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Fire Regimes of the Anthropocene: The Influence of Climate Change on a New Era of Wildfires in the American West

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Environment

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The Influence of Climate Change on a New Era of Wildfires in the American West

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For weeks in September 2020, massive wildfires on the west coast gave rise to smoke plumes so vast that they were visible from satellite images and blocked out the sun in most of California, Oregon, and Washington. Amidst the general unrest of 2020, politicians in the midst of heated discourse fueled by misinformation once again failed to adequately address the realities of catastrophic wildfires in the West. Every year, wildfires rage across North American wildlands, reigniting a highly politicized debate in the United States (U.S.) about the relationship between climate change and wildfire season. Climate change is not the reason there are wildfires in the United States, or anywhere for that matter. Periodic wildfires are essential to the natural cycles of many ecosystems around the world. What is concerning about recent wildfire seasons is the increased prevalence of large wildfires that often burn with greater intensity. Overwhelming evidence indicates that climate change is responsible for this trend. As this is likely to continue, a major shift in wildfire policy is necessary to mitigate the devastating ecological and socioeconomic impacts on the western U.S.

Large wildfires are on the rise in the United States, with deadly consequences and rising costs for the low-density communities they most often affect. In the last five years, the U.S. federal government spent an average of $2.3 billion per year on wildfire suppression, up from the ten year average of $1.8 billion per year. Despite these efforts, wildfires' total annual acreage reached levels unseen since the mid-1950s, when wildfire suppression became widely implemented. Each of the last three decades has had a significantly higher average wildfire acreage than the preceding decade. However, the total number of wildfires has actually gone down in the same period rather than increasing, meaning that wildfires are larger on average, especially in the West. In fact, approximately 94 percent of the total area burned was in the West, while that region accounted for less than 53 percent of the total number of wildfires in 2020. As of October 31st, just over 47 thousand wildfires, the lowest number of wildfires since 1984, had scorched approximately 8.5 million acres of U.S. wildlands in 2020, easily exceeding the ten-year average of 6.4 million acres burned a year. California alone accounts for an unprecedented 3.1

million acres burned in 2020, with five of the six largest fires in its history and the most extensive area burned in the state on record. Although certain aspects of the 2020 wildfire season are record-breaking, the year was not a statistical outlier but rather a part of a multi-decade trend of increasingly large wildfires.

Divisive rhetoric and misinformation may dominate headlines about climate change, but consensus on climate change and its potential impacts on the wildfire season has been long established within the scientific community. With great certainty, the Intergovernmental Panel on Climate Change (IPCC) has shown that radiative forcing resulting from the accumulation of greenhouse gasses (GHG) in the atmosphere has significantly contributed to climate change over 30 years of accumulated scientific data. As predicted by the IPCC as far back as 1990, arid and semi-arid regions of the world have experienced an upward trend in the severity and prevalence of large wildfires.

The mechanisms by which climate change affects wildfires are varied, but it is apparent that increasing temperatures in the West have contributed significantly to conditions that are more conducive to the spread of large wildfires. Species that were once successful in large swaths of the western U.S. are now unable to survive in much of that land due to a rapid shift in average regional temperature ranges. Further exacerbating this problem, the increasing temperature range also brings invasive species further north, damaging or otherwise out-competing native vegetation. Both these impacts contribute to a higher death rate among native plant species, causing an increase in flammable debris. This is a process known as fuel loading. Higher temperatures also facilitate evapotranspiration, the loss of overall moisture content in vegetation. This means that live vegetation ignites more easily. Observed increases over the last 30 years in fuel loading, fuel aridity (the drying out of forests and ecosystems), and larger, hotter wildfires in western U.S. forest ecosystems are likely to continue.

Atypical weather patterns responsible for the particularly damaging wildfires in California may be indicative of a new trend that may compound the impacts of rising temperatures. In 2020, large wildfires in California were linked to 14 thousand lightning strikes that occurred over a three-day period in August. The high-pressure weather systems that hover over the West are responsible for the prevalence of dry thunderstorms and contribute to the dry conditions conducive to wildfires. Human-caused wildfires are typically far more common in California, so the fact that lightning resulted in such massive wildfires is unusual. However, recent studies suggest that increased surface temperatures have altered the air circulation between the equator and the subtropics, known as the Hadley cell. The descent of air into the subtropics, responsible for dry, high-pressure systems, has expanded its range further into the temperate zone in the last several decades. Along with reducing cloud cover, exacerbating droughts, and extending the wildfire season, this trend could have contributed to the unusual string of lightning strikes. If that is the case, the record-breaking 2020 wildfire season in California could become a common occurrence, with the number of large wildfires continuing to increase.

Frequent, large wildfires destabilize ecosystems and are responsible for many structural losses, resulting in tens of billions of dollars in damage annually. Many of these large wildfires keep burning until snow or rain puts them out. As higher temperatures contribute to a longer dry season, these wildfires have more time to spread unimpeded. The increased prevalence of such wildfires will contribute to accelerated erosion, additional carbon emissions, and an increase in periods of hazardous air quality. Moreover, these massive wildfires burn with greater intensity, and conventional fire suppression tactics have proven to be increasingly ineffective. Firefighting is necessary when wildfires pose an imminent threat to human health and infrastructure. However, toxic fire retardants and habitat fragmentation caused by fire blocks are incredibly damaging to the ecosystems' health and impede their ability to recover after a fire. Because the U.S. Forest Service quantifies the productivity of forests in terms of timber available for extraction, the potential deaths of firefighting personnel and disruption of ecosystems are considered acceptable risks to protect corporate logging interests.

Despite the devastating socioeconomic impacts of large wildfires in the West, fire is essential to the basic functioning of arid ecosystems – of which the West is largely comprised. Due to a lack of available moisture in the air, organic matter does not readily decompose, contributing to a buildup of highly flammable biomass over time. Fire regimes, the natural patterns of wildfire size, severity, and frequency within a given ecosystem, directly contribute to species composition and the health of an ecosystem by killing off maladapted species and periodically cycling stagnant nutrients back into the soil in these arid regions. When smaller fires occur and the succession of species is permitted to resume naturally, the surviving vegetation maintains soil structure while creating more resilient, varied ecosystems.

In the U.S., a harmful conservationist framework focused on protecting logging interests informed an ecologically-flawed model of forest management, in which intense fire suppression was applied universally to all wildlands for almost a century. This also included commercial thinning, post-burn clearing, and conventional clear-cutting practices. These practices fail to mimic fire regimes and are actually known to compromise otherwise wildfire-resistant forests' natural structure. Although thinning may seem like a practical solution to the burn deficit, the large, healthy trees that are cleared are also those most likely to survive a fire. This creates a negative feedback loop that strips nutrients from an ecosystem over time. In addition to contributing to erosion and impeding recovery, the controlled "re-stocking" after clear-cutting and post-burn clearing creates areas of densely packed single age trees that are more susceptible to large crown fires.

While it is still early to conclude the extent to which climate change will alter fire regimes, it is clear that human adaptation to large wildfires is unavoidable in the coming decades. In recent years, prescribed burns have been implemented under safe conditions to address the cumulative burn deficit and fuel buildup resulting from overzealous fire exclusion in backcountry areas. Though prescribed burns are applied unevenly due to the hoops and ladders of conflicting state and federal policies, they remain an effective tool to reduce excess fuel loading. A successful wildland management strategy would include wildfire management through close monitoring of remote fires and a robust application of supplementary, prescribed burns, while only engaging suppression tactics when fires pose an imminent threat to human life or infrastructure. • • •