dominates forest and fire policy debates along with suggestions for alternative terms, phrases, and messages to build public support for ecological fire management. The take home messages for forest and climate activists: it is not as the Trump Administration claims that a "lack of active forest management" is causing wildfire disasters. Rather, forests and communities are suffering from the lack of active *fire* management that is guided by ecological wisdom, values, and objectives. Forests are part of the climate solution, and fire is part of stabilizing forest ecosystems and sustaining their rich stores of carbon. Yes, our houses are on fire, but we should not be panicked into accepting the anti-fire propaganda and geoengineering schemes of logging and firefighting interests. Forest and climate activists must unite forces to protect forests as a global climate solution. In that endeavor, forest *fire* defense is climate defense!

END NOTES

1. Harvey BJ. 2016. Human-caused climate change is now a key driver of forest fire activity in the western United States. PNAS 113(42): 11649-11650.
2. Abatzoglou J, Williams AP. 2016. Impact of anthropogenic climate change on wildfire across western US forests. PNAS. 113(42): 11770–11775.
3. Dennison PE, Brewer SC, Arnold JD, Moritz MA. 2014. Large wildfire trends in the western United States, 1984–2011. Geophysical Research Letters 41: 2928-2933.
4. Jolly WM, Cochrane MA, Freeborn PH, Holden ZA, Brown TJ, Williamson GJ, Bowman DMJS. 2015. Climate-induced variations in global wildfire danger from 1979 to 2013. Nature Communications 6:7537.
5. Bowman DMJS, Williamson GJ. 2017. Human exposure and sensitivity to globally extreme wildfire events. Nature, Ecology and Evolution 1: 1-6.
6. Harvey BJ. 2016. Human-caused climate change is now a key driver of forest fire activity in the western United States. PNAS 113(42): 11649-11650.
7. Abatzoglou J, Williams AP. 2016. Impact of anthropogenic climate change on wildfire across western US forests. PNAS. 113(42): 11770–11775.
8. Holden ZA, Swanson A, Luce CH, Jolly WM, Maneta M, Oyler JW, Warren DA, Parsons R, Affleck D. 2018. Decreasing fire season precipitation increased recent western US forest wildfire activity. PNAS 115(36): 8349–8357.
9. Hurteau MD, Bradford JB, Fulé PZ, Taylor AH, Martin KL. 2014. Climate change, fire management, and ecological services in the southwestern US. Forest Ecology and Management 327: 280–289.
10. Rocca ME, Brown PM, MacDonald LH, Carrico CM. 2014. Climate change impacts on fire regimes and key ecosystem services in Rocky Mountain forests. Forest Ecology and Management 327: 290-305.
11. Westerling AL, Hidalgo HG, Cayan DR, Swetnam TW. 2006. Warming and earlier spring increase western U.S. forest wildfire activity. Science 313(5789): 940-943.
12. Jolly WM, Cochrane MA, Freeborn PH, Holden ZA, Brown TJ, Williamson GJ, Bowman DMJS. 2015. Climate-induced variations in global wildfire danger from 1979 to 2013. Nature Communications 6:7537.
13. Keeley JE, Syphard AD. 2016. Climate Change and Future Fire Regimes: Examples from California. Geosciences 6(37): 1-14.
14. Holden ZA, Swanson A, Luce CH, Jolly WM, Maneta M, Oyler JW, Warren DA, Parsons R, Affleck D. 2018. Decreasing fire season precipitation increased recent western US forest wildfire activity. PNAS 115(36): 8349–8357.
15. Riley KL, Abatzoglou JT, Grenfell IC, Klene AE, Heinsch FA. 2013. The relationship of large fire occurrence with drought and fire danger indices in the western USA, 1984–2008: the role of temporal scale. International Journal of Wildland Fire 22(7): 894-909.
16. Higuera PE, Abatzoglou JT, Littell JS, Morgan P. 2015. The changing strength and nature of fire-climate relationships in the Northern Rocky Mountains, U.S.A., 1902–2008. PLoS ONE 10: e0127563.
17. Flannigan MD, Wotton BM, Marshall GA, de Groot WJ, Johnston J, Jurko N, Cantin AS. 2016. Fuel moisture sensitivity to temperature and precipitation: climate change implications. Climatic Change 134(1–2): 59–71.
18. Abatzoglou J, Williams AP. 2016. Impact of anthropogenic climate change on wildfire across western US forests. PNAS. 113(42): 11770–11775.
19. Headwaters Economics. 2009. Solutions to the rising costs of fighting fires in the wildland-urban interface. December.
20. Pyne S. 1982. Fire in America: A cultural history of wildland and rural fire. Princeton University Press.
21. Littell JS, McKenzie D, Peterson DL, Westerling AL. 2009. Climate and wildfire area burned in western US ecoprovinces, 1916–2003. Ecological Applications 19: 1003–1021.
22. Murphy BP, Yocom LL, Belmont P. 2018. Beyond the 1984 perspective: Narrow focus on modern wildfire trends underestimates future risks to water security. Earth's Future 6: 1492-1497.
23. Rocca ME, Brown PM, MacDonald LH, Carrico CM. 2014. Climate change impacts on fire regimes and key ecosystem services in Rocky Mountain forests. Forest Ecology and Management 327: 290-305.
24. DellaSala DA, Hanson CT. 2015. The ecological importance of mixed-severity fires: Nature's phoenix. Academic Press.
25. Pyne SJ. 1995. World fire: The culture of fire on Earth. University of Washington Press.
26. Reinhardt ED, Keane RE, Calkin DE, and Cohen JD. 2008. Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western United States. Forest Ecology and Management 256: 1997-2006.
27. Smith JE, Heath LS, Skog KE, Birdsey RA. 2006. Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States. USDA-Forest Service GTR-NE-343.
28. Gower, ST, McKeon-Ruedifer A, Reitter A, Bradley M, Refkin DJ, Tollefson T, Souba FJ, Taup A, Embury-Williams L, Schiavone S, Weinbauer J, Janetos AC, Jarvis R. 2006. Following the paper trail: The impact of magazine and dimensional lumber production on greenhouse gas emissions: A case study. The H. John Heinz III Center for Science, Economics and the Environment.
29. McCaffrey SM. 2006. Prescribed fire: What influences public approval? Fire in Eastern Oak Forests: Delivering Science to Land Managers, Conference Proceedings. USDA-Forest Service GTR-NRS-P-1.
30. Partners in Fire Education. 2008. Key public opinion research findings on the ecological role of fire. unpublished report by Fairbank, Maslin, Maullin, and Associates, and Public Opinion Strategies.