Self-Perpetuating Warming

By John Benson

July 2026

1. Introduction

It's both ironic and disturbing. We have made progress in reducing anthropomorphic (human caused) pollution. However, the climate change (global warming) associated with the pollutants has already begun, and this warming has many side-effects, including amplification of global warming and major health-impacts. Firefighting has improved in areas typically prone to wildfires. Ironically, this has led to living- and dead-plant fuel accumulation, which, in-turn, leads to larger, more intense wildfires. The final irony is that wildfire-smoke contains precursors for ozone, which increases global warming.

2. Sustained Warming

The atmosphere in many developed countries is substantially cleaner than it was 50 years ago because of the concerted efforts by scientists, nongovernmental organizations, governmental agencies, lawmakers and private industry to reduce the production of key pollutants. Nevertheless, increases in wildfires have caused continent-wide smoke plumes that contain harmful particulate matter, such as dust and soot, and precursors for ozone formation near Earth's surface. Exposure to ozone can cause chronic respiratory diseases and permanent lung damage, leading to premature death. However, ground-level ozone concentration is difficult to quantify because of sparse monitoring stations. A high-resolution map of surface ozone pollution driven by wildfire plumes in the United States was developed and this was used to quantify the risk of human exposure. The findings indicate a 46% increase in premature mortality from wildfire-sourced ozone during 2013 to 2023 compared with that during 2003 to 2013.[1]

Ozone is a secondary pollutant that is formed by chemical reactions of primary pollutants, such as nitrogen oxide, and volatile organic compounds, carbon-based chemicals that easily turn into gas from liquid phase. Consequently, ground-level ozone concentration, which is distinct from the ozone layer in the stratosphere, is sensitive to meteorological factors, such as solar radiation, temperature, humidity, and wind speed, as well as local land use. Policies such as the United States Clean Air Act,[2] *which has been regulating air pollution at a national level since 1963, have led to reductions in population exposure across developed countries. Subsequent improvements in air quality standards have greatly reduced mortality over the past decades. However, there has been an increase in wildfires around the world since 2015, caused in part by increased agricultural burning and increased drying caused by climate change. An additional factor has been the suppression of small, natural fires, which has led to the accumulation of excessive fuel that has stoked fires that burn at much higher intensities.*

[1] Science Magazine, June 4 Issue, article: 'Ozone from wildfire plumes increases mortality,' https://www.science.org/doi/10.1126/science.aei2027

[2] The United States Environmental Protection Agency (EPA), Clean Air Act Text, March 30, 2026. https://www.epa.gov/clean-air-act-overview/clean-air-act-text

The pollutants in wildfire plumes can form ozone downwind both on their own and when mixed with other air masses, such as pollution from transportation, power generation, and industry. Quantifying human mortality from wildfire-driven ground-level ozone is challenging because of the way ozone is formed from mixtures of polluted air masses. In addition, current surface-level monitors only cover 2% of the land area, making it difficult to identify trends and sources at the neighborhood level.

A high-resolution surface ozone model was built using an artificial neural network model, a type of artificial intelligence model that is inspired by the human brain, to map the concentration of ozone from the 723 monitoring sites with continuous data records (from 2003 to 2024) to a 1-km resolution grid spanning the continental United States. The specific locations and times of wildfires were traced by using the change in atmospheric carbon monoxide level as a proxy. Emissions of carbon monoxide have been controlled effectively so that excess carbon monoxide in the air can be attributed to a wildfire occurrence. A three-dimensional chemical transport model was used for atmospheric composition to cross-validate the results. Ozone concentrations with and without fire effects were estimated to the neighborhood scale. The results were then used to assess the fraction of all-cause premature death (deaths that occur before the age of 75 in the United States from any cause) that is attributable to ozone. Combined with the high-resolution map, this yielded estimates of excess mortality due to ozone from wildfires.

2.1. Surface Ozone Model

The surface ozone model connects different source data (satellite remote sensing and ground monitoring stations) and input model types (chemical and meteorological 3D grid models) to quantify the impact of wildfires on ground-level ozone. This exemplifies one of the new aspects of doing science in the age of artificial intelligence: speculative reasoning, which makes inferences to the most likely explanation. This is in contrast with deduction, which draws conclusions from a general rule, and induction, which draws a general conclusion from multiple observations. According to this paradigm, initial disparate observations were extended to move to probable impacts. Such an approach could accelerate counterintuitive findings which can be hard to identify with traditional data analysis and numerical simulations, as seen in a recent study that suggested that wildfires in the western United States may have reduced atmospheric particulate matter in the eastern part of the country by changing rainfall patterns. As wildfires spread into urban areas, burning buildings have been found to increase emissions of toxic air pollutants (see section 2.2).

The field of wildfire research has also benefited from the text processing capabilities of artificial intelligence to take meta-analyses to a new level. For example, a large language model was used to analyze 60,000 articles and identified discrepancies between the geographical and subject areas covered in scientific literature with the extent and types of wildfires occurring around the world. This has shown that studies are biased towards regions that have more research funding, but differences were also found in research on fuel types and climatic drivers. Similar studies on the performance of scientific research by using artificial intelligence models could guide future work. This is important because the impacts of air pollution vary dramatically between neighborhoods and pollutants from wildfires can have exacerbated health effects compared with those that are not related to fires. Future studies could better identify unexpected results, such as reductions in test scores across multiple disciplines for both primary and secondary school students who were exposed to wildfire smoke in the United States.

What needs to be done to mitigate health risks from wildfire-driven ozone and particulate matter? Despite the increase in wildfire occurrences in the western United States, the fraction of area burned is still below long-term historical norms. Restoring routine small wildfires (or increased controlled-burns) *could boost ecosystem health and increase a forest's resilience to larger fires, thereby reducing overall emissions. One of the most effective ways of reducing health risks could be downwind management. Indoor exposure to wildfire-driven pollutants can be limited by improved building codes that reduce the rate at which outside air enters the building and by using air purifiers, and outdoor exposure to them can be limited through public health outreach to discourage outdoor activities during air quality alerts. In both cases, specific initiatives would be required to include the most vulnerable populations to prevent the deepening of existing societal inequities. Deng et al. exemplifies a nascent scientific method that uses an artificial intelligence model to connect and analyze high quality data and numerical models. The success of these methods will continue to depend on the quality of scientific datasets.*

2.2. Los Angeles Wildfires

Author's comment: I'm covering this catastrophe because it is an indication of future events, at least in the southwestern US. Because this area is very arid and thus susceptible to wildfires, when combined with climate change, other factors described above, and rapid conversion of rural areas to suburban neighborhoods, it is highly likely they will face a choice of investing in extremely effective fire-protection measures, or suffering from increasing destruction via wildfire.

The January 2025 Los Angeles wildfires were among the deadliest and most destructive in California history, burning over 57,000 acres, destroying more than 16,000 structures, and causing at least 30 deaths.[3]

By the time the January 2025 wildfires erupted in Los Angeles, the region was in extreme drought, with conditions far drier than normal and among the most severe in decades.[4]

Since the start of the 2025 water year (October 1, 2024), Los Angeles and much of Southern California had received only a fraction of the seasonal average rainfall — just 0.16 inches by January 9, 2025, compared to the normal 4.64 inches by that date. This near-record dryness followed two wet winters that boosted vegetation growth, but then a record-dry fall that rapidly dried out the fuel.

Soil and vegetation moisture: *Soil moisture across much of the region from Santa Barbara to San Diego was only 2% to 5% of average, leaving dusty soils instead of moist ones. Vegetation moisture was similarly low, creating a high "fuel load" that made fires spread quickly once ignited.*

Vapor pressure deficit and fire weather: *Measurements showed an extreme "vapor pressure deficit" — the air's ability to draw moisture from the landscape — which was more than double normal levels in some areas. This, combined with record heat and low humidity, created conditions where wind could ignite and carry flames with little resistance.*

[3] This section's source was the result of a query of Microsoft Bing to report on "Los Angeles wildfires of 2025."
[4] The text from this paragraph to the end of this paper comes from a query of Microsoft Bing to report on "What was the Los Angeles drought status before the January 2025 Wildfires"

Drought classification: *The U.S. Drought Monitor and NIDIS updates from January 2025 described the drought as expanded and intensified in Southern California, including the Los Angeles area, with extreme record or near-record dryness. The combination of persistent dryness, high evaporative demand, and strong Santa Ana winds kept conditions in a critical fire danger zone.*

Climate context: *Scientists linked the severity to a "weather whiplash" — two wet winters followed by near-zero rainfall for months — a pattern not seen in Southern California since the 1992–1993 drought. Climate change and La Niña conditions[5] were also identified as factors that made the extreme fire weather more likely.*

2.2.1. Overview and Timeline

From January 7 to 31, 2025, Southern California experienced a series of catastrophic wildfires, with 14 major fires affecting Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties

The two largest fires were the Palisades Fire in Pacific Palisades and the Eaton Fire in Altadena, which together caused the majority of fatalities and property destruction

The Palisades Fire destroyed 6,837 structures and killed 12 people, while the Eaton Fire destroyed 9,414 structures and killed 18 people.

2.2.2. Causes and Contributing Factors

The fires were fueled by extreme Santa Ana winds,[6] which reached speeds of up to 100 mph, and severe drought conditions exacerbated by climate change. The Palisades Fire originated from a smoldering holdover fire from January 1, reignited by strong winds on January 7.

Other fires, including the Eaton Fire, may have been linked to utility equipment sparks, while several smaller fires remain under investigation. Decades of fire suppression had also increased fuel loads, worsening fire intensity (see the last paragraph in section 2.1).

2.2.3. Firefighting Efforts

Firefighting involved municipal, state, and federal teams, including over 8,500 personnel, tactical aircraft, drones with infrared sensors, and innovative equipment like the StormCell vehicle.[7]

International assistance came from Canada, Mexico, Israel, and other countries, providing firefighters, aircraft, and logistical support

2.2.4. Environmental and Health Impacts

The fires released toxic smoke and black carbon, affecting air quality across the region. The EPA conducted hazardous material removal from nearly 14,000 properties, including lithium-ion batteries, and tested soil for contaminants

Long-term environmental monitoring continues to assess air, soil, and water safety.

[5] https://oceanservice.noaa.gov/facts/ninonina.html
[6] https://en.wikipedia.org/wiki/Santa_Ana_winds
[7] https://www.tmz.com/2025/01/24/jet-engine-powered-truck-fight-los-angeles-wildfires/

2.2.5. Recovery and Legal Proceedings

Recovery has been ongoing, with SBA disaster relief extensions for survivors facing rebuilding delays due to permitting and insurance disputes. Legal actions include a lawsuit against Airbnb for alleged price gouging during the fires and the arson case of Jonathan Rinderknecht, accused of starting the Palisades Fire, which ended in a mistrial with plans for retrial.[8]

2.2.6. Economic and Social Impact

The wildfires caused estimated damages between $76 billion and $131 billion, ranking among the top 10 costliest U.S. disasters. Over 200,000 residents were evacuated, and thousands of homes and businesses were destroyed. Community resilience efforts, including sports, music, and volunteer programs, have supported recovery and mental health.

2.2.7. Key Takeaways

The 2025 Los Angeles wildfires highlight the interplay of climate change, extreme weather, and urban vulnerability. They underscore the importance of preparedness, early warning systems, and coordinated firefighting strategies to mitigate future wildfire disasters in Southern California.

---

[8] As of last week:

- Accused arsonist Jonathan Rinderknecht is back in court after his case was previously declared a mistrial (jury unable to reach a verdict).
- His next status conference is set for August 19.
- Despite the scheduling setbacks, prosecutors and the defense team are preparing for an October retrial.