

Confluence of disastrous environmental events in the western United States

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Introduction

This has been a summer of extremes in the western United States with record heat impacting not just the Northwest, but also the Southwest. Virtually every western state, including Montana, Idaho, Washington, Oregon, California, Nevada, Arizona, New Mexico, Colorado and Utah have been in drought, while record wildfires have burnt across Oregon, California and other states. Although high temperatures and drought are not unusual in the American West, the fear is that climate change fuelled by human activity is making them more intense and frequent.



California Wildfire. Source: Noah Berger.

The West appears to be the region of the U.S. where life as we know it today will face the greatest disruptions from climate change. Because it is so arid, development there has always been precarious and, since the 19th century, its growth has relied on massive federally-funded engineering projects, which have tamed rivers to produce the water and electricity needed for its growing cities. The physical and legal infrastructure of the West is geared toward a certain climate regime that did not actually exist even at the time of development, let alone now.

As far back as 1883, the famous geologist-explorer John Wesley Powell predicted water shortages when he observed that the American West was “piling up a heritage of conflict and litigation over water rights, for there is not sufficient water to supply these lands.” The 20th century proved him prescient as the Colorado River Basin states fought each other over their share of water (Glennon, 2019).



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Drought

A period of lower precipitation across the Southwest since 2000, which, so far, scientists have not definitively linked to a warming climate, has been the most severe since the 1500s, threatening the water supply of communities throughout the West. In June 2021, officials warned that Lake Oroville, California's second-largest reservoir, was being depleted so quickly that it might have to close for the first time ever—a closure that could affect electricity for 800,000 homes. In mid-August, water levels in Lake Mead, the country's largest reservoir that powers the gigantic Hoover Dam, fell so low that the Interior Department declared the first official water shortage in the lake's 85-year history and announced cuts in the promised water allocations to Arizona, Nevada, and Mexico.

California's San Joaquin Valley produces two-thirds of the fruit and vegetables consumed in the United States. Even in a wet year, the San Joaquin River provides nowhere near enough flow to sustain the sub-basin's 95,000 irrigated hectares; three-fourths of the water must come from the ground. The fight over what remains of the aquifer now pits two camps of farmers against each other: those inside the irrigation district, who trace their fertile soil three generations back, and newcomers outside the district, whose orchards grow in poorer soil and rely wholly on groundwater. The depth of the aquifer has plunged so drastically in recent years that many of the shallow irrigation wells have run dry.

Since the early 1970s, California's annual wildfire extent increased fivefold, punctuated by extremely large and destructive wildfires in 2017 and 2018. This trend was very likely driven by the drying of fuels promoted by human-induced warming (Williams et al., 2019). When soil moisture is depleted, the solar energy goes into heating the soil rather than evaporating the non-existent soil water. The heat in late summer before the advent of strong autumn winds enhances the odds that fuels are dry when those winds arrive. This positive feedback effect spurs the rapid progression of small fires into uncontrollable megafires.

Confluence of Perils Exacerbated by Climate Change

One interpretation of the recent heat wave is that it represents a meteorological black swan, a rare dynamical interaction that has always been possible but so rare that, in 70 years of data, there has been observed no weather pattern that was qualitatively similar. An alternative explanation is that climate is changing in such a way that what has been experienced in the past is no longer a reliable predictor of the future. Change is consistently hitting the West at the very high end of what climate models consider possible, and sometimes beyond it. The broiling temperature that the Northwest reached this summer, 121 degrees in British Columbia, was so far beyond observed experience that it exceeded even statistical models' outermost potential extremes for the area (Risk Frontiers, Briefing Note 447, 2021). It is happening faster than the scientists had been suspecting, or at least, in their desire to appear cautious, were willing to publicly forecast.

So the convergence of dangerous effects this summer could be just coincidental: there will be years that are wetter or drier, hotter or cooler, more prone to fires or less. But this year's simultaneous extremes do not seem to be random and there are very direct interactions between extremes in heat, precipitation and fire, and the interactions are such that they reinforce one another.

Electric Power Instability

On top of a stressed water supply, the heat has also strained power grids and prompted pre-emptive blackouts just when people need power the most for air conditioning. Once the power grid goes, the health, transportation, communications, and financial sectors all bear costs. As described in Risk Frontiers' Briefing Note 450 (2021), California's streak of wildfires created record liability for insurers

due to fires ignited by electric power lines. Insurance companies lost a total of \$20 billion in 2017 and 2018; twice the industry's profits since 1991. The state has spent more than \$4.7 billion from its emergency fund from 2010 through 2019 to fight fires. For the past several years, Cal Fire, the state's firefighting agency, has exhausted its firefighting budget only months into the year, leaving little to pay for reducing fuel loads in California's overgrown forests and helping rural communities protect infrastructure and water supplies.

So far, California's approach has been to stabilize the financial health of the state's electric utilities by creating a \$21 billion compensation fund to pay for fire victims' claims, seeded with equal contributions from the companies and their customers. They are also mandating more safety oversight and a requirement that the three largest utilities invest a total of \$5 billion to fireproof their equipment. Increasingly, those precautions have included pre-emptively cutting the power in high-risk areas during windy, red-flag conditions, a measure that is extremely unpopular with customers. The state's (and nation's) largest electric power company, Pacific Gas & Electric, now in bankruptcy, has announced that it will spend \$30 billion to bury power lines in areas that are most vulnerable to wildfires, but charging those costs to consumers would have to be approved by the state Public Utilities Commission.

Impact of Heat and Wildfires on Housing and Health

Extreme heat kills, especially among the elderly and in places ill-equipped to handle it, as was seen in British Columbia, Washington and Oregon this summer (Risk Frontiers, Briefing Note 447, 2021). It also poses threats to outdoor work and recreation that will affect many aspects of how people can live.

Wildfires have already scorched over 800,000 hectares in California this year, choking the air with smoke, spurring widespread pre-emptive power blackouts and forcing the emergency evacuation of hundreds of thousands of people. Tens of thousands of Californians are homeless, and millions more are paying far more in rent than they can afford, commuting into expensive cities from distant suburbs and towns, or doubling up in houses and units.

Much of wildfire destruction in California happens in the wildland-urban interface (WUI), where trailer parks and ex-urban cul-de-sacs and cabins have sprung up amid the state's scrublands, pine forests and grassy ridges. As a result, 2 million homes, or one in seven in the state, are at high or extreme risk for wildfire. The 2018 Camp Fire killed 85 people and destroyed more than 10,000 homes in Paradise, a town situated in the WUI. The year before that, the Tubbs Fire killed 22 people and destroyed more than 5,000 structures, some in Santa Rosa and some in the WUI around it.

Although much of the WUI is naturally vulnerable to fire, human behaviour is primarily to blame for the destruction. People start more than 90% of fires. Dry trees and brush in the WUI might act as natural kindling, but built structures—houses, cars, hospitals, utility poles and barns—act as the most potent fuel. A house burns a lot hotter than the brush does, and a propane tank is far more combustible than a patch of grass.

Although building in the WUI is dangerous, it is done in part because new housing construction is very difficult in many urban regions in California, due to opposition from existing homeowners and strict building codes. The number of people living on the streets in San Francisco and Los Angeles is related to the extreme cost of rent in those cities, which is related in turn to the state-wide housing shortage. Each major fire intensifies the state's housing crisis: rental prices surge, vacancy rates fall to near zero, and families struggle with displacement and homelessness. The cost of homebuilding goes



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up, and resources for families without stable housing are stretched even thinner. The Covid-19 epidemic only exacerbates this housing crisis

In the meantime, California is not doing enough to discourage building in fire-prone areas. Even if the state were to limit future development, millions of Californians already live in the WUI, at risk of having their homes destroyed and their lives endangered by fire, of being unable to insure their homes or of seeing their housing values fall and their economic security imperilled. California's housing crisis has exacerbated its wildfire crisis, and its wildfire crisis has exacerbated its housing crisis, and there is no end in sight for that vicious cycle.

In the coming years, climate change will present the same kind of unanticipated challenges as COVID-19 is presenting now. Like a global pandemic, climate is a very complex system, and it seems that everything that could go bad with the climate is going bad in the American West.

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