

Environment

Fueling Innovation to Navigate the Wildfire Challenge Ahead

The climate-driven wildfire crisis calls for a comprehensive, cross-sector approach to funding, research, and action.

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One glimpse at the [August 2024 wildfire incident map](#) of Western North America and one might have thought half the continent was on fire. Oregon had declared a statewide wildfire state of emergency through September. California was grappling with the Park Fire, the fourth largest in the state's history. New Mexico was recovering from flash

floods exacerbated by the South Fork and Salt fires. The National Interagency Fire Center was reporting 85 large wildfires requiring active management, with nearly 30,000 wildland firefighters and support staff deployed, and evacuation orders in place for 20 fires. Meanwhile, Canada dealt with the incineration of the scenic and popular tourist town of Jasper and the evacuation of Saddle Hills County in Alberta, also requiring emergency measures to sustain incident operations including needing to mobilize international support

through the Canadian Interagency Forest Fire Centre. Fire services worldwide are increasingly engaged in protecting communities and natural resources, in geographies as diverse as North America, Chile, Siberia, Greece, Australia, and South Africa.

The 2024 fires in Western North America are not an anomaly; rather they reflect a global trend. The science is consistent and clear: Extreme wildfires have **more than doubled in both frequency and magnitude** over the past two decades, and this trend is expected to continue. Fires are a natural phenomenon across biomes, affecting just about every continent. However, in the context of unfolding climate change trends, including extreme heat and wind conditions, the risk of wildfire impacts is drastically increasing. Extreme wildfire impacts now span geopolitical boundaries, affecting diverse communities and ecosystems each year. Fires can burn wherever fuel is available, without regard for a community's resources, politics, or development. While the challenge is complex, it is also unifying. We share the burden of catastrophic wildfires, and the potentially irreversible consequences they can cause.

The urgency is high, as extreme wildfires could **increase by up to 30 percent** by 2050 and 50 percent by 2100. In Western North America, as we grapple with the consequences of a century of policy and practice suppressing natural fire regimes and disturbing ecosystem function, and the removal of Indigenous land stewardship, we have to recognize and come to terms with the ways we have contributed to this crisis. Yet, with aligned goals and coordinated action, the wildfire crisis is still a manageable challenge—if, that is, we can shift from outdated methods and legacy mindsets.

We are 17 authors from 17 different organizations across sectors—government, science, business, and philanthropy—who have come together to share how we understand our roles in building the path forward. We cannot address 21st-century fires with 20th-century approaches. Resilient communities and ecosystems cannot rely on the reactive methods of the past. By adopting a comprehensive approach that meets the modern moment, we can combat catastrophic wildfires and even co-exist with beneficial fire.

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Upstream Solutions

To solve the wildfire challenge, we need to systematically invest in the following activities and technologies to reduce risk before wildfires ignite, prevent destruction as they burn, and adapt so we are resilient when the next wildfires burn:

1. Mitigations that matter for communities: Researchers, (re)insurers, land use planners, builders, and others must work with citizens and fire agencies to reduce the vulnerability of communities to extreme wildfires and facilitate coexistence with ecologically beneficial fire, by disrupting fire pathways into communities and between structures, particularly in the **Wildland Urban Interface** (WUI). Although only 4.7 percent of land is WUI, it houses 45 percent of the world's population—including 50 million homes in the United States (more than 30 percent of all housing). Advances in fire behavior modeling help us understand how fires spread in the built environment and determine which ones are most at risk. Research by **Colorado State University** and the **University of California, Berkeley** and AI-powered tools like **Xyloplan** help homeowners and communities prioritize highest-impact mitigation. Further work to understand how fire moves among fuel mediums (vegetation to vegetation, vegetation to structure, and structure to structure) are also being done by Cal Poly's **WUI FIRE Institute**. With these advancements, the insurance industry's catastrophe (CAT) modeling can more accurately capture and reflect the investments that individual landowners and communities have made in high-priority, evidence-based mitigations, incentivizing them at scale.

2. Ecosystem stewardship at scale: Government agencies and other landowners must work together to manage public and private lands using both predictive and traditional

ecological knowledge to harness ecologically beneficial fire and protect ecosystem function, integrity, and services for the conditions of today and of the future. As climate and landscapes change, we must adapt policies and management to reflect fire's role in ecosystems and identify forests at risk of devastating transformative fires. New coalitions and innovators are leading the way in testing and informing land use policy, planning, and adaptive stewardship. An interdisciplinary team of Indigenous and Western scholars and practitioners in Western North America have created a [compilation of recommendations for forest conservation and stewardship](#) while researchers at major universities in the west and around the world, and in cross-disciplinary coalitions like the [Western Fire and Forest Resilience Collaborative](#) are deepening our understanding of 21st-century wildfire, resilience, and the conditions we should expect as we make land management decisions. Private sector companies such as Mast Reforestation, Chestnut Carbon, and BurnBot have developed new tools to help manage and conserve at-risk lands and recover faster after wildfires.

3. 21st-century fire detection, assessment, and response: Fire response agencies must be equipped to leverage advanced technologies and rapid response systems to improve early detection during the critical early-fire window; to track and contain dangerous, fast wildfires to protect communities and ecosystems and reduce economic losses; and to understand where beneficial fire should be allowed to burn. Early, more precise detection allows more time to allocate resources optimally and to safeguard communities, natural resources, and frontline responders, especially in more remote and lesser resourced geographies. [NASA's FireSense program](#) and Emergency Management Spatial Information Network Australia's (EMSINA) [Fire Shield Mission](#), [UC Berkeley's](#) geostationary fixed-stare detection and monitoring system, and the [Earth Fire Alliance's](#) low earth orbit system to detect fires and track fire radiative power at a single-acre pixel—made possible thanks to contributions from the Google research team on sensor design and through support from Google.org, the Moore Foundation, and others—are all advancing our ability to “see” and monitor fires starting when they are still in the incipient phase. Wildfire-detection cameras, air sensors, and AI by companies such as Pano and N5 Sensors are also transforming our ability to detect ignitions. CAL FIRE's adoption of the ALERTCalifornia camera network

shows how government agencies can embrace and deploy new technology effectively, and dramatically improve fire prediction, protection, management, and recovery. Rain is developing software to enable military and civilian autonomous aircraft to aid in fire detection, monitoring, and management. The four-year, \$11 million XPRIZE Wildfire competition, PG&E's research and development efforts, and the Quick Reaction Force run by Los Angeles, Ventura, and Orange Counties in cooperation with Southern California Edison are all fostering innovation. Together, the solutions these efforts engender can save lives and ecosystems, prevent harmful emissions, and have significant economic benefits: A recent study commissioned by the Gordon and Betty Moore Foundation found that cutting wildfire response time by 15 minutes could generate economic benefits of \$3.5-8.2 billion in California alone.

These concepts are not radical; they align with consistent recommendations from government report after report after report. The policy advocacy community, including groups like Resources Legacy Fund, the Alliance for Wildfire Resilience, and Megafire Action are pursuing comprehensive and collaborative policy solutions. The academic research community and the National Science Foundation are signaling a coordinated, integrated approach too—including a call to “Reimagine Fire Science for the Anthropocene” and FIRE-PLAN projects advancing evidence-based, future-looking approaches. Implementing these concepts to meet the urgency of the moment, however, will require innovative partnerships and financing. We need an active and upstream approach to the wildfire challenge.

Cross-Sector Mobilization

First, we need to be strategic in deploying the full spectrum of funding, because the wildfire challenge exceeds what any single source can tackle alone. To drive innovation and scale solutions, we must combine investment and collaboration from various funding niches:

- Individual, family, and corporate philanthropy can support nonprofits, universities,

labs, and companies with charitable intent. These funds are crucial for early-stage research, feasibility studies, and pilot projects co-developed with end-users and communities for charitable outcomes.

- Community foundations are often the first to respond to local disasters—helping to ensure broad coordination between nonprofits and government, and raising funds for need—and are effective and trusted messengers for the need to get ahead of changing conditions and increase community resilience.
- Impact investors can demonstrate market readiness by supporting early business ideas that need concessionary funding to get off the ground.
- Venture capital can bet on the most promising solutions and usher them across the valley of death from early development to broader deployment and scaling.
- Government agencies can adopt validated solutions that offer societal benefit at a fraction of the cost of disaster recovery. With billions in contracts available for disaster management, public agencies can integrate proven solutions, accelerate deployment, and enhance preparedness.
- Private sector entities can bring their considerable resources to bear by adopting solutions that align with bottom-line benefits while contributing to resilience against wildfires.

Second, we've achieved broad agreement around the three action areas above, and now we need cross-sector collaboration to turn it into action. The wildfire challenge impacts security, livelihoods, and natural resources while bridging political and social divides. Nations are already sharing resources for fire response and convening around pre-fire mitigation and stewardship strategies. Because wildfire ignores borders, a shared, proactive, regional approach is required.

For example, in California's Marin County, to respond to the devastating 2017 fires of neighboring counties, 17 Marin towns, cities, and other jurisdictions banded together to develop a regional prevention approach through a Joint Powers Authority. Local

communities, property owners, and government agencies share knowledge and work together to prevent fires. Meanwhile, when it comes to response recovery, community foundations are among the first, helping to ensure broad cross-sector coordination between nonprofits and government, and raising funds for relief. Everyone must do their part in a fire-adapted community, and these are the examples we must follow. It will take all of us, working together, to make a difference given the pace and scale of the wildfire challenge on the horizon.

Third, by addressing wildfire alongside broader resilience issues like climate adaptation, biodiversity conservation, and sustainable development, we maximize the impact of always-limited resources and ensure a stronger return on investment.

In May 2024, 56 countries gathered at the **first inaugural World Fire Congress** in Washington, DC, warning climate change-driven wildfires are “growing in intensity, size, and destructiveness.” The solutions are in reach, and the planet demands we invest in testing and deploying them by each capitalizing on our respective approaches. This past November, 200 innovators, fire service professionals, policymakers, and investors met at the second **Red Sky Summit** to focus on scaling solutions to the wildfire challenge we face—now and in the future.

The wildfire challenge is immense, but strategic investments will fuel innovation to ensure our communities are protected against catastrophic fires and even thrive alongside ecologically beneficial fire. We have the tools and the agency—and plenty of sparks of hope.

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