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Mega-Wildfires in the Western U.S: A New Phenomenon, or Merely Predictable Events?

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(The following is the opinion and analysis of the writer; June 2019)

Executive Summary

Terms such as "Catastrophic, Deadly, Disastrous, and Mega" have been used by various media sources to describe the large, fast-moving and destructive wildfires that have continued to impact the western United States (U.S.) in recent years. This portrayal has become an acceptable, even common place, media-model that never seems to lose its dramatic appeal. It rarely gets critically challenged when journalists attempt to dramatically accentuate or embellish reporting about so-called "megafires" or "the worst fire season ever."[1]

The readers or viewers of these news stories often emerge with the false impression that every acre of a large wildfire burned catastrophically and anything in the aftermath was destroyed left damaged "beyond repair." This commonly used reporting tactic continues to perpetuate widespread belief among the public that all large wildfires are unnatural and entirely destructive events.

However, it is true that recent 2018 wildfires in the western U.S. have been noteworthy due to the extent of acreage burned, structures and lives lost, and long-lasting impacts to humans and ecosystems in the path of the fires. Many of the recent destructive mega-fires were, and will continue to be, devastating long into the foreseeable future.

This paper examines the major causal factors contributing to the historic trends and recent increases in wildfire occurrence, size, impacts, and outcomes in the western U.S. Although trends show that wildfires are getting bigger in size[2], there is an oft-stated assumption that they are also more damaging. There is ongoing scientific debate, along with some conflicting evidence, concerning increasing fire severity.[3] 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 overall severity (USDA Forest Service 2012).

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[1] Ingalsbee, Timothy, Ecological Fire use for Ecological Fire Management. USDA Forest Service Proceedings RMRS-P-73. 2015.

[2] U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 2012.

[3] Williams, Mark A.; Baker William L. 2012. Comparison of the higher-severity fire regime in historical (A.D. 1800s) and modern (A.D. 1984–2009) montane forests across 624,156 ha of the Colorado Front Range.

Managing wildfires that impact forest ecosystems continue to result in an extraordinarily complex and high-stakes challenge. The increase in large, fast-moving, and intensely hot mega fires not only creates increased risks and unacceptable impacts to the human environment, but these fires can have the result of permanently transforming ecosystems and habitats.

In spite of this, large acreage burns do not always translate into the disastrous fires that mega fires have been claimed to be. For example, the Wallow Fire which burned over 535,000 acres in eastern Arizona, started May 29, 2011. The fire started at the height of the Apache-Sitgreaves National Forests fire season, when strong southwest winds and low humidity were prevalent. The strong winds and extremely low fuel moistures resulted in mainly wind-driven fire behavior, with the Wallow Fire making large gains within the first days of its origin, ultimately burning over 535,000 acres in approximately 5 weeks' time. However, examining fire severity impacts found that approximately 17% of the Wallow Fire area experienced high soil burn severity, 14% in moderate and the remaining 69% was in low and unburned conditions.[4] Thus, some of the mega 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 absence of fire for many decades.

Fire Across the Landscape: The Historic Perspective

Throughout history, fire has developed into a natural and essential evolutionary role in many forested ecosystems throughout the western U.S. However, due to fire suppression as a result of Euro-American settlement in the late 1880s, many forests of the West are overgrown and susceptible to catastrophic wildfire.

Because of this, millions of acres of western National Forests are currently at-risk due to degraded conditions and potential impacts, including unwanted wildfire, insect and disease, changing climate, and the lack of adequate thinning treatments. Past fire exclusion policies and fire suppression actions on public lands have led to historic unhealthy forest conditions and ecosystems. These sociocultural actions have led to unprecedented environmental changes that have created conditions conducive to more frequent large-scale wildfires.

Decades of fire suppression have in many places, prevented smaller, less-intense surface fires that help to naturally thin forests. As a result, many forests have grown so dense that once ignited, flames quickly climb understory "ladder fuels" and set the tree canopies ablaze. Crown fires can burn so hot they have the ability to create their own weather, spreading the fire across large landscapes and greatly complicating control efforts.

In the 1880s, forest management practices enabled more young trees to become established. Management policies allowed ranchers' livestock to overgraze the grass, which eliminated the fine-fuels needed to carry fire, allowing more seedlings to survive. Then, fire management policy started to change after the "Great Fire of 1910." This fire raged across three million

[4] USDA Forest Service, 2011 Wallow Fire/Fuels Report, 23p.

acres of virgin timberland in northern Idaho and western Montana and killed 87 people. As a result, federal and state agencies began implementing aggressive fire suppression policies in an effort to reduce the loss of economically valuable timber and protect communities.

Because the role of fire in maintaining healthy ecosystems was not well understood at the time, these management policies produced unintended and far-reaching ecological consequences. Lack of fire in many fire-dependent forests led to the build-up of flammable material and significantly affected forest successional patterns and processes. Changes were particularly dramatic in areas where fires were historically relatively frequent and of low intensity. Increasingly overgrown conditions and high fuel loads elevated fire risk in many areas, leaving them ripe for the ignition and spread of high intensity and severe burns.

Advantages of Natural Fire

While fire is a natural process in most U.S. forests, there is wide variation in the natural fire regimes that characterize different forest types. Fire regime refers to a combination of factors, such as the frequency, intensity, size, pattern, season, and severity of burns.[5] Understanding natural fire regimes is key to evaluating the potential for unwanted wildfire as well as forest restoration needs, since they provide a benchmark for determining the degree to which current forest conditions deviate from their "historical range of variability." Altered fire regimes, often due to long-term fire suppression, are a principle cause of elevated fire risk in many places. Re-establishing an area's natural fire regime can, therefore, be an important goal for forest management and restoration to reduce the threat of wildfire.

In some ecosystems where large wildfires were a natural part of the historic fire regime, there is accumulating scientific evidence that some landscapes could actually provide fire managers unique opportunities to recover fire-dependent species and restore fire-adapted ecosystems that have been adversely affected by the absence of fire. By managing wildfires to achieve beneficial outcomes, fire personnel attempt to actively 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 but less destructive to property.

The "Blame-Game": Looking at Key-Causal Factors of Large Wildfires

It's important to note that in recent years, several of the largest and most damaging wildfires have not occurred in the forested areas of the west, but adjacent to and within the Wildland-Urban Interface (WUI) where millions of people live. The current crisis in wildfire and forest management has its roots in three interacting factors: the outcomes of past forest management and fire suppression policies; significant increases in housing development in the fire-prone WUI; and changes in climatic conditions. Let's take a closer look:

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[5] Brown, J.K. and J.K. Smith, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. General Technical Report RMRS-GTR-42-vol. 2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Past Forest Management and Fire Suppression Policy

Whether sparked by lightning or humans, fire has long been a force shaping the landscape of western public lands. As noted, forest management and fire suppression policies have resulted in the unnatural buildup of fuels in many western forests, making them more susceptible to major fires. These policies have been labeled by some as mismanagement, but the author believes forest officials have been constrained for decades from implementing science-based treatments, in part, because of mis-guided restrictions imposed by Federal judges based on litigations initiated by some environmental organizations. Those constraints are usually magnified in forested areas outside of the WUI influence areas given that WUI areas have priority in land use planning.

Some leaders, including President Trump[6], have recently claimed that the massive wildfires are the result of poor forest management practices. However, in recent years, there has been considerable progress in addressing the massive forest restoration need with the Forest Service treating (thinning) about five million acres a year. Treatments are costly, resources are scarce, and the capacity required to increase the pace and scale of treatments is not commensurate with the need to treat the millions of acres of public lands needing restoration. The result is a management situation where the solutions don't match the severity of the problem.

Indeed, the scale of forest restoration needs is enormous. The U.S. Forest Service estimates that between 65 and 82 million acres are in need of restoration just on lands within the 193 million acre national forest and grassland system. There is, however, no "one size fits all" approach for forest restoration given the wide range of forest types, natural fire regimes, diverse landscapes, and varied degraded conditions of many ecosystems.

Increase in Housing Development in the Fire-Prone WUI

A report by the U.S. Forest Service[7] found that nearly half the population of the U.S. lives in an area with potential for wildfire danger. This equates to about 44 million houses, or one in every three houses in the country, that are located in the WUI. In the western U.S. the highest concentrations of homes are in California, Colorado, and Arizona (See Table 1). According to a study by the Headwaters Economic Group (HEG), eighty-four percent of the risk area from fires has not yet been developed, which means the problem is likely going to get much worse.

Since 2000, more than one million people in Colorado, three million in Arizona, and twenty-one million in California have been threatened by wildfires that came within fewer than 10 miles of

[6] The Guardian News Service, https://www.theguardian.com/us-news/2018/nov/16/trump-california-wildfires-forest-management

[7] Sebastián Martinuzzi & Others, The 2010 Wildland-Urban Interface of the Conterminous United States, 2015 USDA FS.

their towns, according to data from HEG.[8] Between 2000 and 2017, more than 3,000 communities had a wildfire of 100+ acres burn within ten miles of their towns.

Table 1 – Households At-Risk from Wildfire (Western U.S.) – (2017)

Rank	State	Households at High or Extreme Risk from Wildfire
1	California	2,044,800
2	Colorado	366,200
3	Arizona	234,600
4	Idaho	171,200
5	Washington	154,900
6	Oregon	148,800
7	Utah	133,100
8	Montana	133,000
9	Nevada	70,700 (est.)
10	Utah	48,250 (est.)

Source: Verisk Wildfire Risk Analysis - Data from Fireline®

Natural fires are usually suppressed in order to protect homes and people but, as has been shown, fire suppression has disrupted the natural role of fire, causing thicker vegetation and a build-up of fuels in forest areas. However, the author believes homeowners, not firefighters, should be the ones who must be responsible for creating defensible space around their homes, and communities need to change the way they prepare for wildfires.

The Changing Climate: Turning Up the Heat

Key climatic factors for the growing severity of wildfires include rising temperatures, shorter winters, more insect and disease occurrence, and prolonged drought. There is growing concurrence from various science-based studies that indicate increased warming and drying in the western U.S. is linked to increased fire frequency and size, as well as to longer fire seasons.[9]

In the western U.S., temperatures for the past five years have risen an average 1.7 degrees when compared with the 20th century. The Colorado River Basin, Arizona, Montana, Utah, and Wyoming have had temperatures rise more than 2 degrees in the past five years compared with the past century.

The National Climate Assessment[10] concluded that the number of wildfires is projected to increase as the climate continues to warm. The report estimates an additional 1.9 million acres

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[8] Headwaters Economic Group Website; https://headwaterseconomics.org/wildfire/homes-risk/communities-wildfire-threat/

[9] Balch, J.K., B.A. Bradley, J.T. Abatzoglou, R.C. Nagy, E.J. Fusco, and A.L. Mahood. 2017. Human-started wildfires expand the fire niche across the United States. Proceedings of the National Academy of Sciences 114: 2946-2951.

[10] USGCRP, 2017: *Climate Science Special Report: Fourth National Climate Assessment, Volume I* [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 470 p.

could burn each year by 2100. Taking these factors into consideration, including weather patterns shown in tree rings over past centuries, the report concludes that the intensity of fires is linked most closely to rising temperatures, less snowpack, earlier snowmelt, and a longer, drier fire season.

Shorter winters mean there is less snow and that many forest pests, such as the Pine Bark Beetle, do not die off in the winter. As a result, insects are killing and weakening millions of trees. The U.S. Forest Service[11] estimates that over 100,000 beetle-infested trees fall daily in the U.S. national forests, adding to the wildfire risk. Due to recent outbreaks of these destructive insects, tree mortality is reaching proportions never before seen in recorded history.

As the factors of climate change increase the risk of extreme fires, the long-term effects of mega fires may contribute to the underlying cause of climate change through the release of large quantities of carbon into the atmosphere. Although wildfires always release carbon, the amount released through most low-intensity fires typically is offset in subsequent years by vegetation regrowth and recovery in the burnt area. In contrast, the massive amounts of carbon released by mega fires, coupled with declines in the capacity of the landscape to recover, is significant.[12]

Mega Fires in the West: Running the Numbers

Wildfire statistics, and comparisons of how "bad" a fire season is, commonly focus on how many fires burn in a given year, total acres burned, and impacts to the human environment. However, there are other factors that should be considered to accurately describe the severity of fires in any given period. Journalists may succumb to the emotional temptation of declaring the 2018 fire season as the "worst ever,"[13] but let's look at the facts:

The wildfire yearly average for about the first 50 years of the 20th Century (Table 2) was more than double the number of fires, and burned significantly more acres on average, than more recent fire seasons. Since about 2000, the number of fires has leveled out, <u>but the acres burned has been increasing each year</u>. For example, the total number of acres burned between 2009 and 2018 is estimated at 7,972,211; while the number of fires dropped from 70,771 to 66,567.

During the past two decades there have been 45 large fires (over 200,000 acres) occurring in nine western states. The state with the highest number of large fires was Idaho with eleven, followed by eight in California and six in Oregon. However, it is notable that those large fires

[11] Video Documentary: https://www.nationalgeographic.com/video/shorts/1187972675527/
[12] Wear, D.N. and J.W. Coulston. 2015. From sink to source: regional variation in U.S. forest carbon futures. Scientific Reports 5: 16518
[13] Wallace, Tim, Ngu, Ash, Lu, Denise, & Bloch, Matthew, New York Times, August 10, 2018 https://www.nytimes.com/interactive/2018/08/10/us/california-fires.html

that occurred near, and within communities, especially in California, were the most destructive, deadly, and costly when compared to fires occurring primarily within large expanses of forested ecosystems.

Table 2—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
2009-2018	66,567	7,972,211

Source: National Interagency Fire Center

Firefighting Costs

Wildland firefighting budgets of federal land agencies have tripled in size in the last decade, from $1 billion per year on average in the 1990s, to over $3 billion on average, driven in large part by the need to defend homes and businesses. However, the Interagency Standards for Fire and Fire Aviation Operations,[14] states that "structure protection" (defending homes) is a local responsibility and federal wildland firefighters will not take direct suppression action on structures. Yet, agencies continue to spend federal dollars to protect homes from wildfires, sending a clear message that if local jurisdictions do little to reduce wildfire risk, the federal government will still act to protect private property.

Consequently, funding that would otherwise be used to reduce fire risk (such as thinning and eliminating fuels) is instead diverted to fire suppression costs. These excessive costs leave little funding for forest management, capital improvements, or programs required by the Agency's mission. Today, fighting wildfires consumes more than 50 percent of the Forest Service's budget, and this number could grow to 67 percent over the next decade, in large part due to the growing WUI and effects from a changing climate.[15] The cost of suppressing fires has reached all-time highs (Table 3), and the burden of that expense, combined with the increased threat of wildfire, is motivating changes in fire policy at multiple levels of government.

[14]2019 Interagency Standards for Fire and Fire Aviation Operations: https://www.nifc.gov/policies/pol_ref_redbook.html

[15]U.S. Forest Service. 2015. The Rising Cost of Wildfire Operations: Effects on the Forest Service's Non-Fire work. U.S. Forest Service, Department of Agriculture. https://www.fs.fed.us/sites/default/files/2015-Fire-Budget-Report.pdf

Table 3 - Wildfire Impacts & Suppression Costs (2008 – 2017)

Year	Total # of Wildfires	Total Acres Burned	Suppression Costs
2008	78,979	5,292,468	$1,585,856,000
2009	78,792	5,921,786	$ 920,529,000
2010	71,971	3,422,724	$ 809,499,000
2011	74,126	8,711,367	$1,374,525,000
2012	67,774	9,326,238	$1,902,446,000
2013	47,579	4,319,546	$1,740,934,000
2014	63,212	3,595,613	$1,522,149,000
2015	68,151	10,026,086	$2,918,183,000
2016	67,595	5,503,538	$1,975,545,000
2017	71,499	10,026,086	$2,918,165,000
2018	66,567	7,972,365	Unknown

Source: National Interagency Fire Center

Additional factors affecting the increased cost of firefighting is that many communities are not adequately controlling future housing development on fire-prone lands. There is growing advocacy for local governments to assume a greater financial responsibility for emergency response activities, including structure protection, within their jurisdictions.[16] The financial impacts of mega fires usually focus on suppression costs to stop a fire, but the real cost-accounting often exceeds suppression costs ten-fold, and are felt for decades after the fire has been put out.

Finding Solutions in Evidence-Based Science

Identifying solutions to prevent mega fires in the future run the gamut from evidence-based science research to emotional opinions based on casual observance of an event. Clearly, identifying and treating the fuels that feed these large fires is an important place to continue to invest. Whether it involves forested ecosystems or homes in the WUI environment, changes are necessary.

The treatment of fuels has long been effective in reducing fire risk and is expected to make a measurable difference into the future. Serious challenges to needed fuel treatments persist including lack of sufficient resources to accomplish meaningful risk reduction, limited understanding as to where to apply those resources, and a clear sense of what wildfire intensity treatments are designed to mitigate. Do we have the capacity and commitment to make a substantive reduction of wildfire risk in the public lands of the U.S.?

Reintroduction of fire by prescribed or controlled burns has proven to be an effective method of treating fuels and vegetative conditions conducive to large fires and can be part of an important restoration approach. There are places, however, where fuel loads are simply too high or conditions too dangerous for prescribed burns to be safely used. In these instances, hazardous fuel loads can be reduced through a variety of mechanical thinning techniques in understory vegetation.

This author suggests the pace and scale of forest restoration needs to be accelerated by promoting outcome-driven, collaborative processes; by expanding the use of prescribed fire where appropriate; and, by improving the environmental review process of beneficial restoration projects. Forest

[16] The Solutions Journal, Volume 6, Issue 2, P.55-62 | March 2015

sustainability and resilience of forest ecosystems and communities must be improved. Thoughtfully managing housing development in fire-prone areas and continuing to prioritize fire risk reduction in the WUI must also remain key priorities. Evidence-based science must drive future actions regarding climate change strategies, to ensure logical and accurate responses to the biological as well as human environments are effectively pursued.

Conclusion

If the predicted trends of wildfire occurrence and intensity are accurate, more and larger fires will be experienced in the foreseeable future. Reducing risks from mega fires will require that each of the underlying problems are adequately addressed. These include increasing efforts to reduce the massive backlog in forest restoration, achieving more responsible and fire-wise development in WUI areas, changing how communities prepare for and respond to wildfires, and addressing climate change by appropriately-scaled actions of reducing greenhouse gases and by incorporating science-based climate considerations in forest management and restoration strategies.