

ON FIRE: The Report of the Wildland Fire Mitigation and Management Commission



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Sara Clark	Kat Navarro
Sean DeCrane	Paul Steblein
George Geissler	Joe Ten Eyck
Marc Lemmond	G. Michael Zupko IV
Jonathan "Hoby" Miller	

Additional subject matter experts who served as federal designees, participated in panel presentations, provided materials review, responded to requests for information, or provided additional support to the Commission are included in Appendix A.

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Faith Berry	Nicole LaRosa
Evrin Bunn	Cori Lopez
Rebecca Jablonski-Diehl	Erin McDuff
Jenna Knobloch	Shannon McGovern
Amy Krause	Cynthia Moses-Nedd

Staff

Tyson Bertone-Riggs, Coordinator	Annie Schmidt, Coordinator
Kevin Bryan, Facilitator	Robin Roberts, Facilitator
Emery Cowan, Writer/Editor	Jen Mair, Logistics

Cover Photo

This image represents the changing face of fire - an urban conflagration in an atypical month. The Marshall Fire burned over 1,000 homes on the outskirts of Boulder, Colorado in December, 2021. Pushed by high winds and fueled by dry vegetation in addition to residential structures, the wildfire resulted in the evacuation of over 37,500 residents, the closure of Route 36, and two fatalities.

By Patrick Cullis, National Oceanic and Atmospheric Administration

Commission Members

Jamiah Adams

Senior Vice President of Diversity and Justice, The Climate Reality Project, CA
Health Equity

Lucinda Andreani

Deputy County Manager, Coconino County, AZ
County Government Representative

Kimiko Barrett, PhD

Senior Wildfire Researcher and Policy Analyst, Headwaters Economics, MT
Science (social and ecological)

Ann Bartuska, PhD

Senior Contributing Scientist, Environmental Defense Fund, Washington DC
Innovation (alternate)

Aitor Bidaburu

Executive Board Vice Chair, National Wildfire Coordinating Group
Federal Member

Johnna Blackhair

Deputy Director, Bureau of Indian Affairs
Federal Member

Neil Chapman

Wildland Fire Captain, Flagstaff Fire Department, AZ
Municipal Government Representative (alternate)

Joannie Chin

Director, Engineering Laboratory, National Institute of Standards and Technology
Federal Member

Sam Cook

Executive Director of Forest Assets, College of Natural Resources, NC State University, NC
Vice President, Natural Resources Foundation, NC State University, NC
Forest Stewardship and Reforestation

Tim Cook

Washington State Hazard Mitigation Officer, WA
State Hazard Mitigation (alternate)

William (Bill) Cox

Rich County Commissioner, UT
County Government Representative (alternate)

Deanne Criswell

Administrator, Federal Emergency Management Agency
Co-Chair

Cody Desautel

Executive Director, Confederated Tribes of the Colville Reservation, WA
Forestry/Industry Representative

Andy Fecko

General Manager, Placer County Water Agency, CA
Public Utilities Industry (alternate)

Jennifer Flynn

Associate Director of Visitor and Resource Protection, National Park Service
Federal Member

David Fogerson

Nevada Emergency Manager and Homeland Security Chief, NV
State Department of Energy or similar State agency (alternate)

Dan Gibbs

Executive Director, Colorado Department of Natural Resources, CO
State Department of Natural Resources, Forestry or Agriculture, or similar State agency (alternate)

Angela Gladwell

Director, Hermit's Peak/Calf Canyon Claims Office and Mitigation Framework Leadership Group,
Federal Emergency Management Agency
Federal Member

Deb Haaland

Secretary of the Interior
Co-Chair

Jaelith Hall-Rivera

Deputy Chief, State, Private and Tribal Forestry, U.S. Forest Service
Federal Member

Meryl Harrell

Deputy Under Secretary for Natural Resources and Environment, U.S. Department of
Agriculture
Co-Chair Designee

Robyn Heffernan

National Fire Weather Services Senior Advisor, National Oceanic and Atmospheric Administration
Federal Member

Kathy Holder

Utah State Hazard Mitigation Officer, UT
State Hazard Mitigation

James (Jim) Hubbard

Under Secretary for National Resources and Environment, U.S. Department of Agriculture
Deputy Chief (retired), U.S. Forest Service, CO
National Wildland Fire Cohesive Strategy

Gary Jackson

Tribal Vice-Chairman, Cow Creek Band of Umpqua Tribe of Indians, OR
Tribal Government Representative (alternate)

Kacey KC

Nevada State Forester, Nevada Division of Forestry, NV
President, National Association of State Foresters, NV
State Department of Natural Resources, Forestry or Agriculture, or similar State agency

Elizabeth (Eli) King

Washington State Energy Emergency Management Director, WA
State Department of Energy or similar State agency

Brian Kittler

Vice President of Forest Restoration, American Forests, OR
Forest Stewardship and Reforestation (alternate)

Kelly Martin

Co-Founder and Executive Board of Directors, Grassroots Wildland Firefighters, ID
Wildland Firefighter

Cynthia Martinez

Chief, National Wildlife Refuge System, U.S. Fish and Wildlife Service
Federal Member

Madelene McDonald

Senior Watershed Scientist, Denver Water, CO
Public Utilities Industry

Kathleen (Kat) McIntyre, PhD

Environmental Improvement Department Manager, Tahoe Regional Planning Agency, CA
Municipal Government Representative

Nathan Miller

Wildland Superintendent, City of Santa Fe Fire Department, NM
Wildland Firefighter (alternate)

Scott Miller

Senior Regional Director–Southwest, The Wilderness Society, CO
501(c)3 organization with expertise in forest management and environmental conservation (alternate)

Joan Mooney

Principal Deputy Assistant Secretary for Policy, Management and Budget, U.S. Department of the Interior
Co-Chair Designee

Lori Moore-Merrell, DrPH

Administrator, U.S. Fire Administration, U.S. Department of Homeland Security
Co-Chair Designee

Mike Morgan

Division Director, Colorado Division of Fire Prevention and Control, CO
State Fire Response (alternate)

Jessica Morse

Former Deputy Secretary for Forest and Wildland Resilience, California Natural Resources Agency, CA
Innovation

Kari Nadeau, MD, PhD

John Rock Professor of Climate and Population Studies and Chair of the Department of Environmental Health, Harvard T.H. Chan School of Public Health, MA
Health Equity (alternate)

Michael D. Nedd

Deputy Director of Operations, Bureau of Land Management
Federal Member

John O’Keeffe

Rancher, OR
Past President, Oregon Cattlemen’s Association, OR
Forestry/Industry Representative (alternate)

Robert M. Pesapane

Director, Public Assistance Division, Recovery Directorate, Federal Emergency Management Agency
Federal Member

Bob Roper

Senior Policy Advisor, Western Fire Chiefs Association, CA
National Wildland Fire Cohesive Strategy (alternate)

Mariana Ruiz-Temple

Fire Marshal, Oregon State, OR
State Fire Response

David A. Sampson

President and CEO, American Property Casualty Insurance Association, TX
Property Development Industry

Erika Sasser

Director, Health and Environmental Impacts Division, Office of Air and Radiation, Environmental Protection Agency
Federal Member

Marek Smith

North America Fire Director, The Nature Conservancy, NC
501(c)3 organization with expertise in forest management and environmental conservation

Michele Steinberg

Wildfire Division Director, National Fire Protection Association, MA
Property Development Industry (alternate)

Scott Stephens, PhD

Professor of Fire Science, University of California Berkeley, CA
Science (social and ecological) (alternate)

Craig Thomas

Director, The Fire Restoration Group, CA
Prescribed Fire (alternate)

Bill Tripp

Director of Natural Resources and Environmental Policy, Karuk Tribe, CA
Tribal Government Representative

Thomas Vilsack

Secretary of Agriculture
Co-Chair

John Weir

Associate Extension Specialist, Natural Resource Ecology and Management, Oklahoma State University, OK
Prescribed Fire

Former Members

Shane McDonald

Executive Board Chair, National Wildfire Coordinating Group

Federal Member

Ana Montero

Director (former), Public Assistance Division, Recovery Support Function Leadership Group,
Federal Emergency Management Agency

Federal Member

John Murphy

Chief Operating Officer (retired), National Weather Service, National Oceanic and Atmospheric
Administration

Federal Member

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Executive Summary

The wildfire crisis in the United States is urgent, severe, and far reaching. Wildfire is no longer simply a land management problem, nor is it isolated to certain regions or geographies. Across this nation, increasingly destructive wildfires are posing ever-greater threats to human lives, livelihoods, and public safety. Further, the drivers of the wildfire crisis are numerous and complex, and themselves are influenced by multiple forces and factors at all scales. Despite widespread recognition of this crisis and decades of concerted action, wildfire impacts continue to mount.

Since the turn of the century, wildfires have destroyed tens of thousands of structures and threatened nearly 2,000 communities in dozens of states. With tragic frequency, wildfires are turning into highly destructive urban conflagrations, decimating entire neighborhoods and communities and, in some cases, resulting in loss of life. Reminders of the urgency of the need to address this crisis are all too frequent, from the smoky skies that blanketed communities across the eastern United States in the summer of 2023, to, just weeks later, the devastating wildfire in Hawai'i that became the nation's deadliest in more than a century.

Increasingly intense and destructive wildfires also have profound impacts on our natural landscapes and the ecosystem services they provide. Wildfires are wiping out vegetation and habitats, and creating water repellant soils, all of which make landscapes highly vulnerable to post-fire flooding, erosion, and debris flows that pose extensive challenges for drinking water systems, public safety, community infrastructure, and more. Wildfire is also becoming an emergent threat in areas that have little or no history of wildfire and during times of year when landscapes typically have not burned.

While the total costs of wildfire are, at present, impossible to fully tabulate, federal suppression efforts now total well over \$2.5 billion per year. State, local, and Tribal governments also spend unaccounted sums each year on suppression. Yet, these are but a fraction of overall costs and losses. Federal agencies estimate that the total cost of wildfire nation-wide is "on the order of tens to hundreds of billions of dollars per year" (Crowley et al., 2023, p.8). Much of this financial toll is borne at the community level and often quickly overwhelms local resources. Workforces too are strained by increasingly demanding wildfire seasons. In addition to heavy workloads, those working in fire face barriers related to pay, mental and physical health, work-life balance, and other issues.

Though already critical, the nature and impacts of wildfire are only expected to worsen. Wildfire frequency, size, and severity is projected to increase, along with the multitude of associated impacts, from smoke emissions to watershed function.

In the face of this national challenge, Congress took bipartisan action to establish the Wildland Fire Mitigation and Management Commission through the 2021 Infrastructure Investment and Jobs Act (Pub. L. No. 117-58; § 40803, 135 Stat. 1097 (2021)). The legislation charged the 50-member Commission with the ambitious task of creating policy recommendations to address nearly every facet of the wildfire crisis, including mitigation, management, and post-fire rehabilitation and recovery. Recognizing the urgency of the crisis, the Commission was given just a single year to conduct a sweeping review of the wildfire system and produce a comprehensive set of policy priorities.

The suite of recommendations that follow outline a new approach to wildfire, one that is proactive in nature, better matched to the immense scale and scope of the crisis, and more reflective of the multi-scalar, interrelated nature of the overall system. Importantly, just as there is no single cause of this crisis, there is no single solution.

Among the core themes of the Commission's recommendations is a call for greater coordination, interoperability, collaboration, and, in some cases, simplification within the wildfire system. This



Forest Service Law Enforcement & Investigations team was deployed for support after the Camp Fire swept through nearby communities including Paradise, Magalia and Concow in Northern California, 2018.
Tanner Hembree, Forest Service

includes increased integration between programs, policies, and workforces as well as improved incorporation of issues and sectors that have traditionally been set apart from the wildland fire discourse or handled disparately. Solutions also must better address fundamental connections and interactions between the temporal phases of wildfire, including pre-fire risk reduction and post-fire recovery, and between communities, landscapes, public health, utilities, research and technology, and other impacted sectors. Given the complexity of this space, overarching systems for accountability, data-driven decision-making and adaptive management are crucial to support efficacy and continued progress toward long-term change.

The Commission also found broad agreement that federal agencies alone should not – and in fact, cannot – effectively address a challenge of this magnitude. The whole of society must be involved. This requires meaningful shared decision-making with a range of entities – Tribal, state, and local governments; residents; non-governmental organizations; private industry; the research community; and others – at every level. Governance systems and structures must be more inclusive of non-federal entities and must involve greater collaboration, both among federal agencies and between federal agencies and non-federal governments, organizations, and communities. In addition to, and in support of, greater collaboration, partners at all scales should be empowered – through funding, decision-making tools, program flexibilities, and other means – to identify and implement locally driven solutions.

Also critical is the need to shift our approach toward proactive actions intended to better prepare for wildfire impacts, reduce those impacts, and build resilience for the future. For too long, we have relied on a reactionary system that has led to growing costs and losses without effectively addressing overall wildfire hazard and risk. Only through significant investments in proactive planning, mitigation, risk reduction, and the workforce needed to accomplish these tasks can we break the current cycle of increasingly severe wildfire risk, damage, and loss. Importantly, these upfront actions must encompass both the built and natural environment. While significant funding has been put toward hazardous fuels reduction work in recent years, there have not been equivalent national-scale investments and efforts to reduce risk in the built environment and prepare communities before, during, and after a wildfire. Addressing this gap is essential to a comprehensive approach to wildfire.

Solutions must not only reorient towards proactive approaches but must be at a scale that is commensurate with the crisis – one that costs the nation tens to hundreds of billions of dollars per year, and untold non-financial impacts. The wildfire crisis cannot be seen as a problem solvable by a single pulse of funding; it is a challenge requiring sustained investment and commitment.

It also must be acknowledged that while fire is central to this crisis, it is also a critical part of the solution. Beneficial fire – including prescribed burning, cultural burning, and wildfire managed for resource objectives – is necessary to restore fire-adapted ecosystems and reduce the risk of high-severity wildfires that pose a significant threat to communities. Policy change is needed to enable a new relationship with fire, one in which fire is no longer an existential risk to communities and landscapes, but instead an integral and beneficial component of our human and natural systems.

The Commission urges Congress to take swift action to advance the holistic solutions needed to reduce the risk of wildfire to the nation. Only through comprehensive action can we hope to prepare for the wildfires of today and, critically, the wildfires of tomorrow.



Prescribed fire operations in Florida, 2021.
National Park Service

Defining the Crisis

The United States is experiencing a crisis – a present and a future defined by wildfires that are increasingly extreme, vast in scale, and devastating to communities and landscapes. Whether from smoke-filled skies or the loss of lives, homes, and businesses, every part of the country has been impacted by severe wildfires. At the same time, fire is an essential natural process in many landscapes and can play a vital role in helping mitigate risk to people and communities, restoring ecosystems, and sustaining Indigenous cultural practices (Pausas & Keeley, 2019). The nation finds itself in a paradox, in which fire is both central to the crisis and one essential part of the solution.

The need for urgent action could not be greater. Wildfires now regularly impact hundreds of thousands of acres in a single fire and are increasingly burning near and into communities (Congressional Research Services [CRS], 2023b). Between 2000 and 2019, nearly 2,000 communities were threatened by wildfire and between the years of 2005 and 2022, nearly 100,000 structures were destroyed by wildfire (Headwaters Economics, 2020,2023c). The western United States alone has witnessed a 246 percent increase in structures lost to wildfires when comparing the decade from 1999-2009 to 2010-2020 (Higuera et al., 2023). Tragically, some of these wildfires have resulted in urban conflagrations, wiping out entire neighborhoods and communities in a matter of hours and significantly escalating risks to human life. Urban conflagrations can, and have, occurred in dispersed areas across the nation. The 2021 Marshall Fire in Colorado, the 2018 Camp Fire in California, and the 2016 Chimney Tops 2 Fire in Tennessee all provide poignant examples of loss. As wildfires spread, many damage or destroy critical infrastructure, including water resources and power lines, threatening significant and costly long-term losses and disrupted delivery of essential services to communities. Severe wildfires can be followed by intense post-fire flooding and severe erosion known as debris flows, which can cause further impacts to lives, property, infrastructure, and ecosystems that extend many miles and years beyond the event itself (Addison & Oommen, 2020). Much of the time, the impacts of wildfires and post-fire events impose the heaviest toll on people with lower incomes, people of color, the elderly, individuals with disabilities, those with limited English proficiency, and other social vulnerabilities (Coughlan, 2019; Davies, 2018).

Wildfires are not just burning with greater severity,ⁱ but are becoming an emergent threat in areas that have little or no history of wildfire. For example, Hawai'i and the Pacific Islands face an increasing risk of severe wildfire, with Hawai'i's most devastating fire to date – and the country's deadliest wildfire in more than a century – occurring in August of 2023 on the island



View of the 2016 Lava Mountain Fire on the Shoshone National Forest in Wyoming. Note the patches of both high and low severity fire effects.

Kristen Honig, Forest Service

of Maui (Carli, 2023). Areas like eastern United States and the Great Lakes region, while not unfamiliar with wildfire in the 19th century, are also expected to face increasing wildfire risks in the future (Kerr et al., 2018).

Wildland firefighters, and the broader wildfire workforce, are under mounting strain as wildfires have increased in scale, complexity, and severity (Thompson et al., 2022a; Thompson et al., 2022b) and fire seasons have lengthened (Flannigan et al., 2013; Jolly et al., 2015), turning into “fire years.” Those tasked with responding to wildfires face numerous risks and impacts – both mental and physical – including the possibility of severe lifetime disabilities or death. Between 1990 and 2016, an average of 17 firefighters per year died while engaged in wildland firefighting operations (National Wildfire Coordinating Group [NWCG], 2017). Furthermore, rugged, remote, and taxing working conditions, extraordinarily long work shifts, time away from families, and lack of adequate rest are making the wildland fire profession less desirable and increasingly unsustainable (Thompson et al., 2022b). Low salary and benefits and limited and expensive housing, are widespread issues as well, with recent reports naming these as top challenges for federal wildland firefighters (Government Accountability Office [GAO], 2022b; Thompson et al., 2022b).

In addition to the risks and impacts of the fire itself, impacts to human health from inhalation of smoke emissions can have far-reaching and significant consequences. Inhalation of smoke or its byproducts has been linked to a long list of conditions including respiratory and cardiovascular diseases, cancer, and mental health issues (Eisenman & Galway, 2022; Peterson et al., 2022). Smoke from fires in the built environment is of particular concern given the combustion of synthetic materials (United States Environmental Protection Agency [EPA], 2022b). Though wildfire smoke is more prevalent in the West, recent research found that long-term smoke exposure is responsible for upwards of 6,000 additional deaths per year across the contiguous United States, the majority of which occur in the eastern half of the country (O’Dell et al., 2021). Firefighters in particular face prolonged exposure, the impacts of which are still poorly understood, as do agricultural workers and others who work outdoors (Navarro et al., 2019; Navarro, 2020).

Natural ecosystems also experience profound and long-lasting impacts from large, high-severity wildfires. Over the past three decades, annual area burned at high severity increased eight-fold in forests in the western United States (Parks & Abatzoglou, 2020). Wildfires in rangelands in the western United States have seen a more than fivefold increase in area burned from 1984 to 2017 (Li, Angerer & Wu, 2021). High-severity fires often kill existing vegetation, which can increase erosion potential, reduce carbon storage, and change hydrologic function. They can also catalyze conversion from forest to shrubland and from native grasses to annual invasive plants, the latter of which are even more prone to uncharacteristic wildfires, thus creating a self-perpetuating cycle (Guiterman et al., 2022; Pilliod, Welty, & Arkle, 2017). In recent years, wildfires have damaged huge swaths of iconic American landscapes, from western sagebrush to the Mojave Desert’s Joshua tree forests, and continue to deplete already-scarce habitat for rare and endangered animal species (Ager et al., 2013; Albeck-Ripka, 2017; Crist, 2023; Lochhead, 2023). Ecosystems in Hawai’i and in the Pacific Islands are so sensitive that fire often destroys native vegetations that may never recover (Loh et al., 2009; Pickett, n.d.). Wildfires also emit significant amounts of greenhouse gasses that drive climate change, creating another feedback loop that will continue to exacerbate wildfire conditions (Jones et al., 2022).



Wildfire smoke billowing from the South Moccasin Fire in Montana, 2021.

Lauren Kokinda, Bureau of Land Management

The costs of wildfire have put tremendous burdens on governments, communities, and individuals. Federal agencies estimate that the financial costs and losses from wildfire in the United States range from tens of billions to hundreds of billions of dollars per year (Crowley et al., 2023; Thomas et al., 2017). The costs of wildfire response have soared in recent decades, with federal agencies' average annual spending in this category climbing from \$728 million in the late 1980s (1985-1989) to about \$2.5 billion for the five years ending in 2020 (Congressional Budget Office [CBO], 2022). States and local governments also shoulder substantial wildfire response costs, and while harder to track, recent analyses show wildfire costs have consistently overrun many states' budgets (Caudell-Feagan, Huh, & Murphy, 2022). Wildfires also result in a host of other costs and losses, including lost business and tax revenues, depreciated property values, grazing and agricultural losses, healthcare costs from smoke exposure, water treatment costs following water quality degradation, critical infrastructure damage, and impacts to recreation and tourism (Headwaters Economics, 2018; Thomas et al., 2017; Troy et al., 2022). These non-response related costs make up the vast majority of the financial burden of wildfire. Comprehensive analyses estimate that wildfire response costs account for less than 10 percent

of the total cost of wildfire and find that close to 50 percent of the full community costs of wildfire are borne by local-level government agencies, non-governmental organizations, businesses, and homeowners (Headwaters Economics, 2018). The impact on the insurance industry has also become significant in recent years; private insurers in the United States paid over \$50 billion in wildfire losses between 2017 and 2022 (American Property Casualty Insurance Association).

The increases in size, frequency, and severity of wildfires are projected to continue across the country in decades to come (Wasserman & Mueller, 2023; Wuebbles et al., 2017). The projected increase in wildfires is also expected to increase erosion and sedimentation in nine out of ten watersheds by more than 10 percent, and in a third of watersheds by more than 100 percent by 2050 with profound effects on water supply systems through diminished reservoir capacity and other impacts (Sankey et al., 2017). Smoke levels are similarly expected to increase, chipping away at what had been steady improvements in the country's air quality over the past several decades (Burke et al., 2023). Furthermore, a changing climate is exacerbating other natural hazards besides wildfire (e.g., hurricanes, drought, and flooding), increasing the potential for these hazards to overlap and intersect, causing even greater costs and losses (AghaKouchak et al., 2018; Kemter et al., 2021).

While these impacts are dire and continue to worsen, it is important to recognize fire's essential role and the need to leverage its many benefits. Fire is vital to maintaining the structure and function of many ecosystems and can also be a critical tool to mitigate the risk of higher severity fires that threaten neighborhoods, communities, landscapes, and other values (GAO, 2019; Prichard et al., 2021). Fire is also fundamental to the culture of some Indigenous peoples, who for centuries have used fire to promote biodiversity and ecosystem health, support traditional hunting and gathering practices, provide long-term fire protection, and as part of cultural and spiritual practices (Clark, Miller & Hankins, 2022; Kimmerer & Lake, 2001). Prior to European settlement, natural ignitions, and intentional use of fire by Indigenous peoples helped create North American ecosystems in which wildfire is a defining and essential ecological process (Kimmerer & Lake, 2001). Across the continent, native plant and animal species depend on fire to spur nutrient cycling, catalyze seed germination, and create habitat structure, among other benefits. Fire is, and will continue to be, a necessary and inevitable part of our existence.

However, we have largely lost this beneficial relationship with fire. Landscapes that rely upon frequent wildfire have been transformed in the time since Europeans removed Indigenous people from their homelands and prohibited their cultural burning practices (Pyne & Cronon, 2019). Subsequent 20th century policies required the suppression of naturally ignited wildfires, while many landscapes saw widespread harvest of fire resilient trees, overgrazing, spread of fire-adapted invasive annual grasses, and land development. Together, these processes dramatically altered forest and rangeland structure and composition, creating landscapes much more susceptible to uncharacteristic high-severity wildfire and its cascading impacts to ecosystems and communities (Hagmann et al., 2021; Hessburg et al., 2021; Moritz et al., 2014; Prichard et al., 2021). In more recent decades, the decline of widespread commercial harvest on public lands has resulted in the loss of some of the very harvest infrastructure and workforce that should be a part of the solution (CBO, 2022; Spies et al., 2019). Further, large swaths of the United States continue to grapple with the ramifications of flammable invasive species—ramifications that are increasing fire severity and frequency in these non-forested systems (Brooks et al., 2004). The loss of landscape resilience to wildfire has occurred in tandem with

increasing expansion of human development into fire-prone areas, thereby increasing the number of people who could be directly impacted by wildfire. Nearly one-third of people in the United States now live in areas in or near wildland vegetation (Radeloff et al., 2018), making wildfire impacts an immediate consideration for a significant portion of the population, to say nothing of the millions more impacted by smoke.

Warmer and drier conditions driven by climate change are further exacerbating wildfire impacts by changing fire behavior (Westerling, 2016). Average annual temperature in the contiguous United States has increased by 1.2–1.6 degrees Fahrenheit for the period 1986–2016 relative to 1901–1960, with even greater increases in Alaska, the Northwest, the Southwest, and the Northern Great Plains (Wuebbles, 2017). Hotter air, which holds more moisture, draws moisture out of vegetation, creating increasingly parched vegetation that is more prone to burn. This rising vapor pressure deficit has increased risk of extreme fire weather, which in turn, has driven a rapid rise in area burned (Zhuang, 2021). Drier soils and vegetation, along with other factors, are also affecting the length of fire seasons. Western states have seen the wildfire season extend from five months to seven months since the 1970s (Climate Hubs, n.d.). While these trends in wildfire have broadly followed what was projected by researchers, the behavior of individual fires is exceeding our existing models (Hurteau, 2023). Losing our ability to predict the behavior of any given fire – or worse, predicting it incorrectly – has potentially dire impacts for firefighters, communities, and landscapes.

Uncharacteristically large and severe wildfires are already causing extensive damage at the local, regional, and national levels. Yet, what we are experiencing today will be dwarfed by wildfires anticipated within the next one or two generations. High-severity wildfire is a significant and increasing threat to communities, large stretches of native forest and grassland ecosystems, and more broadly, ways of life across America. This is a wildfire crisis but more than that, it should be treated as an issue of national security and responded to with the same urgency and attention. Wildfire is no longer – if it ever was – an issue simply of land management. Rather, the crisis has a direct nexus with emergency management, public health, *and* land management. Solutions must be comprehensive and encompass all of society in scope and scale in order to change our relationship with fire, restore ecosystems, and protect communities.

The Work of the Commission

Recommendations produced by the Wildland Fire Mitigation and Management Commission (Commission) chart a course forward for comprehensive policy change to address the wildfire crisis. Taken together, these recommendations are intended to help lead the nation toward better wildfire outcomes including diminished loss of life and property, and functioning and resilient ecosystems. While the Commission's focus was on federal legislative action, it is this body's intent that the solutions proposed in this report will also be relevant and useful to federal agencies; state, local, and Tribal governments; the non-governmental, private, and academic sectors; and the public at large.

The Commission's recommendations are presented in two complementary ways. An opening thematic summary provides an overview of critical concepts that emerged from the

Commission’s work and spotlights key recommendations that best reflect these concepts. The following sections, which make up the bulk of the report, contain all of the Commission’s recommendations and are organized roughly chronologically, relative to a wildfire event.

About the Commission

The Commission was established by the 2021 Infrastructure Investment and Jobs Act (IIJA) (Pub.L. No. 117-58). In addition to investing billions in wildfire risk reduction, this bipartisan legislation identified a need for new systems and policy solutions to address the crisis that wildfire has become. The Commission was charged with the ambitious task of creating recommendations that address nearly every facet of the wildfire system. Reflecting the urgency of the crisis, the Commission had one year to complete this task, with a report of its recommendations due to Congress by September 2023. Prior to this full report, the Commission was assigned to develop a strategy to meet aerial firefighting equipment needs through 2030.



The Wildland Fire Mitigation and Management Commission on the steps of the Utah State Capitol, September 15, 2022.

Nicole LaRosa, United States Fire Administration/Federal Emergency Management Agency

That report was released in February 2023 and contains many recommendations that are complementary to those put forward in this document.

The Commission itself was deliberately created as a nonpartisan body, including representatives from federal agencies; state, local, and Tribal governments; non-governmental entities; academia; and the private sector. In addition to these official affiliations, Commission members represent a multitude of interests, lived experiences, geographical contexts, and communities of practice. The 50 members possess a broad range of expertise with wildfire, including expertise related to operational firefighting, prescribed fire, cultural burning, watershed restoration, pre-fire mitigation, research, public health, post-fire recovery and more. Members also were encouraged to engage with their communities of practice and place to inform their participation on the Commission. Through this membership, the Commission brings together a rare diversity of backgrounds, experiences, and expertise to undertake what many in this space have long advocated: a collaborative and comprehensive approach to wildfire mitigation and management.

In addition to the expertise that members brought to Commission deliberations, the Commission invited input and recommendations from the public through an online portal. The Commission also hosted panel discussions with a number of subject matter experts on topics including, but not limited to insurance, pre-fire planning, workforce development, innovative financing, and wildfire projections for the future. Some subject matter experts provided ongoing support to the Commission by participating in topical workgroups and through review of briefing materials and recommendations. The Commission wishes to extend a heartfelt thanks to the many experts who provided invaluable perspectives and knowledge throughout the process.

It should be noted that while providing a crosscutting and expansive review of wildfire policy, recommendations often reflect those actions the Commission feels are the highest priority or the most critical for wildfire risk reduction. Congress itself set out the initial list of priority topics in the Commission's enabling statute. The urgency of the crisis and the short timeline of the Commission did not, however, permit a complete review of every possible fire-related policy topic. Omission of a given subject is not meant to imply a lack of importance. Many issues do, indeed, deserve a fuller exploration than the timeline permitted. Where possible, the Commission has set out recommendations to continue the study of more technical problems. Additionally, the Commission recommends routine and regular, holistic, and quantifiable assessment of the wildfire mitigation and management system to assess the efficacy of management approaches and help guide future policy decisions.

While not exhaustively complete, the Commission's work was expansive and reflects the consensus of a diverse and capable body. The Commission urges Congress to continue the spirit of urgency which informed the establishment of the Commission and act now to create much-needed policy change.

Insights: Terminology

Our complicated relationship with fire extends to the terminology used to discuss this topic. A complex Venn diagram of words and definitions are used to reference fire, each with specific distinctions related to where the fire is burning, who is managing it, how it was ignited, and the nature of its

impacts. For example, the term wildland fire – central to the Commission’s name – is defined by the National Wildfire Coordinating Group as any non-structure fire that occurs in vegetative or natural fuels. While this definition encompasses both unplanned wildfire and intentionally ignited prescribed fire, it does not adequately address the current reality of fires continuing to burn into communities, damaging homes, business, and infrastructure. As fires continue to affect both human and ecological systems, our existing fire terminology will continue to face constraints.

Current labels also often fall short of fully capturing the dynamic nature of fire, which can have a range of impacts – both positive and negative – within a single event. Other Commission discussions highlighted the fact that distinguishing between prescribed fire and wildfire fails to capture the universal fact that fire must be used and managed, regardless of ignition source.

The Commission is not alone in recognizing the shortcomings of current terminology to adequately reflect the many dimensions of fire, the varied contexts in which it occurs, the entirety of the values at risk, and the growing interaction between the built and natural environments (e.g., Bean & Evans, 2023; Davis et al., 2023). At the same time, there was not a strong desire within the group to add new terms or redefine existing ones. The Commission instead focused on how to use the language we have to communicate fire’s relevance to all parts of this country, regardless of geography or community size. In this vein, the Commission’s approach focuses on the impacts, objectives, issues, and outcomes associated with fire, more so than how it is labeled.

The Commission’s use of fire-related terminology throughout this report builds on widely used definitions while diverging when needed to better communicate the reality of fire in our world today. Important notes for the reader include:

- “Fire” is used to reference the basic chemical process of combustion, without contextual or values-based associations. Fire can have varied uses and impacts based on the places and ways it occurs.
- “Wildland fire,” as mentioned above, is currently in use in the wildfire community to refer to fires – both planned and unplanned – that burn in the natural (hence, “wild”) environment. In the context of the workforce, “wildland firefighter” refers to those firefighters who traditionally work exclusively in the natural environment in both response and proactive capacities (e.g., through suppression of wildfire and intentional use of prescribed fire). These firefighters typically work for federal or state agencies, Tribal governments, or contract wildland fire companies. This report uses the term “wildland

fire” as a technical term in documents and when it refers to those specialized fire response workforces.

- “Wildfire” is used in this report to reference all fires that burn in the natural environment, regardless of their potential interaction with the built environment. Wildfires can start in the natural environment and transition to the built environment or begin in the built environment and transition to the wildlands. The term “wildfire mitigation and management system” is used where the report wishes to reference the entirety of wildfire-related entities and activities, including pre-fire mitigation in the built and natural environments (which includes the use of prescribed fire), response to fires with a wildland component, and post-fire recovery.
- “Beneficial fire” focuses on the intent of fire’s use for positive outcomes such as community wildfire risk reduction, ecological restoration, or cultural significance. The three types of fire included in the term “beneficial fire” are prescribed fire, cultural burning, and wildfire managed for resource objectives. This term has no statutory or legal grounding.

While terms are used intentionally, there is undoubtedly nuance within each use and errors are inevitable. At its core, the purpose of terminology within this report is to effectively convey the scope and scale of the issues facing the nation.

A Path for the Future: Critical Themes

In the course of its work, the Commission identified seven overarching themes that underpin and unite this body's recommendations. Each of the Commission's specific recommendations reflect one or more of these themes, demonstrating the interrelated nature of the Commission's work and wildfire issues at large. The following section includes an explanation of each theme, followed by several recommendations that the Commission believes embody its intent.



Urgent New Approaches

The wildfire crisis spans jurisdictions and ecosystems, involving and affecting a wide range of entities at a variety of scales. Though historically and institutionally addressed as a land management problem, wildfire extends beyond the wildlands to impact structures, critical infrastructure, public health and safety, and more. Collective, cross-boundary collaboration is therefore critical in this space. However, existing management structures and policies often make this challenging. Wildfire mitigation and management responsibilities are dispersed across numerous agencies, governments, and entities operating at different scales and with distinct missions, programs, budgets, and authorities. While some mechanisms for crosscutting coordination and alignment do exist in actions such as suppression and response, siloed approaches, poor interoperability, and insufficient collaboration have created gaps, barriers, and inefficiencies in many arenas. Existing systems and policies are inadequate to address the magnitude of wildfires of today and to undertake proactive actions at the scale needed to mitigate the wildfires of tomorrow (Tedim et al., 2020; Xanthopoulos et al., 2020). To shift the trajectory of the wildfire crisis, we cannot continue the status quo.

There is a need for a paradigm shift toward systems and structures that are more comprehensive and better address the interrelationships between communities and landscapes and between pre-fire mitigation, response, and post-fire recovery efforts. This includes greater integration between wildfire-related programs, procedures, policies, and workforces and incorporation of issues and sectors that have traditionally been set apart from the wildland fire discourse or handled disparately. Solutions should not and cannot be accomplished by federal agencies alone, but must involve individuals, entities, and jurisdictions at every level of society. A range of different approaches, including greater coordination, interoperability, collaboration, and, in some cases, simplification will be needed to accomplish these aims. There is a need for both incremental and fundamental change, but the Commission emphasizes that top-down, one-size-fits-all approaches and opportunistic half-measures will continue to fall short of desired outcomes.

Commission recommendations that address new approaches to governance and organizational structures include those calling for more coordinated efforts to address community wildfire risk reduction. The Commission also recommends new governance systems that can build clarity around accountability and delegation of responsibilities in the post-fire recovery space – an arena where efforts are especially fragmented. Within individual agencies, improved performance measures can serve to incentivize more holistic ways of working. Other recommendations propose pathways toward more collaborative and accessible systems. While broadly endorsing the vision and goals set forth by the National Cohesive Wildland Fire Management Strategy, the Commission also notes the need for a more expansive and routine review of national wildfire policy, designed to inform decision-makers and enable proactive action.

Selected recommendations aligned with this theme include:

- Establish a Community Wildfire Risk Reduction Program to proactively and comprehensively address wildfire risk reduction actions in the built environment. This coordinating partnership would transform fragmented efforts related to wildfire risk

reduction in communities and create a more integrated, effective, and science-based approach. See Recommendation 1, on page 37 in Chapter 1: Creating the Foundation for Success.

- Create the organizational and financial structures necessary to better integrate the national response to wildfires and post-fire impacts across agencies and scales. Actions in the period of time immediately following a wildfire event are critical to the ability of impacted communities to withstand the next disaster. Actions that build clarity around agency responsibilities post-fire and create a more coordinated, comprehensive approach overall, will improve the recovery process for both landscapes and communities. See Recommendation 60 on page 129 in Chapter 4: Recovering for Resilience.
- Change the system of land management agency performance metrics beyond acres treated or timber volume output to measure success. Reorienting performance measures to focus on outcomes grounded in ecological resilience, values at risk, and social outcomes such as collaboration, community empowerment, partnership, and equity would better incentivize work toward more meaningful measures of success and improve accountability. See Recommendation 147 on page 253 in Chapter 8: Frameworks for the Future.



Fiery sunset over Trumbull Peak during the Ferguson Fire in Sierra National Forest, CA, 2018.

Kari Greer

- Develop a periodic review of the comprehensive wildfire mitigation and management system to assist adaptive management and adoption of needed changes. This review is essential due to changing climate conditions, increasing fire risk and severity, tremendous loss of life and property, and the urgent need for a more holistic, inclusive approach to wildfire mitigation and management. This review would help decision-makers track the implementation of proposed policy changes, improve and assess the efficacy of management approaches, and help guide policy decisions in the coming years. See Recommendation 148 on page 254 in Chapter 8: Frameworks for the Future.

Supporting Collaboration

As noted previously, wildfire mitigation and management affects, involves, and depends on a wide range of entities that goes well beyond federal agencies to include states, Tribes, local governments, the private sector, non-governmental organizations, and academia. These non-federal entities perform essential roles and functions related to wildfire, and bring unique capacities and capabilities that cannot be fulfilled by the federal government. Many times, these entities are better positioned to spearhead local solutions or efforts, but inadequate investments and overly burdensome and complex systems hinder their participation in wildfire mitigation and management or partnership with the federal government.

Successfully meeting the challenge of wildfire mitigation and management requires better involving all relevant entities and every scale of society. Governance systems and structures must become more inclusive and involve greater collaboration among federal agencies, and between federal agencies and non-federal governments, organizations, and communities. Such approaches are essential to building new relationships, creating more cohesive and holistic approaches, and removing the silos that limit effective wildfire risk reduction (Abrams et al., 2015; Huber-Stearns et al., 2021). In addition to and in support of greater collaboration, communities should be empowered – through capacity funding, program flexibilities, and other means – to identify, invest in, and implement their own solutions (Cheng & Dale, 2020; Cheng & Sturtevant, 2012). Community assets and needs vary greatly and federal programs should avoid one-size-fits-all strategies that create greater barriers to entry for some (Paveglio, 2021). Instead, it is imperative that federal programs provide opportunities for widespread participation in the spaces where decisions are made. Tribal participation and empowerment within the fire system are also essential and must be based upon the unique sovereign-to-sovereign relationships between the federal government and each federally recognized Tribe.

The Commission recommends greater support for partnership programs, collaborative groups, and collaborative wildfire planning and management initiatives. In addition, the Commission recommends efforts to increase the accessibility of federal funding and programs and the incentives for state, local, and Tribal governments to invest in wildfire solutions.

Selected recommendations aligned with this theme include:

- Support new and existing partnership programs between federal agencies and non-federal entities. Partnership programs serve a critical role in leveraging the capabilities and

capacities of non-federal entities to help reduce wildfire threats and support landscape-scale, multi-jurisdictional mitigation and recovery efforts. To be successful, partnership programs require both expanded authorizations and increased appropriations. See Recommendation 126 on page 223 in Chapter 7: Investing for Tomorrow.

- Provide financial and technical assistance to support existing and emerging wildfire resilience collaborative groups. Many of these collaboratives lack adequate capacity to effectively participate in planning, implementation, and monitoring yet can provide invaluable place-based knowledge, support effective agency decision-making, and help leverage investments at multiple scales. See Recommendation 139 on page 242 in Chapter 8: Frameworks for the Future.
- Increase accessibility of federal grants for community wildfire risk reduction and post-fire recovery efforts. Too often, these programs exist but are out of reach for both the most at-risk and the most in-need individuals and communities. Efforts to create both programmatic and procedural ease, as well as efforts to support communities to build the capacity necessary to successfully access federal funds, can increase the reach, equity, and effectiveness of federal investments. See Recommendation 142 on page 247 in Chapter 8: Frameworks for the Future.
- Increase and foster local participation in wildfire planning and management through collaborative pre-fire planning initiatives like the Potential Operational Delineations process. Fire management decisions can have consequential impacts for both short- and long-term risk in communities. Pre-fire planning efforts that incorporate local knowledge, seek local support, engage multi-sector partners (e.g., public health partners) and include collaborative decision-making are better positioned to create sustainable change in the built and natural environments. See Recommendations 57 and 58 on page 123 in Chapter 3: Responding to Fire.

Shifting from Reactive to Proactive

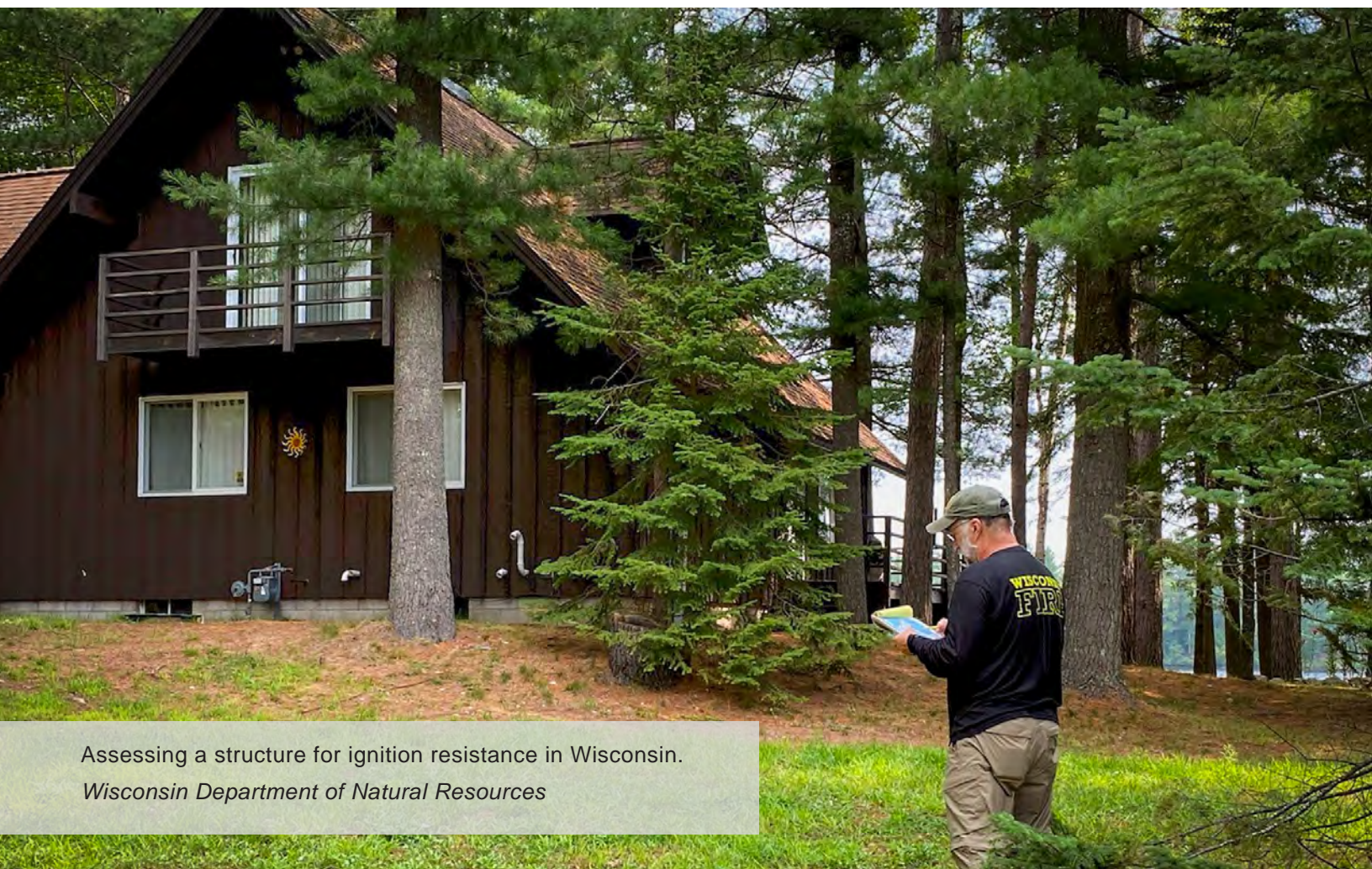
The existing system of wildfire funding, resources, and strategy is predominantly oriented towards reacting to wildfire events, often at the expense of proactive measures. Congressional appropriations heavily favor wildfire response over proactive activities such as retrofitting structures to resist ignition, thinning vegetation near communities, or managing forests and grasslands (including through the application of beneficial fire) to mitigate wildfire risk (Hoover, 2018). Post-fire programs are also insufficiently funded to address the wide range of needs in the built and natural environments, and those programs that do exist largely focus on providing assistance after a wildfire, rather than supporting proactive planning for post-fire assessment and hazard mitigation for communities at high risk that could reduce overall impacts when an event occurs. The reactive approach of our current system is not only incredibly costly, but also does little to mitigate overall wildfire risk across the country, build community and landscape

resilience to impacts, or set them on the path to post-fire recovery (TStelman & Nowell, 2019; Tedim et al., 2020).

Only by putting significantly more focus and resources toward proactive pre-fire and post-fire planning and mitigation can we break the current cycle of increasingly severe wildfire risk and losses; restore fire-adapted ecosystems; reduce risks to communities and increase resilience.

This requires programs, workforce, and funding streams that are additional to response resources and serve to expand capacity for community wildfire risk reduction, wildfire mitigation on landscapes, and strategic, forward-looking post-fire planning and recovery. Proactive actions are also critical for creating the conditions under which fire can be used and managed for the benefit of community and ecosystem resilience.

The Commission recommends greater support for proactive work that helps mitigate potential wildfire impacts for communities and landscapes and enable recovery to a more resilient condition. As a critical counterpart to increased investments in both mitigation and recovery, there is a need to build a diverse, year-round workforce with the capacity to implement the full range of needed activities.



Assessing a structure for ignition resistance in Wisconsin.
Wisconsin Department of Natural Resources

Selected recommendations aligned with this theme include:

- Support a comprehensive approach to community wildfire risk reduction, including through creation of a Community Wildfire Risk Reduction Program, incentives for proactive planning, and protection of critical watersheds and water delivery infrastructure (See Recommendation 1 on page 37 in Chapter 1: Creating the Foundation for Success, Recommendation 3 on page 44 in Chapter 1: Creating the Foundation for Success, and Recommendation 34 on page 87 in Chapter 2: Protecting Public Health).
- Authorize funding for integrated planning and management across all phases of wildfire management (including planning for post-fire impacts). Enabling proactive recovery is essential as it transforms recovery from an action designed to restore baseline conditions into an action designed to reduce future impacts. Planning for post-fire impacts also enables jurisdictions to efficiently limit losses. See Recommendation 66 on page 135 in Chapter 4: Recovering for Resilience.
- Invest in the creation of a workforce primarily focused on restoration and mitigation. The ability to take proactive action and avert escalating wildfire costs and losses fundamentally depends on workforce capacity to complete necessary work. Without community mitigation specialists, land-use planners, loggers, woods workers, rangeland technicians, firefighters, long-term recovery specialists and more, we cannot effectively prepare for, respond to, or recover from wildfires. See Recommendation 89 on page 172 in Chapter 5: Building a Comprehensive Workforce.
- Invest in fuels reduction treatments on public and private lands. Not all landscape mitigation treatments are commercially viable without additional spending, both on direct fuels reduction treatments and incentives for the commercialization of wood bioproducts. See Recommendation 17 on page 64 in Chapter 1: Creating the Foundation for Success.

Enabling Beneficial Fire

Dramatically increasing the amount of beneficial fire on our landscapes is essential. Wildfire is a natural process, and the use of fire is vital to both fire-adapted ecosystems and fire-adapted communities. Fires serve to reduce flammable materials that fuel undesirable high-severity wildfires, thus mitigating risk to communities and fire-adapted landscapes. Knowing these benefits, Indigenous people have used fire for thousands of years to steward natural resources and as a core element of many cultural practices. Today, however, widespread beneficial use fire has largely been lost. As a result, wildfires across the country are burning far less area than they historically would have but are more frequently burning at higher severity and in landscapes no longer adapted to fire (Haugo et al., 2019). Entire ecosystems have missed many cycles of fire (Safford & Van de Water, 2014), compromising overall ecological health and heightening risk to communities in which we live, work, and play.

Expanding beneficial fire, which includes prescribed burning, cultural burning, and wildfire managed for resource benefit, faces a number of legislative and policy headwinds. Proactively

utilizing more low-severity fire to lessen the extent and impacts of high-severity fire runs counter to the dominant paradigm over the last century in wildfire response, which typically favors aggressive suppression and other strategies intended to reduce short-term risk (Tedim et al., 2020). However, this approach perpetuates the further buildup of fuel loads near communities (exacerbating risk of severe wildfire in the long-term) and deprives fire-dependent ecosystems of a process that is essential to their function.

Another complicating factor is that all forms of fire, including beneficial fire, produce smoke that, when inhaled, harms human health, particularly for those who are most vulnerable. The need for more fire to prevent worse fire, and the smoke that is produced from all fire creates real and perceived tensions between the mutually important objectives of protecting public health from the impacts of smoke and enabling and supporting beneficial fire. Additional challenges to increasing the beneficial use of fire as a management tool are created by existing regulations, the potential for legal liability, limitations in available personnel, and changes in climate that, in some areas, have reduced opportunities for prescribed fire and the management of wildfire for resource objectives (Clark et al., 2022; Shultz, McCaffrey, & Huber-Stearns, 2019; Wonkka, Rogers, & Kreuter, 2015).

In most fire-adapted ecosystems, we need significantly more fire on the land and around our communities, not less, which will require adaptation, mitigation, and policy change. Plans and incentives must be reoriented to enable and promote beneficial use of fire and systems must be changed to address barriers such as liability, training, and limited personnel. Communities must be prepared for smoke, both in terms of when to expect it and the actions necessary to reduce its impacts. Public health agencies need to have the capacity to engage with land management



Prescribed fire on the Tewaukon Wetland Management District, North Dakota, 2017.

Jen Jewett, U.S. Fish & Wildlife Service

agencies, state agencies, local and Tribal governments, and communities to better integrate public health and wildfire needs.

The widespread ability to utilize fire in beneficial ways is also dependent upon our collective relationship with fire. Fostering social support for beneficial fire requires building trust amongst all parties through activities such as in collaborative response planning that enables consideration of local needs and values before a fire ever occurs. Finally, Tribes, as the original stewards of our nation's landscapes, must be further empowered to utilize beneficial fire and federal agencies must create conditions that enable such use.

The Commission recommends policy solutions that address the logistical, policy, and resource-related barriers to the beneficial use of fire and also provide means for better protecting public health. The Commission highlights the need for inclusive, collaborative pre-fire planning to help share decision-making, enable mutual understanding, and facilitate the consideration of tradeoffs associated with various wildfire response and management decisions.

Selected recommendations in this theme include:

- Expand support for the further development and utilization of pre-fire response planning, such as the Potential Operational Delineations (PODs) methodology, as a science-based, collaborative, and interdisciplinary framework. Use of pre-fire planning helps improve wildfire response decisions and enables more strategic use of wildfire for the reduction of fuels – and long-term risk – when and where appropriate. Involving more entities in planning stages can further support more informed, and widely supported approaches to wildfire management. See Recommendation 57 on page 123 in Chapter 3: Responding to Fire.
- Increase the capacity of federal agencies and departments, including the Environmental Protection Agency, the Department of Health and Human Services, the Department of Agriculture, and the Department of the Interior, to work with states, local and Tribal governments to ensure that air quality, public health, and land management programs work toward minimizing smoke impacts to human health while enabling and expanding the proactive use of beneficial fire. The nation needs more beneficial fire, but its use must be deployed with public health in mind. Greater investment in health and air quality agencies can help to mitigate the potential impacts of smoke from wildfires and beneficial fire. See Recommendation 39 on page 91 in Chapter 2: Protecting Public Health.
- Instruct agencies to develop the necessary administrative systems to allow resource ordering for prescribed fire to be as seamless as it is for wildfire response. Expanding the use of prescribed fire will require the same kind of rapid, nimble, and cooperative support systems that we have developed for incident response. See Recommendation 14 on page 61 in Chapter 1: Creating the Foundation for Success.
- Empower Tribes to plan and implement more beneficial fire through increased recognition of Tribal fire planning, expansion of the Tribal wildfire workforce, and the statutory acknowledgement of cultural burning to protect and promote this activity. See Recommendation 15 on page 62 and Recommendation 16 on page 62 in Chapter 1: Creating the Foundation for Success, and Recommendation 92 on page 176 in Chapter 5: Building a Comprehensive Workforce.

Supporting and Expanding the Workforce

The nation's fire-related workforce underpins every aspect of wildfire mitigation and management. Simply put, achieving many, if not all, of the Commission's recommendations fundamentally depends on the availability of a robust and diverse workforce to carry them out. However, as agency leadership have confirmed during recent Congressional testimony, the scope and size of the existing workforce is not sufficient for the scale of wildfire risk reduction, response, and post-fire recovery work required now, let alone into the future (*Examining the Challenges Facing Forest Management, Wildfire Suppression, and Wildland Firefighters Ahead of the 2023 Wildfire Year, 2023*). Instead, the current federal wildland fire workforce is tilted toward employees whose highest priority has historically been wildfire suppression. These critical response-focused employees are also under immense strain due to increasingly large, high-severity wildfires. They are experiencing increasing mental and physical health challenges, and declining work-life balance (Navarro et al., 2019; Reid et al., 2016; GAO, 2022c). These factors, combined with low pay and benefits (particularly for the seasonal workforce), limited housing options, and difficult-to-access training and qualifications make it challenging for even the most passionate to create a sustainable federal professional career in wildland fire (GAO, 2022c). Furthermore, the seasonality of many of today's federal wildland fire response positions fails to reflect the year-round need for mitigation, response, and recovery activities. Action is necessary now to ensure wildland firefighters have the pay and benefits necessary for a robust, sustainable workforce.

Federal investment is urgently needed to create new and expanded workforce capacity that is focused on, and tailored to, mitigation, planning, and post-fire response and recovery for communities and landscapes. Enhanced training and professional development opportunities are required to support this workforce and should create diverse pathways into different fire professions. A cross-trained, year-round workforce is vital to address the interconnected aspects of wildfire for communities and landscapes and between the phases of fire. It is also clear that the nation's fire-related workforce needs cannot and will not be met by federal personnel alone, and maximizing the capacity of the workforce will require making better use of all available resources. Efforts to build a more proactive, mitigation- and recovery-focused workforce, and to develop the fire workforce more generally across all phases of mitigation, response, and recovery, must occur across all sectors – public, private, and non-governmental – and at multiple scales, including governments at all levels. The Commission sees workforce development at the local scale as especially important to empower communities to prepare for and recover from wildfire.

The Commission recommends activating and recruiting additional personnel and skillsets into the workforce and developing a multidisciplinary workforce focused on mitigation and restoration. Addressing the known barriers (GAO, 2022c) that impede the recruitment and retention of wildland firefighters is also critically important. Related recommendations call for establishing compensation, benefits, and healthcare (including mental and physical) that reflect the essential role of these personnel in reducing risks and building resilience within communities and landscapes.

Selected recommendations aligned with this theme include:

- Increase wages and benefits for the federal wildland fire workforce. There is a critical need to retain existing federal wildland firefighters and low pay can make this retention difficult. It also incentivizes personnel to work unsustainable levels of overtime. A permanent solution is essential to retaining the workforce we have and recruiting the workforce we need. Critical changes to the pay and benefits system are needed to create a healthy, sustainable workforce. See Recommendation 84 on page 164 in Chapter 5: Building a Comprehensive Workforce.
- Invest in a workforce primarily focused on restoration and mitigation. The workforce needed to effectively address the wildfire crisis extends beyond suppression and must include personnel focused on the critical mitigation work that takes place before a fire begins. See Recommendation 89 on page 172 in Chapter 5: Building a Comprehensive Workforce.
- Create efficient hiring pathways that support development of a larger, more diverse, and inclusive workforce. Hiring processes can impede workforce growth and actions to create more efficient, accessible pathways can help increase the number of personnel available within the system, as well as work toward a workforce that better reflects the communities it serves. See Recommendation 85 on page 166 in Chapter 5: Building a Comprehensive Workforce.
- Better utilize the existing national structure fire service to help respond to wildfires safely and efficiently through increased training opportunities and better integration into the existing resource mobilization systems. See Recommendation 53 on page 115 and Recommendation 56 on page 120 in Chapter 3: Responding to Fire.
- Expand recruitment strategies. Investments in retention help to stop the loss of personnel from the system, but we also must invest in adding personnel to the fire workforce. Recruitment strategies that focus on educational systems and work with local community organizations encourage the next generation to enter careers in fire. See Recommendation 88 on page 169 in Chapter 5: Building a Comprehensive Workforce.

Modernizing Tools for Informed Decision-making

Wildfire is inherently dynamic and complex, with outcomes dependent upon myriad environmental and social conditions. Science, data, and technology can play an important role in better understanding this environment and supporting decision-making. However, current efforts and resources are dispersed, siloed in their operations, challenging to access, and lack overarching structures for coordination or aggregation across relevant disciplines. These conditions hinder the optimal use of research, data, and technology; reduce opportunities

Members of the Gifford Pinchot National Forest work fires on the Mt. Hood National Forest in Oregon, 2023.

Preston Keres, Forest Service



for developing models and decision-support tools; and prevent effective prioritization and coordination of wildfire science and the operationalization of new research and development (President's Council of Advisors on Science and Technology [PCAST], 2023). Additionally, practitioner efforts are often frustrated by a lack of data and analytical tools at the appropriate scales, as well as poor interoperability across scales and jurisdictions (Clavet et al., 2023). Climate change poses an additional challenge by fundamentally shifting wildfire risk, fire behavior, and the trajectory of post-fire recovery in ways that current fire behavior models, and indeed the current fire management system, are not designed to meet (Flannigan et al., 2013; Nowell & Steelman, 2019; Pyne, 2015).

Now more than ever, there is a need for coordinated and unified efforts to understand, model, and adapt to altered conditions. Decision-making must be driven by science and data that reflect the full complexity and the interdisciplinary nature of wildfire in the 21st century (Tedim et al., 2021). We must embrace modern tools, including remote sensing, real-time decision support technologies, and updated modeling. Additionally, firefighters, those working in mitigation and recovery efforts, and communities, need to have a voice in informing wildfire research to ensure it is accessible and useful to those working on the ground. To harness the full potential of science, data and technology, interoperability must be improved, research efforts must be better integrated with applied uses, and decision-support tools and services must be more effectively operationalized for practitioner use.

While federal agencies have an important role to play in sharing information with states, Tribes, local governments, and communities, it is also important to support these entities in their own efforts to collect, analyze, and apply data for informed local decision-making and risk reduction activities. To be most useful, data needs to be accessible and actionable at a field level and made available at the scales and in formats that align with how it will be used. Furthermore,

Indigenous Knowledge related to fire management need to be included, respected, and – when needed – kept confidential.

In recognizing these needs, the Commission recommends several measures that would better coordinate, integrate, and strategically align fire-related science, data, and technology. These include integrating decision support and predictive services in a new joint office, creating an environment for greater data collaboration, and establishing advisory boards to coordinate fire science and research-to-operations efforts. The Commission also encourages support of further applied research, data collection, and analytical tools for key issues and uses, including community wildfire risk reduction, post-fire recovery, and the intersection of wildfire and human health. Finally, the Commission identifies a need for science, data, and technology to be leveraged to support greater accountability and adaptive management within the overall wildfire mitigation and management system.

Selected recommendations aligned with this theme include:

- Establish and fund an interagency joint office with the mission of providing comprehensive assessment and prediction of the wildfire environment through data aggregation and science-based decision support services. Such a center would serve as a much-needed hub for wildfire decision-support functions to wildfire and land managers at all scales of government and could help streamline and create efficiencies in utilization of new technology. See Recommendation 104 on page 195 in Chapter 6: Integrating Modern Science and Technology.
- Support a venue to serve as the national coordinating body for wildfire science research. Such a venue would help to streamline and coordinate much-needed wildfire-related research, leverage resources and multidisciplinary approaches, and provide a means by which to identify practitioner needs and prioritize federal funding and research efforts. See Recommendation 110 on page 204 in Chapter 6: Integrating Modern Science and Technology.
- Support improved operationalization of research through the creation of a fire science and technology board to help coordinate existing efforts. This board should help to identify practitioner priorities as well as transition research into operations. See Recommendation 116 on page 210 in Chapter 6: Integrating Modern Science and Technology.
- Improve data analysis, research, and decision support to aid communities in both mitigation and post-fire recovery efforts. Creation of an interagency Community Wildfire Risk Reduction Program and better integration of technical needs in the post-fire environment will help streamline and enhance community risk reduction and recovery. See Recommendation 1 on page 37 in Chapter 1: Creating the Foundation for Success and Recommendation 114 on page 208 in Chapter 6: Integrating Modern Science and Technology.

Investing in Resilience

Wildfire investments have historically proven vastly insufficient to meet the magnitude of the current challenge. This is especially true within pre-fire mitigation and post-fire recovery. While no effort has been able to fully capture wildfire's financial toll, some estimates put current costs at tens to hundreds of billions of dollars per year (Crowley et al., 2023; Thomas et al., 2017). Anticipated increases in wildfire size and severity are likely to continue driving costs ever higher. The nation now faces a potential inflection point: increase investments in upfront mitigation and planning to reduce the negative impacts of wildfire or continue to face year after year of mounting costs and losses to communities, ecosystems, and human lives.

More funding is critical to support resilient, ignition-resistant, and smoke-ready communities capable of coexisting with wildfire. Funding is also needed for expanded planning and implementation to reduce the impacts of severe wildfire on the landscapes upon which we depend. Finally, funding is essential to develop the workforce and the necessary coordination and partnerships to accomplish those goals. In short, the wildfire crisis needs to be funded, staffed, and acted upon like the national emergency that it is. To do less is to resign ourselves to tremendous costs and losses. Just as with issues of national security, funding for wildfire must be significant and sustained. Short term, year-by-year infusions will be unable to create and maintain durable, large-scale change that will ultimately shift the trajectory of our fire future. While greater investment in mitigation, preparedness, and prevention over the long term will ultimately reduce what must be spent on wildfire response and post-fire recovery, it also must be recognized that these returns will take time (Jones et al., 2017).

Given the transboundary nature of wildfire impacts, investments need to be made and distributed across diverse entities at the federal state, local, and Tribal levels. Entities at all scales should be sufficiently resourced, both to undertake the work being asked of them and to have the capacity to define and meet their own needs. In this vein, Tribal capacity for fire management, consultation, and stewardship needs dedicated support. Greater flexibility in funding is also needed to enable action across ecosystems and jurisdictions. While spending should be strategic with an eye toward building on success, it is equally important for federal investments to address the persistent gaps and disparities in how communities are impacted by, and able to recover from wildfire. Many existing funding opportunities continue to create financial and other barriers for disadvantaged communities. Lastly, although federal investments are critical, depending on federal funding alone to finance wildfire mitigation and management cannot provide a sufficient level or dependability of investment. In addition to increased congressional appropriations, there is a need to encourage and leverage other means of funding for the required work including through development of private industry and incentivizing investments on the part of governments at all scales.

The Commission's recommendations emphasize the need for increased federal funding that is sustained and predictable, keeps pace with the escalating crisis, incentivizes investments by other governments at all levels, and includes a focus on the mitigation of risk and impacts both before and after wildfire.

Selected recommendations aligned with this theme include:

- Congress should increase budgets for the relevant departments and entities that work to mitigate, manage, and recover from wildfire. This includes funding for land management agencies, post-fire recovery programs, wildfire research and science, and community preparedness efforts. See recommendations 129, 130, and 131 on pages 226-228 in Chapter 7: Investing for Tomorrow.
- Congress should ensure that balanced, robust funding for pre-fire mitigation and post-fire restoration is included as part of the wildland fire budget. Such funding is needed to protect communities and landscapes and, ultimately, reduce the proportion of spending needed for wildfire suppression. See Recommendation 124 on page 222 in Chapter 7: Investing for Tomorrow.
- Congress should utilize omnibus, multi-year, mandatory funding authorization and appropriations legislation for wildfire management. Increased certainty is needed to help managers plan budgets and meet priorities on longer, more meaningful time horizons and with greater efficiency. See Recommendation 120 on page 218 in Chapter 7: Investing for Tomorrow.
- Congress should improve the stability of wildfire-related appropriations in order to maintain the investments supported by the Infrastructure Investment and Jobs Act. Making permanent the Wildfire Suppression Operations Reserve Fund, better known as the “wildfire funding fix” will help ensure that suppression costs do not destabilize the very mitigation work intended to reduce the proportion of such costs in the future. See Recommendation 121 on page 218 in Chapter 7: Investing for Tomorrow.

Commission Recommendations

Building on the themes outlined above, the following chapters explore all of the Commission's recommendations in greater detail. The chapters are generally organized in chronological order relative to a wildfire event, beginning with community and landscape mitigation actions taken before a wildfire starts. Subsequent chapters cover recommendations related to public health and essential services; improved wildfire response planning and coordination; post-fire recovery; building a comprehensive workforce for all aspects of wildfire mitigation and management; improved use of science and technology for decision-making; critical investment needs; and finally, approaches to support improved wildfire governance. Taken together, these consensus recommendations attempt to address the full breadth and depth of our wildfire challenge, and present opportunities for transformational actions to meet our country's needs now and into the future.



The Chelan Fire burns near a house in Washington State, 2015.

Kari Greer

Chapter 1: Creating the Foundation for Success

To change the trajectory of the wildfire crisis, our collective focus must expand from response and suppression to also prioritize proactive investments and efforts. The actions taken at multiple scales, by multiple parties, in multiple jurisdictions *before* a fire ever begins also play an important role in determining the total costs and losses from wildfire (Donovan & Rideout, 2003; Thomas et al., 2017). Yet, for far too long, fire response has overshadowed pre-fire planning and risk mitigation (Schoennagel et al., 2017; Smith et al., 2016; Tedim et al., 2020). This perpetuates a reactive and expensive cycle and consigns ourselves to an ever-increasing catalogue of loss. There is perhaps no better example of this than the former practice of federal “fire borrowing” (see Recommendation 125 in Chapter 7: Investing for Tomorrow for a discussion of the temporary fix and need for a more permanent solution). During “fire borrowing,” funds used for pre-fire work were transferred to pay for fire suppression, limiting the ability of agencies to engage in the work that would reduce the need to transfer funds in the first place.

The impact of this focus on response at the expense of pre-fire action is not limited to finances. **The very action of response – of limiting fire spread through the containment, control, and extinguishment of fire – can generate more severe conditions in the future by removing fire as a natural process from the landscape.** Fuels in the form of trees, shrubs and grasses continue to build up, and with them, the potential for extreme wildfire behavior. This trade-off of addressing short-term risk at the expense of long-term gain exemplifies the wildfire paradox, in which fire is both the crisis and part of the solution (Calkin et al., 2013; Cohen, 2008; Dunn, Thompson & Calkin, 2017). Trade-offs also happen outside of response, at the individual level as residents weigh pre-fire mitigation actions against factors such as expense, time, effectiveness, or competing needs and values (McCaffrey, 2015; Toman et al., 2013) and at the community level as decision makers balance the compounding and competing challenges of housing affordability, hazard reduction, and other complexities (Mockrin, Fishler, & Stewart, 2020; Mowery & Punchard, 2021).

Pre-fire mitigation, or actions taken to reduce the potential adverse impacts from fire, is the way in which we break the cycle of increasing cost and increasing risk. Actions to effectively address increasing wildfire risks must be holistic and consider complementary approaches to both wildlands (the natural environment) and communities (the built environment) (Ager et al., 2015; Mortiz et al., 2014). The Commission found that forest and rangeland management and fuel reduction treatments play a significant role in mitigating and managing the risk of wildfire.

However, it is important to note that focus on the natural environment alone is unlikely to fully reduce wildfire-related loss (Calkin et al., 2013; Cohen, 2008; Mortiz et al., 2014). There is critical a need to also focus actions within the built environment.

Wildfire mitigation requires a comprehensive approach, including proactive structure modification for ignition resistance; community planning; capable evacuation and alerting infrastructure; policies to support continuity of operations for both electric and water utilities; vegetation management through multiple means; expanded use of beneficial fire on the landscape; cross-boundary work; project planning; robust public health infrastructure; smoke readiness; and more (Kolden & Henson, 2019). Recommendations in this section focus on actions to achieve long-term resiliency by reducing risk in communities and on the landscape. The Commission found that proactive planning and sustained investment now will save lives, money, and resources in the long-run and that the scale of those investments must also substantially increase.

In the Built Environment

The Commission was broadly tasked with making recommendations to maximize the protection of community water supplies, homes, and other essential infrastructure. While community water supplies are addressed in the Protecting Public Health chapter, this chapter focuses on the collection of human-created components (e.g., homes, businesses, roads, electric infrastructure, and other non-natural elements) of communities.ⁱⁱ This collection of human-created components, collectively known as the built environment, is increasingly at risk from wildfires. Nearly 2,000 communities were threatened by wildfire between 2000 and 2019 and between the years of 2005 and 2022, nearly 100,000 structures were destroyed by wildfire (Barrett, 2023). Wildfires can displace people and destroy structures regardless of community size. For example, in both Malden, Washington (population 225 before the 2020 Babb Road Fire) and Paradise, California (population 27,000 before the 2018 Camp Fire), significant proportions of community structures were lost.

Embers generated by burning material, including vegetation and other structures, pose a substantial threat to structures (Caton et al., 2017; Manzello & Suzuki, 2023; Maranghides et al., 2022; Maranghides & Mell, 2009; Westhaver, 2017). Embers, lofted into the air as material burns, are transported ahead of the main fire, sometimes traveling miles in advance. When those embers land in a receptive fuel bed, such as a gutter filled with pine needles, a wood shake roof, or vegetation immediately adjacent to the structure, they can ignite. The combustion of that single structure can challenge first responders and create countless additional embers and significant radiant heat, igniting more structures and perpetuating the sequence of ignition and loss known as an urban conflagration. Conflagrations can occur because of fires that burn hundreds of thousands of acres, or as a result of much smaller fires. The devastating 2023 fire in Lāhāina, Hawai'i, provides a striking example. That fire burned less than 2,500 acres and yet was the deadliest wildfire in the United States in over a century and destroyed thousands of homes and buildings within the community of Lāhāina.



Aerial view of the 2012 Waldo Canyon Fire outside of Colorado Springs, Colorado.

Kari Greer

Mitigation actions within the built environment often focus on creating conditions that reduce the probability of ignition. Actions such as using ignition-resistant construction materials, maintaining the vegetation around a structure, and carefully planning and designing communities help reduce vulnerability and prevent damage to neighborhoods, businesses, utilities, public water supply infrastructure or any other value at risk (Maranghides et al., 2022). Decades of research has shown the importance of ignition-resistant construction and the condition of vegetation surrounding the structure, and the proximity of structures to one another (Cohen, 2000, 2008; Insurance Institute for Business & Home Safety, 2021; Knapp et al., 2021; Maranghides et al., 2022). Actions such as replacing wood shake roofs or removing vegetation immediately adjacent to a structure are designed to prevent the initiation of the disaster sequence, both preventing an initial loss and limiting the conditions that promote widespread propagation and result in urban conflagration (Calkin et al., 2013). Mitigation actions in the built environment also include smoke preparedness (e.g., alerts, filtration, sheltering, etc.) and actions to protect community water supply infrastructure. While these actions have strong ties to the built environment, they are discussed in detail in Chapter 2: Protecting Public Health.



A house with a clay tile roof. Clay tile roofs are more ignition-resistant than wood shake shingle roofs.
Wisconsin Department of Natural Resources

The position of structures on the landscape (and relative to each other) also influences the risk of structure loss from wildfires (Alexandre et al., 2015b; Knapp et al., 2021).ⁱⁱⁱ As a result, the Commission found that opportunities to examine and guide where development occurs are an important part of the solution.

Despite the importance of this work, investments in wildfire resilience in the built environment have traditionally been less of a focus in the wildfire space than investments in the natural environment. Mitigation efforts and investments by land management agencies (described in more detail within In the Natural Environment section, below) have focused almost exclusively on hazardous fuels reduction. There have been more recent investments in the built environment but of a limited or indirect nature. One notable new program, the Community Wildfire Defense Grant (CWDG) program, funded through the 2021 Infrastructure Investment and Jobs Act (IIJA), includes \$1 billion for community planning and fuels treatment. However, it does not fund any ignition-resistant construction or retrofitting. The CWDG program supports two types of proposals for community mitigation: creating or updating a Community Wildfire Protection Plan (CWPP)^{iv} or implementing eligible projects identified in an existing CWPP. During the first year of the CWDG program, applications far outpaced the pool of available funding, with nearly three times as much funding requested as was available (Headwaters

Economics, 2023). This 3:1 ratio of CWDG applications to available funding underscores the interest and need for ongoing and expanded federal investment in community-based mitigation efforts.

Other recent notable investments in risk mitigation to the built environment include the IIJA's creation of two \$5 billion grant programs for energy resilience. While not specific to wildfire, the programs are intended to prevent outages from climate-related hazards and include activities that reduce ignition risk such as burying powerlines (CRS, 2022a). IIJA investments also included over \$500 million to support drinking water and wastewater infrastructure grant programs. Together, the CWDG program, energy resilience grants, and drinking and wastewater grants represent substantial investments in the built environment. Yet, as these programs demonstrate, communities with high wildfire risk must navigate multiple programs to just begin to address their risk, creating additional barriers to undertaking important action.

The Federal Emergency Management Agency (FEMA) also supports risk reduction in the built environment and several of its Hazard Mitigation Assistance programs include wildfire risk reduction activities.^v Launched in 2020, the Building Resilient Infrastructure and Communities (BRIC) grant program was a product of the Disaster Recovery Reform Act of 2018 (Pub. L. No. 115-254; Div. D (2018)) to help shift from reactive to proactive investments in communities. As such, BRIC does consider requests to fund critical wildfire-related actions such as ignition-resistant construction and retrofits. However, even with the substantial investments in BRIC and in pre-disaster funding through the IIJA, the Congressional Research Service (CRS) reports a disparity in pre-disaster funding when compared to post-disaster funding (CRS, 2022b). BRIC funding also does not appear to be widely used for wildfire. For example, in BRIC's Fiscal Year 2022 grant process, only 7 percent of selected projects identified wildfire management as the primary activity (Federal Emergency Management Agency [FEMA], 2023b). Furthermore, reviews of the BRIC program have indicated that many smaller communities may struggle to access funds due to the complexity of the process (see discussion of Accessibility within Chapter 9: Frameworks for the Future chapter and, more specifically, Recommendation 142). Other FEMA programs that support wildfire risk reduction (e.g., Hazard Mitigation Grant Programs or Hazard Mitigation Grant Program-Post Fire) are tied to disaster declarations or Fire Management Assistance Grant approvals, meaning that applicants must generally wait for fires to occur before applying for proactive assistance (FEMA, 2023a)^{vi}

The Commission found that the **current programs and approaches designed to reduce wildfire risk to residential communities are insufficient**. Many communities lack the expertise, resources, and capacity to apply for and manage grants or to implement and maintain mitigation actions needed at the local level. Further exacerbating the challenge, no single program comprehensively funds community wildfire risk reduction. Rather, the burden falls to local-level entities to navigate and piece together the limited programs that do exist in order to meet their mitigation needs in both the built and natural environment. The Commission found that **to better meet the scale of the challenge, significant changes must be made to better prepare communities before, during, and after a wildfire**. A comprehensive approach is required to create durable, and potentially transformative, changes in community wildfire resilience. The following recommendations reflect this need for more comprehensive solutions.

Insights: Community Capacity

The need for increased community capacity is often raised when discussing how to better mitigate wildfire impacts to communities. Capacity is frequently used synonymously with “resources”, but this characterization of capacity is incomplete. Within the context of community wildfire adaptation, capacity (i.e., adaptive capacity) is the combination of factors that influence the ability of community to take action to reduce or mitigate its risk. Adaptive capacity is comprised of multiple factors including resources, local will, collaborations, and motivation (Paveglio et al., 2012; Paveglio et al., 2015b). It is important not to assume that those communities with few financial resources are without adaptive capacity or incapable of taking action to increase their resilience. Other research has identified sense of community and ability for collective problem solving as key to a community’s ability to increase its wildfire resilience (Prior & Ericksen, 2013). While vulnerability and resilience can be linked (Maru et al., 2014), limiting the concept of capacity to resource availability undervalues significant community assets and contributions to wildfire risk reduction. The Commission favors a multi-pronged approach to building adaptive capacity in advance of a wildfire which included training and technical assistance programs, support for community-based convening organizations, and more.

Recommendation 1

Congress should establish a Community Wildfire Risk Reduction Program via an interagency coordinating partnership including the U.S. Forest Service, the Federal Emergency Management Agency, the United States Fire Administration, the Office of Wildland Fire on behalf of the Department of the Interior’s land management agencies, and the National Institute of Standards and Technology as principal agencies, to proactively address wildfire risk reduction actions and increase ignition resistance of the built environment.

The Community Wildfire Risk Reduction Program would provide multifaceted support of community wildfire risk reduction actions by advancing research and science in wildfire resilience and land use planning; supporting local adoption and implementation of building code standards; encouraging public and private partnerships; and providing funding and other assistance to increase understanding and application of wildfire risk reduction measures in communities. This program would require dedicated, sustained, and consistent funding through new and expanded appropriations, which would be provided to the principal coordinating agencies for program implementation, maintenance, and assessment.

The Community Wildfire Risk Reduction Program could be organized to function as an umbrella structure for all federal community wildfire risk reduction programs, so that communities do not have to go through several federal agencies to support their risk

reduction needs. In addition to the principal agencies, other federal agencies may warrant inclusion as supplemental support, including the Department of the Interior (DOI) land management agencies, Housing and Urban Development (HUD), Environmental Protection Agency (EPA), and other agencies focused on wildfire resilience, climate disasters, and impacts to communities. To ensure risk reduction measures are commensurate with the scale and needs of communities, the principal federal agencies also would need to coordinate and align with state agencies, local departments, and Tribes for aspects of this program, including the distribution of direct competitive and non-competitive funding opportunities.

Opportunities and barriers learned from the Earthquake Hazards Reduction Act of 1977 (Pub. L. No. 95-124, 91 Stat. 1098 (1977)) can provide a potential model regarding the development, deployment, and administration of this community-focused risk reduction program.

More specifically, the program should consider the following risk reduction measures and needs. It is important to note that while many of the risk reduction measures and needs identified below are highlighted in other recommendations of the Commission, the Community Wildfire Risk Reduction Program provides the opportunity to bring these recommendations together in a more cohesive and complementary whole. Some approaches may require congressional action; the program should provide an evaluation of potential options.

- **Financial incentives to encourage critical risk reduction measures to private properties most at risk:** This could include, but is not limited to: a) tax credits similar to those made available for energy efficiency retrofits that would be offered to residents and business owners living in high-hazard wildfire areas for implementing structure improvements that reduce ignition vulnerability, such as fire-resistant design and building materials; b) consistent federal tax treatment for federal, state, and municipal grants received by property owners for mitigation work; and c) authorizing the establishment of tax-preferred catastrophe savings accounts (CSAs) for both pre-incident and post-incident expenses. CSAs are add-ons to traditional savings accounts and are currently available in Alabama, Mississippi, and South Carolina to pay expenses associated with a natural disaster. With all incentives, consideration should be given to non-property owners.
- **Subsidies to offset mitigation costs for economically disadvantaged residents:** Provide subsidies and cost-share opportunities for underserved, low-income, or otherwise disadvantaged households located in high-hazard wildfire areas to cover the costs of critical mitigation measures and structure improvements, including retrofits and new builds to reduce wildfire risk. This is particularly important as socially vulnerable communities may be less likely to participate in wildfire risk reduction programs (Gaither et al., 2011; Ojerio et al., 2010).
- **Support for low-capacity communities:** Expand and fund technical assistance programs and develop resources for communities at greatest risk and with limited capacity to improve wildfire resilience. Block grants could be considered as a potential mechanism.

- **Support for building code or standard adoption and enforcement:** Increase financial support and technical resources to state, Tribal, and local jurisdictions to hire staff and enhance capacity to adopt, enforce, and maintain science-based building codes or standards that govern construction, design, and site development in all ‘wildfire-prone’ regions, not only locations identified as high-risk. These codes and standards may include California’s Building Code Chapter 7A, NFPA 1, Fire Code, and referenced wildfire standards, or the International Wildland-Urban Interface Code. Particular attention should be paid to creating accessible funding pathways to enable communities’ adoption and enforcement of regulatory tools. Those in the highest hazard areas do not always have the capacity to adopt, enforce, and maintain codes and other regulatory tools. Additionally, incentives for land use planning can support local community action and could be incorporated into this program (see Recommendation 3, below).
- **Support for non-agency partners:** Provide funding for non-agency partners to enhance local community capacity in accessing, implementing, and coordinating community risk reduction strategies. Non-agency partners include non-governmental organizations, universities, institutions, and other public and private organizations working at the local level.
- **Research and science:** Increase funding for research and development on topics such as engineering principles, identification of best practices for reducing risk to the built environment, and foundational components of establishing codes and standards. Research outcomes should be applied, iterative, and collaborative, and could be coupled with or informed by those efforts outlined in Chapter 6: Integrating Modern Science and Technology. Research efforts should also include partnerships with the private sector (see Recommendation 6, below). The insurance industry in particular is a critical partner. Efforts should draw on interdisciplinary expertise in land use development, building design and construction, urban planning, and other professions specializing in community resiliency.

“Hazard areas,” as referenced in the recommendations above, are those that have high or very high wildfire hazard potential as defined by a local, state, Tribal, regional, or national wildfire hazard potential assessment.

Several other recommendations put forward by the Commission in this report also could be integrated into the structural organization and strategic objectives of the Community Wildfire Risk Reduction Program. These include recommendations to improve community accessibility of federal grants (see Recommendation 142 in Chapter 8: Frameworks for the Future), and recommendations that address the need for appropriate and interdisciplinary workforce development and science-based guidelines, data analysis, and geospatial modeling to inform and support building code standards. The Community Wildfire Risk Reduction Program also could be expanded to operationalize Commission recommendations related to preparing “smoke ready” communities, water supply protection, and broader workforce development.

Recommendation 2

Integrate wildfire risk reduction measures and technical assistance into existing programs.

Program restructuring efforts should aim to reduce the number of programs any single community has to navigate to implement the full scope of risk reduction activities, while also making existing programs more accessible. Importantly, reducing the number of programs a community must navigate does not necessarily mean reducing the overall number of programs. While it is the hope of the Commission that the previous recommendation helps to consolidate and simplify programs for communities, members urge a critical evaluation of existing programs and needed mitigation activities, including which federal agencies are best positioned to “house” various activities and whether programs are best delivered by federal agencies or by other entities, such as non-agency intermediaries, for the purposes of accessibility.

While necessary changes will vary by program, general strategies include:

- Modify existing programs to support an expanded array of community wildfire risk reduction activities and fund the resources and staffing – both within and outside of federal agencies – that are needed to support these activities.
- Consider diversifying program delivery mechanisms, including use of mechanisms that do not require upfront payment by the awardee.
- Increase support to help communities build the capacity needed to address impacts of wildfire in a sustained way.

Specific programs discussed by the Commission that could be examined for expansion or modification include:

- FEMA’s Emergency Management Performance Grant.
- FEMA’s Assistance to Firefighters Grant program.
- Staffing for FEMA’s Adequate Fire and Emergency Response grants.
- FEMA’s Hazard Mitigation Assistance Grants, including FEMA’s Building Resilient Infrastructure and Communities program.^{vii}
- U.S. Forest Service’s (Forest Service) Community Wildfire Defense Grant program.
- HUD’s Wildfire Recovery & Resilience Grant.



Homes interspersed with wildland vegetation near Waldo Canyon, Colorado.

Kari Greer

Community Planning

In recent decades, residential growth in areas with wildland vegetation has outpaced other land-use types in the contiguous United States (Radeloff et al., 2018). Much of this development has been in fire-prone areas where case studies demonstrate the importance of where and how communities build (Alexandre et al., 2015a; Knapp et al., 2021; Quarles et al., 2013).

Opportunities to guide development exist, though local factors and context remain critical in those decisions (Alexandre et al., 2015a; Syphard et al., 2021). These opportunities include land use planning, building codes, wildland-urban interface codes, and other development codes intended to help reduce the risk of structure and infrastructure damage and loss by requiring the use of ignition-resistant building materials and the modification of vegetation immediately surrounding structures. Some states (e.g., California) have minimum building code requirements to support ignition-resistant construction while other states have optional code requirements or none at all.

Communities often use comprehensive or master plans to set the long-term vision for growth, development, and other elements. The composition of local comprehensive plans is varied and often depends on statutory requirements set by the state, local context, and growth and development patterns of the community. Other planning tools include zoning regulations which can limit the types of uses allowed on particular pieces of property and/or determine the density

of development. Both comprehensive planning and zoning regulations, as well as additional planning tools like ordinances, subdivision standards, and site development plans, are largely handled at the local level (e.g., city or county) but often tier to state requirements.

In its discussions about planning and regulations, as well as the risk assessments used to inform them, the Commission found that to help communities adapt for resilience, individual states and communities must adopt, enforce, and maintain codes regulating construction materials, design, and landscaping for structures and properties located in wildfire-prone areas, for both new construction and significant remodels, rebuilds, and retrofits. The Commission also felt that decision-making about these approaches should be undertaken by entities working at the local, state, and regional scales, rather than at the federal level. These people, agencies, and organizations have the most direct knowledge of, and experience with, local context, which is crucial when developing strategies that are tailored to the unique ecological, social, economic, and political needs of each place. This is particularly relevant given the variability in concerns and barriers related to land use planning and regulations for wildfire risk reduction (e.g., local capacity, lack of public support, concerns about real estate, and others) (Mockrin et al., 2020). Non-federal entities also often have the advantage of being more nimble and able to adapt, refine, and update plans or regulations more easily and in a timelier way.

The Commission therefore strongly endorses the need for community-level action and the retention of policy decision authority for land use and development at the state and local level. Where a need exists – and where the Commission felt federal government should play a role – is in ensuring that those entities have the right tools, resources, and incentives, to make well-informed decisions that will proactively reduce the risk to communities from wildfire. Examples of federal support include financial incentives for communities and individuals, technical assistance, technological innovations, data acquisition and access, and, in particular, directed support for low-capacity communities located in high-hazard areas. The Community Wildfire Risk Reduction Program (proposed in Recommendation 1 above) would meet this niche at the federal level, and through coordination with Tribal, state, and local agencies, leverage national resources, research, and capacity to help encourage and inform risk reduction and land use decision-making at the community scale.

Mapping and analytical tools, which enable the geospatial identification of wildfire hazard or risk,^{viii} are foundations for locally relevant, well-informed decision-making. These tools can also assist in prioritization processes for risk reduction practices, including codes and ordinances, land use policies, hazard disclosures, and allocation of resources. Well-designed mapping and decision support tools can also enable better communication about hazards and risk, support transparency and shared understanding around risk-related decision-making and outcomes, and provide a venue for greater local engagement and the incorporation of local knowledge in these actions.

Hazard and risk evaluation can occur at multiple scales, with each scale requiring different levels of data specificity. There is a particular need for mapping and assessment tools that can be used to inform actions and decisions at more local levels. National-scale maps are useful for providing a generalized assessment and can provide communities, which may not have mapping and modeling capacity, an understanding of their hazard and risk. Yet national-scale maps may not have the level of granularity needed to inform, for example, planning decisions or building code applications at the parcel level. Myriad local factors, including biophysical conditions such as

topography and vegetation, as well as political factors such as state statutes, municipal codes, and other planning and regulatory measures, impact risk at fine scales and are often poorly reflected in national-scale mapping products.

Several states also have wildfire hazard maps, which may be useful for local risk evaluation but often fall short of parcel-level evaluation of hazard. Many of those maps are also outdated. Differences in variable specificities and which variables are included, incompatibilities between maps and data sources, and differences in how they are used can all cause confusion and inconsistencies, particularly related to wildfire hazard and risk levels and terminology.

The Commission made several recommendations designed to support local land use planning and codes and ordinances related to wildfire risk reduction, largely focused on creating incentives and technical assistance to facilitate local action.

Insights: Federal Involvement in Community Wildfire Risk Reduction

The Commission was in broad agreement about the value of efforts to assess risk and to enact plans, policies, and regulations for community wildfire risk reduction when those efforts are driven by – and implemented at the scale of – communities themselves. Also widely held was the view that the federal government can play a valuable role by providing the appropriate tools, incentives, research, resources, and technical assistance to support wildfire risk and hazard assessments, code adoption, and appropriate land use planning at the local level. However, the Commission generally did not support federal involvement in mandating the development of community wildfire risk and hazard mapping and land use planning and regulation.

Commission members held different opinions on the appropriate federal mechanisms for advancing community-level wildfire risk reduction. Supported strategies fell into two general categories: those that encourage individual or community action through the provision of resources and incentives to undertake such work – a “carrot” approach, and those that condition funding or other resource access to the adoption of certain actions or standards – a “stick” approach.^{ix} Some Commission members supported the use of federal resources to compel certain actions or behaviors. However, many Commission members felt that enacting this “stick-based” approach without providing additional resources, underlying support systems, technical assistance, and an effective enforcement strategy would be unlikely to lead to adoption of mitigation actions at a meaningful level in many areas. It also raised concerns about inadvertently penalizing or underserving communities that are in great need of assistance but unable to undertake planning, regulatory measures, or other activities necessary to qualify for funding. Furthermore, zoning or building regulations that limit development in higher-risk areas or impose certain requirements on new and/or existing structures in those areas, could affect housing costs and housing availability in a community.

Ultimately, these discussions led the Commission to find consensus around a portfolio approach that focuses on providing resources, information, workforce capacity, and incentives to empower proactive wildfire risk reduction action driven by, and at the scale of, individuals and communities.

Recommendation 3

Congress should explore, expand, and create incentives to encourage state, local, and Tribal governments to improve land use planning to reduce the risk of wildfires to homes and other community development.

The Commission believes that without significantly better land use planning to reduce the risk of wildfires to development, the costs and impacts of wildfire on communities will continue to grow at a substantial rate. State and local jurisdictions can use a variety of land use planning tools, such as master planning and zoning, to limit the exposure of housing and other community development to wildfire and to ensure adequate evacuation routes. The Commission felt that while proactive science-informed land development planning can have up-front cost impacts on local governments and residents, it is critical to supporting long-term public safety and home affordability by reducing risks, increasing resilience, and improving insurance availability and affordability over the life of a building. The Commission also saw proactive land development planning for wildfire as a critical aspect of wildfire management approaches which could benefit wildfire response and yield long-term savings in mitigation, recovery, and rebuilding.

While decision-making related to land-use planning must happen at the local level, incentives and best practices for improved land use planning in wildfire-prone areas could be integrated, managed, and supported through the proposed Community Wildfire Risk Reduction program. Additionally, data procurement and analytic systems that enable informed decision-making related to building codes and standards are discussed in Recommendation 108 in Chapter 6: Integrating Modern Science and Technology.

Cross-referenced Recommendations

Recommendation 108: Support data procurement and analytic systems that enable intelligence-informed decision-making to inform building codes and standards, and promote ignition-resistant construction and defensible space.

Recommendation 4

Provide dedicated funding to evaluate, build and maintain existing federal, state, and local wildfire hazard data sets and identify a use case to refine and, if necessary, expand national datasets.

There is a need to evaluate what data and tools are available to state, local and federal governments, how they are being used, and how they can be expanded, revised, or better integrated for greater efficacy.^x Compatibility of federal and non-federal datasets should be assessed as well. An overarching goal should be the provision of information at the right scale for the intended uses and outcomes, as well as improved coordination and communication between data and platforms at different scales.

Insights: Insurance and Wildfire Hazard Maps

Several of the Commission's conversations explored the relationship between property insurance and wildfire. This topic has become increasingly urgent as insurers have increased premiums or stopped issuing new policies all together in some states. Such actions are due in large part to increasing wildfire risk and loss costs for insurers and reinsurers, in addition to regulatory constraints that limit ability to manage exposure (such as limitations on rate increases) amongst other challenges. Two important points emerged from the Commission's conversations. The first is related to the potential for wildfire risk reduction actions to impact the cost or availability of insurance coverage. Currently, insurance companies determine costs and coverage based on historical claims data that is used to estimate future probable losses. It was made clear during Commission discussions that because much of community wildfire risk – and the potential for future losses due to wildfire – is related to the potential for embers and radiant heat to spread between structures, structural and landscape modifications must be taken at the scale of entire neighborhoods or communities, not only individual parcels. For this reason, the Commission recommends community-scale actions such as hazard disclosures and support for local land use planning and building codes, in addition to the provision of resources that support individual wildfire risk reduction actions to reduce future losses. These actions have the potential to positively impact insurance affordability and availability.

A second takeaway that emerged from the Commission's conversations addressed the development of publicly available wildfire hazard maps. States and insurers have stated that these maps do not influence insurance rates and coverage determinations (Oregon Division of Financial Regulation, 2022). Instead, insurance companies calculate insurance rates and policies using internal, proprietary maps and methodologies, which consider many factors that can change more frequently than hazard maps used for state

and local planning (California Department of Forestry and Fire Protection [CAL FIRE], 2022). Recognizing the important distinctions between insurers' risk insurance maps and public-facing state and local wildfire hazard maps, the Commission recommends federal support for the latter as valuable tools to better inform policymaking around land use policies, building codes, hazard disclosures and other allocation of resources.

Recommendation 5

Require all-hazard risk disclosures for real estate transactions, including both sales of newly constructed homes and existing homes, involving all federally backed mortgages such as Fannie Mae and Freddie Mac.

All-hazard risk disclosures are important tools for communicating wildfire (and other hazard) risk at a broad scale. While flood risk disclosures are a standard requirement for real estate transactions in the majority of states, only a handful of states require that wildfire risk be disclosed to new homebuyers.

Establishing a national requirement for all-hazard risk disclosures as a part of real estate transactions would promote a common level of awareness among buyers, though efforts would still need to be made to reach renters and buyers who do not obtain a federally backed mortgage.^{xi}

The Commission believes that providing hazard information could motivate greater individual responsibility and consideration of risk – including wildfire risk – in decision-making, as well as more proactive risk reduction actions. To this end, Commission members see it as important for all-hazard risk disclosures to be paired with homeowner education about risk reduction implementation and support resources such as activities, funding sources, and technical assistance providers. Disclosures could also provide an opportunity to educate new buyers on the ecological need for fire in a given landscape, including historic fire regimes and management activities such as prescribed fire and cultural burning that may be needed.

Risk Reduction for Structures

During a wildfire, structures can ignite from a number of sources. Embers, discussed above, provide one means of facilitating ignition, as can direct flame contact and heat from nearby flames (Caton et al., 2017; Himoto, 2022). Thus, to meaningfully reduce wildfire risk to structures and communities, current research supports the protection of structures against embers in addition to mitigation actions designed to reduce flame exposure (Insurance Institute for Business & Home Safety, 2021). This includes using ignition-resistant building materials and reducing nearby vegetation (Cohen, 1999, 2000; Hakes et al., 2017; Thomas et al., 2017; Quarles et al., 2010). Eliminating combustible materials, including vegetation, is particularly important in the area extending five feet from the structure (Hedayati et al., 2018).

Costs related to constructing a wildfire-resistant home can vary, with estimated costs in 2022 ranging from approximately \$2,500 to \$25,000 depending on the improvements (Barrett & Quarles, 2022). Costs related to retrofitting existing homes to improve ignition-resistance are also variable, with estimated costs in 2018 ranging from \$370 for vent replacement to over \$20,000 for sheathing and siding (Quarles & Pohl, 2018). Taking such actions to retrofit a structure can be cost-prohibitive for residents, homeowners, and business owners. The impact of individual structures on whole community wildfire risk makes it critical to provide supplementary support for this work. Analysis indicates that replacing wood roofs in areas with wildfire risk will cost at least \$6 billion nationwide (Smith & Hernandez, 2022). While some of the more costly improvements such as replacement of a wood-shake roof with more ignition-resistant materials can provide significant risk reduction, a number of low- to no- cost actions (e.g., removing debris from gutters, installing flame- and ember-resistant vents and openings, relocation of firewood piles, etc.) can also provide meaningful benefits when undertaken and maintained by residents.

While the fact that home ignitions are primarily determined by conditions on private property means that primary responsibility for decreasing risk of individuals home loss lies with property owners (Calkin et al., 2013), it is also important to recognize that risk is shared within communities and by society at large. This is evident with fires burning in the built environment, as individual structure fires can present risk to adjacent and nearby properties (Cohen, 1999 , 2000; Knapp et al., 2021; Pludow & Murray, 2023). While risk reduction actions at a single



Embers generated inside of Insurance Institute for Building & Home Safety's Research Center (Chester County, South Carolina) illustrate the difference in ignitability between bark mulch and wood siding (left) and more ignition-resistant ground covering and siding (right) during exposure to wind-blown embers.

Insurance Institute for Building & Home Safety

property may benefit the property owner, actions at the neighborhood and community scales can bring broader benefits by reducing the likelihood of ember distribution, conflagration, and cross-boundary transmission. Additionally, research has shown that ignitions on private land are the cause of most wildfires that burn across multiple jurisdictions, highlighting the importance of landowner and community engagement in risk mitigation (Downing et al., 2022). Social science research also indicates that residents who take action on their property are more likely to have neighbors who take action as well (Warziniack et al., 2019).

While a number of programs exist that support individual actions to reduce the ignitability of structures, they are not always accessible. The financial and technical resources offered through programs designed to support this work can be limited and most programs, whether at the federal, state, or local level, require financial or in-kind contributions from the recipient. Establishing a Community Wildfire Risk Reduction Program (Recommendation 1) – would address a significant gap in mitigating wildfire risk to the built environment. Such a program dedicated to wildfire risk reduction of homes and neighborhoods – in the form of structural improvements, building codes, site development, and other land use planning measures – would provide a central entry point for communities to effectively access the needed information, funding, and support for long-term resilience planning.

Examples of existing educational initiatives include Firewise USA® and IBHS Wildfire Prepared Home,™ which encourage residential action such as ignition-resistant construction or retrofitting. Other efforts, such as those by local FireSafe Councils, Fire Districts, or non-governmental organizations, also provide technical and financial assistance to residents. These programs are decentralized and vary by region, offering multiple but variable options for residents seeking to reduce their wildfire risk. Some of these programs receive federal support through grant programs or individual agreements. To further encourage these approaches, the Commission made a number of recommendations to support partnerships and collaboration (see Recommendation 126 in Chapter 7: Investing for Tomorrow and Recommendation 139 in Chapter 8: Frameworks for the Future) and to improve the contracts, grants, and agreements processes (see Recommendation 90 in Chapter 5: Building a Comprehensive Workforce).

Recommendation 6

Encourage and reward innovation in the fields of affordable building material design, subdivision design, landscape architecture, and safe and sustainable building practices to create more ignition-resistant structures and communities.

Development comes with benefits and costs. Local officials, particularly planning and zoning officials, have to strike a balance between economic benefits, housing needs, safety, sustainability, equity and other factors. Given the competing demands faced by many communities, it is unlikely that municipalities will stop allowing new construction or rebuilding in fire-prone areas entirely. Additionally, given the extent of wildfire risk, particularly in the western states, some exposure may be unavoidable within existing communities. Existing scientific research, much of which has been encoded in model codes and standards, can provide the baseline for architects, designers, planners, and others to create the kind of certifications, contests, or other incentives that will spur more innovation toward ignition-

resistance and wildfire resilience. The Commission feels engagement of the private sector, through innovation prizes (e.g., XPRIZE) for wildfire-resilient design and construction, or “seal of approval” for ignition-resistant structure designs or subdivision designs would help spur advancement, similar to the current Leadership in Energy and Environmental Design (LEED) green building certification implemented by the US Green Building Council which sets a globally recognized standard for high-performance green buildings (United States Green Building Council, n.d.).

Electric Utilities

Congress tasked the Commission with formulating recommendations to manage electric utility corridors, which are increasingly threatened or directly impacted by wildfire and, critically, can also spark a wildfire.

The overall system of energy generation, transmission and distribution in the United States has been called “aging and complex” by the American Society of Civil Engineers (ASCE) (ASCE, 2023). Thousands of miles of high-voltage transmission lines and millions of miles of lower voltage distribution lines cross the nation, running through multiple jurisdictions. In recent years, wildfires, in addition to hurricanes, heat waves, and winter storms, have increasingly disrupted and exposed vulnerabilities within the electrical grid (ASCE, 2023; Lawson, 2023). Trees and other vegetation along utility corridors can make contact with the energized lines, particularly during periods of high winds, which has caused multiple catastrophic wildfires in recent years. Since 2015, six of the 20 most damaging wildfires in California have been caused by electric infrastructure (Tilden, 2022), including the 2018 Camp Fire which resulted in 85 deaths, destroyed over 18,500 structures, and caused over \$16 billion in losses. High winds and energized electric infrastructure caused one of the two ignitions that contributed to the 2021 Marshall Fire in Colorado, which caused two deaths and destruction or damage of over 1,000 structures (Dougherty & Johnson, 2023).

Given the widespread impact that utility-caused ignitions can have, some utility providers have begun proactively shutting off power during times of high wildfire risk to prevent wildfires. These shut-offs are a valuable tool in reducing wildfire ignition risk but are not a standard practice across all utility providers. De-energizing transmission lines during a wildfire event is also sometimes needed to enable firefighters to use aerial suppression agents or to work safely near powerlines. However, it should be noted that the resulting power outages from these shut-offs, whether undertaken proactively or in response to an ignition, can be impactful, costly, and widespread. One study on proactive shutoffs in California identified approximately 12 million person-days of outages in 2019 (Abatzoglou et al., 2020). During that same year, costs of proactive shutdowns were estimated to be \$10 billion (Wara, 2019). Those medically dependent on consistent power and populations more vulnerable to heat are especially impacted during power loss events.

Wildfires can also damage electrical lines directly, resulting in long-term electrical outages as lines are repaired. Critically, power loss can cause water utility systems to lose pressure (Whelton et al., 2023), significantly impacting drinking water supplies and limiting water available for firefighting (EPA, 2019a).



Wildfire burns near utility lines during the 2019 Kincadee Fire in California.

Kari Greer

Removing or reducing the density or proximity of vegetation adjacent to electrical infrastructure can reduce the potential for wildfires to either cause an ignition or to damage transmission lines. However, there is no uniform or standard set of best practices for permitting risk reduction work in the rights-of-way for many of the utility lines that crisscross the country and pass through multiple federal jurisdictions in addition to other public and private land. Federal land management agencies each have different processes, timelines, and requirements for management of transmission corridors across the lands they administer. State and local governments also have varying approaches to vegetation maintenance adjacent to distribution lines within their jurisdictions. Several states, including California, Oregon, Washington, and Nevada require or incentivize electric utilities to develop plans to guide the preparation for, and mitigation of, fire risk to infrastructure and service provision. However, the variation between state regulations and utilities' development of wildland fire mitigation plans creates an inconsistent environment for utilities, state energy offices, and land management agencies.

While efforts to streamline and systematize risk reduction permitting in utility corridors are ongoing, the Commission saw need for continued efforts in this direction.

Recommendation 7

Congress should consider development of federal standards for electric utility wildland fire mitigation plans and should encourage the adoption of those plans by all transmission and distribution electric utilities.

As noted above, some states require utility wildland fire mitigation plans, but these plans can be inconsistent. The Commission deliberated at length to determine whether wildland fire mitigation plans should be a federal requirement, or their development should be incentivized. In Commission discussions, some members raised concerns about encouraging federal involvement in the face of existing state approaches that may better reflect the state's unique conditions and work with utilities.

Ultimately, the Commission feels the issue warrants further consideration by Congress. Undertaking an initial exploratory process would daylight additional considerations and potential implications of a standardized regulatory approach.

Should Congress decide to proceed with federal standards, the Commission suggests the following:

- Standards should be collaboratively developed by the North American Electric Reliability Cooperation, federal agencies, state energy officials, Tribal and territorial partners, representatives from the Electric Coordinating Council and members of the utilities sector.
- The following core components should be addressed:
 - ◇ Infrastructure maintenance
 - ◇ Infrastructure improvements

- ◇ Requirement for coordination with the state energy office, state wildland fire authority, and community partners
- ◇ Public safety power shutoffs or reactive shutoffs
- ◇ Vegetation management practices
- The standard should tie into operating plan requirements established by other entities including but not limited to land management agencies, state energy offices, and utility commissions and should also include coordination with existing Community Wildfire Protection Plans.

Electric utilities are not homogenous, varying in ownership types and regulatory frameworks (Lawson, 2023).^{xii} The Commission feels that any standard developed should account for these different ownership types and be adjusted based on service area and customer base.

The Commission also identified a broad need to incentivize ignition-resistant improvements to existing utilities infrastructure. Utilities often face extensive permitting processes which functionally limit their ability to improve infrastructure resilience. The Commission felt that wildfire mitigation plans may provide a mechanism to incentivize and expedite ignition-resistant infrastructure improvements. For example, upgrades identified in wildfire mitigation plans could be made eligible for expedited permitting processes or financial incentives. Additionally, increased agency personnel working with electrical utilities could expedite the permitting process to enable utilities to expeditiously install more ignition-resistant infrastructure.

Recommendation 8

Congress should direct agencies to support implementation of consistent rules and processes for federal rights-of-way and develop a guide for states to adopt similar rules and processes.

There should be consistent implementation of a common set of rules and operational processes, including permitting approvals and timelines, across federal agencies for both regular and emergency work in the electric transmission rights-of-way. Extending the width of rights-of-way should be considered, with the inclusion of a “progressive height area” to allow for shorter brush or trees to grow, so long as they would not be able to fall on a power line. While different ecological needs will naturally result in different outcomes across the country, processes could be aligned similarly to those in section 512 of Federal Land Policy and Management Act (43 U.S.C. §1701-1785). Establishing consistent rules and processes while allowing for flexibility will be an important balance to strike. To ensure the longevity of this cross-jurisdictional consistency, the Commission sees value in a framework for ongoing collaboration between agencies.

Recommendation 9

Continue federal investments in energy infrastructure systems at the generation, storage, transmission and distribution levels for reliability and resilience of the whole system.

As wildfires grow in size and severity, both new and existing energy infrastructure systems will need to be developed for greater reliability and resilience to fire. The focus should be on risk assessment and proactive measures to protect infrastructure from an approaching fire, and to reduce the risk of causing a fire or experiencing an outage.

The Grid Resilience State and Tribal Formula Grants program, funded through the IIJA, provides the type of funding envisioned by this recommendation and these investments should be continued.

Investments could include, but should not be limited to:

- Physical equipment, such as wooden poles to metal or other non-flammable materials, improved conductors, and improved insulated lines.
- Software and technology such as risk modeling software, support for improved design work, weather analytics, and remote sensing. See Recommendation 118 in Chapter 6: Integrating Modern Science and Technology for additional information related to remote sensing investments along electric utility corridors.
- Training for employees.
- Ability to do a “controlled islanding” to a section of transmission or distribution systems in a high-risk area so as to avoid affecting more households than necessary. This controlled removal of power in a part of a system has been proven effective in wildfire events (North American Electric Reliability Corporation, 2021).

These investments should be consistent with minimum codes and standards, particularly with respect to energy storage. It may also be appropriate for levels of support to vary based on ownership type, given the differences between, for example, smaller electrical cooperatives and larger investor-owned utilities.

In the Natural Environment

Many landscapes across North America have evolved with fire as a defining and essential ecological process. Naturally occurring wildfires, as well as the intentional use of fire by Indigenous people, have shaped the composition, structure, and function of a wide variety of ecosystems. Native plant and animal species across the continent are not simply adapted to wildfire, they are dependent on it (McLauchlan et al., 2020).

These fire-adapted landscapes have largely been transformed since European settlers removed Indigenous people from their homelands and prohibited their cultural burning practices. Subsequent federal and state policies requiring the suppression of naturally ignited wildfires, as well as widespread timber harvest, have led to an altered forest and rangeland structure and composition that is more susceptible to severe impacts from wildfire (Hessburg et al., 2021; North et al., 2022; Prichard et al., 2021). These changes have led to a loss of wildfire resilience, and – combined with expansion of human development into fire prone areas and the warmer and drier conditions driven by climate change – are leading to ever-more extreme wildfire conditions and increasingly severe impacts across the United States. This includes an eight-fold increase in the amount of high-severity wildfire in forests in the western United States since the mid-1980s as well as changing fire regimes in native grasslands across the nation (Parks & Abatzoglou, 2020; The Nature Conservancy, 2018; Zouhar, 2021).

These conditions have triggered a self-perpetuating feedback loop, as fire exclusion leads to further fuels buildup which perpetuates risk of extreme wildfire events. This feedback loop cannot be broken without improved wildfire and land management in our fire-adapted landscapes. Fortunately, forest and rangeland management and fuel reduction treatments can play a significant role in mitigating and managing the risk of wildfire.

There is general agreement within the forest ecology research community on the value of actions on the landscapes, when done effectively and in the right place, in reducing the risk of uncharacteristically severe wildfire in forests in much of the United States, even in extreme weather conditions (Hessburg et al., 2021; Jain et al., 2021; Prichard et al., 2021). Fuel treatments reduce risk not by stopping the wildfire's spread, but by moderating fire behavior both in and outside the treatment area and allowing for more response options (Prichard et al., 2021). Treatments can be broadly categorized as thinning, which includes commercial timber harvest, noncommercial thinning, and mastication; burning, which includes the use of prescribed fire, cultural burning, and wildfire managed for resource objectives; or a combination of the two (Kalies & Yokum Kent, 2016; Prichard et al., 2021). Grazing and weed eradication can play a similar role in grass and shrub environments by reducing fuels, but also by limiting the spread of highly flammable invasive grasses (Davies et al., 2022). Proactive forest and rangeland management and ecologically appropriate risk reduction treatments also improve watershed resilience and increase water availability in some landscapes (del Campo et al., 2022).

Historically, in the western United States, emphasis has been placed on mechanical treatments, which are often easier for managers to implement. However, research continues to indicate that effective treatment for wildfire risk reduction in many North American forests requires the reintroduction of beneficial fire (Holland et al., 2022; Prichard et al., 2021; United States Forest Service [USFS], 2012; Vaillant & Reinhardt, 2017). Mechanical treatments can also come with substantial fiscal and logistical limitations, further underscoring the necessity of utilizing ecologically beneficial fire as a core component of wildfire mitigation and land restoration when appropriate (Hartsough et al., 2008; North et al., 2015; North et al., 2021; Stephens et al., 2016). Regardless of treatment type, planning activities that identify fuel treatment placement, align broad land management objectives, and more effectively engage the local community are essential.

While pre-fire mitigation treatments in the natural environment are already in use by land managers, the Commission sees the need to dramatically increase the landscape-scale use

of prescribed fire and cultural burning, as well as continue the use of mechanical thinning and harvest and targeted grazing. This requires strategic landscape-scale planning and implementation at a speed and scale commensurate with the need. Accomplishment of such work also should be done in partnership and across all ownership boundaries to address areas of highest need. Finally, new performance metrics are needed to track and incentivize this work and its maintenance over time.

Insights: Landscapes and Ecosystems

The Infrastructure Investment and Jobs Act, the enabling statute of the Commission, calls for recommendations to specify relevant “forest type” and “vegetation type,” recognizing that the efficacy and appropriateness of a specific treatment is dependent on the ecosystem and vegetation cover of a given area, a policy that is echoed by the IJJA itself (e.g., 16 U.S.C. § 6592(g)(3), (6)).

Broadly speaking, Commission members feel it is important to note that all recommendations should carry the stipulation that any given treatment should be specific to the ecosystem. At a macro scale, increased use of beneficial fire, mechanical treatments, and targeted grazing are needed in many landscapes, but the Commission acknowledges that not all treatments are appropriate in all areas. Local analysis and decision-making are critical to designing appropriate treatments in specific locations and Commission recommendations do not presume to override this locally determined need.

Some treatments may not be appropriate for ecological reasons and not all landscapes are adapted to fire. As climate conditions continue to warm and invasive species continue to spread, many landscapes that had rarely or never experienced fire as a part of the natural process are more at risk of experiencing destructive wildfire. As became painfully clear during the work of the Commission, locations like the Hawaiian and Pacific Islands face an increasing threat of wildfire (Trauernicht et al., 2015). And areas like the forests of the Great Lakes are likely to see uncharacteristic wildfire in the coming decades (Gao et al., 2021).

Use of Beneficial Fire

In fire-adapted ecosystems, **it is critical to dramatically increase both the frequency and scope of beneficial fire to mitigate wildfire impacts to both landscapes and communities.** In addition to this wildfire mitigation function, the landscape-scale use of beneficial fire is necessary for improving ecosystem structure and functions, remediating the effects of decades of fire exclusion, restoring watersheds, and respecting Tribal sovereignty. The deficit of naturally ignited and human-managed fire has already brought deep and long-lasting negative consequences, and the cost of continued inaction – of failing to return fire to the landscape – is high.

Despite the ecological and cultural benefits and a strong record of success, the ability to undertake prescribed and cultural burning faces numerous challenges and will require engagement by multiple sectors of society. Private sector and non-governmental organizations are needed, in addition to federal land management agencies. Native American Tribes, as the first stewards of fire on our landscapes, also have critical roles to play in fostering increased beneficial fire. Different organizations and entities have different needs and increasing the use of beneficial fire will require all elements of society to be both individually empowered and to work together, as is true in addressing wildfire risk writ large (Davis et al., 2021).

While use of fire does carry some risk, in the vast majority of instances, prescribed and cultural burning are successfully kept within desired areas and parameters. Escape rates from both practices are extremely low, and even when fires do escape planned containment lines, they rarely cause significant damage. As an example, the Wildland Fire Lessons Learned Center assessed data from 2012, during which federal agencies conducted 16,626 prescribed burns on nearly 2 million acres of public land. The center documented 133 escaped fires or a 0.8 percent escape rate (Weir et al., 2020). However, the Commission recognizes that although escapes



Prescribed fire mission by South Florida Fire and Aviation (SFFA). SFFA has one of the largest and most active aviation programs within the National Park Service.

South Florida Fire Academy

that cause harm are rare, they can have significant and dire impacts, as seen in New Mexico in 2022. Improved predictive modeling is important to avoid such unintended consequences (see Chapter 6: Integrating Modern Science and Technology).

Prescribed and cultural burn practitioners, particularly those in the private and non-governmental sectors, perceive and potentially face significant legal risk when implementing prescribed fire and cultural burning due to current liability laws, limited legal protections, and limited access to insurance (Clark et al., 2022; Huber-Stearns et al., 2023b; Shively, 2022). Recent assessments have found that fear of legal liability is a widely held concern among practitioners because of the potential for damages from an escaped burn or smoke (Shively, 2022; Weir et al., 2019). Important to note is that this concern may be artificially magnified beyond the actual likelihood of loss by some practitioners, in part due to confusion about the legal exposure they face. Federal employees conducting prescribed burns are broadly protected from liability under the Federal Tort Claims Act (FTCA) (28 U.S.C. § 2671-2680). This act places the burden of compensation for permissible tort damages caused by federal employees (when those damages are allowed at all) on the United States government (Lewis, 2019). However, there is a lack of legal clarity about whether such protections are afforded to non-federal entities conducting burns on federal lands, including non-governmental organizations (Shively et al., 2022), private contractors, or Tribes conducting burns without contracts or compacts through the Indian Self-Determination and Education Assistance Act of 1975 (Pub. L. No. 93-638 (1975)) better known as the “638 Authority”.

In the face of this uncertainty, many non-governmental practitioners (and even some federal employees acting out of an abundance of caution) have sought private prescribed fire insurance policies. Such private policies have become difficult to obtain though, due to growing concerns about increasing wildfire risk and the potential for significant losses. Only a handful of organizations now have coverage, and some who do not are hesitant to continue to practice (Shively et al., 2022). However, the same increasing wildfire risk that is resulting in reduced insurance availability in the private market will only be addressed through more prescribed burning. There is a need for government intervention to help close this financial protection gap and shift the current trajectory.

Amongst agency land managers, barriers to increased use of prescribed fire include a lack of incentives, leadership support, adequate funding, and capacity (Schultz, McCaffrey, & Huber-Stearns, 2019). Agency performance measures are one means by which priorities are identified and incentivized within agencies (Radin, 2006; Schultz et al., 2018). Updated performance measures that better reflect prescribed fire as a priority may help address the issue of internal incentives. Furthermore, updated strategic plans serve an important role in prioritizing and expanding the use of prescribed fire (USFS, 2023a). Indeed, a recent Forest Service review of prescribed fire strategy (2023a) noted the need for improved resource ordering for prescribed fire – a need the Commission also identified.

Management of beneficial fire in the United States (and elsewhere) began with Indigenous people and communities (Lake, 2017). Yet Native American Tribes face significant impediments to engaging in both prescribed fire and cultural burning (Clark et al., 2022). Some of these impediments are shared problems, including limited liability protections, but others are unique to Tribes, particularly when engaging in cultural burning.

Cultural burning, though not currently defined in federal law, refers to the Indigenous practice of lighting fires to produce a desired cultural service, be it promotion of medicinal plants, fiber production, first foods, or for ceremony (Kimmerer & Lake; 2001; National Park Service [NPS], 2023). Use of cultural burning can be quite extensive in purpose and scope and can encompass maintenance of travel corridors, wildlife habitat improvement, water stewardship, pest control, or other activities (Clark et al., 2022). As noted above, both western science and Indigenous Knowledge demonstrate that cultural burning played a fundamental role in establishing and maintaining the fire-dependent ecosystems that characterize the western United States today.

However, the current federal legal framework does not explicitly recognize or define cultural burning, which has led to the default regulation of cultural burning as a prescribed burn, although this has started to change at a state level. California, for instance, has defined cultural burning in state law (California Resources Code § 3333.8), authorized natural resources management agencies to coordinate with Tribes on cultural burning activities and made cultural burning eligible for coverage in a claims fund (California S.B. 926 (2022); Schelenz, 2022).

While cultural burning may result in similar outcomes to prescribed burning, such as wildfire risk reduction, this practice has several distinguishing features. For one, cultural burns may be conducted by a diverse array of Tribal individuals, including those without the formal certification generally required for prescribed burns. Cultural burning also tends to be less formal, at least from a western perspective, and more “integrative of holistic knowledge of place to guide the timing and implementation” of fire (Clark et al., 2022, p. 3). Another key distinction between the two practices is that the authority for Tribal cultural burning is rooted in Tribal law and Tribal sovereignty. Prescribed fire, on the other hand, is generally used to implement federal, state, or local land management programs and tends to be used to accomplish fuels management objectives, though some Tribes use prescribed fire as well.

The Commission found that a number of policy changes could lead to an increase in the proactive use of prescribed fire and cultural burning. Practitioners of all types would benefit from greater and clarified protection from tort claims. Federal agencies would benefit from increased emphasis and accountability regarding the use of prescribed fire and a flexible resource ordering approach like that used for incident response. Finally, Tribal fire programs and cultural burning should be more widely recognized, empowered, and respected.

Recommendation 10

Congress should advance legislation to support a compensation or claims fund for burn damages to third parties that can quickly provide financial relief in instances when burn practitioners adhere to identified best practices.

Practitioners have named the potential financial implications associated with prescribed fire liability and risk as a primary hurdle in the ability to scale up prescribed and cultural burns. Furthermore, according to a recent survey, most non-governmental organizations reported that they would increase their prescribed fire implementation if costs for insurance premiums and deductibles were reduced (Huber-Stearns et al., 2023b) A federally supported compensation or claims fund would help mitigate some of these financial concerns and

allow for injured parties to recover damages from federal actions that would otherwise go uncompensated due to the Federal Tort Claims Act. This claims fund should be designed to complement and bridge, not replace, traditional insurance, and should further require burn practitioners adhere to identified best practices to be eligible for a burn to received coverage. It should be applicable to all prescribed fire practitioners without additional burn certification requirements beyond those already required by state and federal law and policy and should cover cultural fire practitioners with special accommodations to ensure that cultural practices and Tribal sovereignty are respected. Such a fund should not be contingent on any new national-scale requirements or policies related to prescribed burning qualifications. This fund should also provide financial support to impacted burn practitioners facing potential legal exposure, when identified best practices were adhered to.

Potential mechanics for implementing this fund include modeling the fund on the National Vaccine Injury Compensation Program, the September 11th Victim Compensation Fund, California's new Prescribed Fire Liability Pilot Program, or the Oklahoma Prescribed Fire Indemnity Fund. Congress could also consider federal financial support for the establishment of individual state-chartered compensation funds or incentivizing states and others to support a federally chartered fund.

Recommendation 11

Congress should consider and clarify the extent to which the Federal Tort Claims Act provides protection to Tribes and non-federal cooperators burning on federal lands.

Tribes and non-federal cooperators that participate in prescribed and cultural burns on federal lands usually enter into cooperative burn agreements with federal agencies. These agreements typically clarify liability between partners; in most cases, each party is responsible for their own protections. However, these agreements do not address the topic of liability consistently (Shively et al., 2022). Liability-related concerns and uncertainties, along with the challenges in obtaining private insurance, are a widespread deterrent for non-federal entity involvement in prescribed and cultural burns on federally administered lands even though federal agencies are increasingly looking to partners for added capacity. Those concerns could be at least partially mitigated through a determination of whether non-federal partners are covered by the Federal Tort Claims Act, which grants broad protections to federal employees conducting prescribed burns. It is the view of the Commission that it may be appropriate to extend protections to non-federal partners cooperatively burning^{xiii} on federal land under certain conditions, such as adhering to minimum best practices and safety standards. Indeed, Congress has already extended tort coverage to Tribes burning or undertaking other activities under the 638 Authority (USFS, 2020c).

Recommendation 12

Federal agencies should work with Tribes, states, and local partners to develop a strategic plan for the implementation of prescribed fire at a national scale.

A national strategic plan, with specific goals and strategies for increasing the use of prescribed fire, would help create the incentive and the direction necessary for addressing the current deficit in using this practice. In particular, the Secretaries of Agriculture and the Interior should be instructed to develop a 10-year strategic plan for prescribed fire at a national level.^{xiv} Such a plan should: (1) be developed by a panel of agency and non-agency scientists, managers, and other experts; (2) identify ecologically appropriate targets for prescribed fire use at a regional scale; (3) assess current scope and scale of prescribed fire use; (4) include a plan for annual monitoring and report on use of prescribed fire relative to targets and to assess its impacts and effectiveness; and (5) identify barriers and enabling conditions, such as workforce and state and federal policies, to achieving the scope and scale of prescribed fire deemed necessary through the process of defining targets.

The development of such a plan should account for variation in ecosystems, fire regimes, and other factors, as well as the different reasons for undertaking prescribed fire, including fuels reduction and habitat management. Plans should further support and elevate the incorporation of Indigenous Knowledge into fire management.

While other treatments such as mechanical thinning are important, the Commission sees a need for a specific prescribed fire plan given its underutilization in relation to other activities and the need to dramatically increase its use in fire-adapted ecosystems (Larson et al., 2022). Agencies should also consider developing strategic plans that encompass the full scope of fuels management activities, given that lands often require multiple types of treatments.

Recommendation 13

Establish a prescribed fire target based on natural fire regimes as determined locally.

Though federal land management agencies receive funding for prescribed fire,^{xv} neither DOI nor the Forest Service have a specific prescribed fire target, making it difficult to track these agencies' use of and success with this tool (Shultz et al., 2022). While the Commission ultimately supports moving towards more holistic outcome-based performance measures, prescribed fire may not be incentivized to the same extent as other land management activities if no annual outcome goal is established. Creating a dedicated target may serve as a bridge to outcomes-based metrics and encourage and track the use of prescribed fire as a critical restoration tool.

A prescribed fire target should be based on fire regimes and fire return intervals and, given that fire regimes vary by area and ecosystem, should be determined locally.^{xvi} However, consideration should be given for climate change, invasive species, and other factors

altering historic fire regimes (Brooks et al., 2004; Enright et al., 2015; Halofsky, Peterson, & Harvey, 2020). Indigenous Knowledge and the cultural use of fire are key drivers in natural fire regimes and therefore must be acknowledged and addressed in the development of targets. Local input and knowledge should also be considered. More generally, the Commission encourages an inclusive process to establish locally meaningful targets and goals. Finally, prescribed fire targets should be developed and utilized in the context of other performance measures that together drive toward key wildfire mitigation and ecosystem resilience outcomes.

While prescribed fire has benefits for community protection, this recommendation is primarily intended to achieve restoration and resilience goals, which in many ecosystems necessitate the use of fire at much larger scales.

Recommendation 14

Congress should instruct the agencies to develop the necessary administrative systems to allow resource ordering for prescribed fire to be as seamless as it is for wildfire response.

The coordination and mobilization of management and suppression resources for wildfire response has long relied on an effective resource ordering system which allows entities to rapidly request resources from one another with confidence that costs will be settled after the need has been met and the incident has been concluded. However, resource ordering for prescribed fire has historically not had equivalent ease of use, often requiring individual agreements between agencies and other entities such as non-governmental organizations and fire departments. Agreement development is time-consuming and has resulted in less resource availability for prescribed burns.

To effectively increase the use of prescribed fire, resource deployment needs the same level of integration and ease of access as exists for wildfire response. This change should be undertaken at the agency level and should include the ability to utilize existing resource ordering systems. This recommendation was validated by the Forest Service's June 2023 "National Prescribed Fire Resource Mobilization Strategy," which calls for agency supervisors to allow "willing, qualified employees to be available in the Interagency Resource Ordering Capability system for prescribed fire assignments," among other changes (USFS, 2023a). In conjunction with creating an easier, expedited pipeline to personnel and equipment for prescribed fire, Commission members emphasize the need for adequate funding to pay for those resources. This recommendation does not intend for prescribed fire to draw on suppression funds; only to have the same ease of resource ordering and reimbursement.

Recommendation 15

Congress should require the Bureau of Indian Affairs to acknowledge that federally recognized Tribes may develop fire programs on Tribal trust lands under approved Tribal laws, regulations and policy, or other Tribal decision-making processes.

Fire management on Tribal trust lands would be improved if Tribes had more autonomy to apply Tribal laws, policies, and processes on Tribal trust lands, rather than being required to follow Bureau of Indian Affairs (BIA) processes for burn plans and other fire management documents. Increased autonomy and flexibility would both facilitate increased use of beneficial fire by Tribes on trust lands under their jurisdiction and further Tribal sovereignty. Tribally-developed programs authorized under this recommendation should include, among other items, Tribally-developed planning documents, determination of necessary qualifications for participants implementing burns, and mechanisms for approval.

Maximizing Tribal choice with regards to BIA involvement in Tribal fire management programs should be retained to respect the principles of Tribal self-governance, self-determination, and the federal trust responsibility. Tribes should retain flexibility to choose to contract or compact for all or portions of their fire management programs pursuant to the Indian Self-Determination and Education Assistance Act and the Indian Trust Asset Reform Act (ITARA) authorities. Tribes should retain flexibility to elect for BIA to provide direct services for the wildfire management program or to rely on some combination of BIA support to meet their needs.

While this change would further enhance the ability of Tribes to play an expanded role in fire risk reduction, questions about liability for escaped burns or other first, second, and third-party damages may remain. However, issues of liability may be addressed if coupled with previous recommendations (Recommendations 10 and 11) to support a compensation or claims fund for burn damages to third parties.

Recommendation 16

Congress should acknowledge Tribal cultural burning in federal law, ensure it is not confused with prescribed fire, and grant agencies the authority to coordinate with Tribes on the conduct of Tribal cultural burning on federally administered lands.

Congress should ensure agencies acknowledge the ceremonial and spiritual aspects of cultural use of fire and grant federal agencies the authority to coordinate with Tribes regarding Tribal cultural burning on federally administered lands. Implementing this recommendation would require an agreement or other mechanism to be developed between the relevant agency and Tribe to establish a framework for how to enable cultural burning, including an agreed-upon process for coordination, communication, and managing risk. The agreement would outline the conditions (i.e., general locations, vegetation characteristics,

seasonality, extent, notification procedures, etc.) under which cultural burning would occur. Agency authority to enter into agreements regarding cultural burning should be compliant with federal law. Such agreements or mechanisms should be programmatic; cultural burning would be carried out as an ongoing activity, rather than requiring renegotiation on a burn-by-burn basis. The Commission also feel it is important that such agreements are recognized as being based on a sovereign-to-sovereign relationship between a Tribe and the federal government.

Mitigation Through Mechanical Treatments

Forest and rangeland management and fuel reduction treatments can play a role in mitigating and managing the risk of wildfire and, more generally, creating resilient ecological conditions (Johnston et al., 2021). Mechanical thinning has the potential to reduce risk and offset costs while also bolstering local economies. In range ecosystems, targeted grazing has been proposed as a more financially sustainable method of creating fuel breaks. **Together, revenue-generating forest and rangeland management and the development of markets for treatment byproducts offers an opportunity to offset costs, as does the commercialization of byproducts of ecological restoration.** This is critical given that fire risk reduction treatments and maintenance carry financial costs and are vulnerable to ongoing appropriations processes.

Where environmentally appropriate and economically feasible, mechanical thinning projects – the removal of trees and brush using equipment and crews – can help reduce fire risk, restore watershed integrity, and allow remaining trees to become older and more resilient (Hessburg et al., 2021; Johnston et al., 2021). In some areas, mechanical treatments may be a necessary first step to prepare for the reintroduction of beneficial fire or may provide benefits even absent the reintroduction of fire (USFS n.d.c.). In cases where thinning involves the commercial harvest of trees for use in the wood products industry, this work can serve to generate revenue that can help to offset costs. Mechanical fuels reduction and forest restoration work can also generate substantial amounts of biomass, such as small diameter wood and slash (e.g., branches, bark, and treetops) that is generally considered unprofitable by the forest products industry. Without commercial demand, this material often gets left on the landscape after fuels work is complete, which, in some ecosystems, can increase wildfire hazard in subsequent years.

Nationwide, a relatively small portion of the forested acreage in need of fuels reduction treatments is viable for commercial treatments (i.e., treatments that would produce positive net value without additional investments) based on existing market values, landscape characteristics, industrial demand, availability of subsidies, agency policies, and other factors (North et al., 2021).^{xvii} Instead, many areas that are a high-priority for fuels reduction treatments are inoperable or dominated by low-to-no-value trees and other vegetation (Hartsough et al., 2008; North et al., 2015; Stephens et al., 2016). In the face of these conditions, adequate and sustained federal appropriations are, and will continue to be, essential to achieve treatment activities at the locations and scales necessary to effectively mitigate unwanted, high-severity fire.



A masticator prepares to remove hazardous fuels in Mill Gulch, Colorado, 2021.

Glenda Torres, Bureau of Land Management

Given the substantial costs of fuels reduction treatments, market-based strategies, including the utilization of commercial byproducts and the commercialization of byproducts, must also be a part of the solution. In forest ecosystems, developing commercial wood processing industries that utilize materials from fuels reduction and ecological restoration projects can defray the costs of this work and incentivize the removal of woody byproducts that are usually left on the landscape due to lack of viable markets. To ensure these commercial wood processing facilities are able to acquire financing, maintain operations, and remain economically viable, they must have a sustainable, dependable source of forest products.

Even with expanded markets, newly developed products, and support for industry however, fuels reduction projects are unlikely to ever be cost-positive at a broad, national scale. As such, there will be a persistent need for both sustained federal investments and support for market-based approaches.

Recommendation 17

Invest in fuels reduction treatments.

Effectively addressing the current backlog of fuels reduction treatments (as well as the ongoing maintenance of those treatments) requires investments at an unprecedented scale. The Forest Service alone has set a goal of using thinning and beneficial fire to treat 20 million acres of national forest land and to support the treatment of 30 million acres of other federal, state, Tribal, and private lands over the next decade in order to mitigate wildfire

hazard in the highest priority landscapes (USFS, 2022c). DOI has also identified needs to implement more active management work to maintain past treatments and address additional areas to reduce wildfire risk and improve wildfire resilience (United States Department of the Interior [DOI], 2022). This potentially amounts to enormous costs, with estimates for prescribed fire ranging from \$125 to \$489 per acre and mechanical thinning ranging from \$700 to more than \$2,000 per acre (CBO, 2022). In addition to a scaling up of investments to meet federal lands fuels reduction needs, Congress should work with states and other partners to provide and incentivize funding for treatments on other jurisdictions to effectively address landscape-scale approaches.

While costly, it should be underscored that investing in proactive fuels reduction activities has potential to mitigate the even higher costs that result from wildfire. Fuels reduction can be thought of as a waste disposal stream: possessing some economic value but ultimately a service we should be willing to pay for. Put another way, spending on fuels reduction treatments are investments that help avoid future wildfire-driven costs. As noted in previous sections, programs that deploy fuels reduction funding should prioritize accessibility, offering cost-share options and match waivers as needed and appropriate.

Recommendation 18

Congress should support and expand the Collaborative Forest Landscape Restoration Program.

The Collaborative Forest Landscape Restoration Program (CFLRP) is a leading program for catalyzing collaboratively driven ecosystem restoration projects at scale. Not only does the program provide an influx of funding for the implementation of critical forest and watershed restoration projects, it also explicitly requires collaboratively developed project proposals and multi-party monitoring, the latter of which facilitates accountability and opportunities for adaptive management. Through these design elements, CFLRP serves as a highly successful model for how federal programs can institutionalize collaborative approaches and be more responsive to local community needs and desires. The Commission notes that the program should, at a minimum, receive appropriations for the full authorized amount and should potentially be increased.

As noted in the discussion of community water supplies in the following chapter (see Recommendation 35 in Chapter 2: Protecting Public Health), the Commission also saw opportunities to expand CFLRP to be more inclusive of watershed protection, without creating additional requirements. Other members noted the value of a CFLRP equivalent or expansion focused on prescribed fire.

Recommendation 19

Congress should invest in wood processing facilities and the wood utilization sector more generally.

In vegetation management projects, trees, and parts of trees (e.g., branches and treetops) that cannot be used for commercial purposes may be left behind on the landscape. This material can exacerbate wildfire intensity if a fire occurs in the area (Prichard et al., 2021). Disposal strategies such as open pile burning may degrade air quality through smoke production and release carbon that contributes to climate change.

The wood processing industry, including firewood producers, pallet mills, sawmills, or biomass power facilities, have potential to utilize and produce value from the byproducts of restoration, defraying the overall costs of fuels reduction, providing viable market outlets for material that otherwise would be uneconomic to remove, and helping address air quality and climate concerns. However, the Commission believed that industry may be hindered by a lack of private sector investment in infrastructure related to forest products harvest, manufacturing, and utilization. Long-term federal investment and commitment is needed in this realm to help reattract private industry and funding. Such long-term funding is particularly needed to expand and maintain the necessary workforce for wood processing (see Recommendation 90 in Chapter 5: Building a Comprehensive Workforce).

The Commission put forward several potential mechanisms for advancing that aim:

- Conduct an inventory of existing sawmills and biomass utilization facilities compared against high-risk areas to determine regions that do not currently have a sawmill or are in need of additional wood processing infrastructure or capacity.
- Consider cost share programs between the federal government and states to incentivize small forest products businesses.
- Appropriate seed funding for new forest products infrastructure.
- Encourage long-term wood supply contracts to, for instance, promote the full utilization of existing stewardship contract and agreement authorities with term-lengths of up to 20 years.
- Develop a federal program to secure or lease land for new mill capacity.
- Enhance coordination between U.S. Department of Agriculture (USDA) Rural Development and the Forest Service to increase the commercial infrastructure needed to support mechanical treatments.
- Use the federal tax code to incentivize investments in forest product harvest and utilization. This might include production or investment tax credits for renewable energy generation, accelerated depreciation of harvest equipment, or manufacturing plant investments.
- Provide Renewable Identification Numbers (RINs) credit for aviation fuel, renewable natural gas, and other products made from biomass on public and private lands.

Congressional action would be required to extend RINs Credit to include the use of federal feedstock.

- Design programs and policies to incentivize utilization of excess biomass, focusing on newer and cleaner technologies that can effectively process and utilize woody material generated by wildfire resilience activities.
- Establish incentives and tools for uses of woody material that sequester carbon, release less emissions than open pile burning, or replace fossil fuel combustion and result in relatively lower emissions.
- Provide incentives or direct support for the transportation of woody biomass to regional facilities.

In general, target areas for investment could include manufactured wood products such as mass timber, fossil fuel replacements like renewable natural gas or sustainable aviation fuel, and traditional wood products like dimensional lumber. Regardless of the mechanism used, federal efforts should aim to incentivize wood utilization at the community scale and at appropriate ecological scales of need. Additionally, it is the Commission's desire that federal investment, as much as possible, increases local community benefit from the value of biomass through, for example, incentivizing local utilization.

Recommendation 20

Fund more research and pilot projects for biofuels and biomass utilization technologies and opportunities through a new collaboration between the Forest Service Research & Development and the Department of Energy.

Research and innovation have the potential to lead to economically viable uses for biomass generated by forest and rangeland projects. Boosting commercial demand and utilization for otherwise low-value biofuels and biomass could help improve the overall financial outlook for mechanical fuels reduction projects.

To this end, there is a need for additional federal investment in research, initial pilot projects, and commercialization strategies, which are often critical for new biomass utilization technologies to reach commercial viability. The Department of Energy (DOE) and the Forest Service's Research & Development (R&D) arm are well-positioned to work cooperatively on this endeavor. For example, building upon wood product innovations and economic analyses from the Forest Service, DOE biofuels funding could support appropriately scaled biomass utilization facilities. Universities can also support this work and are already frequent partners with Forest Service R&D.

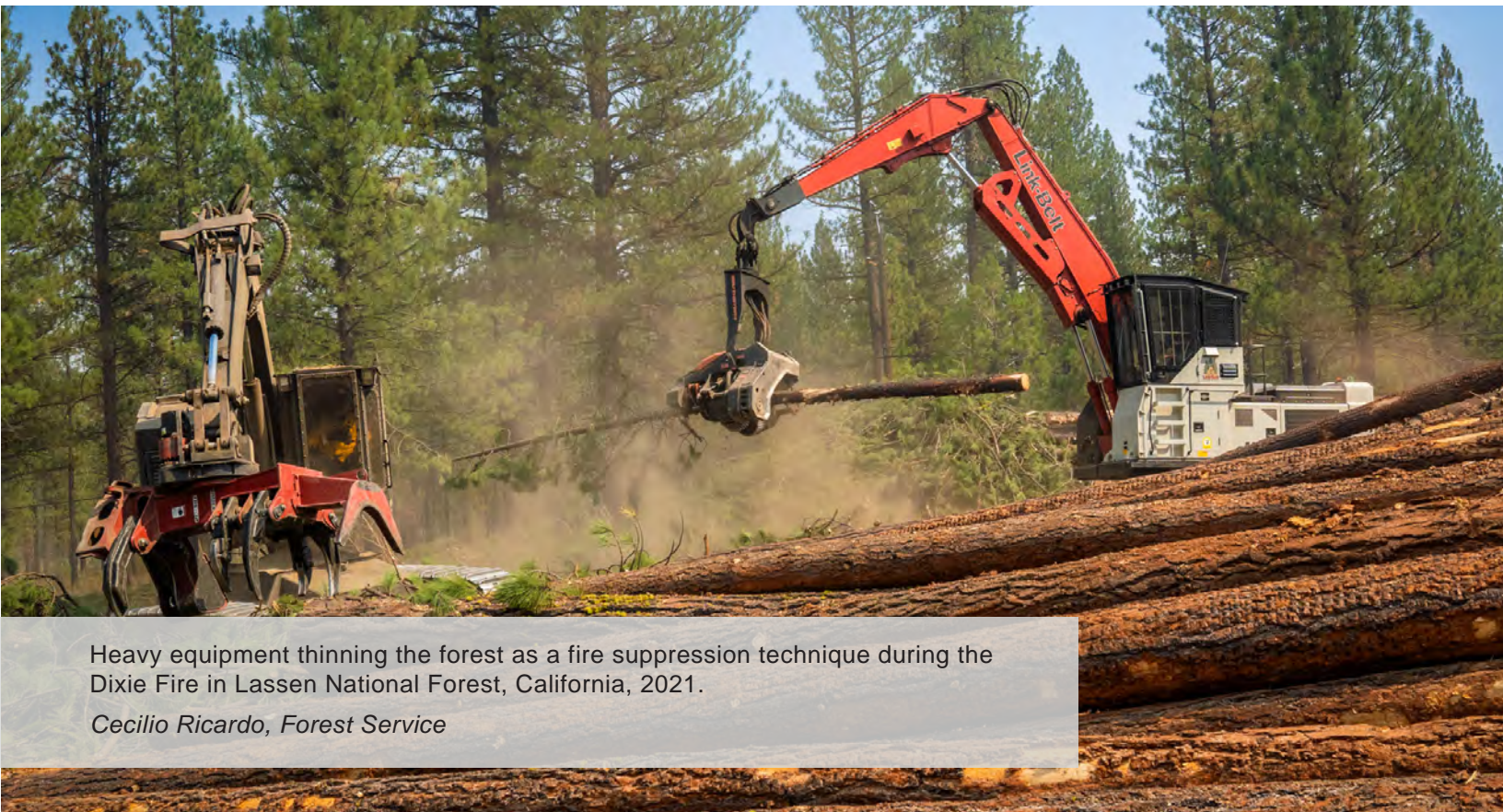
Other mechanisms for advancing this recommendation include supporting the analytical work needed to establish biomass facilities and expanding DOE funding to support bioenergy with carbon capture and storage, biochar production, and cogeneration using waste biomass from fuels reduction treatments. The existing Biomass Research and Development Initiative could also support this effort.^{xviii}

Recommendation 21

Incentivize the adoption of new technologies and processing systems to produce value-added, and demand-driven innovative wood products.

When biomass utilization technologies become available for commercial use, there is also a role for the federal government to support their broader adoption. This support could take the form of subsidies to mechanical treatments or the use and authorization of longer-term contracts in order to generate longer-term supply of harvestable timber that is ecologically appropriate and aligned with wildfire risk reduction. Pilot projects in particular should be emphasized.

Potential programs and strategies that may merit additional federal support in this arena include the Forest Service's Wood Products Infrastructure Assistance grant program, Community Wood Energy and Wood Innovation Grant program, and Wood Innovations Grant program. In addition to supporting these programs, there is a need to support scaling up infrastructure innovations from initial pilots to commercial application.



Heavy equipment thinning the forest as a fire suppression technique during the Dixie Fire in Lassen National Forest, California, 2021.

Cecilio Ricardo, Forest Service



The Ventura Fire Department uses goats for flash grazing on the edge of a community.
Ventura Fire Department

Mitigation Through Grazing

While rangelands are unique from forests in many ways, wildfire plays an integral role in both of these ecosystem types. The grazing of livestock — including cattle, goats, and sheep — can play an important role in the health of rangelands and the way fire behaves on those landscapes. Grazing practices can change the dynamic of rangeland impacted by invasive grasses, for example, and have been found to improve native bunch grass survival when wildfire does occur (Ratcliff et al., 2022).

Grazing that aligns with landscape conditions and management objectives can also support wildfire mitigation by reducing fine fuels (e.g., grasses and shrubs) that ignite easily and carry and spread fire faster than larger fuels. Grazing can decrease fire intensity, thereby reducing damage to rangelands while improving firefighting conditions (Davies et al., 2022)

In some circumstances, increased speed and flexibility of grazing permits may be used to improve efficacy of wildfire mitigation treatments. Temporary non-renewable permits can provide that flexibility and have long been used to allow permittees to take advantage of years of high forage production. However, a more streamlined process is needed to enable permits to be more rapidly issued and changed, allowing permittees to quickly adjust to conditions on the ground. Yet another consideration is the interaction between grazing and the beneficial use of fire, given that the fine fuels utilized by livestock are also necessary to carry fire when it is desired for landscape health. Grazing should not be considered a substitute for beneficial fire, though in certain cases it can be used in conjunction with fire.

These potential benefits notwithstanding, grazing can also have detrimental effects from both an ecological and a fuels management standpoint (Davies et al., 2022). This activity must therefore be applied strategically and best practices for individual landscapes must be taken into consideration, including practices related to stocking rate, kind and type of animals, and season of use.

Recommendation 22

Manage fine fuels and shrubs through the expanded use of flexible, targeted grazing when it aligns with wildfire impact reduction objectives and desired environmental conditions and landscape goals in a specific ecological system.

Strategies for facilitating the use of grazing for wildfire mitigation benefit could include increased staffing, flexible permitting, expanded federal authorities, and new technologies. Specifically, options include:

- Address internal agency trends such as high turnover among staff that leads to loss of local knowledge and more centralized processes that deprive regional rangeland managers of the necessary authorities to address local areas conditions and needs.
- Create additional flexibility in, and speed up timelines for, permits. While statutory authority exists for temporary nonrenewable animal unit months (commonly known as “AUMs”),^{xix} Commission members reported that agencies are not using it or are issuing permits too slowly to be effective, given the realities of seasonal changes in forage and snow.
- Improve the flexibility, accessibility, usability, and responsiveness of temporary non-renewable permit applications.
- Expand use of existing Forest Service and Bureau of Land Management (BLM) authorities and create new authorities or processes to implement livestock grazing for fine fuel reduction that is responsive to dynamic fuel loading in space and time, and flexible enough from a process standpoint to be impactful in a timely fashion.
- Consider increasing the use of remote sensing to improve targeted grazing, in part through the use of virtual fencing. These technologies will initially require financial support but may later lead to cost savings by reducing the need to build and maintain physical fences.

Recommendation 23

Federal agencies should expand the use of existing authorities and develop new, nimble ways to apply targeted, off-season grazing to treat invasive annual grasses on landscapes to reduce the role these invasives play in the uncharacteristic frequency and severity of wildfire, thus helping to restore ecosystem function.

The spread of invasive annual plant species in grassland ecosystems has transformed fire regimes and altered habitat for key species (Fusco et al., 2019). Overgrazing during the growing season can perpetuate this trend by decreasing native perennial grasses, leading to subsequent dominance by invasive annual grasses that significantly contribute to increased wildfire risk. However, targeted off-season grazing, or grazing which occurs outside of typical permitted grazing seasons, can move plant systems away from invasive annuals and toward native perennial vegetation (Davies, et al., 2022).

Greater flexibility should be afforded to permittees to enable the increased utilization of off-season grazing to reduce invasive annual grasses. Effective treatment may require a greater number of AUMs than authorized under the permittee’s current grazing permit. Tools for operationalizing this recommendation could include “emergency” authorizations for areas with immediate and/or emerging needs as well as strategic deployment of grazing for fine fuels management at a larger scale.

There may also be a role for other treatments besides grazing to address invasive annual grasses, such as use of sterile annual grasses, herbicides, and other approaches. Fuel breaks are another successful approach to reduce wildfire risk in areas invaded by flammable invasive grasses (Maestas et al., 2016; Shinneman et al., 2018). The Commission did not, however, reach agreement on the use of other treatments. Many members saw value in practitioners having a number of different treatment options at their disposal, but some members felt strongly that other alternatives come with too much uncertainty and ecological risk or are sometimes in conflict with certain Tribal laws. The Commission was in agreement on the general need to reduce invasives, given their role in uncharacteristic wildfire.

All Lands Actions

As is often stated as a truism, wildfire does not respect jurisdictional boundaries: a fire that starts on one land ownership may—and often does—spread to any other. This means that managing wildfire risk requires an “all lands” or cross-boundary approach to prioritization, planning, and implementation of risk reduction treatments. Accomplishing cross-boundary work must include all the relevant landowners and administrators, including state, local, and Tribal agencies, private landowners, and non-governmental organizations (Charnley, Kelly & Fischer, 2020; Huber-Stearns et al., 2023a).

Many landscapes in need of wildfire risk reduction and restoration of fire-adapted ecosystems feature a mix of land ownerships, management jurisdictions, and diverse parties with interests in those lands. Cross-boundary wildfire transmission is also increasing, with recent research in the western United States suggesting that more ignitions originate on private lands than public (Downing et al., 2022). Working collaboratively across boundaries and among various entities is therefore critical for cohesive, effective treatments.

Given this, the Commission sees the need for greater flexibility of federal funds to be used across boundaries, increased use of cross-boundary authorities, and increased programs for private landowners to dispose of woody biomass left over from risk reduction treatments. It should be noted, however, that collaboration can play a critical role in cross-boundary restoration and the Commission also recommends funding for such efforts (see Recommendation 139 in Chapter 8: Frameworks for the Future).

Recommendation 24

Increase the flexibility of federal funds to move across boundaries.

Though widely touted, all-lands work is often exceedingly challenging, in part due to funding sources that can only be used within a single jurisdiction. Without streamlined cross-boundary funding systems, the burden falls on practitioners to piece together multiple funding sources to accomplish a single cross-boundary project (Ellison et al., 2018). Creating or expanding authorizations and appropriations to allow for greater use of funds across jurisdictional lines would, in part, help address this barrier and facilitate much-needed mitigation work.

To better understand the challenges and opportunities for facilitating greater funding flexibility, Congress should commission the Government Accountability Office (GAO) or some other entity to review existing programs, rules, and authorities that enable or inhibit cross-boundary work.

Recommendation 25

Congress should allow for a certain percentage of hazardous fuels funding above agency base levels to be used across ownership boundaries – including through voluntary engagement of private landowners – based on demonstrated needs for integrated project implementation to address risks.

Recognizing the importance of conducting wildfire risk reduction on all jurisdictions and ownerships, the 2018 Farm Bill authorized the Forest Service to use up to \$20 million in hazardous fuels funding on lands outside of the National Forest System (CRS, 2019a). There is a need to build upon this authority. One mechanism could be increasing the amount of hazardous fuels funding that can be used on non-federal lands, though Commission members warn that doing so must avoid siphoning funding from federal land management agencies. Some Commission members suggested that structuring the authorization as a percentage rather than a dollar amount could allow for growth at the same rate as agency appropriations.

Cross-boundary projects must be grounded in thoughtful, strategic planning and placement of treatments that effectively respond to risks and hazards. While such work is important, Commission members note that it should not be the sole or primary factor behind funding decisions.

Recommendation 26

Expand Good Neighbor Authority to more federal entities, including the U.S. Fish & Wildlife Service and National Park Service.

The Good Neighbor Authority (GNA) (16 U.S.C. §2113a) is a key tool enabling the Forest Service and BLM to collaborate with states, counties, and federally recognized Tribes to conduct restoration-focused projects on both federal and non-federal lands. Specifically, GNA

authorizes these non-federal entities to implement restoration work on BLM and Forest Service-administered lands. It also includes a temporary authorization to allow states to retain revenues from projects with commercial components, then use those funds to accomplish additional restoration work on federal lands through a GNA agreement (CRS, 2023a). The authority has generally been perceived as successful by entities who have used it, with advantages including the ability for federal agencies to leverage the expertise and unique capabilities of states, counties, and Tribes (Kee et al., 2023; Kelly, Charnley, & Pixley, 2019; Santo et al., 2019; Schultz et al., 2019).

By expanding this authority to other federal agencies, Commission members hope to facilitate opportunities for non-federal partners to add capacity in areas where those agencies may be understaffed. The Commission also discussed and is supportive of expanding the management of GNA revenue to Tribes.

Recommendation 27

Increase resources for programs to help private landowners dispose of woody biomass.

Fuels reduction on private lands is critical to reducing wildfire risk. While a number of programs help private landowners reduce hazardous fuels, significant costs still remain. This cost barrier may disincentivize landowners from undertaking fuels reductions or they may either opt to burn this material in piles, which can affect air quality, or leave it on the landscape, which can exacerbate wildfire intensity, should one occur in that area. There is a need for programs that support biomass disposal through activities such as wood chipping, hauling, and biomass utilization. These programs could be supported by USDA Rural Development and should consider opportunities to promote the utilization of biomass by private landowners. These strategies should be applied to both proactive wildfire risk mitigation as well as post-fire restoration.

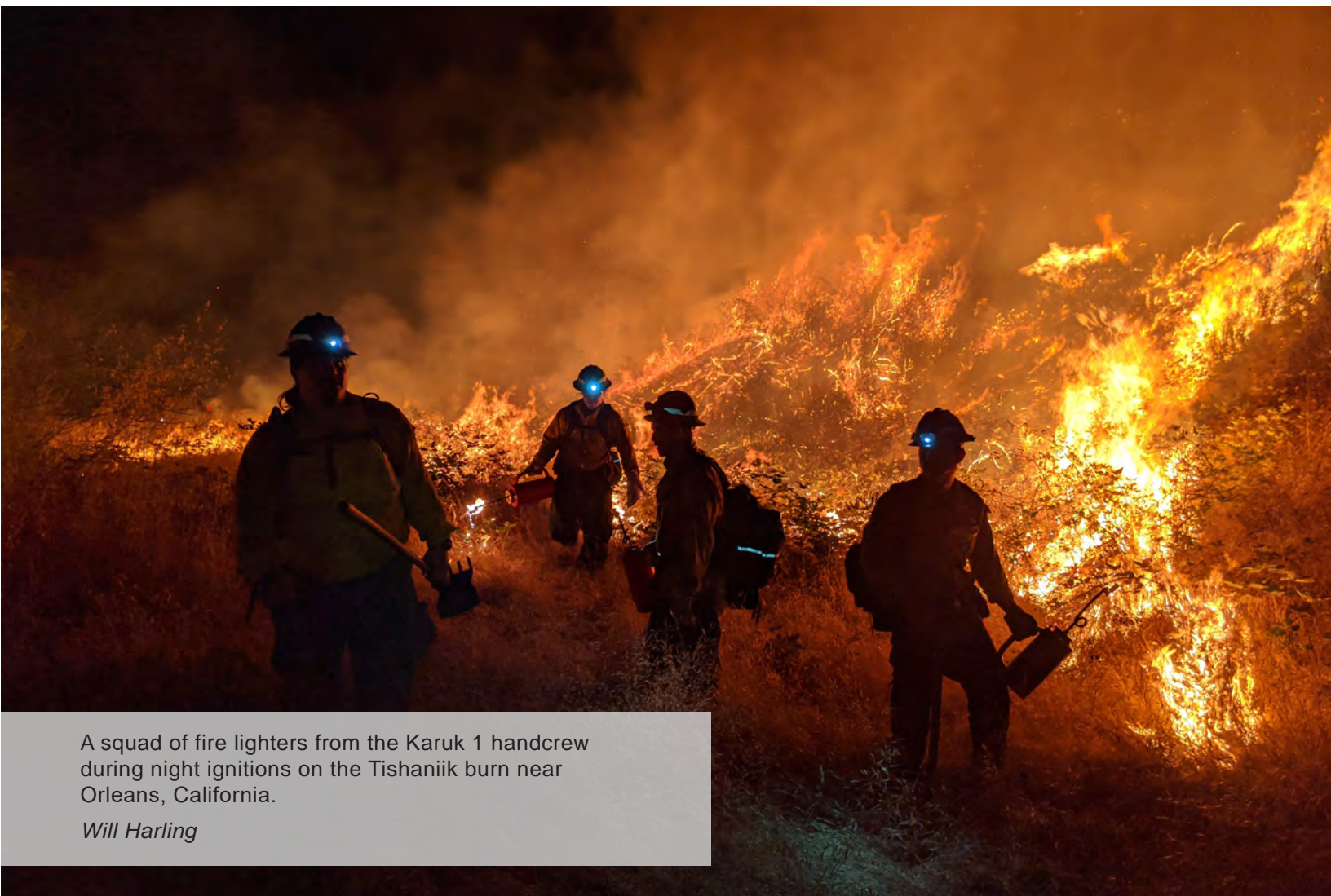
Enabling Indigenous Stewardship

Congress has repeatedly recognized the importance of cross-jurisdictional and landscape-scale management in laws such as the Good Neighbor Authority, the Tribal Forest Protection Act (TFPA), and the Healthy Forests Restoration Act (HFRA)^{xx}. Such stewardship is necessary to achieve wildfire resilience and ecosystem restoration goals. Tribes are well positioned to coordinate and implement this work, as demonstrated by existing Tribal self-determination and self-governance initiatives.

However, the legal frameworks and funding mechanisms for Indigenous stewardship^{xxi} are incomplete, variable, full of inefficiencies, and misaligned with the true needs of Tribal communities. These shortcomings significantly impact ability of Tribes to fully contribute to overall wildfire mitigation and management, ecosystem health, and community wellbeing. While federal agencies possess some authorities to work in partnership with Tribes, these authorities are often underutilized for a number of reasons, some of which require agency or legislative

action to resolve. **More action should be taken to alleviate barriers of entry for Tribes wishing to engage in Indigenous stewardship and wildfire mitigation work.**

There are, however, promising opportunities to build on existing authorities to accomplish shared stewardship goals. Successes such as TFPA, use of “638” contracts and compacts under the Indian Self-Determination and Education Assistance Act (commonly referred to as “638” contracts and compacts after the law’s Public Law number: 93-638), cross-boundary implementation of Reserved Treaty Rights Lands (RTRL) projects, GNA, and Master Stewardship Agreements are each a step in the right direction, but do not completely meet the true needs of Tribal communities. Tribes and federal agencies are, in some places, successfully working together to deliver co-stewardship using these laws, however updated and new authorities and additional investments in building and sustaining Tribal capacity would allow more Tribes to be equitably engaged.



A squad of fire lighters from the Karuk 1 handcrew during night ignitions on the Tishaniik burn near Orleans, California.

Will Harling

The Commission found multiple opportunities for policy change to address these issues, enhance partnerships between Tribes and federal agencies, and further support Tribal self-governance and self-determination. Specifically, the Commission recommends expanding existing, and developing new, authorities for federal agencies to engage in co-management and co-stewardship; enabling Tribes to expand prescribed and cultural burning programs; providing funding to enable this work; and enhancing the ability of Tribes to share information without risking compromising confidentiality. See the Use of Beneficial Fire section in this chapter for recommendations related to cultural burning and Recommendation 115 in Chapter 6: Integrating Modern Science and Technology.

The Commission's full set of recommendations related to Tribal stewardship and management are intended to work together. The full suite of recommendations would provide the enabling conditions for improved co-management^{xxii} by creating improved authorities; supporting Tribal fire programs, protecting data confidentiality; and by providing funding for Tribes to accomplish stewardship work.

Insights: Tribal Sovereignty and Trust Responsibility

As distinct, independent political communities, federally recognized Tribes retain their original inherent Tribal sovereignty as recognized in the Constitution and subsequent legislative actions, with Tribal sovereignty, Tribal self-governance, and self-determination as foundational principles in the exercise of this sovereignty (see *Worcester v. Georgia*, 31 U.S. 515 (1832)). In addition, the United States has an inherent “trust responsibility” with respect to federally recognized Tribes rooted in the long and complicated history between the federal government and Tribes (see *Seminole Nation v. United States*, 316 U.S. 286 (1942); see also *Cherokee Nation v. Georgia*, 30 U.S. 1 (1831)). This trust responsibility requires the federal government to protect Tribal treaty rights, lands, assets, and resources, as well as to provide federal assistance to ensure the success of Tribal communities (Bureau of Indian Affairs [BIA], 2017). Authorities such as Indian Trust Asset Reform Act should be utilized to promote additional support for self-governance.

Recommendation 28

Congress should reinforce federal agency requirements for coordination with Tribes when engaging in land management planning.

The United States has a complex political and legal relationship with federally recognized Indian Tribes, as established in the U.S. Constitution, treaties with Indian Tribes, statutes and regulations, executive orders, court decisions and international law (General Services Administration [GSA], 2017). Tribal consultation is the formal, government-to-government dialogue between official representatives of Tribes and federal agencies to seek input on

federal policies and actions. Consultation is one-way federal agencies can meaningfully recognize the sovereignty of Tribes and their long-standing ties to lands now administered by the federal government (BIA, n.d.c). For example, Executive Order 13175, “Consultation and Coordination with Indian Tribal Government” charges all executive departments and agencies with engaging in regular and meaningful consultation with Tribal officials in the development of policies that have Tribal implications (See Executive Order 13175, 65 Fed. Reg. 218,67249 (Nov. 9, 2000)) Nevertheless, the broad nature of these existing directives has led to inconsistent application, with some Tribes reporting an inability to provide input at times and in a manner that would result in meaningful incorporation of Tribal priorities and goals.

Coordination should include the identification of Tribal priorities and opportunities for Tribes to work toward mutual objectives across multi-jurisdictional landscapes. Congress should ensure that federal land management planning processes fully integrate Tribal goals and objectives in developing or revising land management plans, and that those plans honor reserved rights and resources retained by Tribes. Agencies should also be encouraged to activate all available policy and pathways to engage in coordination with Tribes.

One mechanism for such coordination could be the use of expanded co-management authorities recommended below (see Recommendations 29 and 30 below). Rather than leaving Tribes in a consultative role, co-management agreements could engage Tribes more fully.

Recommendation 29

Congress should ensure that federal agencies have the directive, capacity, and authority to enter into equitable and meaningful co-stewardship and co-management agreements for multi-jurisdictional lands, and to support Tribal self-governance in order to address wildfire risk reduction, management, and recovery, and to enable beneficial fire practices.

Federal law currently constrains the ability of federal agencies to enter into meaningful and beneficial co-management agreements with federally recognized Tribes. Agencies should be given authority and encouraged to enter into co-management agreements that recognize and enable Tribal decision-making authority. Some Commission members suggested that co-management agreements could recognize Tribal sovereignty and decision-making authority or could require both the federal government and a Tribe to approve certain actions, with a clear default scenario if no agreement is reached. The consensus recommendations highlighted the importance of ensuring that agencies have both the necessary authorities and capacity to enable co-stewardship and co-management agreements, and that they use those authorities to enter into and expand agreements for wildfire risk reduction and beneficial fire use.

Increased capacity to engage in this work is an important ingredient as well, and federal agencies should be sufficiently staffed to meaningfully meet their charge to consult with Tribes.

Recommendation 30

Congress should provide the U.S. Department of Agriculture stand-alone authorities to enter into co-management agreements with Tribes that would allow the Forest Service to share, defer or transfer decision-making authority with or to a Tribe or Tribes for management of Forest Service programs or activities.

In recognition of Tribal self-governance, Congress should expand co-management authority to Forest Service programs, functions, services, and activities. While the Forest Service has been able to expand the use of co-stewardship agreements with Tribes, the current lack of baseline co-management authority has led to limitations in the ability of the Forest Service to work in partnership with Tribes to address the wildfire crisis and right historic injustices. It should be noted that DOI reported that it already has such authority.

In developing a standalone authority, Congress should build on what has been learned from the previous successes and failures of existing authorities, including 638 contracts and compacts, the Tribal Forest Protection Act, and the Indian Trust Asset Reform Act. For example, previous agreements with short timeframes led to inefficiencies as Tribes and federal agencies needed to frequently renegotiate. As a result, the Commission feels that co-management agreements should have sufficient longevity to be effective. While this number is not prescriptive, the Commission feels that agreements lasting 15 years or more may be appropriate.

The Commission understands that complex and overlapping legal obligations would require federal agencies and departments, in the exercise of such new or expanded authorities, to be consistent with other applicable federal laws.

Insights: Tribal Geographies

Defining geographic areas associated with individual Tribes for purposes of authorizing co-management is a complex topic. The Commission found that it is difficult for Federal agencies to be put in the position of determining or validating such geographies. Recent collaborative efforts like the Indigenous Peoples Burning Network and Western Klamath Restoration Partnership have shown that when the involved parties can find agreement, much can be accomplished. This often requires discussion and decisions at a local level.

Recommendation 31

Congress should make permanent the Indian Trust Asset Management Demonstration Project by eliminating the 10-year sunset, allowing continued participation in the Indian Trust Asset Reform Act.

The Indian Trust Asset Reform Act (ITARA) (Pub. L. No. 114-178, 130 Stat. 432 (2016)), was passed in 2016 and allows, in part, for the authorization of Indian trust management demonstration projects for surface leasing and Tribal forestry (United States Department of the Interior [DOI], 2023). Through Indian Trust Management Plans and demonstration projects, several Tribes have engaged in forest management projects. However, the ITARA pilot program is set to expire.

Tribes have demonstrated tremendous leadership in the management of Tribal trust assets and many Tribes wish to exercise greater sovereignty as they manage them. The management of Tribal trust assets are critical components to generating income for Tribes. Given the role mechanical thinning can play in fire risk reduction, further enhancing the ability for Tribes to take on more of this kind of work has important benefits to the nation. Furthermore, the economic potential of commercial thinning projects can serve as an important offset to the overall costs of fire risk reduction. Permanently authorizing the program would provide Tribes better opportunities to participate in such projects and fully benefit from the provisions of ITARA.

Permitting and Project Planning

Before being implemented, wildfire risk reduction projects on federally administered land must first be planned and permitted. Development of guiding strategic plans for a land management unit are required under various laws, including the National Forest Management Act (NFMA) (Pub. L. No. 94-588, 90 Stat. 2949 (1976)) and the Federal Land Policy and Management Act (FLPMA) (43 U.S.C. § 1701-1787), and further refined by regulation and policy. These guiding plans, known as “land and resource management plans” or “forest plans” for the Forest Service and as “resource management plans” for the BLM, help to place guardrails on future projects and activities, identify desired outcomes, set the vision for subsequent management actions, and identify appropriate areas for work at broad scales. Such land management plans do not, however, guide site-specific actions (USFS, 2017). Rather, project plans and permits provide the more detailed analysis of a proposed project on the ground and more directly guide implementation (Cowan, 2022; USFS, 2017). Both planning processes typically provide the primary means for engaging the public, as well as state and local governments and Tribal nations. Because planning and associated analysis is required before most activities and implementation can occur on the ground, these processes are important and necessary preconditions to carrying out wildfire risk reduction.

In addition to the guidance and strategic direction offered in a land and resource management plan, numerous additional laws must be adhered to in the planning process. The 1970 National Environmental Policy Act (NEPA) (42 U.S.C. § 4321-4370m) is perhaps the best known of



Walatowa Timber Industries mill processes timber products from USDA restoration work in Jemez Pueblo, NM, 2019.
Lance Cheung, USDA with permission of the Pueblo of Jemez

these laws and serves as an eponym for the planning process itself. NEPA requires federal agencies to assess the environmental impacts of a proposed action before making a decision or committing resources to a project (CRS, 2011). Proposed actions may still have environmental impacts but if impacts are anticipated, federal agencies must undertake a more robust analysis of the proposed action. Levels of analysis range in complexity and include categorical exclusions, used when no significant environmental impacts are anticipated; environmental assessments, used when the impact is unknown; and environmental impact statements, used when significant impacts are expected (CRS, 2021). NEPA also provides the public an opportunity to comment on proposed actions, bringing public participation into federal decisions (GAO, 2014). NEPA analysis is typically completed by interdisciplinary teams of diverse specialists in order to better evaluate the potential impact of a proposed action. These teams are more commonly known as “Interdisciplinary Teams.”

In addition to NEPA, two other laws can create additional planning requirements for wildfire risk reduction projects. The Endangered Species Act (ESA) (Pub. L. No. 97-304, 96 Stat. 1411 (1982)) of 1973 is intended to protect plant and animal species that are in danger of extinction or likely to face extinction. The presence of ESA “listed” species requires additional on-the-ground analysis of wildfire risk reduction projects, as well as “consultation” with either the U.S. Fish and Wildlife Service or the Department of Commerce’s National Marine Fisheries Service (GAO, 2019). The National Historic Preservation Act (NHPA) (16 U.S.C. § 470-470x-6) of 1966 requires federal agencies to consider the potential impacts actions might have on historic sites (CRS, 2012). This, too, requires additional site-specific analysis in the form of archaeological and cultural resource surveys (CRS, 2020).

The Commission found that federal land management planning efforts and requisite environmental analyses are often not completed at a pace commensurate with the increasing impacts of wildfire. **Improving planning and analysis are challenges we need to meet to achieve consistent, flexible integration of evolving wildfire science.**

Recent efforts to speed planning include the Forest Service's 2017 Improving Environmental Analysis and Decision Making initiative,^{xxiii} as well as the accompanying solicitation of feedback from partners captured by the Wildfire Crisis Strategy Roundtables hosted by the National Forest Foundation in 2022. The Forest Service completed revisions to its NEPA regulations in 2020 and has used revised provisions in recent decisions. In addition, IJA provided much-needed investments in NEPA and planning capacity, which will help address constraints that impact the ability of agencies to work at the pace needed.

In June 2023, during the Commission deliberations process, Congress included changes to the NEPA in the Fiscal Responsibility Act of 2023 (Pub. L. No. 118-5, 137 Stat. 10 (2023)). The impact of these changes has yet to be felt, however the Commission believes that the following recommendations are likely to remain important, even considering recent statutory changes.

Recommendation 32

Expand funding and staffing for planning and Interdisciplinary Teams of federal land management agencies.

Studies point to staff turnover and lack of staff capacity to complete planning and analysis work as key factors in planning and permitting delays (e.g., Fleischman et al., 2020; Ruple et al., 2022). Between 1992 and 2018, the number of Interdisciplinary Team leads positions decreased by 45 percent, with other positions involved with planning and analysis also declining, including foresters (74 percent decrease), forestry technicians (49 percent decrease), and engineering technicians (72 percent decrease) (National Association of Forest Service Retirees [NASFR], 2019). With more limited staff capacity, workloads are heavy. Interdisciplinary Team leaders may coordinate three to four analyses simultaneously, which can contribute to more extended timelines. Fleischman et al. (2020) found that the median time for the Forest Service to complete a categorical exclusion is 105 days, an environmental assessment is 392 days, and an environmental impact statement is 882 days, or just under 2.5 years. Anecdotal evidence suggests similar challenges for the bureaus within DOI. In general, the Commission agrees that lack of capacity and staff turnover are major contributing factors to delays in planning and implementation.

Given these declines in staffing and the continuing importance of strategic environmental analyses to effective wildfire mitigation and management, the Commission recommends that funding for planning and analysis personnel be increased. To inform strategic investments, agencies should also develop strategic plans that identify the total need for planning staff and should consider directing funding to areas where there are identified capacity needs, with a focus on fuels treatments and ecosystem restoration.

This capacity should be added through internal staffing and potentially via partnerships or contracting with external entities, including private, non-governmental, and state, local,

and Tribal entities as appropriate. The Commission sees value in bringing a diversity of resources and contributors to this task. Non-federal parties may even be better suited than agencies to undertake some parts of the environmental analysis process. Tribes, for example, should be go-to partners to undertake archaeological and cultural resource surveys.^{xxiv} In scaling up work with external entities and partners, agencies are also responsible for ensuring there are sufficient staff positions tasked with managing and liaising with partners.

In addition to expanding the number of people available to support planning and environmental analysis, agencies must provide their employees with the skillsets, opportunities, and incentives to engage collaboratively with non-agency interests during and beyond the defined public outreach and comment processes required by NEPA. This includes the development and funding of employee training, use of performance measures that value collaboration, and the explicit inclusion of collaborative activities in employees' programs of work and job descriptions. Collaboration with communities during environmental planning and analysis is especially essential in places with a history of low trust between the federal government and the public (Sturtevant & Jakes, 2008).

Recommendation 33

Explore mechanisms to make planning more effective and efficient, such as improved information gathering, training, staffing, collaboration, and programmatic analyses for restoration and hazardous fuels reduction activities.

While lack of agency capacity and staff turnover are major contributing factors to delays in planning and implementation, increasing staffing alone may not guarantee efficiency in planning. Fundamental parts of the process may also need to be redesigned to enable planning at larger scales and in ways that are more adaptive. The Commission discussed, but did not come to agreement on, specific potential mechanisms for operationalizing this goal. Those mechanisms included:

- Encouraging or increasing the use of programmatic environmental analyses, which assess environmental impacts of proposals (e.g., programs, plans, or policies) that are broad in reach and may include several similar or connected projects, implementation over a longer timeline, or implementation over a larger geographic area (45 CFR § 900.207) (Department of Ecology, 2013). More specific project proposals can then tier to this programmatic analysis, avoiding the need to re-analyze activities already covered in the overarching document.
- Phasing, which involves defining large landscapes for future planning and then moving to new planning areas as others are completed.
- Increasing the use of various categorical exclusions for mitigation-related work.

Conditions-based analysis was also noted as a possible tool. Conditions-based analysis establishes a framework of possible environmental conditions, along with allowable management activities associated with those possible conditions. Using guiding parameters set

out in the approved environmental analysis, land managers decide which activities to undertake in a particular place based on an assessment of site conditions prior to implementation (USFS, 2022a). Commission members who supported a conditions-based approach noted that it holds potential to impart greater flexibility and longevity than a completed environmental analysis document. Specifically, they said that conditions-based analysis enables decision-making and adaptation based on conditions observed on the ground closer to the start of implementation. This is in contrast to making determinations during the original analysis process that are based on data which, some Commission members noted, may be imprecise, inaccurate, or outdated either at the time of analysis or by the time the agency is ready to implement. Those members who expressed concern with conditions-based analysis noted that it determines allowable and appropriate activities without site-specific analysis and potentially without adequate public participation. However, there was some indication that this concern could be addressed through adequate staffing, funding, and incorporation of robust collaborative efforts and site-specific analyses.

Insights: Improved Permitting and Planning

As noted in the recommendations above, the Commission was in general agreement that planning, including robust public engagement and effective analysis of environmental impacts, is critical to wildfire mitigation and management, and that continued improvements in efficiency and effectiveness are needed.

The Commission reached agreement that increased staffing is a part of the solution, but staffing increases alone were seen by some members as insufficient. Opinions varied as to other solutions, however. Some members identified that while the planning process needed improvement, they felt that that success could be achieved by federal agencies within the existing law and policy, while other members advocated for changed legal interpretation of the role of land management plans or fire plans serving a direct role in project permitting. Some members also questioned the extent to which planning requirements should even apply to prescribed fire actions. Other members saw opportunities for congressional action, such as the creation of additional categorical exclusions or mandatory time limitations on the planning process.

The discussion of planning, while yielding only a few consensus recommendations, shed light on the complexity of the topic. Specifically, discussions struggled to disentangle the role of land and resource management plans from project planning; separate land management planning requirements from the requirements of NEPA, NHPA, and ESA; administrative policy requirements from agency priorities; and indeed, planning from implementation. In all cases, members agreed that planning and implementation needed to be inclusive and collaborative, faster and nimbler in the face of rapidly changing conditions, and done at larger scales. However, few solutions – other than those mentioned above – emerged as a consensus pathway forward.

Chapter 2: Protecting Public Health

Addressing the public health impacts of wildfire is one of the critical challenges facing the nation. **The public health impacts of high-severity wildfires, including those wildfires that burn within the built environment, can be substantial, affecting whole communities as well as the workforce.** Human fatalities and injuries, smoke emissions, impairment of drinking and wastewater systems, and trauma and mental health challenges are among these impacts. With respect to human health impacts from smoke, many of our most vulnerable residents (including, but not limited to, infants and children, older adults, people with heart and lung conditions and those who are pregnant) are the most likely to be negatively affected and for those with limited resources or outdoor jobs, the ability to mitigate impacts can be particularly challenging.

Public health outcomes are closely tied to pre-fire mitigation, response, and post-fire recovery efforts, and are connected to both the built and natural environments. **At its core, the wildfire crisis is also a public health crisis. Solutions to both are wedded.**

Recommendations related to the protection of community water supplies by entities and organizations at multiple scales are discussed in this chapter. Whether examining solutions at the local or federal level, protecting community water supplies is dependent upon the linkages between the natural and the built environment. High-severity wildfire can have profound impacts to the watersheds where source water originates, the treatment of drinking water, the infrastructure that connects water to communities, and the residents who depend on these systems for clean, safe drinking water. Water supply impacts extend well beyond the fire perimeter, as degraded water quality and debris flows can affect downstream communities miles away. Recommendations presented below aim to minimize impacts to water supplies and maintain water delivery to communities.

Smoke, and its mitigation and management, provides another example of how public health is at the nexus between the built and natural environments. Smoke is the most far-reaching of fire's impacts, with emissions travelling potentially thousands of miles from their source. All forms of smoke, whether from fire that is planned or unplanned, can negatively impact human health.

Inhalation of smoke or its byproducts has been linked to a range of health impacts, including respiratory and cardiovascular-related impacts, that can lead to thousands of emergency department visits, hospital admissions, and premature deaths each year (Fann et al., 2018; Neumann et al., 2021; O'Dell et al., 2021). Fine particulate matter, known as PM2.5, makes up



Smoke produced from the Pioneer Fire in the Boise National Forest, 2016.

Kari Greer

the vast majority of total particle mass emitted from wildfires and is especially harmful because of the small size, which enables the particles to penetrate deep into the lungs and potentially cross into the bloodstream (EPA, 2019b). Of growing concern is that emissions from fires that burn extensively in synthetic materials (e.g., from fires in the built environment) may contain particularly harmful particles to human health when inhaled (Kim et al., 2021). Yet, research also continues to indicate that effective treatment for wildfire risk reduction in many North American forests requires the reintroduction of beneficial fire (Holland et al., 2022; Prichard et al., 2021; United States Forest Service [USFS], 2012; Vaillant & Reinhardt, 2017). These impacts from smoke and the need for fire highlight a key challenge discussed throughout this report: fire is both central to the crisis and one essential part of the solution. The Commission's recommendations attempt to navigate this tension, as well as provide mitigation measures for individuals and communities to reduce the impact of smoke in the face of a future with increasing fire.

In addition, while the Commission was not formally charged with making recommendations related to evacuation, the Commission felt this topic was deeply connected to its statutory charge to address the protection of human life. For that reason, recommendations related to evacuation are also included below.

Safeguarding Community Water Supplies

The Commission was charged with making policy recommendations related to the protection of community water supplies. The Commission felt strongly that as demand for water resources continues to increase, **protecting existing water supplies from the threat of high-severity wildfire is essential.**

Watersheds that are able to withstand the impacts of wildfire are fundamental to deliver a clean, reliable, and affordable water supply to individuals and communities. Forested lands contribute 46 percent of the surface water supply nationally, with over half of the population of the United States benefiting from forested lands for drinking water supplies (Liu et al., 2021; Liu et al., 2022). Water from forested watersheds can also have substantial economic benefits by reducing costs for water treatment and other water infrastructure (Bladon et al., 2014). Functioning watersheds – meaning those not damaged by high-severity fire – also help to slow and store water runoff that might result in downstream flooding, as often occurs in the wake of a high-severity fire (Ebel et al., 2022).

However, uncharacteristic, high-severity wildfires in watersheds that are not fire adapted can significantly impact community water supplies at every point in the water delivery process (Bladon et al., 2014; Ebel et al., 2022). In terms of source water, wildfires that burn at high severity can produce water repellent soils and create landscapes susceptible to post-fire flooding, debris flows, and increased peak flows,^{xxv} all of which can impact the function and integrity of watersheds (Ice et al., 2004; Neary et al., 2005; Robinne et al., 2021). Increased sediment and debris transported by rain or snowmelt across impaired landscapes can degrade water chemistry, obstruct water conveyance infrastructure, and reduce water storage capacity, all which threaten consistent water delivery to communities (Hohner et al., 2019). Increased levels of dissolved organic matter, volatile organic compounds, and heavy metals, such as arsenic, mercury, and manganese also can significantly impact community water supplies and may exceed conventional water treatment capabilities (Abraham, Dowling, & Florentine, 2017; Draper et al., 2022; Emelko et al., 2011; Smith et al., 2011).

The projected rise in wildfire frequency and severity is expected to increase erosion and sedimentation in 9 out of 10 of watersheds by more than 10 percent, and in one third of watersheds by more than 100 percent by 2050 (Sankey et al., 2017). Removal of that sediment can be costly: after the 2020 Grizzly Creek fire in Colorado, sediment removal was estimated to cost at least \$8 million (Troy et al., 2022). Costs are not confined to sediment removal, however. The cost of managing degraded water quality and watershed rehabilitation after the 2003 Old, Grand Prix, and Padua Complex Fires in California far outweighed the cost of suppression efforts: "...researchers concluded that suppression and emergency response costs accrued by a host of public agencies — over \$61 million — accounted for only 5 percent of the total, long-term cost of the wildfire. Post-fire recovery and water mitigation expenditures were the most expensive categories in the study, with government agencies (and the public) shouldering an estimated \$534 million burden" (Western Forestry Leadership Coalition, 2009, p.11).

Loss of power to treatment facilities can also affect water delivery service by limiting the treatment, and therefore the availability, of potable water for consumption. Depressurization of water distribution systems also poses a risk to water quality. In the 2017 Tubbs Fire and 2018 Camp Fire, chemical contamination was found in the water distribution network, likely exacerbated by depressurization. (Proctor et al., 2020). In the 2021 Marshall Fire, six public drinking water systems serving nearly 67,000 people were damaged, sustaining power loss, direct damage to infrastructure, and more (Whelton et al., 2023). In the 2018 Carr Fire, loss of power and inadequate generators resulted in a 17-day boil water notice in one community (EPA, 2022a).

As these cases clearly demonstrate, high-severity wildfires pose substantial risk to drinking water supplies, including contamination and degradation of water quality, damage to water collection and conveyance infrastructure, and reduction of water storage capacity resulting from post-fire sedimentation.

While wildfire-related impacts to community water supplies can be significant, they may not be triggered until the occurrence of another event, such as heavy rainfall after a wildfire that transports sediment into the water source. Depending on the timing of these triggering events, water-related impacts of wildfire can begin soon after ignition or they can present several years after containment and can last for an extended period of time (Cannon et al., 2008; Hohner et al., 2019; Reale et al., 2015; Smith et al., 2011).

When impacts do occur, either as an immediate consequence of the fire itself or as a result of post-fire sedimentation, urgent response is needed. However, federal support can lag behind. Many Commission members felt that wildfire and disaster recovery programs are designed for single-event response and do not accommodate cascading hazards, such as drought-wildfire-monsoon-flood cycles that cumulatively overwhelm local resources, often for several years after a fire. These parameters can limit disaster assistance available to some of the most heavily impacted communities (see Chapter 4: Recovering for Resilience for an expanded discussion of cascading hazards and policy recommendations). Even when resources are available, there is varied understanding of necessary treatment activities after wildfires. One recent review of literature concluded that “national and industry approaches for water system contamination response to wildfires do not exist” (Whelton et al., 2023, p. 3). While, as previously noted, the 2021 Infrastructure Investment and Jobs Act (IIJA) made important investments in the nation’s drinking water infrastructure, the Environmental Protection Agency (EPA) 2018 Drinking Water Infrastructure Needs Survey and Assessment identified \$472.6 billion in necessary improvements in drinking water infrastructure through 2038 (EPA, 2018).

When wildfire does impact a community’s water supplies, it is often the case that state, local, and Tribal public health agencies and water providers lack capacity and resources to assess, sample, and provide timely outreach to consumers relying on local drinking water systems (Jankowski et al., 2023; Proctor et al., 2020; Wait et al., 2020). A review of wildfire damage and contamination in wells after the 2021 Marshall Fire found variable guidance for well owners and a lack of post-fire studies of drinking water and well inspection (Jankowski et al., 2023). The Commission felt that coordinated, proactive wildfire preparedness planning can help address and develop alternatives to these constraints, reducing wildfire impacts to water supplies.

Recommendation 34

Expedite funding to support water utilities in both immediate and long-term wildland fire recovery to maintain water delivery to consumers.

When water flows across burned landscapes and into waterways, increased sediment and debris flows can alter water chemistry. Affected water utilities must adapt to these water quality impacts through, for example, supplemental or enhanced treatment processes to accommodate degraded water entering treatment facilities from a burned watershed. To ensure safe drinking water, infrastructure repairs or improvements must be completed before degraded water enters the treatment plant. It is essential that funding be available and accessible to utilities to repair, improve, or add to treatment infrastructure before the first post-fire impacts occur. Throughout the process, water utility providers should consider rebuilding and recovery approaches that integrate greater wildfire resilience.

The Commission identified the following needs in this arena:

- Expedited grant funding for drinking water treatment plant upgrades and repair, development of additional treatment infrastructure, and development of access to alternative water sources in order to maintain water delivery in the event a wildfire impacts raw water supplies.
- Inclusion of both direct impacts (e.g., burned assets) as well as secondary impacts (e.g., contamination) for water utilities participating in response, recovery, and mitigation programs.

Recommendation 35

Authorize and incentivize flood mitigation, water quality, and source water protection projects in existing wildfire mitigation and wildfire recovery programs to protect community water supplies.

Forest resilience represents a crucial component of watershed resilience. The Commission found that proactive and ecologically appropriate forest restoration and resilience treatments are needed to improve the function of watersheds across the country. To better protect these watersheds and the critical water supplies they contain, programs that support fuels reduction and other ecological restoration work should include a greater focus on source watersheds, riparian areas, and protection of drinking water infrastructure (Jones et al., 2017; Niemeyer, Bladon, & Woodsmith, 2020). The following are programs that could be modified:

- The Collaborative Forest Landscape Restoration Program (CFLRP): Give additional consideration to projects that protect critical source watersheds within the CFLRP target geography. CFLRP is also discussed in Recommendation 18 in Chapter 1: Creating the Foundation for Success.

- The Joint Chiefs Landscape Restoration Partnership (JCLRP): In addition to maintaining the current list of eligible activities, Congress could add activities that protect water quality and drinking water collection infrastructure, including nature-based solutions. Include additional evaluation criteria that consider how proposals enhance resilience to a wide range of natural hazards, such as flooding and drought, and incorporate watershed restoration and protection efforts pre- and post-wildfire. The JCLRP is also referenced in Recommendation 77 in Chapter 4: Recovering for Resilience.
- The Joint Fire Science Program (JFSP): Authorize and appropriately fund the JFSP to work with regional partners to develop and implement watershed health-related fire research including determining appropriate fuel reduction treatments within riparian areas and address remaining research gaps about the wildfire risk reduction and post-fire benefits of process-based restoration approaches. Process-based restoration represents one source water protection technique that can build resilience to wildfire. It uses simple, structural additions to riparian corridors that mimic natural processes to recover the ecological functions of riparian and wetland ecosystems. The JFSP is also referenced in Recommendation 111 and Recommendation 116 in Chapter 6: Integrating Modern Science and Technology.

Additionally, collection of water delivery infrastructure data, including that of rural and smaller water providers, should be completed to ensure water resources are incorporated into pre-planning and decision-support tools.

Recommendation 36

Increase funding and technical assistance to state, local, Tribal and territorial public health agencies and water provider partners to increase local capacity for wildfire preparedness and resilience planning.

Funding and technical assistance are needed for public health agencies and water providers to work with other agencies at the federal, state, and local level to undertake necessary wildfire-related preparedness planning. This preparedness planning should aim to anticipate and minimize wildfire impacts to water systems. While the IIJA provided appropriations for water infrastructure improvements, additional wildfire-specific funding to support public health agencies and water provider partners to better prepare for wildfire impacts to water systems would help safeguard public health. Increased capacity investments may include training and equipment for testing water quality for contaminants and toxins, implementing interventions to prevent and control harmful impacts, and assessing source water and watershed infrastructure. Public health entities and water providers also need support to provide guidance and direct assistance to community members that rely on federally unregulated drinking water and onsite wastewater systems. Additionally, support should be provided for the development of recommendations, lessons learned, and best practices for these activities. This recommendation complements Recommendation 67 in Chapter 4: Recovering for Resilience.

Recommendation 37

Equip state, local, Tribal and territorial public health agencies and water provider partners to provide resources and support to residents to ensure access to safe drinking water after wildfire.

When wildfire severely damages water infrastructure, results in service disruption, and/or causes contamination of potable water or private wells, residents may need access to alternative water sources to be able to return to their homes or businesses. Private well owners may need an additional level of support, including water contamination testing, infrastructure damage inspection, and repairs.

The Commission felt that public health agencies and water provider partners provide essential environmental public health services to communities that rely on both federally regulated and unregulated drinking water (private wells, springs) as well as onsite wastewater systems. Public health agencies and water provider partners are well-positioned to, and often already do, address these essential environmental public health needs. However, further support is needed so these entities can more effectively serve this function. In both the Tubbs and Camp Fires, guidance to residents was found to be inadequate (Proctor et al., 2020). Specific needs include the provisioning of immediate resources for private well owners for testing and contamination removal. If utility-provided water is unavailable, public health agencies should also be supported to assist with identification and provision of alternative sources.

Recommendation 38

Support identification of public health risks associated with exposure to wildfire-contaminated water and development of evidence-based water use recommendations.

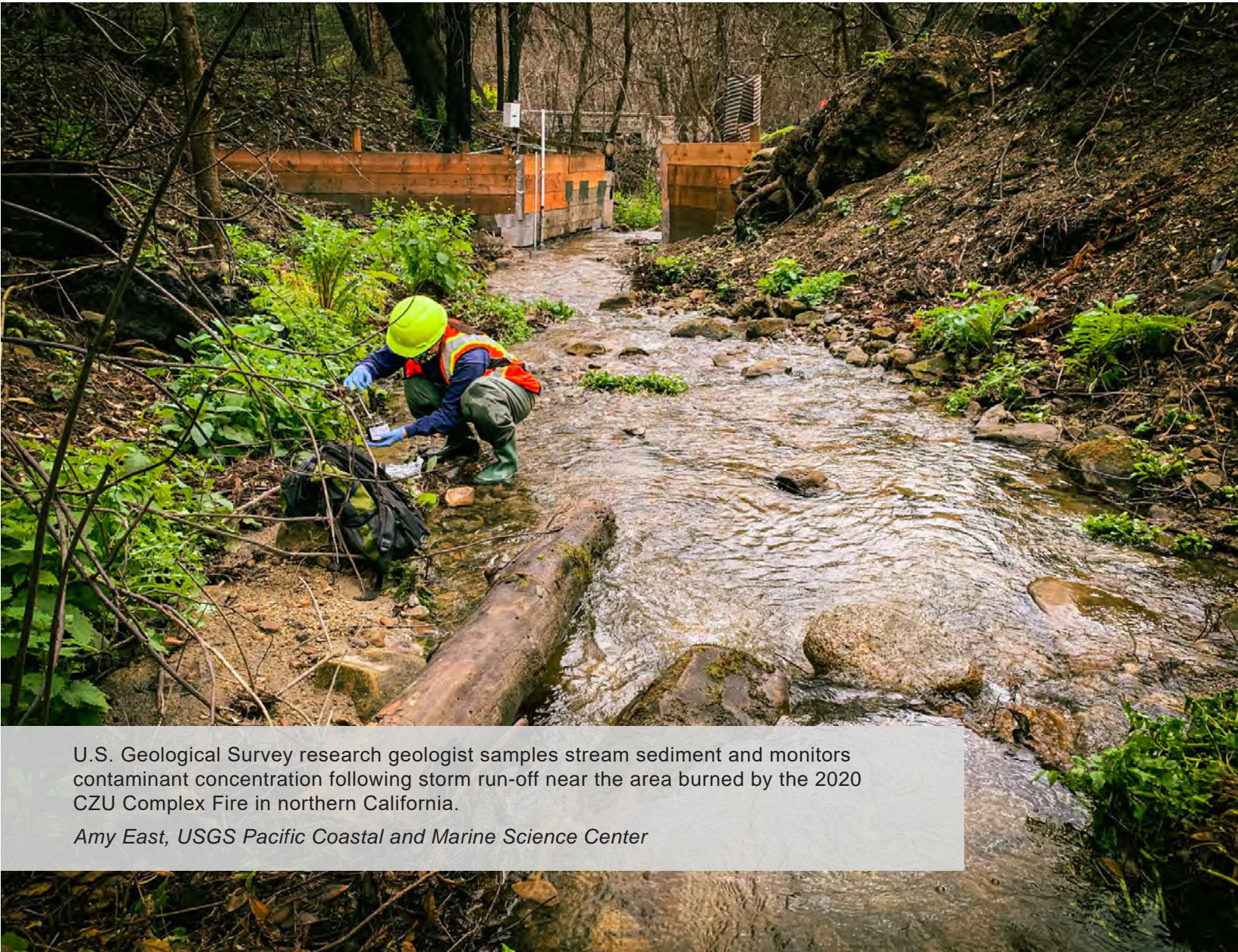
Contamination of potable water supplies creates an immediate public health risk, but little guidance exists regarding how communities should respond. There is a need for greater clarity around the type of testing required and thresholds for replacement or continued utilization of water infrastructure (Proctor et al., 2020). The need for improved understanding is not confined to public water utilities and extends to private water sources as well.

In addition, research on this topic may include:

- The cause of volatile organic compound (VOC) contamination, the primary contaminants of concern, and their occurrence within premise plumbing and distribution systems after a wildfire.
- Mitigation methods for preventing and controlling VOC contamination.

- Short-term and long-term changes in source waters (both ground and surface waters) that might impact a drinking water utility's ability to treat and produce safe drinking water.

In addition to investigation into these topics, the Commission felt there would be value in conducting risk assessments and modeling efforts to determine which water and wastewater utilities are most likely to be impacted by wildfires to help prioritize resources for treatment upgrades and source water protection. This assessment should consider both the direct and indirect impact of wildfire on utility facilities, source water intakes, wellheads, distribution systems, collection systems, and other infrastructure.



U.S. Geological Survey research geologist samples stream sediment and monitors contaminant concentration following storm run-off near the area burned by the 2020 CZU Complex Fire in northern California.

Amy East, USGS Pacific Coastal and Marine Science Center

Increasing Public Health Capacity

Public health agencies also provide an essential bridge between pre-fire mitigation and incident response. Research, public health guidance, and other work by public health agencies in advance of a wildfire support response actions (e.g., stop use orders for drinking water, alerts for wildfire smoke) that are important for safeguarding the public. Case studies of California fires in 2017 and 2018 indicate county public health agencies in particular can be a focal point for survivors yet are often capacity-limited (Rosenthal et al., 2021). Increases in public health capacity are foundational to many other public health recommendations and include recommendations related to the role of the nation's public health agencies and organizations in working with individuals, entities, and jurisdictions to safeguard health before and after a wildfire. Without this wildfire-focused capacity support, members of the Commission felt making necessary changes to protect public health would be difficult, if not impossible.

Recommendation 39

Congress should provide funding for federal public health agencies to address the impacts of wildland fire and should authorize and fund cooperative programs between federal public health, emergency, and land management agencies to better align programs and goals.

Congress should explicitly recognize the public health impacts of wildfire as a critical component of management and mitigation activities. Key federal agencies charged with protecting public health, including the Environmental Protection Agency (EPA) and the Centers for Disease Control and Prevention (CDC), lack commensurate funding to address health risks, community impacts, and air quality implications associated specifically with fires burning in wildlands (including “beneficial fire,” collectively including prescribed fire, cultural burning, and wildfire managed for resource objectives to mitigate the possibility of future high-severity wildfires) as well as those fires burning in the built environment.

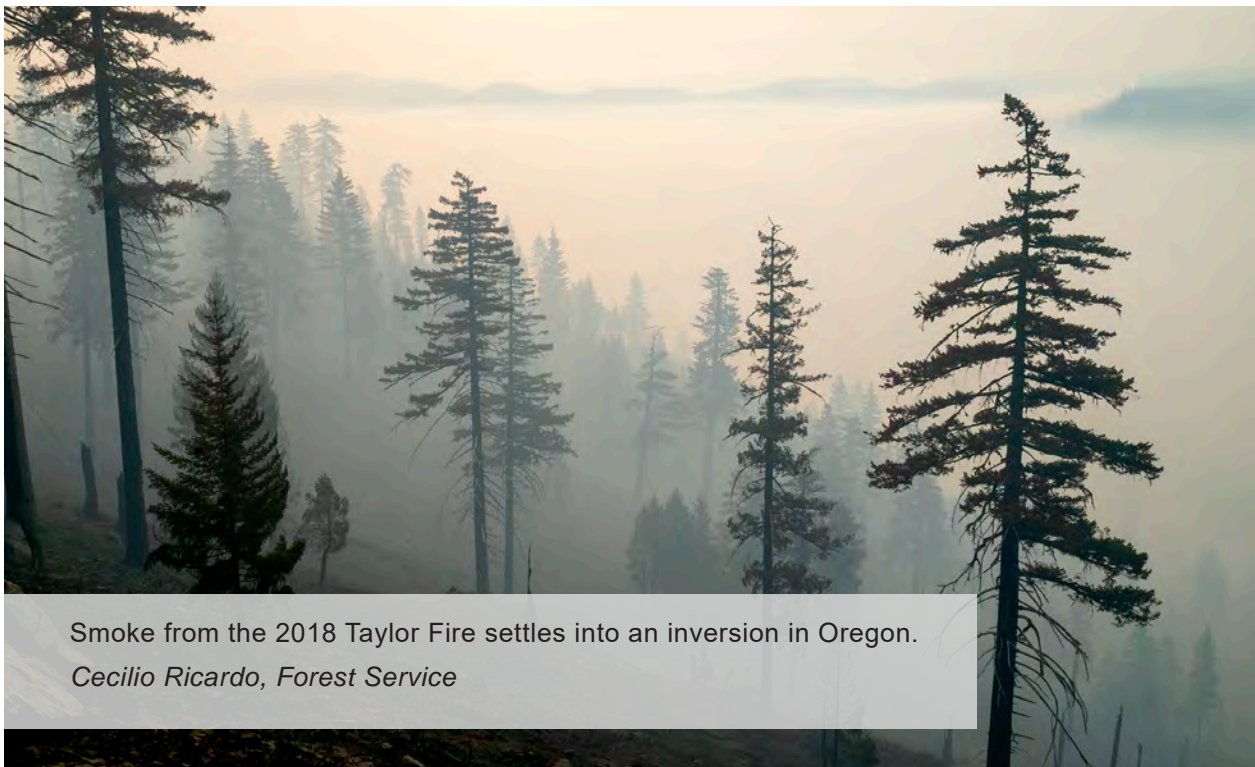
In addition to funding federal public health agencies to address these impacts, the Commission suggests creation of an integrated wildfire health program or other effort to establish a more formal structure for coordination among relevant agencies (e.g., the EPA, the Occupational Safety and Health Administration, the Indian Health Service, the CDC, and the National Institutes of Health). Congress should provide both the necessary authorities to establish this type of cooperative program and base program funding that is commensurate with federal investments in other key wildfire mitigation and management activities. In addition to an integrated program, the Commission emphasizes the need for increased coordination between federal public health agencies, land management agencies, and emergency response agencies to ensure that community and workforce health and wellbeing are systematically integrated into wildfire mitigation and management activities at all levels.

Recommendation 40

Provide resources to state, local, and Tribal public health authorities to work with wildland fire agencies, the public, and healthcare providers to promote wildland fire and smoke readiness, mitigate risks, and reduce level of potential impact per event.

Tribal, state, and local public health agencies have extensive public outreach experience and capabilities, knowledge of local needs and conditions, and partnerships with community health care providers – all assets that can enable them to play key roles preparing for, responding to, and recovering from health impacts caused by wildfire. However, the Commission found that these agencies often lack dedicated capacity to engage in wildfire-related activities, and to do so proactively and in coordination with wildland fire agencies.

Tribal, state, and local public health agencies need increased support to promote community readiness and risk reduction in the context of fire. For example, healthcare providers may need training to better understand the public health impacts and resources to communicate with patients, particularly those with pre-existing conditions such as cardiovascular and pulmonary disease, about potential health risks related to smoke from wildland fires and fires within the built environment, as well as actions that can be taken to reduce smoke impacts. Agencies also need resources to train and equip community healthcare providers to work effectively with patients affected by fire. Federal support should include both technical assistance and funding, which can be partly distributed through pass-through grant programs for community organizations.



Smoke from the 2018 Taylor Fire settles into an inversion in Oregon.

Cecilio Ricardo, Forest Service

Addressing Smoke Impacts

There is little doubt that smoke will be an expanding part of Americans' future. Wildfire smoke has led to increasing concentrations of fine particulate matter pollution in many states, and this trend is expected to grow with increasing wildfire activity (Burke et al., 2023; EPA, 2022c). As discussed above, smoke is far reaching, and all forms of smoke can negatively impact human health.



Smoke impacts can be costly. An Office of Management and Budget (OMB) estimate places the impact of wildfire smoke-related health care expenditures at between \$128 million and \$226 million per year by 2100 (Office of Management and Budget [OMB], 2022, p. 31). These impacts can also be wide-ranging and geographically dispersed. For example, in the summer of 2023, in the midst of the Commission's work, smoke from Canadian wildfires blanketed New York City and Washington D.C. Despite the broad geographic dispersal of smoke, risks related to smoke inhalation are not equal; infants and children, older adults, people with heart and lung conditions and those who are pregnant are particularly vulnerable (EPA, 2019b). Outdoor workers, including wildland firefighters, also face increased exposure to wildfire smoke (Navarro, 2020).

However, at the same time that human health impacts from smoke are a critical – and worsening – problem, the Commission continues to validate the essential need for increased

use of beneficial fire. Specifically, the Commission believes increasing the application of beneficial fire will support risk mitigation of future smoke emissions from wildfire events.

While all forms of smoke have negative health impacts, there is broad recognition that significantly increasing the application of beneficial fire in a strategic and coordinated manner is critical to mitigate the risk of high-severity wildfires and increase ecological resilience in many North American landscapes (Holland et al., 2022; Prichard et al., 2021; USFS, 2012; Vaillant & Reinhardt, 2017; see also Chapter 1: Creating the Foundation for Success, above). Some studies indicate prescribed fire produces fewer smoke emissions than high severity wildfires (Liu et al., 2017) though additional work related to prescribed fire emissions is called for by both researchers (Urbanski et al., 2022) and the Commission (see Recommendation 109 in Chapter 6: Integrating Modern Science and Technology).

The Commission acknowledges there are real and perceived tensions between the mutually important objectives of protecting public health from the impacts of smoke and enabling and supporting land management practices that reduce the future risk of large, high-severity fire events. While balancing these needs is challenging, the Commission believes that with sustained investment and increased cooperation, federal agencies, Tribes, and state and local agencies can work together under existing laws to clarify and align regulations, policy, and practice to promote these mutual objectives.^{xxvi}

The following recommendations attempt to address public health impacts of smoke through several interconnected avenues, including better resourcing entities at all levels that have smoke management responsibilities, assessing and improving the regulatory framework to enable use of beneficial fire, and supporting community mitigation actions. Importantly, recommendations on the protection of firefighter health from smoke impacts and smoke-related research are located in Chapter 5: Building a Comprehensive Workforce and Chapter 6: Integrating Modern Science and Technology, respectively (see Recommendations 98, 100, and 109).

Cross-referenced Recommendations

Recommendation 98: Invest in existing and new research and development to improve, and mitigate adverse physical, mental, psychological, and emotional impacts to firefighter health and safety when operating in both the built and natural environment.

Recommendation 100: Invest in the completion of a human health risk assessment for worker exposure to wildland fire smoke and smoke from wildfires in the built environment to estimate the nature and probability of adverse health effects in humans who may be exposed to hazards from smoke with the intent of creating best management practices to mitigate the extent and duration of exposure.

Recommendation 109: Invest in existing and new data collection, data availability, advanced technologies, and research to support use of beneficial fire while protecting human health and documenting emissions levels.

Insights: Smoke Management

The Commission's discussions about smoke, human health, and wildfire were some of this body's most extensive, and most challenging. Ultimately, the Commission did come to a number of consensus recommendations, all of which are grounded in agreement on two core acknowledgements: that there is a need to increase beneficial fire, and, at the same time, there is a need to reduce the impact of smoke on humans.

Commission members emphasize the long-term net value of beneficial fire for mitigating future high-severity fire and the associated impacts from smoke emissions. While acknowledging that beneficial fire produces smoke that can harm human health, the Commission also emphasizes that this smoke can often be carefully managed in terms of duration and pollutant concentration. This is in contrast to emissions from unplanned, high-severity wildfire, particularly those wildfires that result in an urban conflagration. Given the overall value of beneficial fire for mitigating the risk of future high-severity wildfire, restoring ecological resilience, and restoring core cultural practices of Indigenous people, the Commission considers expanded use of this tool to be of paramount importance.

The Commission also underscores the need for a parallel increase in measures to protect the public from the adverse health impacts of smoke emissions, including smoke from beneficial fire. The Commission recognizes the significant public health impacts of smoke which have been well-documented in the scientific literature and stressed the need to



Prescribed fire in the Monongahela National Forest, West Virginia, 2018.

Tanya E. Flores, Forest Service

address these impacts, particularly as they affect historically marginalized communities.

The Commission discussed at length the balance between the need to accommodate greater use of fire and to protect public health and the Commission agrees that both are needed. However, some members expressed concern that policies intended to reduce the human health impacts of smoke have not adequately accommodated beneficial fire and run the risk of limiting its much-needed expansion.^{xxvii}

While the balance the Commission ultimately achieved in its smoke-related recommendations relied heavily on recognition of the value of protecting public health and increasing the use of beneficial fire, it also hinged on the continued need to support mitigation actions in the public health context (e.g., Recommendation 43 below). Those mitigation actions intend to reduce or prevent human inhalation of smoke to ensure that communities are capable of living in a future where increased smoke is inevitable, whether from the expanded use of beneficial fire or the continued impacts of uncharacteristic wildfire.

Recommendation 41

While enabling proactive use of beneficial fire, Congress should increase the capacity of federal agencies, including Environmental Protection Agency, Health and Human Services, the U.S. Department of Agriculture, and Department of the Interior to work with state, local and Tribal governments to ensure that air quality, public health, and land management programs work toward minimizing impacts of smoke to human health and to ensure communities and individuals are better prepared for anticipated smoke from all forms of wildland fire.

Fire has long played a critical role in ecosystems across North America and the reintroduction of beneficial fire is widely acknowledged as an essential tool in reducing fuel loads and creating landscapes that are less prone to high-severity wildfire. The frequency and scope of beneficial fire must be dramatically increased in fire-adapted ecosystems in order to protect ecosystems and communities.

The need for expanded beneficial fire as a wildfire mitigation and risk reduction tool has also received strong Congressional support in recent years. Under IIJA, both the U.S. Department of Agriculture (USDA) and the Department of the Interior (DOI) received unprecedented funding to reduce wildfire risk, in part by significantly expanding the use of beneficial fire over the next 10 years. Specifically, the legislation included \$500 million for planning and conducting prescribed fires and related activities (Pub. L. 117-58; 135 Stat. 1097, Sec. 40803(c)(13)). Complementary efforts to increase use of prescribed fire are occurring on state, Tribal, and private lands.

Effectively balancing the clear need for increased use of beneficial fire with the equally important need to protect public health requires unique and specific capacity within federal agencies. Most importantly, agencies need the personnel and funding necessary to be able to work with each other and other non-federal entities on a coordinated approach for achieving air quality, public health, and land management objectives. A joint effort is crucial for aligning policies to effectively support these multiple objectives and to support consistent guidance and communications with communities about preparing for and reducing smoke impacts.^{xxviii}

The Commission recognizes that multi-agency coordination has started to occur through the White House Wildfire Resilience Interagency Working Group. As of 2023, the group was mapping existing efforts to better understand smoke and its impacts in order to identify gaps and identify specific goals for future work. The group also was working on communication, developing consistent information about federal activities, operational approaches for addressing smoke from wildfires and prescribed fire and science in this realm, and processes for responding to requests for subject matter experts and data. These ongoing efforts should be built upon.

In addition to baseline capacity for improved agency coordination and alignment, Congress should support capacity for USDA, DOI, the Department of Health and Human Services (HHS), and the Environmental Protection Agency (EPA) to collaboratively develop programs and proactive public health communication and community engagement strategies and tools. This should include support for the U.S. Fire Administration (USFA) and the National Oceanographic and Atmospheric Administration (NOAA) as well. Collaborative efforts could include those to reduce smoke impacts to the public, such as the EPA and Forest Service Fire and Smoke Map, and to support the appropriate application of best practices for land management and air quality protection (such as Basic Smoke Management Practices) in beneficial fire planning and implementation across jurisdictions.

Recommendation 42

Direct the Environmental Protection Agency, the Department of the Interior, and the U.S. Department of Agriculture to work together to expeditiously evaluate current federal regulations and guidance around the treatment of smoke from wildland fire in air quality management programs with the intent of ensuring the programs can accommodate increased use of beneficial fire. Such an evaluation includes the exceptional events pathway and making any necessary changes to enhance programmatic and procedural ease and clarity while ensuring protection of public health, in a manner consistent with the Clean Air Act. Further, Congress should provide resources to ensure federal, state, and local authorities can expand their capacity to document and exclude wildfire and beneficial fire smoke from regulatory significance.

As part of the federal Clean Air Act (42 U.S.C. § 7401-1765), the EPA is required to establish National Ambient Air Quality Standards (NAAQS) for common harmful pollutants, including fine particles and ozone. States and Tribes with EPA-delegated air quality programs are

responsible for determining how they will meet these national standards and for responding when areas are “classified as nonattainment,” which occurs when an area violates the NAAQS or contributes to a violation of the NAAQS in a nearby area. Because non-attainment comes with additional requirements and special compliance schedules (CRS, 2022d), states and Tribes generally take action to meet attainment goals (NWCG, 2020).

Though smoke emissions from fire include pollutants regulated by the Clean Air Act, some events can be treated differently for the purposes of determining non-attainment, given that they are considered unusual or naturally occurring and are not reasonably controllable. The EPA’s Exceptional Events Rule (40 C.F.R. § 50, 51) addresses wildfire and other similar events by enabling air agencies to submit a “demonstration” and request that EPA except or exclude (for the purposes of



The Camp Fire as shown from NASA’s Operational Land Imager on November 8, 2018. Over the course of the next eight days, air quality in the surrounding areas continued to degrade. In Chicco, California, PM2.5 concentrations were almost 100 times above the average reading (California Air Resources Board, 2021).

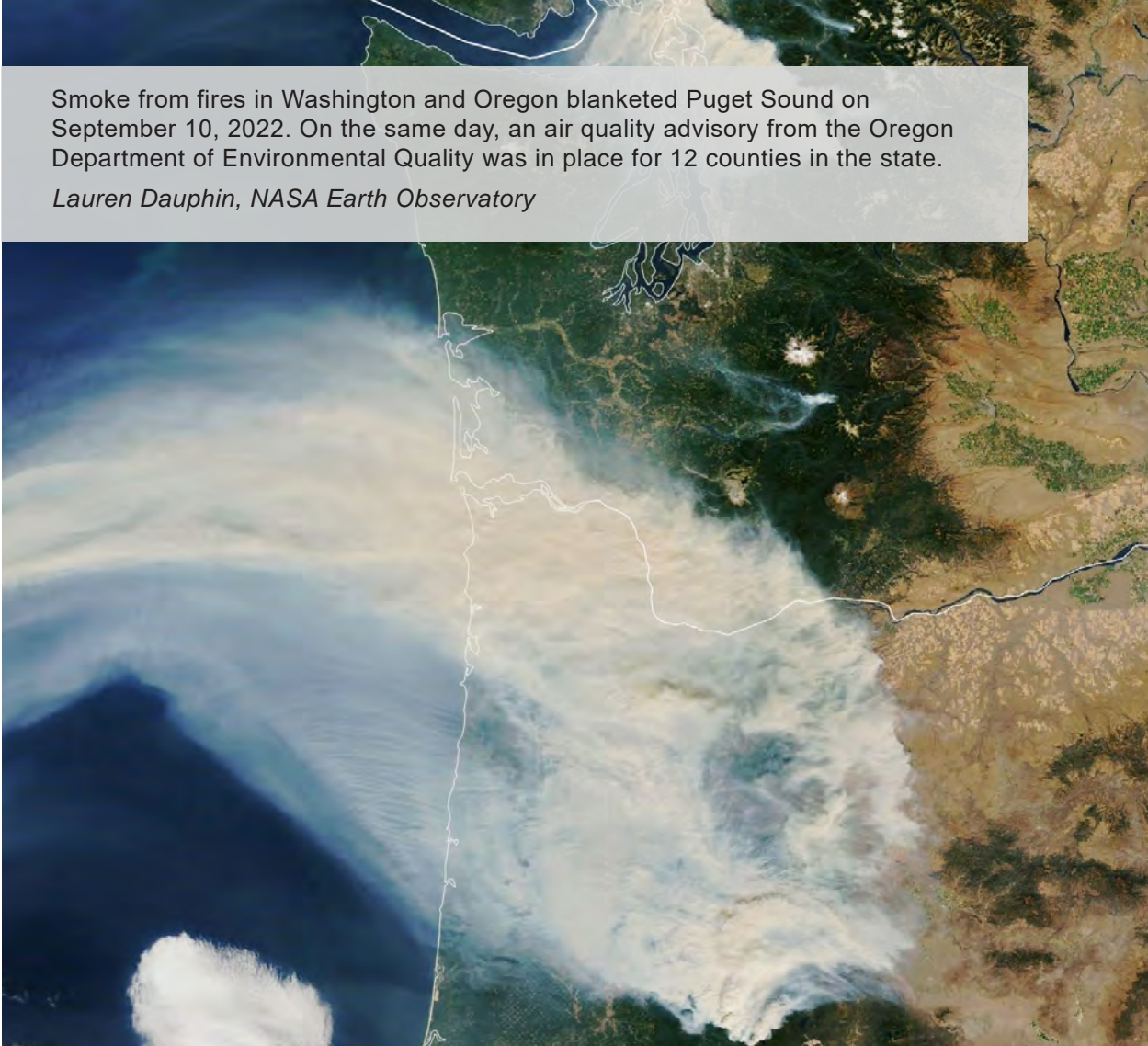
Joshua Stevens, NASA Earth Observatory

certain regulatory determinations) pollution concentrations caused by that event if associated pollutant concentrations otherwise would have triggered a NAAQS exceedance or violation or otherwise resulted in certain regulatory impacts. In 2016, EPA revised the Exceptional Events Rule and included specific provisions for prescribed fires.

It remains EPA’s intent, through the Exceptional Events Rule and accompanying guidance and implementation tools to provide an efficient pathway for exclusion of air monitoring data influenced by wildfire and beneficial fire emissions^{xxix} from certain regulatory decisions. The 2023 U.S. Government Accountability Office (GAO) report “Wildfire Smoke: Opportunities to Strengthen Federal Efforts to Manage Growing Risks” summarized interviewee reflections that “state and local agencies are unlikely to use [the Exceptional Events Rule] for prescribed burns because the agencies would not likely approve prescribed burns that could cause National Ambient Air Quality Standards exceedances in the first place” (GAO, 2023, p.74). GAO noted that documentation required to demonstrate a clear causal relationship between the event and a NAAQS exceedance – a requirement of the Exceptional Events Rule – is often time-consuming, technically complicated, and resource-intensive to prepare (GAO, 2023).

The Commission sees opportunities to work within the Clean Air Act and the associated regulatory systems and processes to accommodate both increased use of beneficial fire and protection of public health from smoke impacts. The intent of an expeditious evaluation of federal regulations, their implementation, and guidance called for in this recommendation should be to determine the barriers and challenges of the current processes, including the Exceptional Events Rule, and then to undertake efforts to address the identified issues to ensure programmatic and procedural ease.

In parallel to this review and revision effort, federal, Tribal state and local authorities must be provided adequate resources to undertake the activities needed to expand beneficial fire use via existing regulatory pathways. That includes resources for data tracking to identify and exclude wildfire and beneficial fire smoke from determinations of regulatory significance as well as the administrative capacity necessary to utilize the Exceptional Events Rule and manage the regulatory compliance process. Further funding and support should be

A satellite image showing the Puget Sound region in Washington state. The image is partially obscured by a semi-transparent grey text box. The text box contains the following text: "Smoke from fires in Washington and Oregon blanketed Puget Sound on September 10, 2022. On the same day, an air quality advisory from the Oregon Department of Environmental Quality was in place for 12 counties in the state." Below the text box, the satellite image shows a large plume of white smoke or haze blanketing the Puget Sound and extending inland. The land is shown in shades of green and brown, and the water is dark blue.

Smoke from fires in Washington and Oregon blanketed Puget Sound on September 10, 2022. On the same day, an air quality advisory from the Oregon Department of Environmental Quality was in place for 12 counties in the state.

Lauren Dauphin, NASA Earth Observatory

provided for non-federal partners at all scales to meet smoke management requirements, including best management practices during beneficial fire operations. Federal agencies also should work with states, Tribes, local air regulators, and land managers to support consistent understanding and interpretation across the system of EPA's guidance, consistent with this recommendation's intent.

Recommendation 43

Invest in existing and new community and individual preparedness efforts, infrastructure development, public communication and engagement opportunities, and mitigation programs at the federal, state, local, Tribal, and territorial level to reduce smoke impacts to human health.

The Commission felt strongly that actions which enable people to prepare for and live safely with smoke are not only important, but indispensable, to the increasing use of beneficial fire.

Despite the importance of public health messaging, resources, and tools to help the public reduce and avoid smoke impacts, available resources for this work are limited and fragmented. There are also inequities in people's vulnerability to smoke and ability to mitigate its impact that have not received sufficient attention and support (EPA, 2019b). Infants and children, older adults, people with pre-existing heart and lung conditions, and those who are pregnant are among the populations more vulnerable to smoke (EPA, 2019b). Additionally, factors such as socioeconomic status, housing, outdoor employment, access to health care, race and ethnicity, access and functional needs, and language barriers all influence a person's ability to protect themselves through actions such as the use of air filtration, respirators, modifications of structures, or spending more time indoors.

Given the potential extent of smoke impacts to communities, investments are needed in a range of preparation and mitigation efforts at the federal, state, local, Tribal, and territorial levels. Programs should put particular focus on addressing inequities and improving the mitigation opportunities available to communities with populations and households disproportionately impacted by wildfires and smoke exposures. Offerings should be made available to both renters and homeowners and designed to address smoke from both wildfire and beneficial fire.

Important activities that should be considered for additional investment include:

- Planning processes (e.g., Community Wildfire Protection Plans, Natural Hazards Mitigation Plans, Tribal Hazard Mitigation Plans, or pre-fire response plans) that address or could address smoke preparedness and other public health protection measures.
- The creation of "smoke-ready communities" and infrastructure, including early and iterative collaboration between the EPA and other public health agencies with Tribes, agencies, states, territories, non-governmental organizations, and land management agencies. A "smoke-ready community" is one in which residents are prepared and empowered with evidence-based, locally-relevant information to take actions to reduce health impacts from smoke.

- Community mitigation and preparedness actions, including but not limited to smoke alert systems, air filtration devices, guidance for personal protection actions, building enhancements and retrofits, and clean air shelters.^{xxx}
- Research by agencies such as the EPA, HHS, and the Indian Health Service to better understand populations and communities disproportionately impacted by smoke, the corresponding health impacts, and the steps that can be taken to mitigate those health impacts.
- Research to evaluate the relative effectiveness of different interventions and barriers to their adoption.
- Research, guidance, and standard development related to remediation of buildings affected by a fire or smoke event.^{xxxi}

Improving Air Quality Alerts

While smoke impacts to air quality are of considerable concern for public health, there is no consistent system for reporting current smoke conditions or forecasting future conditions. In addition, the existing national system of air quality monitoring networks is limited in reach due to the relatively high cost of installation and maintenance.

Several smaller-scale efforts have been developed at the federal level in recent years to address specific monitoring needs for wildland fire. Those include air monitors made available through the Interagency Wildland Fire Air Quality Response Program and through the Environmental Protection Agency (EPA) Wildfire Smoke Air Monitoring Response Technology pilot program. Despite these efforts, and the regulatory air monitoring efforts overseen by EPA, remote firefighter camps and smaller population centers affected by smoke can lack adequate observational air quality data. Recent efforts by the Forest Service and EPA to expand the availability of data from low-cost air quality sensors through AirNow have begun to fill this gap, but additional investments are needed.

Recommendation 44

Invest in a nationally consistent smoke monitoring and alert system to provide consistent, real-time information and forecasts on air quality impacts from wildland fire.

This monitoring system would provide important data to inform research, data availability and technology efforts referenced throughout the Commission's recommendations. A combined investment in Forest Service, DOI, EPA, and National Weather Service (NWS) capabilities is necessary to build key components of a smoke monitoring and alert system. This investment should:

- Increase availability of smoke sensors to ensure adequate and accessible data.
- Increase use of speciation monitors for research purposes to distinguish wildfire smoke from other forms of pollution.
- Expand land management agency smoke personnel and equipment to enable greater availability for both wildfire smoke events and larger prescribed fires.
- Expand support for the Interagency Wildland Fire Air Quality Response Program.
- Expand EPA emergency response capacity (personnel and equipment) to measure pollution from fires that involve combustion of hazardous materials and to communicate information during smoke events.
- Bolster the underlying EPA AirNow framework and technology and enhance [AirNow.gov](https://www.airnow.gov) and AirNow-Tech, including improvements to the AirNow EPA and Forest Service Fire and Smoke Map, AirNow Forecast Submittal System and the AirNow mobile app. Include resources to continue modernizing and sustaining AirNow as a state-of-the-art, real-time resource for providing robust and actionable information to protect public health from smoke.
- Provide the NWS with the access and ability to collect all air quality forecasts, public notifications, and alerts for smoke issued by federal, state, local, Tribal, and territorial air agencies and disseminate them through Weather Forecast Office networks. This approach would enable the successful NWS alert system for weather hazards to be extended to support smoke communications to protect public health and visibility.



- Improve coordination between the USDA, DOI, EPA, CDC, NOAA, and NWS to establish a public county-resolution smoke alert system for public health and roadways safety in addition to the current NWS Dense Smoke Advisories, which are based on visibility.

Investments in new efforts may also be needed, in addition to support and expansion of existing efforts.

Supporting Evacuation

While the Commission was not specifically tasked with formulating recommendations related to evacuation, members felt evacuation to be an essential part of the Commission's charge related to the protection of human life. Recent fires that quickly moved into and through communities, such as the 2023 fires in Hawai'i, the 2021 Marshall Fire in Colorado, and the 2018 Camp Fire in California have highlighted the critical importance of evacuation, evacuation planning, and evacuation communication. During catastrophic fire events, evacuation can be essential in conditions that enable rapid fire spread and limit fire response.

Communication is an important element of public health protection and effective evacuation. The decisions that individuals make regarding whether or not to evacuate depend, in part, on cues and information coming from official sources (McCaffrey et al., 2018). Alerts range from relatively common Fire Weather Watch alerts that inform the public of dangerous fire weather conditions, Red Flag warnings representing further heightened fire danger, and both imminent and mandatory evacuation notices (FEMA, 2023c).

FEMA and NOAA are the primary federal agencies involved in public alerts. NOAA is responsible for fire weather warnings, forecasts, and predictive services, while FEMA manages the Integrated Public Alert & Warning System (IPAWS). IPAWS serves as the nationwide local alerting system through the use of push messages to mobile phones, broadcast alerts on radio and television, and through the NOAA Weather Radio system (FEMA, n.d.). NOAA Weather Radio All Hazards (NWR) is a nationwide network of radio stations broadcasting continuous weather information from the nearest NWS office (National Oceanic and Atmospheric Administration [NOAA], 2023). These systems provide a national framework for emergency alert communications. However, the decision to issue fire warnings and evacuation notices are made at the local level.

The Commission found that **inconsistent tools and approaches to communication and public messaging of impending wildfire threats result in varying levels of awareness, preparedness, and public safety across communities when wildfires occur**. Lack of standardized terminology and protocols across communities is particularly problematic given the increases in new residents and transitory populations in wildfire-prone regions. Research indicates that clear, actionable, and relatable messaging is important in effective wildfire evacuation notices (Santo, Huber-Stearns, & Smith, 2021). Inconsistent and variable evacuation terminology also limits the ability of small, local jurisdictions to receive communications support from larger agencies or organizations. Larger organizations may, for example, be able to

produce non-English publications and communications products that can be challenging to produce rapidly at a local scale. To address this issue, the Commission recommends greater uniformity of terminology and support for local jurisdictions.

Recommendation 45

Local entities should be empowered and supported federally to utilize the best available technology to develop a consistent method or methods for evacuation.

Local police, sheriffs, and emergency managers are responsible for making and carrying out warning and evacuation orders for wildfires and other disasters, an authority that the Commission feels should remain at the municipal and county level. However, these local entities may lack the tools and resources needed to effectively plan for and implement warnings and evacuation processes that alert the public and help them move out of harms' way.

Federal financial and technical support should be made available to local emergency managers to help improve evacuation communications systems and bring them up to national standards. These improvement efforts should seek to create systems that bridge the digital divide and function in remote areas with little communications coverage and in the event of a loss of power or telecommunications networks. While needs will be highly place-dependent, the Commission suggests a number of strategies that could be federally supported to help address evacuation communication needs.

- Fill in cellular coverage gaps and harden existing infrastructure to prevent loss of cellular service. Ensure redundancy of coverage should communication equipment lose function during a fire.
- Support greater adoption of interoperable communication systems.
- Support adoption of new technologies to help cell phone evacuation alert systems reach more targeted areas. The existing evacuation system sometimes notifies too large of an area to be useful and so is underused.
- Expand siren alarm systems as an alternative tool in the absence of, or in the case of, lost cell phone coverage. Ensure there is clear communication about what a siren is intended to signal.
- Utilize wildfire detection systems, which can provide automated early warning detection.
- Transition existing “opt-in” alert systems to systems in which people are automatically enrolled with the option to opt out.
- Enable Emergency Operations Centers and NWS to serve as dissemination points to utilize Wireless Emergency Alerts^{xxxii} through the IPAWS for the issuance of non-weather emergencies, such as standard wildland fire Evacuation Immediate.

- Utilize NOAA Weather Radio as a backup system.
- Establish and maintain designated shelter areas in communities that build on recent research from the National Institute of Standards and Technology for shelter design details.

In addition to these options, the Commission recommends a broader assessment of existing wildfire communication and alert systems that could produce best practices and effective alert system for wildfires. As communities grow, they also should look to create evacuation planning that incorporates pre-fire spatial planning and evacuation drills, including the identification and communication of a shelter, safe exit route, post-fire recovery, and re-entry plan.

Recommendation 46

Congress should direct that a national standard of evacuation terminology and product type per the Federal Emergency Management Agency’s Common Alerting Protocol be established and utilized for fire purposes. This product should include the use of “Ready, Set, Go!” terminology and be supported with national communications products.

Congress should initiate the adoption of a single, standardized approach to communicating wildfire-related evacuations, with language that is descriptive of the action or level of threat. This could be a combined interagency effort of the NOAA, U.S. Fire Administration, and land management agencies. Specifically, a national standard for immediate evacuation within FEMA’s Common Alerting Protocol^{xxxiii} should be established for notification of wildland fire related evacuation notices. The “Ready, Set, Go!”^{xxxiv} terminology, which is already being utilized in many communities, offers an excellent, easy-to-understand model. This terminology should be integrated into a national all-hazard standard. Additionally, NWS should be able to engage the IPAWS Wireless Emergency Alerts to issue standard wildland fire Evacuation Immediate for non-weather emergencies.

As part of implementation of a new standardized approach, a national campaign should be developed to promote consistent use of “Ready, Set, Go!” terminology. Congress also should make additional funding available to local jurisdictions for public messaging, outreach, and engagement. The Commission notes that within the “Ready, Set, Go!” framework, there will need to be local flexibility to determine specific evacuation and preparedness actions associated with various terms. For example, sheltering in a local refuge area may be safer than evacuating during the “Go” phase in certain places and for certain hazards (Maranghides et al., 2023). Importantly, this recommendation is not intended to affect local authority to issue evacuations, but to enhance the dissemination and functionality of evacuation notices when they are issued.

Chapter 3: Responding to Fire

As wildfires grow larger, more complex, and all too frequently burn into and through the built environment, there is an increased need to improve frameworks for coordinating fire responders.^{xxv} Coordination systems and practices that facilitate interagency coordination, including legal agreements, systems for ordering and tracking resources, and training standards, have long been in place in both the structural and wildland fire services, but as the complexity of the problem grows, greater integration of those responders, as well as other emergency managers and partners, is needed.

The Commission was charged with an evaluation of the coordination of response to, and suppression of, wildfires and the development of recommendations to improve the same. The Commission found that **national coordination requires the support and participation of all relevant entities, from the local to the federal, to utilize all resources effectively.** As the occurrence and severity of wildfires increases, efficient and flexible mobilization of all available resources becomes vital.


The Commission also sees value in engaging in more incident response pre-planning before a wildfire ever starts. **Improving wildfire response coordination requires significantly improved pre-planning and positive relationships among all responders.** Application of analytical tools and inclusion of relevant partners before an incident begins can greatly improve the success of response operations during an incident. Success, however, should be measured as the overall, long-term reduction of risk. Importantly, long-term risk reduction may not be achieved through rapid suppression, which in many cases can increase, as opposed to decrease, risk over time. Successful shepherding of fire for long term risk reduction requires improved inclusivity of interested parties, including local government, Tribes, community members, and users of public lands.

Over the course of this review and discussion, the Commission developed recommendations that focused on two major themes: improvements to the framework for various entities to work in partnership in wildfire response and improvements to strategic planning that can occur before a fire starts. Put another way, recommendations cover both coordination of incident response and pre-fire planning.

Improved Response Coordination Frameworks

The system to respond to wildfire in a coordinated and cooperative fashion across federal, state, local, and Tribal entities has evolved over the past hundred years. The 1911 Weeks Act (36 Stat. 961, 16 U.S.C. § 515) established a cooperative framework for wildfire response, empowering states to be federally supported in managing wildfires (Forest History Society, n.d.). Frameworks for cooperation continued to grow through congressionally approved multistate regional compacts, starting with the Northeastern Forest Fire Protection Commission, initiated in 1947. These regional, multistate compacts allow for sharing of personnel and equipment between the states within a given compact for fire suppression, as well as with neighboring Canadian provinces (Northeastern Forest Fire Protection Compact, n.d.).

At the local level, additional interagency cooperative frameworks emerged in the 20th century, including the pioneering Firefighting Resources of Southern California Organized for Potential Emergencies (better known as FIRESCOPE), which was developed in Southern California in the wake of deadly wildfires in 1970. This effort provided an early model of the current cooperative framework and is still in use (Stambler & Barbera, 2011). The concept was further expanded to include all hazards in 1982, but adoption of the system was not universal. Finally,



Night operations on the Pine Gulch Fire in Colorado.

Kyle Miller, Forest Service

the September 11th terrorist attacks in 2001 led the Federal Emergency Management Agency (FEMA) to create the all-hazard National Incident Management System (NIMS), first published in 2004 and since revised. NIMS is not an organization but rather a collection of processes, systems, and a shared vocabulary, collectively shepherded by FEMA to facilitate delivery of resources to incidents of all kinds (FEMA, 2017).

Aside from the shared vocabulary and processes provided by NIMS, four additional elements enable functional interagency resource sharing: the legal agreements that permit cooperation and define details such as liability; the administrative systems that manage after-incident reimbursements; resource ordering systems that coordinate the functional mobilization of responders; and qualifications that help ensure baseline training and experience standards are aligned across participating entities. Compacts, agreements, and reimbursement mechanisms are critical to enable the mobilization of diverse resources, including state, federal, Tribal, local, and non-governmental resources. However, improvements are needed for greater mobilization and utilization of local resources in particular.

While the current national resource status and ordering system (formally called the Interagency Ordering Capability or “IROC”) may provide the core architecture for coordination of response resource ordering, some Commission members noted that participation from the full spectrum of parties that are eligible and needed is still limited. The functional inclusion of municipal and Tribal fire departments is particularly challenging, even though the pathways for participation do exist. One key barrier to fuller engagement of these entities is the multitude of inter-governmental and inter-organizational agreements, compacts, and other cost reimbursement arrangements required to be a part of the wildfire response system. Developing and maintaining these legal arrangements strains administrative capacity, both for smaller local entities and even for larger agencies responsible for managing numerous individual local agreements in a given area. Given this complexity, federal agencies have ended their involvement in hundreds of local-level agreements in recent years. This trend has spurred some states to fill the void by becoming hubs for agreements that allow local resources to be utilized as part of the national wildfire response. As such, both state compacts and congressionally-established multistate regional compacts have become increasingly critical to the overall mobilization of all response resources.

The Commission found that insufficient and delayed reimbursements to Tribal, state, and local governments also deter collaboration in wildfire response and result in the potential underutilization of the total potential pool of resources. In some instances, federal reimbursement rates have not fully covered partner entities’ indirect rates or they have not been sufficient to account for local conditions such as union contracts or higher-than-average costs of living. Non-standardized agreement language was also noted by Commission members as a source of delays, as each agreement may have different reimbursement requirements and allowable expenses. Lengthy adjudication and untimely federal reimbursement processes pose similar barriers. Reimbursements from federal agencies can take years to complete, disincentivizing participation in resource sharing by local, state, and Tribal entities that may not be able to hold debt on their books for the months or years required for a reimbursement. Issues of untimely payment at times extend to contractors, similarly disincentivizing participation in wildfire management. Factors contributing to these delayed timelines include incomplete claim forms, lack of training, poor ordering and tracking processes, and generally slow bureaucratic processes.



Blue Ridge Hotshots working on the Dixie fire on the Lassen National Forest, California, 2021.

Cecilio Ricardo, Forest Service

To maximize the number of non-federal entities willing and able to participate in local, regional, and national wildfire response efforts, there is a need to update and reform compacts and agreements, expedite reimbursement timelines, and improve mechanisms for determining reimbursement rates. Doing so will not only add to total resources in the system, but also diversify the response workforce. State, Tribal, and local fire organizations bring particular value to wildfire response, including knowledge of structure fire suppression and knowledge of and familiarity with the local landscape and any prior work in the area, such as relevant past fuels reduction. Local resources can also serve to provide valuable baseline coverage when other resources are deployed elsewhere.

Reforms to compacts and agreements should seek to improve resource sharing across jurisdictions and better integrate local resources, Tribal resources, and non-traditional partners. The efficient and flexible mobilization of all available response resources is increasingly vital as the occurrence and severity of wildfire continues to grow and as the use of prescribed fire increases, putting additional demands on the existing resource system.

Insights: Changing Organizational Expectations for Response

The federal approach to wildland fire response has historically relied on the concept of “total mobility;” the doctrine that resources will be placed in the area of highest need regardless of a resource’s geographic location or agency affinity (NWCG, 2023). This concept was initially implemented during a period when different regions of the nation experienced peak fire season at different times of the year. Since then, the regional fire seasons have

lengthened and now overlap more often than previously, which has led to a decreased ability to share resource outside of a resource's home geography. In the face of these trends, improved resource sharing and coordination is vital to utilize all of the potentially available resources more efficiently for wildfire response, including Tribals, state, local, and non-governmental personnel.

The Commission is in agreement that as fires continue to burn into communities and the built environment, wildfire should no longer be seen exclusively as a land management issue. For some members, this realization also implies a needed shift in how we think about responder coverage for wildfire incidents. Some members felt that more change was needed to make wildland fire response more like structure fire response. These changes could include preparing for wildfire with continuous, 24-hour dispatch coverage and resource availability and an increased emphasis on "all hazards," not just wildfire. Some Commission members called for the use of "standards of cover" for wildfire response. Such standards, widely in use in structure firefighting, amount to a performance measure and promise to respond to an incident within a given geography within a fixed amount of time. Core to this concept is the opinion of some Commission members that wildland fire response should be more holistically considered as a part of emergency management writ large.

Other Commission members noted that the current strategy of total mobility allows for maximum flexibility and that such flexibility is needed most when resources are strained. Furthermore, defining a standard of cover is not a strategy in and of itself, but rather a performance measure and choosing how to define a meaningful standard is not a trivial task.

Cooperative Compacts

Recommendation 47

Congress should help advance efforts by the Alliance of Forest Fire Compacts, State Foresters, and others to update regional compacts to meet modern fire management needs and to submit the updated compacts for congressional approval.

There are eight regional compacts in the United States, most of which were authorized by Congress more than 70 years ago. These compacts encompass groups of adjacent states and, in some cases, adjacent Canadian provinces. Additionally, within regional compacts there are specific state-to-state compacts, which can be updated and revised under existing state authorities. While states and their partner organizations must determine the specific

needs for modernized regional compacts, Congressional action is needed to authorize any modification to those regional compacts (CRS, 2023c).

Existing regional compact authorizations inhibit the sharing of resources between compacts, and do not clearly define individual state liability indemnification. These compacts should be modified to better reflect current conditions and needs, including for prescribed fire and other beneficial fire management activities. Priorities include:

- Clarification of liability indemnification in compact-to-compact agreements.
- Improved reciprocity between compacts.
- Improved ability for Tribes to enter into compacts.
- Clarified ability to mobilize local resources through compacts.
- Improved ability to form compacts with other countries.
- Allowance for compact-holders to be able to determine the needed details of these arrangements on a case-by-case basis.

In addition to the points above, Congress should consider the past work of the National Association of State Foresters and other interested parties that have urged the reopening of compacts and have developed specific proposals to modernize them. Congress should also seek feedback from the Alliance of Forest Fire Compacts. Feedback should also be solicited from other entities that would potentially be made eligible for these compacts, including Tribes and fire chiefs' associations. The Wildland Fire Leadership Council (WFLC) may be positioned to help coordinate exploratory conversations about this topic.

Recommendation 48

Congress should enhance Tribal participation in fire management compacts with states and foreign nations.

Few Tribes presently participate in regional wildfire compacts with states or foreign entities. Enabling more Tribes to enter into compacts will expand the available resources for wildfire response and management, including beneficial use of fire. Whether it be through modification of the Weeks Act (as noted in recommended Recommendation 49 below), an addition to the Indian Self Determination and Education Assistant Act, or another mechanism, all policy modifications should make sure to advance parity and equity for Tribes in the compacting process. Entities that should be consulted in implementing this recommendation include, at a minimum, the Intertribal Timber Council and the National Congress of American Indians. In addition to expanded authority, many Tribes will require additional funding to support the response workforce, as noted in Recommendation 92 of Chapter 5: Building a Comprehensive Workforce.



Firefighters from the Redwood Coast Fire Department gear up to work on the Kincaid Fire in Sonoma County, California.

Kari Greer

Recommendation 49

Revise the Weeks Act to include Tribes in the management and restoration of fire on equal footing to states.

The Weeks Act of 1911 provided funding and authority for states to manage wildfires within their geographies through fire protection plans and state agencies. However, this framework for fire management, which continues to this day, did not explicitly include federally recognized Tribes.

Modification of the Act to include Tribes on equal footing to states, and to reorient its focus from fire protection to fire management and restoration, would bring the Weeks Act into the modern era and help empower Tribes to engage more fully in fire mitigation, management, and response. Furthermore, inclusion of Tribes in the Act would provide another recognition of Tribal sovereignty and equitable cooperation between Tribes, states, and the federal government.

Reimbursements

Recommendation 50

Changes are needed to allow for more rapid reimbursements to response entities to enable greater participation and increase the pool of potential response capacity.

While the legal mechanisms exist to share response personnel and equipment across jurisdictions, the practice is functionally hindered by inconstant reimbursement rates and processes. Lack of adequate staffing within federal agencies can play a role in these delays, which are compounded by complications associated with review and adjudication of charges and variable rates, including true costs and allowable billables. These delays can deter local entities and Tribes from deploying resources to assist in response, as doing so risks straining their budgets and going into deficit for months or years until reimbursement is provided. Issues with untimely or insufficient reimbursements occur across agencies and have caused friction between federal and non-federal entities.

Some states, such as Colorado, California, Nevada, and Washington, have actively utilized compacts and state-to-state agreements to mobilize state, local, and private resources. In doing so, those states filled an intermediary role by reimbursing local and private responders and then holding the debt on their books until repayment by the receiving jurisdiction (be it another state, federal, or international body). This practice carries risks, however, with some states unable to play this role due to lack of sufficient budgets, statutory limits on the practice, or fiscal administrative policies.

The Commission did not identify a single best solution to this problem, and a one-size-fits-all approach may not be feasible or appropriate. However, there was agreement that any new

reimbursement mechanism should be timely and streamlined, with a goal of rapid repayment. Possible solutions include providing federal funds to support states in the establishment of revolving funds, as has become the practice in some states, to quickly pay local government resources. Alternatively, a federal entity could provide rapid reimbursement to less well-resourced partners while waiting for settlement from the entity that received those resources. Either approach is likely to require the development of additional administrative capacity, at a state and federal level.

Additionally, discussion included the role of FEMA's Fire Management Assistance Grant program (FMAG). Although the Commission feels the FMAG program is not suited to play a rapid reimbursement role as described above, removing the 25 percent cost share could help incentivize more participation by local fire departments. This was based on the experience of some states that have stepped up to provide rapid reimbursements, thereby covering the total expenses to local departments, while knowing that only 75 percent of those costs will be reimbursed through FMAG. Furthermore, the Commission seeks clarity on the use of FMAG to pay for prepositioning of fire responders, noting that this too should be considered a covered expense. See Recommendation 62 in Chapter 4: Recovering for Resilience for further discussion of possible expansion of FMAG authorities in the post-fire space.

Recommendation 51

In order to facilitate the prioritization of public safety in response resource ordering, Congress should establish a task force of relevant entities to review eligible costs for the purposes of expedited resource deployment and reimbursements processes.

Reimbursements also occur at differing rates depending on multiple factors, including variable wages and benefits, different policies regarding pay for “portal-to-portal” deployment, and other factors. Cost differences between entities are to be expected, yet a history of disputes over costs has led to “resource-shopping” or seeking the lowest reimbursable rates rather than utilization of the nearest and most efficient available resources. Additionally, confusion and lack of standard reimbursable rates contribute to the slow reimbursement process noted above.

To avoid protracted reimbursements and resource-shopping, the Commission recommends a task force review and identify eligible costs for inclusion in agreements. The intent and goals of this process should be to streamline reimbursements, rather than favor or set lowest costs. Specifically, the goal of the task force should be to make recommendations to ensure the following values are achieved in the reimbursement process:

- Reimbursement guidance should result in utilization of the closest available resources.
- Reimbursements should cover the true costs of an ordered resource.
- Reimbursements of both personnel and equipment should be addressed.
- Consideration should be given to fair reimbursement of responding entities based upon socioeconomic factors and administrative capabilities.

- Guidance and recommendations should result in more rapid reimbursements of costs.
- Mobilization should be maintained for the duration of an assignment.
- Reimbursement systems should not result in entities losing or gaining money on response.

Resource Ordering

Recommendation 52

Some locations offer positive examples of more effective resource mobilization and should serve as models for other areas.

Colorado, California, and Nevada offer good examples of improved integration of all available resources through interagency dispatch centers and statewide collaboration and cooperative agreements. Federal and state funding should be made available to support the development of similar efforts in other states.

The Commission notes several desirable elements in existing state models, including dispatching centers that provide continuous, around-the-clock service; statewide mutual aid systems that include all resources by default unless they intentionally opt out; interagency dispatch systems that better utilize the nearest available resources; and systems that enable greater flexibility to use local fire departments or other resources on shorter duration or closer deployments. Fundamentally, state-level coordination strategies should support greater interoperability between state, local, Tribal, federal, and contracted entities. While noting these desirable attributes, the Commission also underscores the need to enable state-level flexibility. Federal funding in support of state resource mobilization efforts therefore should not come with conditions that dictate which models or approaches are used by any individual state, given that needs will vary.

Recommendation 53

Congress should direct a task force to explore the potential to improve the national resource ordering and status system and ensure that it is more accessible to qualified entities and individuals.

Resource ordering and dispatching occurs through multiple routes ranging from a formal system to personal relationships and communication. Requests for, and tracking and allocation of, resources at all scales is aided by the Interagency Resource Ordering Capability (IROC) software. IROC is managed by the National Wildfire Coordinating Group



Heavy equipment at a fire camp in August, 2021.
Casey Steenhoven, Bureau of Land Management

(NWCG) and has strong federal agency participation, as well as representatives from state and local entities.

The IROC system is open to any interested and qualified entity, including state and local fire agencies and departments. However, the Commission sees the need for an evaluation of the strengths and limitations of the current system and identification of any needed improvements to ensure that it is functional and inclusive of the diverse array of state, local, Tribal, and non-governmental entities needed to respond to wildfire more holistically.

Insights: Accessibility of the Resource Ordering System

Commission members engaged in significant discussion regarding the current framework of resource sharing, including the existing resource ordering platform (IROC), qualifications and training standards, and mutual aid agreements, ultimately reaching consensus on the recommendations listed in this report. All members agreed on the fundamental goal of increasing participation and resource sharing, from local fire departments in particular, but opinions varied as to how much change – if any – is needed to the current approach. Some members noted that existing systems like IROC

and National Wildfire Coordinating Group qualifications were fundamentally sound and constitute a national resource sharing framework. Other members noted the inaccessibility of the existing framework for local fire departments, Tribes, and non-governmental organization partners. Agreement was reached on the need to evaluate the existing framework more thoroughly to better identify its strengths and limitations, but some members continued to see a need for policy change in this space.

Qualifications and Training

The system of wildfire response coordination relies heavily on being able to deploy resources and personnel where and when needed – a system of interoperability and modularity. One key component is a rigorous qualifications system that provides training and curricula on a given subject and tracks individuals with those qualifications (FEMA, 2017). The system is designed so that any qualified individual, regardless of employer, can be mobilized and utilized in incident response with a high level of certainty that they have received sufficiently similar training and experiences as any other person with the same qualifications. This allows for Incident Commanders and managers more generally to plan and order specific personnel resources.

One of the key roles of the NWCG is to establish the standards used for any given qualification in the wildland fire community (NWCG, 2013). Qualifications range from broader courses needed for entry level positions to the very specialized, such as those needed to serve as Air Operation Branch Director. In addition to coursework and classroom training, most qualifications prepare an individual to serve as a “trainee,” permitting them to execute related functions under the supervision of a fully qualified individual. Hands-on experience is recorded in a “task book,” which specifies how many times an individual must demonstrate competence before becoming fully certified in a specific qualification (NWCG, 2022).

The training and qualifications established by NWCG are used by many agencies and individuals, including contractors and state, local, Tribal, and federal employees. However, there are multiple administrative systems and databases for tracking qualifications. The Incident Qualifications and Certification System (IQCS) is the administrative system used to track such qualifications across federal agencies and employees (Incident Qualifications and Certification System, n.d.). IQCS handles qualifications tracking for all federal partners to NWCG, as well as the U.S. Air Force and U.S. Army; however, it does not manage qualification tracking for all entities that participate in wildfire response. States use a parallel system known as the Incident Qualification System (IQS) (Colorado Division of Fire Prevention & Control, n.d.). While some larger non-governmental and national conservation corps organizations have negotiated access to the federal IQCS system for their employees, this access is rare (Shively, 2022). Most non-governmental entities have struggled to find a workable solution to this challenge (Shively, 2022). Similarly, those Tribes that establish their own qualification systems – rather than relying on those established by NWCG – face challenges in access and recognition.

Bureau of Land Management staff conducted a training exercise using a sand table in May, 2021.

Avi Farber, Bureau of Land Management contract photographer



These existing wildland fire qualifications systems, as well as the associated training and curricula, are based on hard-learned lessons and were designed to ensure safety and high performance regardless of the affiliation of a responder. At the same time, these qualifications can be very difficult for a range of practitioners to obtain. Federal wildland firefighters and non-federal fire practitioners alike often struggle to gain access to the training, coursework, and practicum experience required under NWCG standards. As noted above, some aspects of the system make gaining the necessary qualifications particularly challenging for volunteers and non-governmental organizations. Additionally, some prescribed fire qualifications require individuals to have significant wildfire suppression experience, which can be hard to acquire for those whose primary job responsibilities are outside of suppression or who work for local agencies and organizations without easy access to routine wildfire assignments.

The nation needs wildfire training and qualification systems that are easily accessible to all interested parties and empower all fire management personnel, not only those associated with federal agencies or land management. Bringing in these additional personnel and partners to increase mitigation and response capacity is vital for overcoming current strain on the fire response workforce. The Commission feels it important to increase access to these opportunities and puts forward the following recommendations to help address these issues.

Recommendation 54

Increase access to qualifications and training opportunities for all partners.

While training requirements vary greatly across much of the fire-related workforce, personnel with responsibilities related to wildfire management and the beneficial use of fire (including prescribed fire) on federal lands must adhere to the interagency standards and systems established by NWCG. Increased access to qualifications and training is needed for partners outside of the federal system.

The Commission sees many opportunities for improved access and advancement in this space, so that necessary investments are made in workforce development, capacity, and training across all parts of the wildfire workforce. Many recommendations are highly administrative in nature, but all of these options ultimately require additional funding to accomplish. Options include:

- Non-federal parties, including employees of local fire departments and Tribes, need to receive more opportunities to enroll in training courses and, critically, to receive time on fire assignments to finalize response credentials. Participation in fire assignments – a kind of practicum – is critical because NWCG standards require significant demonstration of competency in the field for successful completion of “task books” and full certification. This may require additional coordination to connect those needing training opportunities with those who are qualified to train.
- Functionally, completion of the NWCG practicum process requires access to assignments and dispatching. Therefore, to improve access, both the fire qualifications management system (the Incident Qualifications and Certification System, or IQCS) and resource ordering system (the Interagency Resource Ordering Capability, or IROC) also must be more inclusive of non-federal entities and individuals.
- NWCG should be encouraged to continue its current review of speed to competency and recognition of prior learning policies. This review should also identify any disparities in time to competency presented by gender. Should policy changes or additional funding be required to operationalize the resulting recommendations, Congress should encourage the agencies to adopt necessary changes.
- Consider expansion of the NWCG certification board to include significantly more non-federal and nonstate partners.
- In addition to addressing disparities in dispatching opportunities, NWCG, in partnership with an expanded body of representative non-federal entities, should be instructed to review the task book practicum requirements for attaining full certification in qualification to determine if such requirements can be met through other means or otherwise made less burdensome, particularly for individuals for whom response is not their full time or primary job. This review should also consider changes needed to make sign-off on task books less reliant on a single individual in the field to remove the impact of personal biases on the part of certifying individuals.

Recommendation 55

Create and fund more training opportunities for the mitigation and management response workforce.

In addition to increasing access for more partners to qualifications and training opportunities, there is a need to expand the overall number, type, and capacity of training opportunities for both federal and non-federal entities. The Commission identified several areas ripe for increased investment and expansion, including expanded training and professional development for the community mitigation and recovery workforce; development of prescribed fire academies and training exchanges; mid-career fire leadership academies; and improved agency administrator training for managing wildfire. Accessibility for non-federal partners should be a priority as these entities offer diverse assistance to federal agencies besides wildfire response, including assistance in planning and post-fire recovery.

The Commission feels that the wildland fire response workforce would benefit from opportunities for mid-career training through the creation of a Middle Fire Leaders Academy open to federal and non-federal employees alike. Such an academy should focus on providing rapid training and certification for emerging wildfire and beneficial fire leaders. This would help encourage a wider array of workers to enter and stay in the fire workforce and help fill non-entry level positions. Additional and expanded training is also needed for agency administrators (i.e., the managers and decision makers working on wildfire incidents and prescribed burns). Agency administrators should receive sufficient training to make informed decisions regarding the beneficial application and management of fire, including managing local fire regimes and other forms of beneficial fire use. This could be accomplished through support for and expansion of existing training offerings and could occur at the local level. Commission members note that an expansion of a fire environment center, as discussed in Recommendation 104 of Chapter 6: Integrating Modern Science and Technology, would help support more informed decision-making on these topics.

Recommendation 56

Congress should increase support for the U.S. Fire Administration to provide expanded community-based wildfire training and engagement of the nation's non-federal fire service; promote fire-adapted communities to build community resilience; and improve coordination with wildland fire management as a critical and necessary partner in wildfire risk reduction.

As noted throughout this report, wildfire is no longer solely a land management problem. With increasing frequency, fires move across the environment, transitioning from wildfires to fires within the built environment. More than one million people provide fire and emergency medical services focused on the built environment through local career, volunteer, and paid-per-call organizations (United States Fire Administration [USFA], 2023b). This represents a large potential workforce for wildfire response. These local responders are often some of the first resources on scene when wildfires impact communities. As wildfires increasingly

reach the built environment, particularly in places where wildfire response has been atypical, it is essential for both community and firefighter safety that these responders have wildfire training. Many of these organizations are adapting their programs to meet increasing wildfire challenges but some remain under-trained and under-equipped.

The national structural fire services – comprised of state, Tribal, and local agencies as well as non-governmental organizations – may be able to reduce and respond to evolving threats posed by wildfire but need to be better integrated with the traditional wildland fire community. As wildfires have and will continue to grow in extent and severity, the need to protect communities and critical infrastructure requires a national public safety agency that can provide training and expertise to structural fire agencies and that can partner effectively with existing wildfire response agencies and coordinating groups such as NWCG.

The U.S. Fire Administration (USFA) is well-positioned to function in that intermediary role. The agency can help support the national fire services through training and engagement with local agencies well versed in protecting the built environment from fire. Further, USFA is highly capable of supporting further coordination of the national fire service with wildland fire agencies.

Enabling the USFA to increase its ability to support, train, and equip the existing structural fire protection workforce for wildfire response will significantly improve the level of service provided by local fire and emergency medical services organizations. Training should cover wildfire that occurs in both landscapes and communities and should be inclusive of local



Engines from multiple response entities from across the western region on the 2013 Beaver Creek Fire near Hailey, Idaho.

Lance Cheung, USDA

and Tribal fire personnel. Increased funding for State Fire Training grants administered by the USFA, including multi-year funding appropriations, would help support state and local planning for capacity and capability goals. Additional work may include code and standard development, data management, and national communications.

The Commission does not, however, want to see a separate system of training and qualifications created for the national structure fire service; rather, the Commission encourages better integration between the national fire service and wildland fire agencies and felt the USFA was well-positioned to support this integration.

The opportunity exists to specifically recognize the USFA as having an equal and vital role in wildfire mitigation and management. As one possible example, USFA could take an expanded role as one of the co-chairs of the Wildland Fire Leadership Council for the purpose of better integrating the built environment into wildfire management.

Planning for Incident Response

Pre-fire response planning represents an important strategy to support both safe and effective wildfire response and the increased use of fire for land and resource benefit, which is critical for long-term wildfire mitigation and management. Pre-fire response planning is the practice of gathering relevant specialists and interested parties to discuss and explore response options under different scenarios in advance of a fire, allowing for the development of strategies and plans well before an actual incident (Colorado Forest Restoration Institute, n. d.). This process offers an opportunity to improve response coordination and to be more inclusive of all parties before an event occurs.

Working through different response scenarios during pre-event planning enables fuller exploration of when and where suppression is most appropriate to achieve wildfire risk reduction and ecological restoration, supporting managers in considering, and creating decision-making processes around options other than full suppression. At present, many wildfires that are suppressed under low and moderate fire danger conditions are the same fires that could be utilized beneficially to reduce fuels buildup and achieve longer-term resource and protection objectives (Thompson et al., 2022c). The Commission believes that wildfire response strategies must consider long term solutions given that short term aggressive response can result in increased fuel loads that actually exacerbate the long-term wildfire risk and the potential for large high-severity wildfires well into the future. Furthermore, use of wildfire planning is critical in designated Wilderness areas that may otherwise have tightly limited management options for pre-fire mitigation work. The Commission also notes that pre-fire planning can be used to help prioritize the location of fuels treatments by identifying which fuels breaks might be most important across multiple fire scenarios. Strategic, indirect wildfire response tactics can not only improve long-term conditions for communities and landscapes; they can also reduce firefighter exposure to risk. Collaborative groups, permittees, landowners, and other potentially impacted parties can participate in pre-fire planning as well by helping to identify important values and assets that land managers may not have otherwise considered. Pre-fire discussions that include interactive participation and communication provide an opportunity to build trust and increase community acceptance of a variety of management strategies (Steelman & McCaffrey, 2013).

Potential Operational Delineations (PODs) are a relatively recent, but increasingly important, example of pre-fire response planning that supports proactive wildfire response planning and the measurement of effective and efficient response. PODs combine the use of spatial analytical tools and consultation with local fire management practitioners to develop potential control lines that can be used to manage future fires (Colorado Forest Restoration Institute, 2020). Planners bring together fire management personnel to review modelled fire behavior and discuss and agree upon different control points based on various weather and risk scenarios. Subsequent meetings can bring in more interested and impacted parties to identify values at risk within a given area and plan potential responses to ignition within any given POD (Colorado Forest Restoration Institute, 2020). These workshops include fire personnel but can – and should - be made more inclusive of partners to ensure effective and inclusive planning (Thompson et al., 2022c). As of 2022, at least 40 National Forests have completed the PODs development process, representing 73 percent of forests in the continental western United States (Rocky Mountain Research Station, 2022) but needs continued and expanded collaboration with communities. Additionally, there are opportunities to expand the use of PODs for a broader set of resource goals before, during, and after wildfires.

Recommendation 57

Congress and agencies should expand support for the further development and utilization of pre-fire response planning, such as the Potential Operational Delineations methodology, as a science-based, collaborative, and interdisciplinary framework for improving wildfire management and mitigation, integration of land management objectives with wildfire management objectives, and collaborative engagement.

Federal funding is needed to support the widespread adoption and use of science-based, collaborative, and comprehensive pre-fire planning on all land management units. The Infrastructure Investment and Jobs Act (IIJA) provided up to \$100 million for the U.S. Department of Agriculture (USDA) and Department of the Interior (DOI) to support the development of PODs (Pub. L. No. 117-58, 135 Stat. 1098, Sec. 40803(c)(7)). However, additional, and ongoing, dedicated funding and other incentives may be needed to support more meaningful partner engagement strategies, including local and Tribal collaborative efforts. These efforts are integral to informing pre-fire tools and processes, and to extending planning beyond federal boundaries, if appropriate. Along with new funding, the Commission recommends Congress request periodic updates or develop a performance measure to track the development and use of pre-fire planning on federal land management units.

Recommendation 58

Increase and foster local participation in collaborative pre-fire planning and management through pre-fire planning initiatives like the Potential Operational Delineations process.

As wildfires grow larger, more severe, and more threatening to life, property, and resources, they are impacting and engaging a greater sphere of people and interests. States, Tribes,

localities, and other partners should have more opportunities to provide input that can help inform fire management decision-making.

Allowing a broader range of non-federal participants to be involved in wildfire management can add several advantages, such as better addressing far-reaching smoke impacts and helping to foster greater understanding and social support of management decisions such as the beneficial use of fire (McCaffrey, Wilson, & Konar, 2017; Steelman & McCaffrey, 2013; Thompson et al., 2022a). For example, engaging public health partners in pre-fire planning could support smoke-readiness for communities and reduce the risk of human health impacts. Collaborative engagement also can help develop clearer terminology for explaining fire response decisions to the public.

Pre-fire planning processes are an opportunity for greater inclusion of diverse interests in this phase of wildfire management. Planning processes should be structured to bring together people from different phases of wildland fire management (e.g., pre-fire planning, land management, and response) with those from other relevant facets of land management, and those representing other relevant interests, including those of local communities. Incorporating Tribal perspectives is particularly important to ensure that potential control lines are not established in places or manners that would adversely impact cultural resources or other Tribal values. However, such coordination should also ensure that such information is kept confidential when requested by the Tribe. For more information on Tribal data confidentiality, see Recommendation 119 in Chapter 6: Integrating Modern Science and Technology.

While the Commission found robust collaboration is entirely consistent with the best use of pre-fire planning and has occurred in some cases, many other pre-fire planning processes have been undertaken by agencies with minimal outside engagement.

Recommendation 59

Congress should examine whether Farm Service Agency and Natural Resources Conservation Service programs can be used to compensate producers for forage losses due to the use of beneficial fire to reduce the threat of catastrophic wildfire and make statutory changes if needed to support this use.

Several existing programs, including the Farm Service Agency's Livestock Forage Program and the wildfire forage loss section of the Emergency Livestock Assistance Program, allow for the compensation of livestock owners for forage losses due to adverse events such as drought, blizzard, and wildfire. USDA's Natural Resources Conservation Service may also have existing programs that could be adapted to meet this purpose. Congress should ensure that these programs can also compensate livestock owners if the use of prescribed fire or wildfire managed for resource objectives results in the loss of forage. Allowing for such compensation may help mitigate the negative impacts of beneficial fire on livestock owners, addressing what can be a key barrier to expanded use of fire in some places.



Chapter 4: Recovering for Resilience

More wildfires are burning large areas at high severities, creating acute and chronic post-fire impacts in both the built and natural environments, yet defining the “post-fire period” itself can be difficult. While the period after fire suppression is often referred to as the beginning of the post-fire period, the 2017 Thomas Fire resulted in 23 debris-flow related deaths even before the fire was contained (Kean et al., 2019). The end of the post-fire period is also poorly defined. Impacts vary by fire, and can occur days, weeks, or years after the fire; and, in some cases, can cause permanent change. For many communities, high-severity wildfires result in an ongoing watershed emergency for years, increasing the risk of flooding, debris flows, and other cascading events. Further complicating the definition of the post-fire period, extended and variable timelines, together with increasing fire frequency, can create environments where both pre- and post-fire mitigation actions overlap. The significance and magnitude of post-fire impacts, as well as the magnitude of the need, spurred the Commission to extend its recommendations beyond the statutory charge in the 2021 Infrastructure Investment and Jobs Act (IIJA) to make recommendations that address a broad suite of recovery needs.

Communities that have experienced significant wildfires often identify extensive post-fire needs that existing programs and authorities may struggle to meet (Edgeley & Paveglio, 2017; Rosenthal et al., 2021; Moloney et al., 2023). Needs that arise in the natural environment during the post-fire period are diverse and evolving, ranging from time-sensitive post-fire assessments and emergency activities necessary for the protection of values at risk to longer-term ecological restoration. Debris flows and flash floods can occur miles downstream of the burned area and risk can last for years after the fire (County of San Mateo, 2021; National Weather Service, n.d.).

In addition to the considerable impacts to the landscape and associated hazards to downstream or downslope communities, communities in the post-fire period can experience challenges resulting from economic losses, damage to infrastructure, increased housing costs and demands, and more. Mental health impacts can also occur. After the 2016 Fort McMurray wildfire in Canada, children aged 11-19 years experienced mental health impacts for at least three years after the fire (Brown et al., 2021). Another case study from Paradise, California after the 2018 Camp Fire found that mental health impacts within the educational systems were significant and compounded by existing social vulnerabilities^{xxxvi} (Hamideh, Sen, & Fischer, 2022). This exacerbation of existing inequities and vulnerabilities is not unique to the Camp Fire, nor to wildfire disasters, though there have been numerous efforts to understand and identify

social vulnerability within the context of wildfire ((Davies et al., 2018; Palaiologou et al., 2019; Paveglio et al., 2015a; Wigtil et al., 2016).

While research has shown that communities of color are disproportionately vulnerable to the impacts of wildfire (Davies et al., 2018), vulnerability is not limited to race. Wildfire can cause numerous points of stress (e.g., the need to evacuate quickly, understand evacuation instructions, absorb losses) in which existing social conditions (e.g., the lack of a car due to age or access, limited English proficiency, low income, or lack of housing) both limit the ability of an individual to react in the moment and recover in the long-term. Additionally, research indicates that vulnerable populations may also struggle to participate in post-disaster decision-making, further limiting the ability of these populations to recover (Hamideh & Rongerude, 2018).



Case studies of post-fire costs provide insights into both the magnitude of the post-fire expenditures and the complexity of post-fire needs. Research has estimated that wildfire suppression costs account for less than 10 percent of the total cost of wildfire (Headwaters Economics, 2018; et al., 2017). Larger studies focused on assessing the true costs of wildfire indicate both the enormity of recovery costs as well as the difficulties in complete accounting of wildfire cost and losses (Troy et al., 2022). To provide an example, surveys completed a decade after the 2010 Schultz Fire in Arizona indicated that 25 percent of respondents experienced significant stress as a result of the fire and post-fire flooding (Colavito et al., 2021). This personal stress and impact can also produce individual economic costs (e.g., time off work, health insurance claims). In addition, subject matter experts reported communities potentially face the loss of income or tax base, which may lead to diminished financial ratings for municipalities

(e.g., credit scores, municipal bond ratings) that can further contribute to financial costs and losses – issues that often go undocumented in larger cost accounting efforts.

The Commission feels strongly that **actions taken in the post-fire period should improve resilience in both communities and ecosystems**. There is no doubt that recovery presents incredible challenges as both costs and losses can be significant. Faced with immediate crises and needs, communities often focus on rapid restoration of pre-fire conditions, foregoing the opportunity to build back to a better state (McGee et al., 2020). However, recovery is an opportune and critical time to make investments that go beyond simply restoring baseline conditions, but to also improve overall resilience of both communities and landscapes (Mockrin et al., 2016; Rosenzweig & Solecki, 2014; Schumann et al., 2020).

The task of addressing post-fire impacts falls to a multitude of agencies and governments, each with unique jurisdictions, authorities, resources, and internal policies, incentives, and practices, yet the Commission found no consistent formal process to look at the overall picture of hazards and recovery. Part of the challenge experienced in the post-fire period is that **the recovery of ecosystems and communities are fundamentally linked, but the approach is fragmented**. According to the Government Accountability Office (GAO), more than 30 federal entities share responsibilities for different components of disaster recovery (GAO, 2022b).

Even with the broad distribution of responsibilities, the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) (Pub. L. No. 93-288, 88 Stat. 143, as amended)^{xxxvii} is a cornerstone of federal disaster recovery. Through the Stafford Act, states, territories, or Tribal governments can request federal assistance when state and local capacity has been exceeded. Importantly, federal aid provided through the Stafford Act is not automatic; it must be both requested and approved. Federal assistance is designed to supplement, not supplant, the work occurring locally. After a state or Tribal government requested assistance, the Federal Emergency Management Agency (FEMA) receives and evaluates the request for assistance and then makes a recommendation to the President on whether to issue a disaster declaration.

There are two main types of disaster declarations, emergency and major. Broadly speaking, resources available through the declarations process are Public Assistance, Individual Assistance, and Hazard Mitigation Assistance. Public Assistance provides “supplemental Federal grant assistance for debris removal, emergency protective measures, and the restoration of disaster-damaged, publicly owned facilities and specific facilities of certain private non-profit organizations” (FEMA, 2020a, p. 17) while Individual Assistance funds temporary housing, repair or replacement of owner-occupied homes, crisis counseling, mass care, disaster legal services and more. Hazard Mitigation Assistance is comprised of three main FEMA programs: the Hazard Mitigation Grant Program (HMGP), the Building Resilient Infrastructure and Communities (BRIC) program, and the Flood Mitigation Assistance (FMA) program. The Safeguarding Tomorrow through Ongoing Risk Mitigation Act of 2020, or the STORM Act (Pub. L. No. 116-284, 134 Stat. 4869 (2021)), created an additional program to support mitigation actions through a state revolving fund. Another type of assistance, separate from the disaster declarations process and known as Fire Management Assistance Grants (FMAG), can also be requested through the Stafford Act, and is discussed in greater detail later in this report.^{xxxviii}

During the declaration evaluation process, a determination is made regarding which types of assistance will be made available to communities. In several instances, Public Assistance

has been approved while Individual Assistance has been denied, spurring calls for increased transparency around the process for evaluating disaster declarations, particularly in rural places (Edgeley & Paveglio, 2017). Research indicates that both Public Assistance and Individual Assistance may be underserving some communities, particularly those with social vulnerabilities (Domingue & Emrich, 2019; Drakes et al., 2021). Commission discussions touched upon the declarations process, but ultimately did not pursue recommendations that would alter the way in which disasters are declared or the criteria used to evaluate disaster requests. Instead, the Commission focused its recommendations on expanding eligible activities within existing assistance types (Public Assistance and Individual Assistance, as well as the assistance provided through FMAG). The Commission also made recommendations related to the provision of assistance to those communities that do not receive a disaster declaration, as the vast majority of wildfires in the nation fail to reach this threshold.



The 2017 Thomas fire, one of California’s largest wildfires on record, burned more than 280,000 acres across Ventura and Santa Barbara counties for nearly a month, leading to large debris flows in the Montecito area in January 2018.

Jason Kean, U.S. Geological Survey

Days after fatal debris flows devastated Southern California’s Montecito community, a team of U.S. Geological Survey geologists joined county, state, and federal partners to survey and evaluate the aftermath of the Thomas Fire.

Jason Kean, U.S. Geological Survey

In addition to making recommendations related to the Stafford Act, the Commission focused its attention on landscape recovery efforts, which are no less complicated or fragmented than recovery efforts occurring within communities. Interagency efforts, such as Burned Area Emergency Response (BAER), are often confined to federal land in ways that wildfire response is not. While suppression efforts feature significant multi-agency coordination, the same rarely holds true in the post-fire period. This lack of coordination can have unique impacts for Tribes during recovery efforts as culturally important sites can be impacted during wildfire response and recovery.

Previous efforts to improve the federal response to disaster have been fragmented as well. GAO noted that the current approach to disaster recovery “is the product of over 40 years of incremental efforts to address emerging issues in disaster recovery through legislative reform,” in addition to the differences in agency regulation and policy (GAO, 2022b, p. 1). This dispersed and decentralized system, overlapping areas of responsibility, and incremental approach has

created conditions where **programs to support post-wildfire flooding and debris flow risk mitigation are often reactive instead of proactive.**

Recommendations of the Commission focus both on system-wide changes to governance structures within the post-fire space as well as specific, tangible recommendations that can support both community and landscape recovery. Additionally, the Commission has noted where Congress could support emerging best practices and agency actions within the post-fire space. It is, however, important to recognize that recovery is not just a function of the federal government. The Commission was tasked with making recommendations to Congress and, as such, many of these recommendations focus on the federal system. Critically, these recommendations are not intended to pre-suppose federally-owned solutions but rather to support flexible, locally-driven recovery processes.

Recommendation 60

Create the organizational and financial structures necessary to better integrate the national response to wildland fires and post-wildfire impacts across agencies and scales.

The Commission found the transition from wildfire response to management of post-fire hazards and long-term recovery is fragmented between multiple entities and across multiple scales. During this transition period, individuals, and local partners, with varying support from states, navigate what is a complex network of recovery programs and associated authorities, jurisdictions, and eligibility requirements. This task can be further complicated by varying interpretations of program requirements. Additionally, the collection of federal programs and authorities designed to address post-fire impacts is, on the whole, insufficient for the extensive protection, assessment, and recovery needs that arise. The current level of fragmentation has left significant gaps and unmet needs and lacks overarching accountability that could help ensure the effectiveness of post-fire response and recovery.

The Commission sees a need to create a more comprehensive, national approach to managing post-fire hazards and impacts across scales, between jurisdictional and land ownership boundaries, and among federal and non-federal entities. Increased collaboration and coordination as well as additional accountability are all likely part of the solution. The Commission feels that coordination and collaboration are needed to better integrate efforts across agencies, scales, and jurisdictions while greater accountability is needed to spur the collective effort required to establish post-fire systems that are truly effective, comprehensive, and accessible.

The Commission sees a need to establish governance that can build clarity around accountability and delegation of responsibilities post-fire to improve the recovery process for both landscapes and communities. This governance structure should aim to improve coordination between federal agencies managing post-fire recovery. It should also improve coordination for post-fire planning, capacity-building, and coordination in high-risk areas before an event occurs. Another aim should be to increase impact at the local level and

better support jurisdictions at other scales via funding, coordination, timely execution, and communication, access to data, technology, and decision support tools, and more.

Specific to the transition period between wildfire response and recovery, agencies could be directed to develop policy and guidance for post-fire Incident Recovery Teams to improve coordination and alignment in this phase. During discussions, the Commission observed that interagency, interjurisdictional cooperation is both common and well-functioning for wildfire response and saw an opportunity to extend that functionality for a limited window into the post-fire period. Suppression-focused Incident Management Teams could transition responsibility to Incident Recovery Teams to organize and manage tasks related to post-fire risk mitigation and recovery. These teams could provide a less abrupt transition to community-led recovery efforts. Federally-established guidelines could help support consistent implementation through standardized resources, roles and responsibilities, and process descriptions. If implemented, federal guidance also would need to clarify metrics used to deploy these teams and length of deployment, given that the post-fire period is both difficult to define and, at times, lengthy.

Accomplishing these goals may require some level of increased centralization for greater accountability, training, interoperability across agencies, and common standards and protocols in addition to increased collaboration and coordination within existing agency structures.

Recommendation 61

Increase the deployment speed of mitigation and recovery funds.

The risk of post-fire hazards, including flooding and debris flows, begins as soon as wildfire moves through an area. In some cases, catastrophic post-fire flooding and debris flow events even occur while suppression is still in progress. The rate of erosion is typically highest in the first year following wildfire (Neary et al., 2005). Timeliness is therefore crucial for post-fire hazard mitigation efforts, should assessments indicate they are necessary, to limit damage from precipitation events.

Though post-fire resources are needed almost immediately, federal disaster response processes for assessing risks and allocating funds can take substantial time (Moloney et al., 2023). In some cases, federal assistance is available, but comes too late to be meaningful. Review of FEMA's Public Assistance and Hazard Mitigation Grant Program (HMGP) indicated it can take years from an initial application for funding to reach the ground through these programs (GAO, 2021a). This assessment was validated by subject matter expert testimony to the Commission. Commission discussions noted a number of different factors that could contribute to lengthy deployment times, including the reimbursable and pass-through nature of the programs, the capacity of grantees and subgrantees, existing environmental compliance requirements, state-level requirements and processes, and fraud prevention and accountability mechanisms that are built into many of these programs. Without respect to cause, the Commission felt protracted timelines often hinder initial hazard response efforts that are key for mitigating both immediate and cascading post-fire events.

As a result, the Commission recommends that funding from programs designed to support post-fire needs should ideally be made available within no more than 90 days of application. Meeting this funding timeline may require a review of statutory and administrative barriers that impede the ability of communities to rapidly access funds. Programs that should be reviewed include, but are not limited to:

- Natural Resources Conservation Service Emergency Watershed Protection Program (EWPP)^{xxxix}
- Farm Service Agency Emergency Forest Restoration Program (FSA EFRP)^{xl}
- U.S. Department of Agriculture Rural Development Grants
- FEMA HMGP and post-fire HMGP^{xli}
- FEMA Individual Assistance
- FEMA Public Assistance
- FEMA Building Resilient Infrastructure and Communities (BRIC) program.
- Small Business Administration programs

More timely deployment of federal post-fire funding complements other recommendations made by this Commission to increase the capacity of federal, state, local, and Tribal entities to manage post-fire recovery (see Recommendation 68 below, which includes the provision of funding and technical assistance to non-federal partners, and Recommendation 77 below, which includes the establishment disaster funding for USDA and DOI so work can immediately begin with state, local, Tribal and territorial partners to address issues that are impacting both downstream values and assets and federal lands after a wildfire). To effectively work together, these solutions must address the interrelationship between local capacity and federal funding availability. Increasing the speed of fund deployment is only effective if local organizations and entities have the capacity to deploy and manage those funds while building local capacity only goes so far if federal sources of support are not accessible within the timelines that are needed by local entities.

Recommendation 62

Expand the support available through Fire Management Assistance Grants.

When a wildfire represents a “threat of major disaster,” the state can request a Fire Management Assistance Grant (FMAG) from FEMA to support management of fires regardless of land ownership. The FMAG declaration process is relatively quick: processes are in place to enable immediate verbal requests to FEMA personnel with written documentation. Once awarded, the FMAG program provides 75 percent federal cost-share for eligible costs incurred during the incident period. Declarations are based on threats to lives and property (including threats to hospitals, prisons, schools, police and fire stations, water treatment facilities, public utilities, and major roadways); availability (or lack thereof) of

firefighting resources; fire danger conditions; and potential economic impact. FMAG supports eligible actions until the fire is contained as defined by the National Wildfire Coordinating Group (NWCG). This confinement of the incident period to containment of the fire itself represents a significant challenge in the post-period as impacts can occur days, weeks, or even years after the fire.

As FMAG declarations are intended in part to avert the need for an emergency or major declaration, eligible activities are focused on firefighting activities and administrative costs, with limited assistance provided for emergency protective measures. Currently, funding for essential assistance can be provided if the assistance is “directly related to the mitigation, management, and control of the declared fire” while mitigation activities designed to “reduce the potential for future fires or to minimize damage from future fires” are ineligible (FEMA, 2021b). Activities designed to safeguard lives and property from impacts in the post-fire period are ineligible, regardless of whether they are directly attributable to the fire.

Making emergency protective measures eligible under FMAG Category B beyond the end date of the incident period would help address what is a significant need for post-fire protection and recovery funding that is especially high in places where there has not been a declared disaster. FMAG authorities should be expanded beyond the current focus on fire mitigation, management, and control to provide timely, proactive support for actions that reduce the long-term impacts of post-fire flooding and debris flows. Extending FMAG funding to include these activities would better enable the immediate actions necessary to address downstream impacts and potential impacts as a critical part of overall wildfire response. Should these activities be made eligible through the FMAG process, it will be important to provide the capacity necessary to continue to effectively administer the FMAG process at the regional level. The Commission sees value in the responsiveness that currently exists within the FMAG program and would like to see that responsiveness extended to additional activities as opposed to creating a more administratively complex process which cannot meet essential timelines in either the response or recovery period.

Recommendation 63

Expand Federal Emergency Management Agency Public Assistance-eligible activities to cover downstream risks caused by wildfire.

As noted above, Public Assistance can provide “supplemental Federal grant assistance for debris removal, emergency protective measures, and the restoration of disaster-damaged, publicly owned facilities and specific facilities of certain private non-profit organizations.” (FEMA, 2020a, p. 17). The use of Public Assistance funds to reduce the risk to downstream values, however, is relatively complex and depends on factors such as jurisdiction, type of activity, the incident period, type of incident, and more. While the flexibility that may be inherent in the application of existing Public Assistance policies can be seen as beneficial, lack of clarity around eligible activities in the post-fire period likely prevents some proactive action to protect downstream values. The Commission recommends clear expansion of eligible activities to lessen the impact and ultimate costs resulting from wildfire. This may be accomplished by changing statutory guidance and Public Assistance policies pursuant to

Section 403(a)(3)(I) of the Stafford Act which relates to the reduction of immediate threats to life, property, and public health and safety.

Additionally, the Commission recommends clarification of the post-fire activities that are currently eligible under FEMA's Hazard Mitigation Grant Program (HMGP). Within program guidance for both HMGP and Public Assistance, it will be important to articulate how the programs will work in coordination to reduce post-fire risk.

Recommendation 64

Enable multiple events stemming from the same cause to be treated as additive under federal wildfire and disaster recovery programs.

Impacts in the post-fire period are often characterized by a cascade of hazards such as flooding and debris flows that all stem from one initial wildfire event. The Commission found that these debris flows and flash floods can occur miles downstream of the burned area, can occur repeatedly, and can pose a risk for years after the fire. Though these cascading events are common, the Commission found that many wildfire and disaster recovery programs are designed for a single event response. As a result, jurisdictions may be unable to access federal resources if they experience several successive events that individually are not enough to trigger federal assistance under existing declarations processes, even if cumulatively the events exceed the capacity of local or state resources. Post-fire flooding or debris flows can be particularly challenging in this sense as many federal programs close the incident period (and allowable expenditures) with fire containment even though fire-created hazard and risk still exist.

There is a need to redesign federal wildfire and disaster recovery assistance programs to better address the cumulative impacts of repetitive weather events in burned areas. Knowing that this effort will need to establish some temporal boundaries, the Commission recommends that the timeframe for assistance be tied to a risk-based monitoring plan based on local conditions.

Recommendation 65

Expand the National Disaster Recovery Framework under Presidential Policy Directive 8 for the Recovery Support Function.

The Commission also feels it is important to establish sources of support for states, Tribes, and municipalities in instances when wildfires have significant social and ecological impacts, but do not meet the criteria necessary to qualify for a Presidentially Declared Disaster or a Fire Management Assistance Grant (FMAG). The Commission notes that sources of support for these entities are extremely limited. Additional work is likely needed to determine the criteria for assistance related to these incidents. However, opportunities to support states, Tribes, and municipalities outside of declared disasters exists through the National Disaster Recovery Framework.

The National Disaster Recovery Framework (NDRF)^{xiii} is guidance (not statute) to support disaster recovery planning. The NDRF “advances the concept that recovery extends beyond simply repairing damaged structures” and supports “the continuation or restoration of services critical to supporting the physical, emotional, and financial well-being of impacted community members” (FEMA, 2016, p.1).

Throughout its discussions, the Commission weighed the value of the NDRF, and supported the continued application of this framework with the modifications noted below to make it more useful for post-wildfire recovery.

There is a need to expand and improve the NDRF under Presidential Policy Directive 8 (PPD-8) Natural and Cultural Resources and Community Assistance Recovery Support Functions. With respect to the Natural and Cultural Resources Recovery Support Functions, the Commission recommends expansion to include degraded watersheds and long-term ecological restoration. Partnerships and coordination could also be expanded (e.g., through broadening the listed sub-agencies). With respect to the Community Assistance Recovery Support Function, the Commission feels this could be expanded upon request in places where post-fire risks exist.

Planning for Post-Fire

As previously noted, the Commission found that proactive planning and mitigation actions before a wildfire can significantly reduce impacts and costs in the post-fire period. This front-end work can also lay the groundwork for more effective post-fire response, reduced post-fire impacts, and generally streamline the provision of technical support and other resources after a wildfire.

Though valuable, communities and agencies often struggle to obtain funding and resources for proactive post-fire planning, training, assessment, and hazard mitigation activities. Pre-disaster planning is particularly important for addressing post-disaster impacts in the built environment (e.g., impacts to housing, healthcare, education, social cohesion and more), particularly those exacerbated by existing inequity (Finucane et al., 2020; Flanagan et al., 2011; Hamideh et al., 2022; Peacock et al., 2015). The ability of vulnerable populations to participate in decision-making after disaster (Hamideh & Rongerude, 2018) further necessitates accessible planning actions taken prior to a wildfire. However, the importance of pre-disaster planning is not confined to the built environment. Existing programs to address post-fire flooding and debris flow hazards in both the built and natural environments are often reactive in nature, only releasing funding for planning and mitigation actions after an event occurs.

The Commission felt that post-fire management strategies should reflect the reality that post-fire risks and hazards in the built and natural environments begin immediately after ignition and can extend years after a wildfire event. Different phases of recovery each bring their own sets of potential impacts and recovery needs for infrastructure, community services, forests and other vegetation, soils, water resources, and other values.

Recommendation 66

Authorize funding for integrated planning and management across all phases of fire management (including planning for post-fire impacts).

Federal funding offerings should be revised to better support the front-end planning, preparation and mitigation needed to create more integrated approaches across all phases of fire management, including post-fire, in both the built and natural environments. Encouraging and supporting proactive planning for wildfire and its impacts not only helps jurisdictions limit losses, but also transforms recovery from an action designed to restore baseline conditions into an action designed to reduce future impacts. This notion of supporting planning to mitigate impacts and improve overall outcomes aligns with several other Commission recommendations, including those below related to post-fire housing needs as well as those advocating expanded support for pre-fire response planning (Recommendation 57 in Chapter 3: Responding to Fire) and evacuation planning (referenced in Recommendation 45 in Chapter 2: Protecting Public Health). As a potential starting point, Congress should direct agencies to review and modify existing programs that provide financial and technical assistance for planning to ensure post-fire preparedness planning is an allowable and encouraged activity.

Federal agencies should work with state emergency management partners that administer or manage FEMA multi-hazard mitigation planning grants to improve such programs. Technical support from universities, consulting firms and agencies with science and modeling skills to conduct planning postfire could be used to support these efforts. Efforts should explore funding to enhance Community Wildfire Protection Plans (CWPPs)^{xiii} and the wildfire components of Hazard Mitigation Plans,^{xiv} Tribal Mitigation Plans,^{xv} and other similar resources to better incorporate post-fire hazards, risks, and management options for both the built and natural environments. Development of these plans is valuable in facilitating collaborative conversations and shared understanding about wildfire risks and hazards, while laying the groundwork for proactive mitigation actions (Jakes et al., 2007; Williams et al., 2009; Williams et al., 2012). Additional actions could include developing agency agreements or Memoranda of Understanding to link hazard mitigation planning and CWPPs.

Additionally, the Commission recommended the following:

- Modify FEMA's Public Assistance, Building Resilient Infrastructure and Communities (BRIC) program, and Hazard Mitigation Grant Program (HMGP) to allow State Management Costs to be used to fund state, Tribal, and local capacity-building for improved recovery and proactive disaster mitigation. Funds should be permitted to cover states' general program management functions, rather than being tied to a specific event. Applicants and sub-applicants should be authorized to keep any unspent Management Costs for recovery and mitigation capacity, though federal funding provided as part of Covid-19 stimulus packages may need to be excluded.
- Fund and enable states to lead BRIC Direct Technical Assistance programs to help small rural communities and others to access grants and programs more equitably.^{xvi}

Recommendation 67

Provide funding to local entities (e.g., community-based organizations, collaboratives, public utilities, watershed coalitions, fire departments and districts, Tribes, and local government) to proactively complete assessments of values at risk susceptible to post-fire impacts.

Federal agencies should provide local entities with tools to facilitate assessment efforts. While FEMA's Hazard Mitigation Assistance (HMA) funding can be used for this purpose as it relates to development of hazard mitigation plans, often the considerable effort needed and long timelines for receipt of HMA funding is a barrier to communities that require financial support. The Forest Service's Community Wildfire Defense Grant (CWDG) program also provides funding for this work in a wildfire-specific context, but that program is not permanently authorized. In addition, FEMA should be directed and funded to create a wildfire module in its Hazus Program^{xlvii} that would provide a standardized method for estimating potential post-wildfire-related losses to the built environment.

Recovery in the Built Environment

Recovery is more than land management and emergency response; it also must include social considerations. Communities impacted by wildfire experience challenges that go far beyond direct damage caused by the fire, including impacts to economies, subsequent impacts to or strain on infrastructure, increased housing costs and demands, mental health impacts and more. While federal agencies can and do provide recovery support, many of the responsibilities for long-term post-fire recovery are taken on by local, state, Tribal and territorial governments, non-governmental organizations and Community or Voluntary Organizations Active in Disaster (COAD/VOAD).

Individuals may struggle after wildfire if personal savings and/or insurance is not adequate to cover losses. Financial resources available to individuals after disaster include, but are not limited to, federal Individual Assistance (if Individual Assistance is approved as part of a major disaster declaration) and loans through the Small Business Administration (SBA).^{xlviii} Often, non-governmental organizations step in to fill the gap of any remaining unmet needs (Meyer et al., 2022). Community capacity for long-term recovery is variable across the nation and some communities, particularly those who have not experienced significant wildfires, may not yet have developed knowledge necessary for effective post-fire coordination, prioritization, and funding acquisition (Edgeley, 2022).

The Commission felt that coordination in the post-fire period is important to ensuring recovery in the built environment. Further, the Commission noted that building capacity in governments,

organizations, and communities at all scales is critical, both for the post-fire period and in the development of overall resilience.

Recommendations focused on individual and community recovery emphasize that the needs of communities and other individuals and local entities must be taken into account throughout the recovery and restoration process and that federal agencies should coordinate with affected communities to the extent possible before, during, and after fire. The following recommendations focus on capacity, financial protection solutions, and housing.

Recommendation 68

Increase funding and technical assistance to state, local, Tribal, and territorial partners to manage post-fire recovery and incentivize the development of state and local post-fire recovery capacity.

Federal support should aim to build skillsets, personnel, and general capabilities within non-federal governments, Tribes, and organizations to be able to effectively address extensive needs that arise post-fire. Additionally, it is increasingly important for federal agencies to recognize the local capacity present within communities; resilience is more than assets or resources, it is a complex network of social processes with tangible benefits (Imperiale & Vanclay, 2016).

Increased coordination and capacity are particularly important as recovery can represent a significant opportunity for broader fire adaptation and indeed for building resilience as a whole (Aldrich, 2017; Kapucu, Hawkins, & Rivera, 2013; Lee, 2019). Federal funding and technical assistance should recognize local capacity, augmenting and supplementing where needed. In addition to supporting local capacity development, it is the intent for federal investments to spur local, state, and Tribal governments to increase their own investments toward building internal recovery capabilities. The Commission sees recognizing and increasing the capacity of non-federal entities as a critical counterpart to other recommendations for increased federal agency capacity to take on post-fire recovery.

Federal funding and technical assistance for this purpose should be provided to governments as well as non-governmental organizations and could be routed through existing programs such as the Emergency Management Performance Grant program. Critical functions that should be supported with funding; technology; mapping, data, and decision support tools; and other forms of technical assistance include: post-fire assessments, prioritization of long-term recovery needs across ownerships, and engagement of private landowners in recovery in both the built and natural environments. In the natural environment, Commission members noted the importance of ensuring there are adequate contract and agreement mechanisms, such as Good Neighbor Authority, to enable governments and other potential partners or contractors to expand capacity for post-fire work on federal and non-federal lands. As part of technical assistance, federal agencies could be directed and funded to improve state, Tribal, and local level training related to wildfire and post-fire impacts.

Under the umbrella of building capacity to manage post-fire activities, the Commission noted that local-level governments, non-governmental organizations, Tribes, and other entities also

need financial support to enable their staff to spend time engaging with federal agencies. Close coordination between federal agencies and other governments and partners is essential for both effective response and to ensure local needs, skillsets, and resources are taken into account during post-fire recovery and restoration. Local capacity to engage in the recovery process is particularly critical in Tribal communities. Tribes must be involved in this work to appropriately address unique considerations, such as the potential for post-fire activities to disturb grave sites or other culturally sensitive areas.

Damage from the 2018 Carr Fire, California.

Cecilio Ricardo, Forest Service



Recommendation 69

Congress should request a comprehensive study on the relationship between financial protection solutions available through the private market and federal disaster recovery to support federal efforts to modernize federal post-disaster recovery benefits that ensure resources are complementary rather than conflicting.

Federal disaster recovery programs have not kept pace with evolving state laws and private market financial protection solutions, resulting in potential conflicts about how and when federal disaster benefits should apply. State laws and private market financial protection solutions are rapidly evolving as they modify and, in some cases, introduce new coverages.

This is creating uncertainty in the post-disaster recovery process of how and when federal recovery benefits should apply.

Examples of this rapid change include individual state laws with varying requirements for private market insurance benefits and timeframes to collect those benefits. Other recent changes include new parametric coverage options and catastrophe bonds that government entities may secure to financially cover losses resulting from damaged infrastructure, debris removal, and other impacts to critical structures in the community.

A comprehensive study on the relationship between private market financial protection solutions and federal disaster recovery can support individual recovery. Additionally, the study should explore incentives that encourage individuals and communities to obtain sufficient financial protection to support post-disaster recovery.

Recommendation 70

Amend the Stafford Act to allow section 1206 funding for code enforcement for up to 24 months rather than the current 180 days.

The Stafford Act provides the statutory authority for many FEMA programs and the types of assistance they can offer. The Stafford Act has been amended numerous times, including through the Disaster Recovery Reform Act of 2018 which makes funding available to communities approved for Public Assistance to support code administration and enforcement. Currently, activities taking place up to 180 days after a major disaster declaration are eligible for reimbursement. However, this time period is too short to be effective, and should be increased substantially. A two-year timeline is more reflective of the fact that projects often go on for years and require documents and processes be reviewed and verified at many levels to comply with federal rules.

Housing Solutions

Housing availability has become a widespread concern in many communities across the United States, with one 2021 report estimating that the nation has a housing supply deficit of 3.8 million units (Khater, Kiefer, & Yanamandra, 2021). Structure loss and damage due to wildfires can severely stress already limited housing supplies and reduce housing availability both within affected communities and in communities adjacent to burned areas (Moritz & Butsic, 2020; Rosenthal, Stover, & Haar, 2021; Spearing & Faust, 2020). Secure housing can be one of the most significant challenges faced by wildfire survivors and can have cascading impacts (e.g., impacts to mental and physical health, access to healthcare, employment status) (Rosenthal et al., 2021). These impacts can be long-lasting as research has shown that homes lost in wildfire are replaced at varied rates. Rebuilding post-fire is relatively common in California, with almost 60 percent of buildings rebuilt within three to six years of the fire (Kramer et al., 2021). Nationally however, one study reviewed data from 2000 to 2005 and found only 25 percent of homes lost in wildfires were rebuilt within five years (Alexandre et al., 2015a).

There must be greater federal support for this aspect of community recovery, as the costs related to providing short-term sheltering and long-term rebuilding quickly overwhelm the resources of residents, homeowners, businesses, local jurisdictions, and Tribal governments. Beyond the financial impacts, federal housing assistance can be slow and cumbersome leaving wildfire survivors without shelter for years (Rosenthal et al., 2021). Low-income households are particularly vulnerable to displacement (American Planning Association, 2014). Additionally, while the federal government can support housing after a wildfire in limited instances, there are few resources that provide support for longer-term housing recovery needs.

Housing assistance during a Presidentially Declared Disaster is provided through the Individual Assistance program, specifically the Individuals and Households Program (IA-IHP), authorized through the Stafford Act.^{xlix} The IA-IHP, when authorized, provides “financial assistance and direct services to eligible individuals and households who have uninsured or underinsured necessary expenses and serious needs as a result of a Presidentially-declared disaster. IA-IHP assistance is not a substitute for insurance and cannot compensate for all losses caused by a



Aftermath of the 2020 Almeda Fire in southern Oregon.
Adobe Stock

disaster; it is intended to meet basic needs and supplement disaster recovery efforts” (FEMA, 2021a).

State, local, Tribal, and territorial governments already have authorities to develop and regulate housing but are hampered by limited and difficult-to-access federal funding for post-fire housing solutions. Individual Assistance in particular can be difficult for some communities to navigate. Due to rigid definitions, Individual Assistance may also struggle to serve residents with informal rental agreements or who lack documentation (Moloney et al., 2023). At the individual level, natural hazards can exacerbate wealth inequality (Howell & Elliot, 2019) and factors like race, income, and ethnicity can impact housing recovery times (Peacock et al., 2015). Survivors of wildfires have also noted that federal programs such as IA-IHP could be improved with more rapid provision of assistance and provision of longer-term support (Moloney et al., 2023; Rosenthal et al., 2021).

The Commission found that flexible housing solutions are needed to accelerate individual recovery. Both streamlined delivery systems and enhanced flexibilities are needed to empower local, state, Tribal and territorial entities to deliver needed housing solutions and enable survivors to jumpstart their recovery, while reducing long-term risk and building resilience.

The Commission proposes a number of ways to build housing-focused capacity.

Recommendation 71

Establish a new grant program to fund local, state, Tribal, and territorial entities to build disaster sheltering, expand housing capacity, undertake pre-event planning, and support community readiness.

Grants should be federally-funded for the first five years, with sustained grants transitioning to accessible cost-share arrangements thereafter. Rapid deployment could be supported through pre-positioned contracts and agreements to support sheltering and case management delivery. Funded activities should include work with permitting and utility providers to pre-establish surge capacity needed to support disaster sheltering and housing, as well as research and development of alternative sheltering solutions.

Recommendation 72

Enable more flexible use of existing disaster grant funding and expansion of agency authorities in order to increase local, state, Tribal and territorial capacity to design and implement post-disaster and permanent housing solutions.

To encourage innovation, non-federal agencies could be funded to develop creative disaster response and recovery strategies and action plans for approval before a declared disaster. These strategies should demonstrate how innovative solutions will be equitable, timely, and cost effective. Specific needs named by Commission members were down payment assistance and homeownership counseling for renters. Suggested modifications to existing

programs include expanded FEMA or Small Business Administration authority to fund rental property repairs beyond “multifamily housing” and expanded Housing and Urban Development (HUD) authority to provide a permanent Community Development Block Grant Disaster Recovery program mechanism to provide faster permanent housing support to non-federal entities and governments. HUD should identify local, state, Tribal, territorial entities that have a lack of affordable housing or old housing stock and use that information to drive planning focused on permanent, affordable solutions for disadvantaged communities. The Commission also identified a need to support state management of FEMA’s Individual Assistance program, including state pre-disaster housing strategies and plans for rapid post-incident implementation, as well as development of proactive strategies for the implementation of disaster sheltering, crisis counseling, and disaster case management.

The Commission sees value in the continuation of FEMA’s Individual Assistance Individuals and Households Program (IA-IHP) as a source of financial assistance for disaster survivors. Technical assistance should be provided for state, local, and Tribal entities working with those individuals. Further, Congress should explore additional support for state, local, and Tribal entities managing Individual Assistance grants through increasing the allowable management costs. Currently, unlike other grant programs, there is limited to no funding available for a state or local governments to manage the Individual Assistance grant program, which can further drain already limited local capacity.

Recommendation 73

Establish a separate category of federal assistance with enhanced flexibilities for sheltering.

While, as noted previously, some federal support for housing is provided through the Individual Assistance Individuals and Households Program (IA-IHP), the Commission found that new authority is needed for a separate category of federal assistance to provide the flexibilities and resources needed to meet the needs of providing a safe and sustainable place for people to stay in a post-fire environment. Establishment of a separate category of federal assistance for sheltering should enable local, state, Tribal, and territorial entities to rapidly deploy innovative solutions for sheltering that incorporate flexibilities (i.e., without requirements associated with section 408 of the Stafford Act). FEMA could play an expanded support role by providing technical assistance to these non-federal entities focused on sheltering activities, as well as enable the development of strategy and administrative plans for sheltering that improve overall preparedness — activities that are presently not reimbursable under the current suite of FEMA Individual Assistance programs. Additionally, the Commission sees merit in allowing tabletop or preparedness exercises under this new funding category.

As part of this new category of assistance, distinctions between “temporary housing” and “emergency shelter” should be reviewed and revised as necessary to enable greater flexibility and improved ability to house displaced residents. This revision may include removing the distinctions between the two activities. Presently, each activity has separate authority, policies, funding, and guidelines for implementation. In addition, sheltering

activities should be expanded to provide a temporary place to stay for a defined period of time beyond emergency protective measures.

Additionally, Congress should consider a Direct Federal Assistance provision similar to Section 403 of the Stafford Act which authorizes federal agencies to “provide assistance essential to meeting immediate threats to life and property resulting from a major disaster.” This new authority should also enable FEMA to provide financial assistance to homeowners and renters to purchase and install their own Temporary Housing Units¹ as permanent housing.

Finally, solutions should not come from government alone. Federal agencies should engage with the private sector to develop innovative strategies to increase the availability of rental resources after disasters.

Recommendation 74

Utilize existing sources of mitigation funding to reduce future loss to housing resources and build community resiliency post-fire.

It has become increasingly common for communities to experience repeated wildfire events or other disasters, making it critical to expand post-fire rebuilding and repair strategies that reduce future potential for damage and loss. Rebuilding without upgrading structures to better withstand future wildfire is a lost opportunity that perpetuates individual and community vulnerability to ignition.

Programs such as the Hazard Mitigation Grant Program (HMGP) and the Building Resilient Infrastructure and Communities (BRIC) program that provide much-needed mitigation-focused funding could be incentivized or required to provide funding to state, local, and Tribal entities for the repair and mitigation of homes impacted by disaster. Those programs should establish conditions to ensure a percentage of funding is focused on disadvantaged communities. There are also opportunities to integrate wildfire resilience more deliberately into federal agency efforts to provide sheltering and permanent housing after disasters. That could include allocating a percentage of HMGP funding to implement residential risk reduction strategies alongside existing agency-funded sheltering and permanent housing solutions. Similarly, mitigation funding could be streamlined and expedited to complement FEMA’s Individual Assistance Individual and Households Program (IA-IHP) funding as an option for permanent repair.

Building codes are also important tools to encourage ignition-resistant construction and other strategies that reduce the risk of future disaster-driven structure loss. These types of resilience-focused building codes should be encouraged during rebuilding, especially in areas where FEMA and other agencies provide sheltering and permanent housing solutions. It is important to note, however, that competing local priorities (e.g., the basic need to house populations after disaster, cost implications of rebuilding) can also impact where and how rebuilding occurs (Kramer et al., 2021; Mockrin et al., 2020).

Lastly, there should be coordination with the National Flood Insurance Program as a mechanism for mitigating the financial impacts of post-fire flooding. Key actions include an evaluation of flood insurance requirements to increase compliance and evaluation of the potential to provide more than three years of Group Flood Insurance Policy for survivors.

Recovery in the Natural Environment

Uncharacteristically large and severe wildfires, climate change, and invasive species pose tremendous challenges to post-fire ecological recovery, and watersheds in particular. Similar to community recovery, the restoration of watersheds is undertaken by a range of entities including state, Tribal, and local governments, land management agencies, private landowners and contractors, non-governmental organizations, watershed groups, and water utilities. This work, which includes restoration of burned land, stream channels, and riparian areas, intends to reduce soil erosion and debris flows that impact natural resources, cultural resources, and communities (Neary et al., 2005; Robichaud, Beyers, & Neary, 2000). Watershed restoration also serves as a critical recovery component to protect drinking water supplies and water collection and conveyance infrastructure (Martin, 2016; Robinne et al., 2018; Robinne et al., 2021), but often does not qualify for key disaster recovery funding. Watershed recovery work can take significant time and require sustained cross-boundary partnership efforts. It is important that research and best practices be used to create strategies tailored to diverse ecological conditions while also supporting the landscape-scale action needed to match the size of current and future wildfires. In addition to watershed recovery, reforestation and other post-fire recovery efforts support ecosystem function and integrity, biodiversity, carbon stewardship, and other important ecological recovery needs.

There is a need for significant new investments in the science of ecological recovery from wildfire, as well as the continued advancement of practices for effectively integrating that science in both policy and management before, during, and after fire. Recommendations in this section focus on assessment of burned areas, existing federal programs, development of seed capacity, and more. An additional recommendation related to recovery in the natural environment can be found in Chapter 6: Integrating Modern Science and Technology (see Recommendation 114).

Cross-referenced Recommendations:

Recommendation 114: Expand support for the development and application of scientific research into, and monitoring of, post-fire ecological recovery and compounding disturbances, especially for wildfires featuring large high-severity patches where ecosystem type conversion is likely in absence of management interventions.

Recommendation 75

Authorize and fund the interdisciplinary, cross-jurisdictional assessment of burned areas.

After fire impacts federal jurisdictions, land management agencies will often assemble Burned Area Emergency Response (BAER) teams to undertake post-fire risk assessment efforts. Each agency has its own version of BAER teams, which are generally composed of diverse specialists who assess fire impacts on, and potential post-fire risks to, federal or Tribal trust lands. Existing post-fire assessment efforts produce several key products, including soil burn severity maps, specialist reports (such as hydrology, geology, and engineering), and Burned Area Reflectance Classification (BARC) maps, which reflect post-fire vegetation condition.ⁱⁱ Agencies such as the U.S. Geological Survey (USGS) also have assessment capabilities. USGS can provide debris flow hazard assessment and monitoring; water flow, water quality, flooding, sedimentation hazard assessment, and monitoring; burn severity mapping on both federal and non-federal land; satellite imagery and data; vegetation recovery, including invasive species control, native species recovery, evaluation of treatment effectiveness, and monitoring. The Natural Resources Conservation Service (NRCS) undertakes a Damage Survey Report process during deployment of its Emergency Watershed Protection (EWP) Program.

These assessments can form the basis for on-the-ground mitigation measures to reduce wildfire-related risks. While actions designed to reduce downslope or downstream post-fire impacts are not necessary on every fire (Neary et al., 2005; Robichard et al., 2010), a clear and accurate assessment of the hazards and risks can lay the foundation for more cost-effective mitigation and better protection of values at risk (GAO, 2003).

Importantly, existing post-fire assessments are largely focused on federally administered and Tribal trust lands, vary by agency, and often need additional funding support. Federal BAER teams do not typically assess state or private land or downstream risk and while USGS has the authority to work on non-federal lands, funding may not be adequate to meet the needs. While there are some state and local efforts that are based on the BAER model, these efforts are not consistent throughout the nation. NRCS, through the EWPP, does assess and support work non-federal land, but is not permanently authorized. The federally-focused scope of BAER assessments, and lack of integration between post-fire assessment processes on various jurisdictions, is among the examples of how post-fire is siloed in ways that wildfire response is not and represents a critical limitation in this space.

There is a need for multi-entity, cross-jurisdictional burned area risk assessments that integrate federal assessment efforts and encompass federal and non-federal land to support more cohesive post-fire response and recovery. Just as responders work across various jurisdictions to protect public and private lands in a unified way during wildfires, post-fire assessments should be inclusive efforts designed to evaluate and protect values at risk, regardless of jurisdiction. As such, this authorization should not only enable assessment work across property boundaries but should also allow action on federal lands that protects non-federal values at risk, which is not a part of existing federal BAER authorities. Congress

should also enable BARC data assessments to extend to lands outside of federal land management jurisdiction.

Extending burned area assessments to encompass federal and non-federally administered land would provide a powerful tool for state and local jurisdictions, Tribes, and other partners such as non-governmental organizations that largely lack the ability to obtain such data for non-federally administered lands or values at risk. While communities or local jurisdictions may be able to technically access tools that are available for post-fire assessments, the effectiveness of these tools can be limited by the need for the user to possess specialized knowledge or the tools' requirement of complex data inputs (Driscoll & Friggens, 2019). Post-fire maps and analyses are especially critical to inform risk assessments for localities, which are often required by federal agencies to move forward with implementing certain protection and risk reduction actions.

These assessments are supported by other recommendations (see Recommendation 114 as well, in Chapter 6: Integrating Modern Science and Technology) which, broadly speaking, call for coordinated and integrated research and service provision to field personnel. Such research is essential to providing accurate and timely assessment of conditions on the landscape.

To operationalize this recommendation, existing assessment authorities could be extended, and funded, to enable existing teams to include all values-at-risk in their assessments and to work across jurisdictional boundaries when warranted by conditions on the ground.



View of an area burned at high severity after the 2023 Elkhorn Fire in Idaho.

Kari Greer

Alternatively, a new type of cross-jurisdictional team could be established to provide assessment on non-federally administered land. In the case of the latter, existing BAER authorities should be extended (as described above) during the time period required to stand up a cross-jurisdictional effort. The desired output of both mechanisms is the development of one comprehensive assessment per burn scar.

Additional considerations include:

- The makeup of existing assessment teams (including BAER teams) should be reviewed for opportunities to increase participation.
- Assessment teams (including BAER teams) could be staffed through existing resource ordering processes but could also include the use of non-federal capacity and resources, such as states and Tribes.
- Liability protections and safety of both existing and newly established assessment team members should be addressed.
- Assessments should not be contingent upon the disaster declarations process.
- A goal should be ensuring access to cross-boundary mapping and assessment products in a timely way.
- Any approach to expanding the scope of burned area assessments must be resourced with additional staff and funding.

Recommendation 76

Establish dedicated funding for the Natural Resources Conservation Service Emergency Watershed Protection Program.

The Emergency Watershed Protection (EWP) Program provides communities with financial and technical assistance for projects that address impacts of a disaster that pose an imminent threat to human life, property, or both. Importantly, the EWP Program does not require a major disaster declaration and, for projects which are deemed a critical threat, contains processes for accelerated timelines (GAO, 2021b). Yet, funding for this program is typically provided through supplemental or continuing appropriations, which can limit the funds available after disasters (GAO, 2021b). The Commission recommends dedicated funding be identified for the program. Additionally, given the cross-jurisdictional nature of wildfire, EWP funds should be clearly authorized for use on federal lands to better enable the protection of values at risk.

To improve program accessibility, match requirements should be lowered or eliminated. Furthermore, Congress should address indemnification and liability-related barriers to accessing this program. Public and private landowners are only eligible for this funding if they are represented by a project sponsor, which must be a state, county, or city government, a special district, or Tribal government. Current program design requires project sponsors to take on all of the liability, which is not readily covered by insurance. The creation of an insurance pool for sponsors could enable wider use of the EWP program.



Hillslope stabilization in the Hualapai Mountains, Arizona.
Suzanne Allman, Bureau of Land Management

Recommendation 77

Increase authorizations and appropriations for watershed rehabilitation programs post-wildfire.

In the face of existing gaps, a range of wildfire and disaster recovery programs and authorities should be expanded to better support time-critical watershed rehabilitation, including short-term flood mitigation measures and extended hillslope and channel restoration efforts. Increased appropriations should be provided in conjunction with expanded authorities. These increased appropriations and authorities should occur across agencies as interagency action is needed to reduce risk most effectively. When treatment is warranted, some treatments (e.g., those occurring in the channel) are most effective when coupled with those occurring on the hillslope (Neary et al., 2005). Presently, these actions may be undertaken by different federal programs under different authorities and with different funding streams (e.g., the US Army Corps of Engineers may install rock cage gabions to reduce flow velocity and the Forest Service may place logs across the slope to increase infiltration).

Current gaps in federal agencies' post-fire disaster support could be addressed through a new source of disaster funding that agencies could use immediately for combined, or coordinated,

post-fire response. This funding would facilitate timely action for recovery that wouldn't hinge upon the disaster declarations process, or legislative action on standalone disaster response funding. As part of this effort, Congress should establish disaster funding for the U.S. Department of Agriculture (USDA) and Department of the Interior (DOI) so work can immediately begin with state, local, and Tribal parties to address issues that are impacting both downstream values and assets and federal lands after a wildfire.

Funding should be made available for both federal and non-federal lands. Some existing programs, such as the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program, may already be well positioned to assist in administering funds on private lands. USGS also has broad scientific capabilities in fire and post-fire environment and can provide information, data, and tools to support hazard assessment, monitoring, mitigation, and planning in areas of debris flow, water flow and quality, contaminants, sedimentation, invasive species control, and vegetation recovery. This disaster funding would be distinct from the post-fire funding that FEMA offers through programs such as Public and Individual Assistance and Hazard Mitigation Grant Program (HMGP) post-fire.

Programs currently focused on wildfire mitigation can also be expanded to include wildfire recovery as an eligible and encouraged activity. Specifically, the Joint Chiefs Landscape Restoration Partnership should be authorized to incorporate post-fire preparedness and recovery efforts and funded accordingly.

The Commission also notes that existing programs for watershed rehabilitation and community recovery, such as the Burned Area Recovery programⁱⁱⁱ and the Emergency Forest Restoration Program, should be funded at the appropriate scale. As a general rule, eligibility and access for local, state, Tribal, and territorial partners should be prioritized.



Sagebrush seedlings grown at Birds of Prey National Conservation Area to be planted in sites previously burned in wildfire during summer 2012.

Matt Germino, U.S. Geological Survey

Recommendation 78

Develop the seed capacity necessary to support post-fire restoration and revegetation in a manner considerate of historic and future disturbance regimes, biodiversity, and ecosystem process and function.

Reforestation and revegetation involve the renewal of vegetation cover by establishing young trees (in the case of reforestation) or other plant species (in the case of revegetation) and include both natural regeneration or replanting. With respect to forests, high-severity wildfire can result in the conversion of forests to other types of landscapes (Davis et al., 2019; Parks & Abatzoglou, 2020; Stevens-Rumann & Morgan, 2019). High-severity wildfires can also limit the ability of ecosystems to naturally regenerate due to the removal of seed sources from the landscape.

As the size and severity of wildfires has increased, a parallel rise in reforestation and reseeding needs has strained existing capacity (National Academies of Sciences, Engineering, and Medicine, 2023). More specifically, the state and federal seed inventories and seed collection efforts are not sufficient to address both recent and anticipated post-fire reforestation and revegetation needs in the United States. The Forest Service alone estimates that its seedling production needs to quadruple to meet current and expected future needs, while additional demand is coming from non-forested ecosystems; the large majority (80 percent) of reforestation needs on Forest Service-administered lands are driven by wildfire (USFS, 2022c).

Reforestation and revegetation infrastructure in the United States needs additional investment, particularly in seed collection, processing, and storage, and in seedling cultivation. This investment should also include investment reforestation and revegetation planning and implementation, including assessment, site preparation, planting, and monitoring. Not only is there a need to increase funding, staff, and infrastructure overall, but systems also must be developed to better handle unpredictable and sudden surges in demand caused by wildfires or other disturbance events. Reduced survival rates of planted seedlings due to climate change presents yet another layer of challenges.

Reforestation actions were included in IIJA via incorporation of language from the Repairing Existing Public Land by Adding Necessary Trees or REPLANT Act (Pub. L. No. 117-58; 135 Stat. 429 Title III, Sec. 70301-70303 (2021)). The REPLANT Act directs the Forest Service to create a priority list of reforestation projects, removes the funding cap on the Reforestation Trust Fund, and enables actions to ensure adequate seed sources and availability. While recognizing the significant reforestation funding and policy provisions in IIJA, the Commission sees a need to further develop seed capacity for post-fire reforestation and revegetation. Proposed strategies include:

- Request that the Secretaries of Agriculture and the Interior assess and report to Congress on the adequacy of current seed inventories for post-fire reforestation and revegetation, as well as the adequacy of seed collection, processing, and storage programs in light of current and anticipated post-fire reforestation and revegetation

needs. The recent joint USDA and DOI report on reforestation published in April could form the foundation for such an assessment and report (DOI & USDA, 2023).

- Develop direction to federal land management agencies about comprehensive seed collection and banking. This direction should seek to better align seed collection, seed use planning, storage, and testing guidelines with current industry standards; build consistency in practices and requirements utilized by seed initiatives as they relate to post-fire long term recovery; and address any limitations in exchanging appropriate seed stock across jurisdictions as may be necessary to support climate-informed reforestation and revegetation approaches. Seed data management systems for public nurseries and seed banks should also be modernized to support integration of data from federal and state nurseries and seedbanks.
- Invest in both the human and infrastructure capacity needed for revegetation activities. One concept put forward by the Commission would pair trained seed collectors with existing public lands job and volunteer programs such as Youth Conservation Corps and AmeriCorps to create a national seed corps that would bolster seed collection capacity to support production at federal, Tribal, and state nurseries.
- Continued investment in nurseries should be encouraged as well, including funding and technical assistance for state, private and Tribal nurseries. One specific policy mechanism could be the codification of the Forest Service's Reforestation, Nurseries, and Genetics Resources (RNGR) program along with expanded appropriations for the program.
- Support policy and implementation efforts through relevant research and development efforts. For example, advances in research and development, aided by significant investments in monitoring, are critical for developing climate-informed strategies to improve both short- and long-term survival rates for planted seedlings.
- Additionally, Congress should create and fund new DOI authorities that are similar to the Forest Service's expanded REPLANT Act in order to support post-fire reforestation in watersheds.

Recommendation 79

Direct agencies to review existing programs for statutory and administrative barriers that prevent distribution of funds to local jurisdictions to mitigate impacts from higher flows as a result of wildfire and amend statutes as necessary.

After a wildfire, rainfall on burned areas has the potential to create significantly higher peak flows (Neary et al., 2005). Existing infrastructure (e.g., culverts, drainages, etc.), though sized appropriately for the pre-fire landscape, may need to be prepared or upsized to handle this increased volume of water. Federal post-fire programs do not always cover these preparatory actions. The Commission sees these actions as critical and time-

sensitive needs resulting directly from the fire itself and which challenge local capacity (e.g., time, personnel, funding). As an example, some preparatory actions can be perceived as maintenance as opposed to a direct need resulting from fire impacts.

Recommendation 80

Authorize and fund the maintenance, deployment and monitoring of a national cache of rapid-deployment rain gauges, stream gauges and weather stations.

Timely and strategic installation of these devices is vital for providing advance warning of post-fire flooding events. Risk to downstream locations begins immediately after ignition and the existence of warning systems can make the difference between timely and effective evacuation and loss of life. While federal agencies (e.g., the National Weather Service



A stream gauge in Chelan County, WA collects data to be used by water managers, emergency responders, utilities, environmental agencies, universities, consulting firms, and recreation enthusiasts.

*Jason Detamore,
Chelan County*

and the USGS) and some local agencies undertake rain gauge placement and monitoring after a wildfire event, funding for equipment and operation is not always readily available. Expansion of these networks, and including temporary stream gauges for flow and water quality, could provide critical warning to downstream or downslope communities. The expansion of these networks is also consistent with the 2021 National Landslide Preparedness Act (Pub. L. No. 116-323, 134 Stat. 5075 (2021)) which called an expanded debris flow early warning system (CRS, 2023d).^{liii}

Recommendation 81

Encourage the Department of Homeland Security to work with the Federal Emergency Management Agency to expand existing Categorical Exclusion N12 to include activities associated with post-wildfire soil stabilization and erosion control measures and/or work with FEMA to create a new categorical exclusion that addresses post-wildfire soil stabilization and erosion control measures.

Soil stabilization and erosion control activities can be critical for public safety and for mitigating the impacts of post-fire flooding and debris flows on values at risk such as structures, infrastructure, water sources, and recreation sites. Categorical exclusions are generally the least detailed and complex level of environmental analysis, which can enable faster environmental review processes – a potentially important asset given that timeliness

is essential during the post-fire period (Cowan, 2022). However, most existing categorical exclusions available to agencies address pre-event mitigation or prevention activities. A categorical exclusion to address post-fire soil stabilization and erosion control could help speed the implementation of these often urgently needed activities. The Commission is aware that recent amendments to the National Environmental Policy Act (NEPA), made via 2023 legislation to temporarily suspend the nation's debt ceiling, provide for the adoption of categorical exclusions listed in another agency's NEPA procedures.

Recommendation 82

In developing and executing post-fire landscape recovery policies, authorities, oversight, and funding, Congress should support the collaborative development and use of landscape-scale post-fire assessments and recovery plans that are based on the best available ecological and climate science to identify and prioritize restoration projects.

The dramatic challenges of post-fire ecological recovery associated with uncharacteristically large and severe wildfires, climate change, and invasive species require significant new



Volunteers install structures to prevent hillslope erosion after the 2012 Waldo Canyon Fire.

Coalitions and Collaboratives

investments in the science of ecological recovery from wildfire and in advancing the practices for effectively integrating that science into management strategies before, during, and after fire.

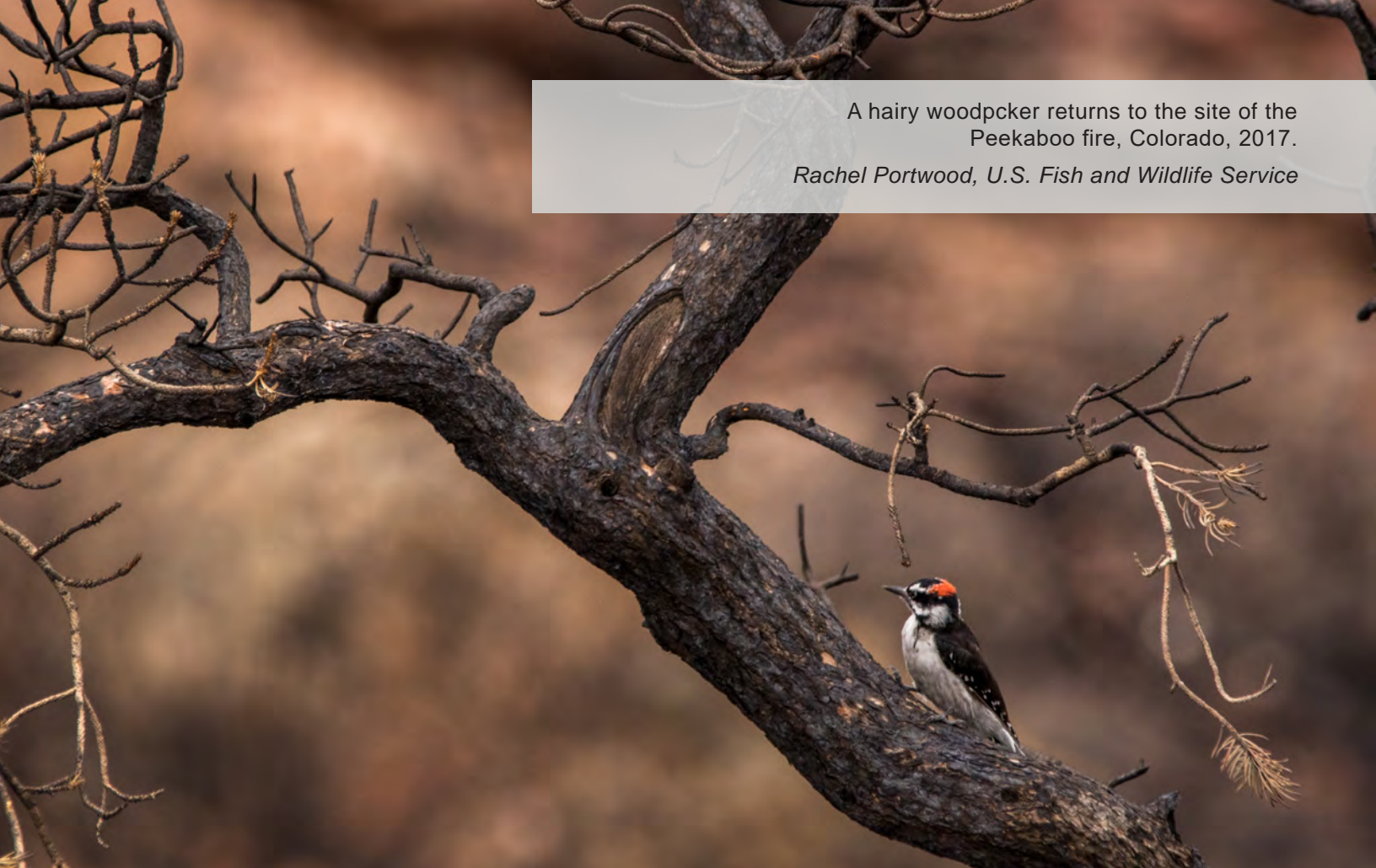
Post-fire ecological restoration interventions should be based on the following six guiding principles, which were originally established in the Forest Service General Technical Report PSW-GTR-270 “Postfire Restoration Framework for National Forests in California” (Meyer et al., 2021): (1) restore key ecological processes, (2) consider landscape context, (3) promote regional native biodiversity, (4) sustain diverse ecosystem services, (5) establish a prioritization approach for management interventions, and (6) incorporate adaptation to agents of change, including climate change. In regard to native biodiversity, while the Commission fully endorsed the need to promote regional native biodiversity as the goal of post-fire restoration work, the Commission noted that it does not recommend completely limiting available short-term management options by restricting all post-fire recovery to the use of only native vegetation. For example, there are some limited cases when sterile non-native seeds may be preferred as an initial response because they stabilize soils faster than natives while on some sites non-native species may best prevent establishment of invasive annual grasses. Above all, the Commission emphasizes the need to ensure that revegetation is ecologically appropriate. Watershed restoration, including channel and riparian area rehabilitation, also represents an integral component of post-fire ecological restoration.

When developing post-fire restoration plans for federal, state, Tribal, local, and private lands, agency leaders should work collaboratively with interested parties. Planning processes should make sure Indigenous Knowledge and local knowledge are sought out and considered. Social and behavioral science expertise also should be part of this collaborative planning, as social considerations are an important part of recovery. Providing dedicated funding for these assessments, plans, and projects is essential to fostering implementation.

In discussing the implementation of post-fire actions, the Commission encourages agencies to utilize existing minimum requirements analysis processes and authorities to approve and execute recovery projects on burned land within designated wilderness areas that pose post-fire flooding risks to downstream communities, infrastructure, and critical services.

Emerging Best Practices

Given the expanding nature of wildfire impacts across the country, focus on the post-fire period is continuing to grow. A working group convened through the Wildland Fire Leadership Council (WFLC) and the Western Governors Association has been working since 2019 to highlight opportunities for change. The White House Wildfire Resilience Interagency Working Group (IWG) has held numerous sessions to better understand existing government post-fire programs and needed administrative changes. This effort included a workshop in early 2023 convening a substantial cross-section of agency and non-governmental partners to explore opportunities for action in the post-fire period to better meet the needs of communities. While the Commission’s work focused on recommendations to Congress, the Commission does support taking some actions that are largely administrative in nature. The Commission recognizes the critical



A hairy woodpcker returns to the site of the Peekaboo fire, Colorado, 2017.

Rachel Portwood, U.S. Fish and Wildlife Service

importance of the post-fire period as well as the need for continued emphasis and focus. While these actions may be possible under existing statutes, the Commission recognizes that the agencies will need the appropriate resources to complete this work and recommends Congress fund these efforts.

Recommendation 83

Support emerging best practices and agency actions to improve planning, response, and collaboration in the post-fire period.

These best practices and agency actions identified by the Commission include the following:

Post-fire master agreement

Establish a post-fire memorandum of understanding and master agreement to facilitate work among federal agencies, states, Tribes, and local governments to accomplish recovery needs across jurisdictions and at multiple scales. These vehicles for national and sub-national coordination and work across jurisdictions should establish a standing coordinating group for post-fire recovery and mitigation. The group should focus its efforts on coordination and deployment of multiple authorities and programs, promoting shared stewardship post-fire, and facilitating implementation of a cross-jurisdictional recovery strategy. In early 2023,

alongside and complementary to the Commission's recognition of the need for increased post-fire coordination, the IWG began efforts to create a memorandum of understanding for agencies working in post-fire. The goal is to create a coordinating group to align and clarify roles, responsibilities, and terminology across Federal agencies and improve integration of federal postfire programs. Such a structure could then be applied during specific incidents and by regional geographies to address needs immediately after an event through the longer continuum of recovery in communities and on the landscape. This could support actions outlined in Recommendation 60, above.

Cross-boundary resource sharing

Work to ease the sharing of personnel and equipment across boundaries and create guidance for cost apportionment and sharing. This recommendation aligns with Recommendation 24 in Chapter 1: Creating the Foundation for Success (related to authorization of cross-boundary funding).

Planning considerations for post-fire conditions

Wherever possible, integrate analyses of changed post-fire conditions and any necessary recovery actions into planning documents (e.g., environmental analysis completed under the National Environmental Policy Act, land management plans, Community Wildfire Protection Plans, Hazard Mitigation Plans) to expedite and improve post-fire recovery. When wildfires impact areas that have already been considered in environmental planning and analysis processes, agencies must often redo analyses to account for changed conditions and post-fire recovery actions that weren't contemplated in original plans. This is time and resource-intensive and delays important and often time-sensitive work. Considering the potential for wildfire and post-fire impacts at the outset of planning processes can enable more timely recovery actions. Where co-management with Tribes occurs, planning processes and the subsequent implementation should account for Tribal environmental laws and regulations.

Chapter 5: Building a Comprehensive Workforce

The wildfire mitigation and management workforce is comprised of a range of sectors, including wildfire response, pre-fire mitigation and planning, community preparedness and risk reduction, and post-fire recovery. While the Commission was not tasked specifically with a review of workforce issues, the Commission found that **increased workforce capacity is essential for sustaining fire response, risk reduction (including the use of beneficial fire) and recovery.** Commission discussions emphasized that a comprehensive, expanded, and sustainable workforce is a cornerstone of our ability to change our fire future. Without this robust workforce, many of the Commission’s recommendations become far less feasible and may, in fact, become impossible.

With temporary pay increases for wildland firefighters (initially established by the 2021 Infrastructure Investment and Jobs Act [IIJA]) slated to expire close to this report’s release date, workforce issues have been at the forefront of national conversations. While there is a need to address workforce issues broadly, federal wildland firefighter pay was a significant point of urgency in the discussions of the Commission and was further highlighted through the vast number of comments the Commission received on this subject via the public comment portal. The most frequent public recommendation was to make the temporary pay increase permanent.

It is clear from numerous reports, assessments, and accounts that the wildland firefighting workforce is under significant strain (GAO, 2022c; Thompson et al., 2022b). Increased fire activity during more parts of the year has meant that the wildland firefighting workforce faces heavy workloads, likely increasing hazards to personnel and exacerbating existing problems with recruitment and retention (Thompson et al., 2022b). GAO (2022b) identified seven barriers to recruitment and retention within this workforce, including low pay, career advancement challenges, poor work-life balance, mental health challenges, remote or expensive duty stations, limited workforce diversity, and hiring process challenges. These topics were also the subjects of frequent attention in the public comments received by the Commission. Indeed, recent research has questioned whether the interagency wildfire-response system is a system “on the brink” (Thompson et al., 2022b, p.1).

The Commission is strongly supportive of sustained pay increases for wildland firefighters and sees an urgent and pressing need for action to address this issue.

Addressing the immediate needs of wildland firefighters is a pressing issue and while they are an essential and invaluable part of the overall wildfire mitigation and management system,



Hotshot crew works to dig lines during the Dixie Fire in Lassen National Forest, California, 2021.

Preston Keres, Forest Service

the Commission also saw the need to examine the broader workforce. Describing the total composition of that overall wildfire-related workforce is not a simple task, however. The number of people involved in this workforce extends well beyond those employed by federal agencies and includes state, Tribal, local, private-sector, and non-governmental organization staff.^{liv}

Expanding the lens further, numerous agency staff, at all levels of government, are vital to planning and implementing various aspects of wildfire mitigation and management work, from planning specialists to contract administrators. These agency employees not only participate in the broad wildfire-related workforce, within the land management agencies in particular, they may also be mobilized directly as firefighters as demand for firefighters increases. As an example, an employee may work as a resource specialist (e.g., a botanist or silviculturist) for most of the year, but during peak fire season that same employee may serve as a wildland firefighter, resource advisor, helicopter manager or any other wildland fire position for which they are qualified (see discussion of Qualifications and Training in Chapter 3: Responding to Fire, above).

Other federal agencies such as the Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Administration (NOAA), the National Weather Service (NWS), the Environmental Protection Agency (EPA), U.S. Geological Survey and more play critical roles in wildfire mitigation, response, and recovery. The Government Accountability Office has

noted FEMA staffing shortages previously (GAO, 2020, 2022a). The vital role of public health agencies, including EPA, in wildfire mitigation and management was discussed above in Chapter 2: Protecting Public Health and, as noted previously, wildfire-related staffing remains limited within EPA (GAO, 2023).

State programs provide a significant portion of the equipment, personnel, and training used to respond to and manage wildfires. Collectively, states spent \$1.9 billion on fire suppression in 2018, compared to federal expenditures of \$3.1 billion in the same year. Subject matter experts shared that same year saw over 8,000 state personnel mobilized through the National Interagency Coordination Center (NICC). Additionally, states play a significant role in helping to train volunteer firefighters and rural fire departments (more below). As with the federal workforce, state wildland firefighters are a combination of dedicated firefighters, as well as militia members. Employees are also a mix of permanent, full-time employees and seasonal positions, both permanent and temporary. In addition to resources provided through land management agencies, the state response workforce can include emergency management personnel and National Guard members. As an example, between 2014 and 2021, over 4,000 members of the Washington National Guard reportedly deployed to support wildland fire operations (Zucco, 2022).

Local fire districts and departments are also a significant proportion of the workforce, with over 1.2 million firefighters listed in the national fire department registry (USFA, 2023b). In addition to the vital role that local fire districts and departments play in wildfire response, local fire agencies play an important role in wildfire mitigation. As an example, the National Volunteer Fire Council offers a Wildland Fire Assessment Program to provide training on how to conduct structure risk assessments in fire-prone areas (National Volunteer Fire Council, n.d.).



A combination of volunteers and paid staff from the Coalition for the Upper South Platte work together to reduce fuels. This workforce is essential to reducing wildfire risk. Non-governmental organization staff supports safe operations, plans projects, maintains equipment, coordinates volunteers, and more.

Coalition for the Upper South Platte

However, it is essential to note that the wildfire mitigation and management workforce is not limited to wildfire response, nor agency employees. A host of private sector employees are also critical to wildfire risk reduction, response, and recovery efforts. These include community planners, mitigation specialists for the built environment, forest products industry personnel, including loggers, mill operators, researchers, recovery specialists, and more. Here, again, information can be scarce, with recent research finding little is known about the important labor-intensive forestry workforce (e.g., hand thinning and piling activities), which is often reliant on a workforce of immigrant, guest worker, and undocumented laborers (Deak et al., 2023).

Non-governmental organizations also play a vital role in risk reduction and recovery, in particular. Non-governmental organizations often bring critical local knowledge, philanthropic funding, and community participation to wildfire mitigation, including the use of prescribed fire, and can serve as a vital bridge between community members and agencies (Huber-Stears et al., 2021). Community members and volunteers serve as neighborhood ambassadors, working within their communities to spur residents to take mitigation action around structures (Wildfire Adapted Partnership, n.d.). Rangeland Fire Protection Associations, composed of volunteers and discussed in more detail below, can be important contributors to wildfire response. Long-term recovery organizations, comprised of local community organizations, volunteers, agency representatives, and more, are also critical during disaster recovery (Moloney et al., 2023). Other non-governmental organizations are often active in recovery and are particularly valuable because of the personal relationships that they bring to community recovery (Miller & Mach, 2021). Each of these entities, professions, organization types, and individuals are an important part of the wildfire workforce, making essential contributions before, during, and after fire.

Overall, the Commission found that wildland firefighters are a critical element of the wildfire mitigation and management workforce, as are other personnel who play vital roles including federal planning and specialist staff, community planners, mitigation specialists for the built environment, forest products industry personnel (e.g., loggers, drivers, and mill operators), recovery specialists and more.

Despite imperfect data on the full composition of the wildfire risk reduction, response, and recovery workforce, the Commission found that **a significantly larger workforce is essential**



Taking a break while working fires on the Mt. Hood National Forest in Oregon, July 22, 2023.

Preston Keres, Forest Service

to expand the scope and scale of wildfire mitigation, increase the use of beneficial fire, and to meet fire response, community preparedness, and post-fire recovery needs now and in the coming decades. To meet this need, there must be expanded efforts in recruitment and retention across the full range of sectors and positions that contribute to fire mitigation, management, and recovery, including land management and community planners, implementers of community risk reduction and wildfire mitigation actions, wildfire managers, disaster recovery experts, and communications and operations support staff. Furthermore, the availability of this workforce should not be contingent on the length and duration of wildfire seasons, as has historically been the situation for both many response personnel and workers in the woods. Expansion of and support for the existing workforce, greater interoperability with historically unincorporated and underutilized workforces, and development of new place-based mitigation focused workforces should be pursued together to bolster overall workforce with year-round capacity.

Through its discussions, the Commission also found that **there is a need for a fire workforce that reflects the diversity of the nation and the communities they serve to address past barriers and ensure a safe, inclusive, and welcoming work environment.** Improvements to recruitment, hiring, training, retention, promotion, and support are needed to build this diverse workforce, including efforts that go beyond our traditional avenues. Workforce development should be comprehensive across fire-related needs, with opportunities and support structures to create a sustainable, lifelong career in fire.

Efforts should focus on supporting our national – not simply federal – wildfire-related workforce. Tribes, non-governmental organizations, contractors, municipalities, and community members are well-suited to engage in mitigation to homes and properties, beneficial fire activities, and wildfire management through their communities. Strategic support and expanded resources, including accessible and relevant training, funding access, and viable career pathways, are needed to grow the non-federal workforce and to help foster the next generation of fire practitioners. Given the complex and inter-related challenges of the mitigation and management workforce, it is important to note that these recommendations do not occur in isolation. The Commission found that **changes to one sector of the fire workforce are likely to have ripple effects on many other sectors within and outside of the federal system.**

The Commission focused its recommendations on supporting the workforce we have and building the workforce we need. Recommendations focus on recruitment and retention, workforce expansion, training, supporting workforce health and wellbeing, and housing.

Insights: The Next Generation

To better inform the Commission's work, members requested input from outside experts on a broad spectrum of wildfire issues presented in panel discussions. One panel focused on the next generation of the fire workforce and provided an opportunity to hear directly from young adults working in wildfire and related fields. Subject matter experts included recent high school graduates, youth corps members and crew supervisors, university graduate

students, Indigenous fire practitioners, and members of student congress and youth-focused fire collaboratives.

Panelists spoke passionately about intergenerational decision-making as an underutilized and undervalued asset in wildland fire management. They also emphasized the long-term consequences of current fire management practices and highlighted the burdens current policies place on future generations. Broadly speaking, these subject matter experts advocated for policy solutions focused on accessibility and inclusivity of the current fire management system, a need for intergenerational decision-making, and the importance of education and educational systems to workforce development. Specific policy solutions suggested by panelists included the creation of youth commissions and the deliberate inclusion of young adults in interagency collaborative spaces such as the National Wildfire Coordinating Group (NWCG). Panelists also encouraged investing in fire management programs in schools.

The Commission endeavored to incorporate the perspectives shared by these young people into many of its recommendations. Specifically, recommendations focused on hiring and recruitment as well as the accessibility of training and qualifications systems incorporated input from the next generation subject matter experts. It is the hope of the Commission that the recommendations set forward in this document support not just the next generation of the fire workforce but the next generation writ large.

Recruiting & Retaining the Workforce

Hiring, recruitment, and retention of the workforce are some of the most significant gaps within the existing wildfire mitigation and management system. Recent studies continue to emphasize factors such as pay, career advancement challenges, poor work-life balance, mental and physical health challenges, remote and often expensive duty stations, limited workforce diversity, and hiring process challenges (GAO, 2022c). These challenges are extremely significant within (Thompson et al., 2022b), though not limited to, federal land management agencies. However, given the charge to the Commission for recommendations to Congress, the bulk of the Commission's recommendations related to hiring, recruitment and retention are focused on the federal workforce.

Federal land management agencies have a significant body of work focused on proactive wildfire mitigation on lands they manage, which involves a wide variety of staff including foresters, engineers, managers, range managers, biologists, botanists, and others. Agencies also employ dedicated wildland firefighters, which numbered approximately 19,000 as of 2022

(GAO, 2022c), many bought on seasonally during months of high fire activity. In addition to these dedicated firefighters, there are numerous other federal employees both within and outside of the traditional land management agencies who contribute skills and time to fire issues. This portion of the workforce is mobilized temporarily as reservists but do not have primary job responsibilities in wildland fire and/or may work in different aspects of the fire system during different times of the year (e.g., a person may be part of the prevention workforce before peak fire season in a given location but shift exclusively to the response workforce as demand increases). Other federal agencies support research, data and technology, predictive services, and other functions that support fire-related needs, though many of these agencies support multiple hazards (e.g., hurricanes, tornados, volcanos, and more). Post-fire recovery is another arena in which federal agencies are often highly engaged.

Across many of these agencies, the existing pay, hiring, and benefits systems are creating challenges for hiring and retaining federal employees. These barriers are especially apparent in the face of growing demands for wildfire response and, more recently, influxes in federal spending from the Inflation Reduction Act (IRA) and IIJA. These investments are spurring major hiring needs within federal agencies in order to ramp up capacity for implementation. Hiring pathways, compensation rates, and employee benefits are three areas where the Commission believes important improvements could be made.



Bureau of Land Management smokejumpers get ready to deploy over the Point Fire in Arkansas.

Pat Johnson, Bureau of Land Management

In addition to retaining the existing workforce, policy changes are needed to foster the recruitment levels needed to fill new positions. This is particularly true as the recommendations above encourage significant expansion of both the fire response and mitigation workforces.

Recommendation 84

Increase wages and benefits for the federal wildland fire workforce.

Compensation is often named as a top barrier to the federal government and Tribes to hire and retain a well-trained, qualified, and experienced workforce for wildland fire mitigation and management activities (GAO, 2022c). As one recent example, a 2023 study that focused on federal wildland firefighters found those employees' compensation trails that of state agencies in California, Colorado, Oregon, and Washington by an average of 33 percent (Alkhars et al., 2023). The same study also found that benefits packages for federal wildland firefighters, including healthcare and retirement contributions, were well below those state agencies (Alkhars et al., 2023). As of 2023, pay for federal firefighters began at \$15 per hour, and while these employees also receive pay for overtime and hazardous duty, many have noted that higher pay was available for less hazardous work in other sectors (GAO, 2022c). While the IJJA provided a temporary pay increase for federal firefighters, it is set to expire at the end of September 2023.^{lv} Without imminent action, federal firefighters at the time of this report's publication face a pay cliff that will significantly impact well-being and morale, with further repercussions for workforce retention and recruitment. There are currently bipartisan efforts to extend or make permanent some of the IJJA pay reforms and the Commission broadly supports these efforts as a starting place for reforming wages and benefits.

With current pay rates, many in the wildland fire workforce cannot afford to live in places where they work. The problem is significant enough that some firefighters have been reported to live in tents or out of their cars during fire season due to the inability to cover the cost of housing (Osgood, 2021). Because of low base wages and guaranteed hours, firefighters have come to rely on and expect significant overtime and hazard pay, but that can have adverse impacts on work-life balance and exposure to fire-related risks and hazards (Alkhars et al., 2023; GAO, 2022c). Though less tangible, pay disparities between state and federal firefighters working side by side on a fire can also be a blow to morale. Without adequate compensation, many in this profession cannot sustain a long-term career as federal firefighters.

The issue of low pay is not limited to firefighters, however. The \$15 per hour minimum wage applies to General Schedule (GS) grades 1-4, which often include staff working in wildfire mitigation, prevention, or recovery. A range of federal agencies that employ these staff have reported difficulties hiring due to salaries that do not match high costs of living (Herbert, 2023). Low pay and high turnover – both from vacancies and promotions – can impact important proactive mitigation projects when, for example, environmental assessments on those projects are delayed because the local unit has been unable to hire the necessary specialists. Such vacancies also create problems for partnership and collaboration as relationships must be made anew after staff turnover.

In addition to issues of low pay for entry-level firefighting positions, middle and upper management and specialists are also impacted by current pay cap policies. Agencies have the discretion to waive bi-weekly pay caps for federal employees working on fire assignments but annual pay caps, which are fixed for all federal employees, still limit how much federal employees can earn over the course of a year. Annual caps are low enough that subject matter experts reported the cap impacts employees in middle fire management and specialized, technical positions, resulting in employees who possess needed and specialized skills being unable to work after reaching the annual pay cap.^{vi} Waivers of the annual pay cap require congressional action. Furthermore, prescribed burning activities are usually limited by both the bi-weekly and annual pay caps. As more work is needed for planning, conducting, monitoring, and studying prescribed burns, these activities should also be eligible for pay cap waivers.

Wage increases are needed for the federal wildland mitigation and management workforce and those should be permanent, as opposed to temporary. For federal wildland firefighters in particular, the Commission recommends:

- Establish an additional pay premium based on use of qualifications while on an incident. More specialized skills and qualifications would be rewarded with pay premiums, regardless of base pay, helping to incentivize the development of difficult-to-obtain, high-responsibility qualifications, and fostering the retention of employees with those qualifications.
- Expand hazard pay to be applicable to both work on an active fire line and prescribed fire. Examine whether post-fire work is appropriate to include.
- Provide standby premium pay to all employees for all time spent deployed on multi-day wildland fire-related incidents. Currently, personnel are not paid for the hours in which they are released from work but still assigned to a fire. Federal employees are paid for their travel to and from the incident. This change would maintain equity with other responder organizations, recognize variable work hours and conditions, and provide for administrative efficiency through standardized compensation for 24-hour periods.
- To the extent possible, as wages and benefits are increased for the federal wildland firefighting workforce, wages and benefits should be increased for Tribes that enter into compacts for firefighting. According to the Department of the Interior (DOI), of the 574 federally recognized American Indian and Alaska Native Tribes, about 90 currently manage their own wildland fire programs.
- Increase or waive annual federal pay caps for work on both wildfire response and prescribed burning. Furthermore, agencies should make bi-weekly pay cap waivers available for prescribed burning.

The Commission also recommends the following related to benefits for federal wildland fire workers:

- Authorize the “buy-back” of temporary or seasonal time allowing an employee to, for a price, retroactively include their years as a seasonal employee in the calculation of retirement.
- Authorize overtime to be included as part of retirement annuity calculations. Currently, overtime and hazard pay earnings are not factored into defined benefits calculations, as they are with other federal entities. Though as noted above, overtime and hazard pay make up a considerable portion of federal firefighter wages (Alkhars et al., 2023).

Recommendation 85

Create efficient hiring pathways which support development of a larger, more diverse, and inclusive workforce.

Hiring process challenges are one of several key barriers facing federal workforce recruitment and retention, particularly with respect to wildland firefighters. This includes the length of time between when a job is posted and when a given position is scheduled to begin work and the time between when a person applies for a given position and when an offer is made. Both intervals can last several months and, according to some Commission members, up to half a year. Some Commission members felt that these timelines are impractical for job seekers, leading to missed opportunities to recruit viable candidates or a loss of those candidates when they find other jobs during lengthy waiting periods. The timing of wildland fire job postings pose further barriers as positions for an upcoming year are often posted during fire season of the current year, making it difficult for those deployed on wildfires to apply. In some agencies, individual units have a limited ability to hire quickly and locally due to the centralization of hiring and human resource functions in one service center.

In addition to these logistical challenges, current practices have not produced a federal workforce that, at least in the wildland fire sector, is reflective of the nation’s diversity. Most federal wildland firefighters in 2021 identified as male (84 percent) and white (72 percent) (GAO, 2022c). Recruitment of women and underrepresented racial and ethnic groups has been a priority for the agencies, but given the current composition of the workforce, has been challenging (GAO, 2022c). Some studies indicate that BIPOC (Black, Indigenous, people of color) women enter at higher pay grades but advance more slowly within the Forest Service (Sachdeva et al., 2023) and that, at least in 2009, white men held higher average pay grades within federal service (Ricucci, 2009).

A new system should allow for more local and regional discretion in hiring, rather than national centralization. This may include direct hire authority for participants in Job Corps Civilian Conservation Centers and Public Land Corps participants (similar to the 2018 Farm Bill authority for Resource Assistance Program), and other important workforce programs led by agencies. The Commission also acknowledges that for specific specialized positions national hiring may still be most appropriate. Hiring should occur throughout the year as needed, but the time between offers and start dates for seasonal positions should be drastically reduced.

Agencies also should consider efforts to align core competencies, performance standards, and hiring standards to enable greater interoperability between agencies. Greater alignment would also support skill-building for diverse positions within agencies, reward high performance, and promote career advancement.

With these efforts and others, agencies should also be directed to place a priority focus on creating cultural change to ensure a safe and welcoming environment for everyone in the workforce. This should involve identifying and removing potential barriers to a high-performing workforce that is inclusive of women and under-represented communities. The workforce should reflect the diversity of the nation and local communities.

Recommendation 86

Address “break in service” rules and retirement benefit portability.

Existing “break in service” rules for federal retirement benefits have been acknowledged as creating barriers to employee retention. Currently if a federal wildland firefighter needs to leave their job for family or personal reasons (e.g., to take care of young children, elderly parents, or a spouse), and later decides to return to a career in fire, they have to re-enter the firefighter retirement system. The GAO report “Barriers to Recruitment and Retention of Federal Wildland Firefighters” further describes this system, and the break in service provision:

[F]ederal firefighters who work more than 3 years in primary, or rigorous, positions are eligible to participate in a special retirement system, similar to that of law enforcement, in which they pay more of their salary toward retirement benefits but are generally required to retire at age 57, earlier than other federal employees. After serving 3 years in such a position, firefighters can move to a secondary firefighting position, while retaining eligibility for the special retirement benefits. Secondary positions are often less strenuous and allow them to continue to use their experience and training to help the agencies achieve their mission as they age, according to officials. However, if firefighters take a break in service and later decide to reenter the workforce, they have to return to a primary firefighting position to be eligible for the special retirement system they had participated in earlier. Some firefighters may be unable or unwilling to return to a primary position for various reasons, such as family caretaking duties, and, therefore, lose their special retirement benefits, which officials said may affect retention, especially of women firefighters (2022b, p. 19).

There should be an evaluation of opportunities to allow personnel to retain wildland firefighter retirement benefits with or without a break in service. The Commission desires to see a system that would enable firefighters to take a break in service and then “restart” their progress toward retirement from the time they leave a covered position with no loss in firefighter retirement eligibility. The Commission believes that addressing this barrier could not only help retention overall but could also aid recruitment of former firefighters who may be interested in returning to the job. Additionally, some members of the Commission felt this was a critical barrier to address for gender diversity and inclusivity within the workforce.

With respect to retirement benefits, the Commission supports two changes to improve portability:

- Allow federal employees to continue paying into federal retirement accounts when transferring to Tribal jobs. The employer (Tribes in this case) would be responsible for the employer match; evaluate existing authorities and make adjustments as necessary to enable employer compensation.
- Modify Intergovernmental Personnel Act Mobility Program to (a) ensure that participants are not penalized in how time worked counts for retirement purposes and (b) create a shared position job series, to ensure that shared positions are compensated at a rate commensurate to the complexity level.

Recommendation 87

Authorize the Secretary of the Interior to develop a Wildland Fire Management Casualty Assistance Program in order to provide assistance to next-of-kin of critically injured, ill or deceased firefighters or support personnel injured or killed in the line of duty; to include emergency family member travel, benefits counseling, and casualty assistance and notification training.

The Commission views the national obligation to ill, injured, or deceased firefighters and their families as an important and critical responsibility. Prompt accurate reporting, compassionate notification, and assistance to the next of kin and others designated to receive benefits and entitlements are essential and should be enabled. While some agencies have the necessary authorities to support this work, DOI does not. The creation of a Wildland Fire Management Casualty Assistance program within the DOI, which could be modeled after existing programs such as those used in the Forest Service, civilian areas of the federal government, or the Department of Defense, would support those goals. Importantly, this recommendation would not result in changes to existing authorities for Line of Duty Death benefits for federal firefighters and support personnel. Should additional agencies or departments also need these authorities, they should be provided.

Appropriate operating guidelines and standards for carrying out program functions should be developed, and the program should cover:

- Notification of the family of a firefighter that was killed in the line of duty, or a firefighter who requires hospitalization or treatment at a medical facility due to a line-of-duty injury or illness.
- Reimbursement of family for expenses associated with travel to visit a firefighter who was killed in the line of duty, or a firefighter who requires hospitalization or treatment at a medical facility due to a line-of-duty injury or illness.^{lvii}
- Support and professional counseling for the family of a firefighter who was killed in the line of duty, or a firefighter who requires hospitalization or treatment at a medical facility due to a line-of duty injury or illness through Family Liaisons.^{lviii}



Hotshot crew member works to put out spot fire during the Caldor Fire in the South Lake Tahoe Basin area in 2021.
Joe Bradshaw, Bureau of Land Management

Recommendation 88

Congress should provide funding and authorization for expanded recruitment strategies.

The fire workforce is facing a demographic attrition crisis as more skilled personnel retire or resign without a pipeline of workers to replace them. To counteract these trends, recruiting must be scaled up to meet both short-term needs and the longer-term goal of creating a fire-related workforce that remains viable and robust in the decades to come. Additionally, strategies should target roles across sectors (i.e., not solely federal hiring needs and not solely focused on wildfire response) and across the career arc, including entry level positions and mid-career roles that may be better filled by professionals from related but complementary fields. In developing workforce recruitment strategies, the Commission urges a focus on education delivery at multiple levels (including high school, vocational education, community colleges, and universities) and the coordination of efforts with local community-based organizations and economic development offices.

Mechanisms for consideration include:

- Provide financial support for community colleges and vocational programs that address natural resources, emergency management, landscape resilience, firefighting, community planning, and other related programs to support the mitigation, response, and recovery workforce.
- Direct agencies to increase the use of recruitment tools, such as incentives for higher education or student loan forgiveness.
- Increase funding for job and conservation corps programs, including opportunities at USDA through Job Corps, Public Lands Corps and Resource Assistants Program partnerships, as well as existing efforts such as the DOI's Pathways Program.
- Increase recruitment from and make it easier for participants in those and similar programs to be converted into the workforce.
- Authorize and fund training for incarcerated and formerly incarcerated workers interested in mitigation and management careers.
- Authorize and fund Tribally led mentoring and leadership programs, including between Tribal youth and elders, in order to create accessible and relevant education surrounding natural resources for the next generation.

Any investments in recruitment should be longer term and part of a larger strategy to recruit and retain the workforce. Single-year funding is both unable to meet current needs and may present later challenges for career advancement as a single, large cohort moves through the system.

Expanding the Workforce

The Commission recommendations have highlighted the need for extensive action in both the built and natural environments. However, this urgently needed work cannot occur without significant expansion of the workforce across multiple sectors – public, private, and non-governmental – and at multiple scales, including local, state, Tribal, territorial, and federal.

Personnel engaged in pre-fire mitigation in both the built and natural environment include a wide range of agency staff from federal, Tribal, territorial, state and local governments; private sector employees who implement pre-fire work, including noncommercial woods workers, loggers, arborists, landscapers, and related personnel; rangeland specialists; prescribed fire practitioners; community preparedness planners and coordinators; evacuation planners; community-based mitigation specialists; structure assessment personnel, including volunteers; and more. The mitigation workforce is also supported by unpaid labor: neighborhood ambassadors, community organizers, volunteer firefighters, and even some structure assessors can all be volunteer members of the workforce.

From a land management perspective, the federal workforce that supports mitigation activities has seen years of declining investment, due in part to increases in wildfire size and severity that required federal spending to be shifted to response functions. For the Forest Service, for example, not only have overall staffing levels declined, but staff dedicated to non-fire land management duties have become a much smaller share of that agency's workforce. The number of non-fire forest management personnel employed by the agency decreased by 54 percent between 1992 and 2018, while the number of fire personnel employed by the agency rose 132 percent (NASFR, 2019). Since the passage of the "fire funding fix" (discussed in Recommendation 121 in Chapter 7: Investing for Tomorrow), the infusion of additional spending through the IIJA, and increased baseline appropriations, federal land management agencies appear to have been able to start restaffing to some degree, though it is unclear what types of positions have been added. Recent reports on state budgets and wildfire have noted that they face challenges in funding mitigation activities when legislatures are being asked to dedicate such significant sums to wildfire response (Caudell-Feagan et al., 2022).



Watershed rehabilitation efforts supported by replanting native plants, 2019.
Joe Bradshaw, Bureau of Land Management

Given staff capacity constraints and because there is substantial overlap in the skillsets and capacities needed for wildfire mitigation and wildfire response, it has been standard practice for the land management workforce to undertake both activities. Fuels crews, for example, may conduct prescribed burning in the spring season then transition to wildfire response during the summer months. Yet, one outcome of this seasonal shift is the drawdown of mitigation and planning resources in order to fulfill demands for short-term response, sacrificing opportunities for the beneficial use of fire to achieve management objectives and other ecological restoration and wildfire mitigation activities.

Like the mitigation workforce in the natural environment, many in the community mitigation workforce are not solely dedicated to that task. For example, local fire departments may conduct structure risk assessments, participate in Community Wildfire Protection Plan (CWPP) development, and complete fuel reduction projects as part of their emergency response duties. Local government staff may have community wildfire risk reduction (e.g., wildfire risk reduction planning or enforcement of defensible space regulations) as part of multiple job responsibilities and public health departments may dedicate staff time to helping community education and mitigation of wildfire smoke impacts when the need arises.

However, as wildfires have increased in size and intensity, utilization of a single workforce to balance both emergency response and proactive mitigation has become increasingly challenging, if not impossible. In addition, and related, to this growing demand on response resources is the need to dramatically scale up mitigation activities in both the natural and built environments. This will require not only preserving existing workforce capacity for these activities, but also adding to it.

In short, wildfire risk reduction work, whether focused on the built or natural environments, cannot expand without a parallel expansion in this workforce. Expansion must occur across sectors – public, private, and non-governmental – and at multiple scales, including local, state, Tribal, territorial, and federal. Because of the interdisciplinary nature of community resilience, the Commission's recommendations are focused on facilitating workforce development and retention across a broad range of fields and include those who are not exclusively tied to wildfire suppression but support integrated program delivery.

Recommendation 89

Invest in the creation of a workforce primarily focused on restoration and mitigation.

The Commission sees the need for expanded, focused workforces for both community and landscape risk reduction, though the structure of each is likely to look different.

A robust and diverse community wildfire risk-reduction workforce, including professionals trained to provide implementation, education, and enforcement of wildfire mitigation measures (e.g., home hardening and defensible space) is essential. This may include development of “fire-adapted coordinators” or “resilience coordinators” with robust training, funding, and resources related to mitigation actions taken in the built environment both before and after wildfire. Interactive engagement is a critical component of effective

residential wildfire risk reduction (McCaffrey, 2015) and expansion of the workforce in a way which supports this interactive approach is essential.

The activities needed for community wildfire risk reduction, from structural improvements to risk assessment and community planning, require workers and skillsets from a range of disciplines, sectors, and scales. Personnel in this workforce, particularly at the local level, can come from various entities, such as public health agencies, local fire districts or departments, conservation districts, non-government organizations, land management agencies, and the private sector.

The Commission also sees a number of possible strategies to create opportunities and career pathways for a landscape restoration and mitigation workforce. This workforce may include those focused on prescribed fire, fuel treatments, or post-fire restoration, among other activities. Opportunities for skill building and diversification, in addition to expanding the number of personnel, are also necessary for those working in landscape restoration.

Opinions differed to some degree as to how exclusively focused on mitigation work an expanded workforce should be, with options including a workforce focused on restoration, a mixed restoration and response workforce, or an expansion of the wildland fire response workforce. In all cases, and whether in the built or natural environment, the Commission supports a multi-pronged approach that includes:

- Dedicated personnel focused on restoration and mitigation that are not available for wildland fire response (e.g., local fuels crews working exclusively on landscape restoration, or community mitigation professionals working solely on built environment assessment and risk reduction). Recruitment and retention strategies for this workforce should focus on people with career goals in prescribed fire and natural resource management, rather than suppression.
- Support personnel that are available both for restoration work and local wildland fire response. Models for this work should include local workforces with limited geographic mobilization and regional prescribed fire cadres or modules, which could be mobilized to support local efforts and provide expertise. While these units should primarily be focused on prescribed fire and proactive mitigation work, they could also be made available for fire response on a limited basis. These teams could be interagency and/or public-private partnerships. A potential model is “all hands, all-lands” prescribed fire teams, first developed in New Mexico, and being piloted in northwest California (Forest Stewards Guild, n.d.).
- Expansion of the existing wildland response workforce to incorporate year-round work on fuels treatment, prescribed fire, and other mitigation work. While not all firefighters may be interested in year-round work, the option should be made available to better utilize personnel in the existing workforce who are ready and willing to diversify their work experiences. It is important to note that maintaining year-round work does not necessarily require the same workers to work year-round. Additionally, expanding these positions from seasonal to year-round is only feasible if there are efforts to improve firefighter work-life balance during the peak of the fire season. This would require fewer overtime hours and the functional ability for firefighters to take time off as needed.

While it is the Commission's desire to see a workforce that has a primary purpose of mitigation and restoration, members noted that there is also value in allowing for some amount of flexibility between the response and mitigation workforces to remain adaptable to future management needs and to enable the movement of personnel between them, if needed.

Another potential workforce development strategy is to bolster state, Tribal government, and local municipality prescribed fire and mitigation workforces through the expansion or creation of a block grant program. Such a program could be accomplished through the Forest Service State, Private and Tribal Forestry division. Not all states or Tribes see a role for themselves as implementation partners but for those that do, funding should be made available for expansion and training of restoration and mitigation workforces to match federal and non-federal investments.

Across all strategies, compensation and benefits should be commensurate with the responsibilities associated with wildfire response to encourage long term commitment to this work. Doing so would position mitigation roles as financially attractive alternatives to mid-career firefighters who may wish to transition to less geographically mobile work.

Lastly, the Congressional Research Service (CRS) or GAO could be tasked with assessing the extent to which existing federal workforce development programs provide training and professional development opportunities in the field of wildland restoration and wildfire risk mitigation and provide suggestions for how workforce development programs can be improved and tailored to restoration and mitigation. This sort of assessment could provide a clearer picture of existing obstacles to growing a diverse landscape restoration and wildfire mitigation workforce.

Recommendation 90

Improve the contracts, grants and agreements process and expand investments in the non-federal workforce.

Non-federal workers, including those employed by state, local, and Tribal governments, non-governmental organizations, and the private sector, make up a significant part of the fire-related workforce. For instance, the National Association of Forest Service Retirees estimated that 15 percent to 50 percent of Forest Service work is performed by “partners, volunteers, and community groups” (2019, p. 8).^{lix} The non-federal workforce also plays an important role in proactive mitigation work on state, local, Tribal, and private lands, supporting community risk mitigation work via structure assessments, ignition-resistant retrofitting services, fire-focused maintenance work, and community planning, and in supporting community and watershed recovery post-fire. In wildfire response, one subject matter expert reported that contractors account for approximately 24,000 members of the workforce while, as discussed above, state employees also account for a large, but difficult-to-count portion of the workforce due in part to the prevalent use of the reservist model for staffing.

As the scale of wildfire response, mitigation, and post-fire recovery needs grow, workforce expansion must include making better use of these existing non-federal workforces. Contracts, grants, and agreements are the main mechanisms used by federal agencies to work with other entities, making them a key focal point for potential improvement.

The Commission supports the following changes:

- Make contractual mechanisms (including grants, agreements, contracts, and compacts) easier to implement and invest in the hiring of the additional federal staff necessary to support expanded contract processes. The goal should be to enable Tribes, non-governmental organizations, and other entities to more easily complete needed beneficial fire and other stewardship work on federally administered lands.
- To enable partners, contractors, and grantees to expand their workforce, funding provided through these mechanisms should be sustained and multi-year. Efforts should include sufficient levels of capacity funding for these entities to support the administration of all included activities.

As noted elsewhere in the report, it is important to allow federal agencies the flexibility to waive match requirements for grants and agreement processes when recipients or cooperators are providing critical services to federal agencies and to address barriers that result in inequity (see Recommendation 143 in Chapter 8: Frameworks for the Future).



Contract tree planters hand planting Whitebark Pine seedlings in Flathead National Forest, 2020.

Erika Williams, Forest Service

Recommendation 91

Federal agencies should build on the successful model of Rangeland Fire Protection Associations and provide more federal surplus equipment to RFPAs and other volunteer fire response entities.

Rangeland Fire Protection Associations (RFPAs) are all-volunteer crews of ranchers that have training and legal authority to respond to fires on private and state lands alongside federal agency firefighters (Davis, Abrams, & Wollstein, 2020; Stasiewicz & Paveglio, 2018). They can also be authorized to respond on federal lands. Numerous RFPAs now exist in several western states. These associations, which operate in landscapes where there is little to no existing fire protection, fill an important gap in the response workforce. While generally focused on fire response, previous research has found that potential may exist for RFPA engagement in a wider range of activities, such as fuel breaks or prescribed burns (Davis et al., 2017b).

While an important mechanism for added local-level capacity, RFPAs could benefit from improved equipment access, increased federal grant funding, additional training, and more supplies.

Recommendation 92

Tribes should be supported to expand mitigation, response, and restoration workforces.

Severe wildfires have significant impacts on Tribal lands. In 2022, the Bureau of Indian Affairs (BIA) reported over 3,182 wildfires that originated on BIA-protected lands, resulting in approximately 255,600 acres burned (BIA, n.d.a). Tribes and BIA also provide wildfire response, with at least 40 BIA-managed wildfire programs, including 22 Tribally-managed programs, that serve 1,102 communities (BIA, n.d.a). Because Tribes lack property taxing authority on trust lands and generally do not levy income taxes on their members, Tribes have limited options for generating additional revenue for wildfire-related programs (National Congress of American Indians, n.d.) beyond federal financial support (see Tribal Sovereignty insights box in Chapter 1: Creating the Foundation for Success for more information). Mechanisms for this support are primarily from funding through the DOI and BIA, and supplemented with other grants, contracts, and agreements with partners such as the Forest Service State, Private and Tribal Forestry and other DOI land management agencies.

Transformational change of the federal wildland fire workforce will require related changes to how the DOI, through BIA, supports and empowers the Tribal wildland fire workforce. First, BIA should recognize wildfire mitigation activities, including fuel reduction, beneficial fire, and land stewardship, as part of wildfire management and Tribes should be able to request funding or personnel to address these important activities. The Tribal wildfire management workforce should also have the ability to work across jurisdictional boundaries, in keeping with the need to address risk reduction across all lands. Additionally, funding requests should

be more streamlined (e.g., through a “portal” where Tribes themselves request funding) rather than relying on the BIA to request funding, through the DOI, on behalf of Tribes.

The Commission understands that BIA recently engaged in efforts to reform processes for requesting Tribal Wildland Firefighter Full Time Equivalents that support development and retention of Tribal employees. This is important as some Tribes opt for BIA to provide direct services, but others utilize the 1975 Indian Self-Determination and Education Assistance Act (better known as the “638 Authority”) and receive funding to implement programs directly. Tribal 638 contract and compact Full Time Equivalent (FTE) positions are not currently considered by DOI for inclusion of Cost-of-Living program increases in common with DOI funded bureaus. FTE non-inclusion results in annual budget reductions for Tribes, inadvertently depriving Tribes of personnel funding that personnel employed directly by BIA receive. This has the effect of reducing overall program funds for Tribes.

Recommendation 93

Congress should support implementation of a Reservist Program to increase both planning and implementation capacity for increasing the pace and scale of planning for and applying wildland fire.

The loss of federal institutional “placed-based” landscape knowledge through retirements, resignations and transfers is happening at an accelerated rate (Westphal et al., 2022). Currently, retirees can be hired under the “Administratively Determined” (AD) authority for wildfire preparedness and prescribed fire. Use of such hiring is mostly local in nature and scope, but oftentimes a local unit lacks capacity to manage such a program. Additionally, when individuals are hired under an AD authority, retired federal employees forfeit their earned benefit if they are paid over the exempt amount, creating a de facto penalty and disincentive for retirees to engage in the AD program.

A more comprehensive reservist program would be able to send personnel to the most urgent program needs, nationwide. This could include requests for specialists such as biologists, archeologists, planners, public information officers, prescribed fire specialists, and others. This effort should not be constrained to emergency events within the local area where the person lives, as the AD program currently requires. The Commission expects that such a program would provide a significant benefit by allowing for the hire of people with a proven track record of success. It should be noted that the creation of the proposed program need not be constrained to retired federal employees. People within the private and non-governmental sectors could also add to the pool of professionals to increase capacity nationwide. As an additional benefit, this new program could also serve as a mentoring program for experienced individuals to teach, train, and mentor the current and next generation of land management stewards.

Recommendation 94

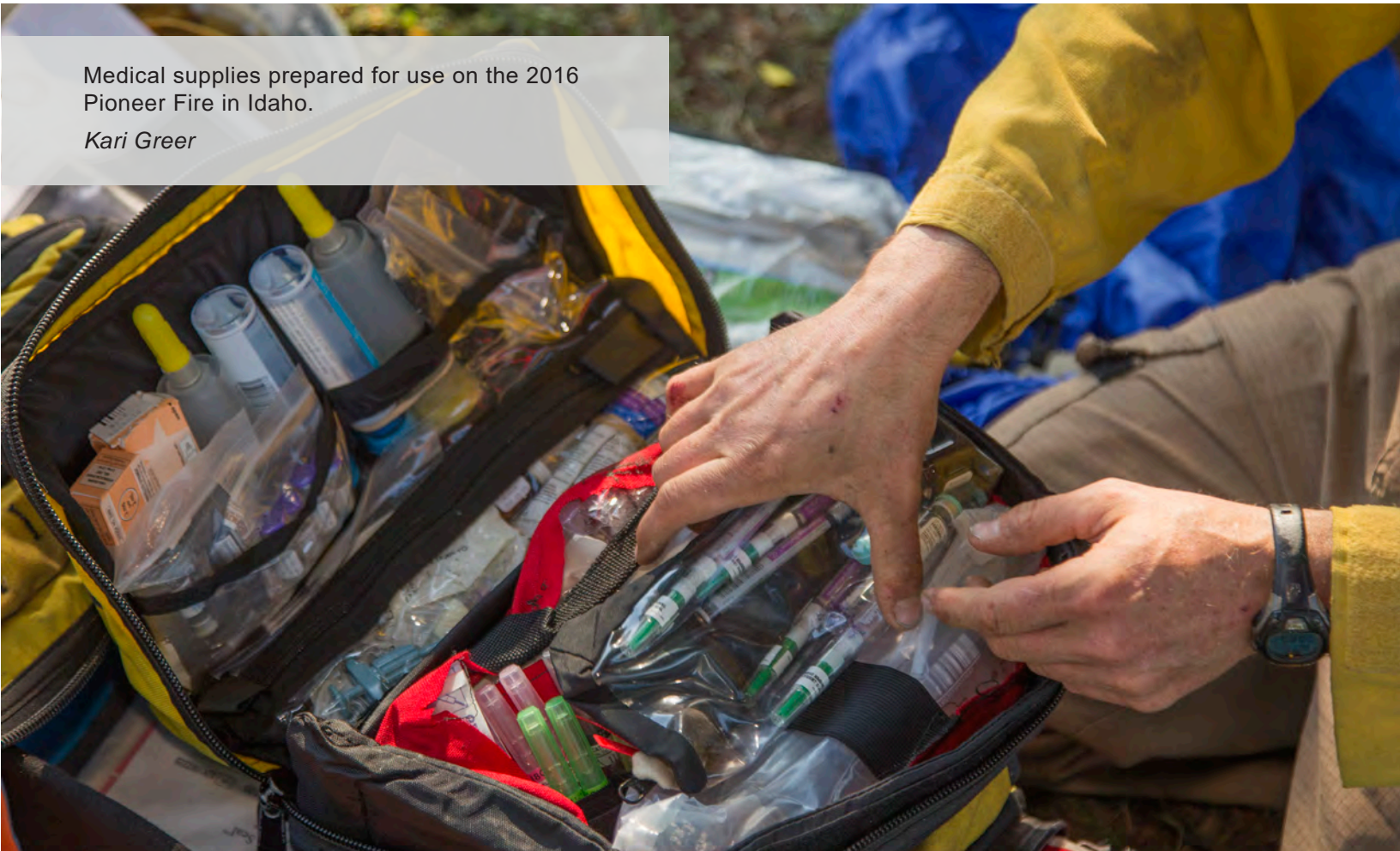
Authorize emergency medical care providers to operate on all hazard responses, including wildland fires.

Changes are needed to allow for emergency medical care providers to operate more fluidly across state boundaries and on various types of hazards. Current emergency medical training certifications are recognized and licensed on a state-to-state basis (National Registry of Emergency Medical Technicians, n.d.). While there are reciprocal agreements between some states, wildland fire creates an environment where a medical professional might be called to a distant state from the one in which they are certified.

To remedy this and allow more utilization of trained professionals in a broader geography, an authorization process for wildland care providers is necessary. Such a national emergency system should include a minimum scope of practice, standardized protocols for treatments, and a patient care reporting system. The Commission also recognizes the need for mechanisms to enable the compensation of state and local resources involved in the development of training and standards.

Medical supplies prepared for use on the 2016 Pioneer Fire in Idaho.

Kari Greer



Training

While qualifications and training for the response workforce was discussed at length in Chapter 3: Responding to Fire, training and qualifications are essential within the non-response workforce as well. In addition to increasing access for more partners to qualifications and training opportunities, there is a need to expand the overall number, type, and capacity of training opportunities for both federal and non-federal entities in the mitigation and recovery workforce. This includes additional and new training and professional development opportunities.

The Commission identified several areas ripe for increased investment and expansion. As noted elsewhere in this report, accessibility for non-federal partners should be a priority as these entities offer diverse assistance to federal agencies in areas beyond wildfire response, including mitigation, planning and post fire recovery.

Recommendation 95

Create and fund more training opportunities for the mitigation and management workforce.

Training opportunities for the mitigation and management workforce are essential and should include:

Community Risk Reduction and Mitigation Training

The workforce focused on risk reduction in the built environment needs increased development of core competencies that match the complexity of wildfire's risk and impacts to communities. Wildfires are increasingly encompassing and moving between communities and undeveloped landscapes, which requires a workforce that understands the intersections between community risk reduction principles and fire behavior across both the built and unbuilt environment. Those working in this space also need to understand the social, cultural, and political dimensions of risk and hazard mitigation, which are integral to successful implementation. The community wildfire risk reduction workforce must be capable of incorporating that multidimensional knowledge into comprehensive, cross-sector proactive risk reduction work, including land use planning, structure modifications, and community evacuation (or shelter-in-place) strategies.

Workforce training must reorient toward this interdisciplinary focus for existing roles and should also look to develop positions such as fire adaptation or resilience coordinators that are part of an emerging workforce dedicated to aligning programs and coordinating implementation at the intersection of wildfire risk reduction and community resiliency. Accessible technical training will be required to support this shift and development in the workforce.

Training investments must be two-pronged: one focused on professional development that upskills people currently working in the arena, and a second that creates career pathways through partnerships with entities such as conservation corps, community colleges, local job training programs, and universities. Training should be interdisciplinary but should not be overly complex or restrictive in terms of prerequisites or length. In parallel to workforce training efforts, agencies should take the necessary actions to ensure that qualifications requirements for community wildfire risk reduction positions are appropriate for the anticipated scope of work and do not create unnecessary barriers to entry for workers.

Prescribed Fire Training

Expanded training opportunities through regional prescribed fire academies, centers, and training exchanges are needed to bolster and expand prescribed fire qualifications and the workforce. Lack of access to training has historically been a bottleneck to the development of a prescribed fire workforce. To increase prescribed fire capacity, there is a need for more training opportunities, all of which should be open and accessible to any interested party, including contractors, non-governmental organizations, and Tribes. Federal funding should be made available to establish and expand prescribed fire training centers and programs throughout the country to increase the accessibility of this important skillset.

Currently, the country has only one National Interagency Prescribed Fire Training Center in Tallahassee, Florida, though a second training center is under development. Funding should go to support not only new centers and programs, but also the continued operations of the existing Prescribed Fire Training Center. Funding also should be made available to expand the Prescribed Fire Training Exchange (TRES) and Women-in-Fire Training Exchange (WTRES) programs. These programs offer a successful model for providing critical hands-on training in prescribed fire that is accessible to participants from any organization. Lastly, prescribed fire academies should place an emphasis on hiring and empowering Indigenous burn practitioners as instructors, including of cultural fire practices, and establishing and supporting Indigenous-led programs and centers, while taking care to ensure that such activities are not appropriative.

See Recommendation 55 in the Qualifications and Training section of Chapter 3: Responding to Fire for specific recommendations related to training for the response workforce.

Insights: Evolution of the Wildland Fire Workforce

The history of U.S. wildfire response has evolved over the last hundred years from a wildland fire workforce of volunteers and professional foresters on secondary duty to the more specialized system we see today, including a dedicated workforce and an increased capacity for resource sharing.

Through the early 20th century, wildfire response was largely a local issue driven by natural resource protection concerns, with the workforce composed of foresters, short-term hires, and volunteers (Alexander, 1974). Local fire departments, state forestry agencies, and federal land management

agencies responded to fires on their own jurisdictions and with resources assembled for each specific incident. The first wildfire control program was established in 1885 in the Adirondacks Reserve in New York, with another program developed in Yellowstone National Park the following year (USFA, 2001). The Civilian Conservation Corps of the 1930s constituted the first semblance of a federal wildland fire workforce and the first federal fire crews were organized in 1939 on an experimental basis (Alexander, 1974). This same year saw the creation of the first smokejumper crew in the Pacific Northwest. By 1961, federal agencies had established the Inter-Regional Fire Suppression (IRFS) program as the first major expansion of local experiments in dedicated, mobile federal fire crews we now know as Hotshots (Alexander, 1974). Paralleling this federal effort, states, Tribes, and local fire departments also built out more professionalized wildfire response workforces.

The evolution of the wildland fire workforce is ongoing, with much of the rank-and-file workforce still employed seasonally even as wildfire seasons have become years and fires themselves grow in complexity and increasingly burn into the built environment. However, this is changing. Recent investments through the IJA have allowed federal land management agencies to begin converting at least 1,000 seasonal positions to year-round employment to meet the wildfire reality (USFS, 2023b).

The skills and training expected and needed from this workforce has also changed over time. There are many advanced qualifications in use in wildland fire, yet the average entry level wildland firefighter receives about 54 hours of basic training to begin work. In comparison, while requirements differ by state and department, one study found the national average time to complete introductory training for a structure firefighter to be 270 hours^x (NWCG, n.d.c.; Mulherin & Weckman, 2015).

Recommendation 96

Ensure that fire mitigation and management personnel are trained in and respectful of Tribal sovereignty and cultural practices.

It is important for agency staff and others to recognize that cultural burning practices encompass much more than fuels reduction and are often an important part of Tribal self-governance and culture. Federal and state employees, including those designated as Tribal liaisons, rarely have sufficient training to understand the unique elements of cultural burning. Adequate training programs should be developed to ensure that workers have access to necessary background and information to do their jobs well and with respect for Indigenous burning practices. Efforts should be made to ensure that incorporation of Indigenous Knowledge into training programs is not appropriative. Instead, the incorporation of Indigenous Knowledge must come with recognition of and support for Tribal sovereignty.

In addition, cultural training and integration of Indigenous Knowledge is important for many mitigation and management activities, including to ensure understanding of areas and resources important to Tribes, like culturally significant plants or sacred sites, that may be impacted by fire or fire management decisions.

Protecting Health and Wellbeing

The mitigation and management workforce is under significant mental health stress, caused by low wages, extended emergency incident deployments, life threatening job duties, extended separation from families on a yearly basis, and workload demands that exceed capacity due to high vacancy and turnover rates. Recent studies of mental health issues among wildland firefighters in particular have found these personnel face significantly higher rates of substance abuse, past-year suicidal ideation, probable major depression, probable Post-Traumatic Stress Disorder, and probable generalized anxiety disorder than the general United States population (O'Brien & Campbell, 2021). As summarized by the Departments of the Interior and Agriculture, “wildland firefighters work in an arduous, stressful environment that is physically and mentally taxing. They spend months away from family and friends, endure death and serious injury among their community, and face very real hazards every time they are deployed” (DOI & USDA, 2022). These hazards include the safety risks associated with working directly on a fire and the more far-reaching health impacts related to smoke exposure, which are discussed below (Recommendation 100). On top of those factors, firefighters work incredibly long hours when they are on shift, which puts further strain on both physical and mental health. According to the Government Accountability Office (GAO), DOI reported that almost half of fire personnel worked upwards of 500 hours of overtime in the 2021 fiscal year, with some working as many as 1900 hours (GAO, 2022c). Health challenges impact non-firefighting roles as well. Dispatchers, for example, deal with significant mental and physical health impacts (Smith, Holmes, & Burkle, 2019). Practitioners in the mitigation and recovery fields also have indicated mental health is a concern (Miller & Mach, 2021; Schmidt, 2021) though fewer formal avenues for support exist for those individuals.

The mental and physical toll of firefighting has gained increasing attention in recent years. Provisions in the IIJA directed the DOI and U.S. Department of Agriculture (USDA) to establish programs for wildland firefighters to address mental health needs, provided temporary pay increases, and funded improved physical safety and additional training (DOI, n.d.c). Additional efforts to address mental health within the wildland firefighting workforce include the National Wildfire Coordinating Group Subcommittee on Mental Health, development and use of a “refresher” video focused on mental health for use in annual recertification training, availability of the Employee Assistance Program (EAP), and continued assessments of mental health needs and gaps. However, the wildfire mitigation and management workforce is broader than the response workforce and continued challenges exist.

The Commission's recommendations reflect a need to improve and expand existing support systems and create new support systems that better address the intersecting mental and physical health challenges faced by the entire wildfire mitigation and management workforce.

Recommendation 97

Invest in a comprehensive approach that addresses mental and physical health.

There continue to be significant gaps and healthcare access issues for the fire-related workforce. For example, firefighters' access to care during the wildfire season is complicated by long, unpredictable hours and remote work locations, while outside of wildfire season, seasonal workers may lose access to care. Mental health challenges place burdens on the families of wildfire response workers as well. Those not working directly on wildfire response, such as dispatchers, also face mentally and emotionally taxing circumstances that can have significant health impacts (Smith et al., 2019). Additionally, the Commission believes that Indigenous workers face significant on-the-job discrimination and related mental health challenges.

A comprehensive approach to mental and physical healthcare for this workforce should seek to improve access to trauma-informed, culturally competent clinicians and case management services and improve the current firefighter culture to empower and support firefighter health and wellbeing. Specific recommendations include:

- Increase access, including both availability and duration, to mental health professionals for permanent as well as temporary and seasonal workers.
- Provide presumptive coverage for depression, generalized anxiety disorder, Post-Traumatic Stress Injury and Post-Traumatic Stress Disorder, as well as respiratory and cardiovascular disease.
- Empower the treating physician to determine necessary duration of care. Track the mental health of wildland fire personnel throughout their career.
- Continued investment and stable funding of work begun through IIJA.

While much of the recent focus on wildland firefighter mental and physical has focused on federal firefighters, the Commission desired better support for wildland firefighters, without regard to employer. The Commission recommends the creation of systems that support state, federal, local & Tribal governments, as well as contract firefighters, in their totality. The Commission also recognizes the impact of this work on other associated professions outside of, but fundamentally tied to, firefighting such as those working in the dispatching system and in post-fire recovery and desires to see a comprehensive approach for the wildfire-related workforce.

Recommendation 98

Invest in existing and new research and development to improve, and mitigate adverse physical, mental, psychological, and emotional impacts to firefighter health and safety when operating in both the built and natural environment.

While there are robust studies about the health risks faced by structural firefighters, current research is limited regarding wildland firefighter physical and mental health and occupational exposures, including smoke and dermal exposure. There are considerable differences between the experience of structural firefighters and the wildland firefighting environment, culture, fuel types, and available protective technologies. Those differences include the potential duration of smoke exposure, with wildland firefighting assignments lasting up to 14 days and repeating for the length of a fire season. Unlike structural firefighters, wildland firefighters do not wear personal protective equipment to reduce smoke exposure due to the challenging and dynamic environment in which they work. In fact, no such personal protective equipment is approved for use in this environment (Navarro, 2020). Further complicating this question is the fact that wildfires are increasingly burning into and through neighborhoods and communities, which creates unique conditions and impacts for firefighters.

The limited research that has been done suggests this occupation takes a heavy toll. Studies have found wildland firefighters are more likely to experience decreased lung capacity, increased oxidative stress and respiratory symptoms, increased risk of cardiovascular effects from smoke exposure, and increased risk of lung cancer (Ferguson et al., 2016; Liu et al., 1992; Navarro et al., 2019). Firefighters have been found to experience symptoms of probable depression, generalized anxiety disorder and Post Traumatic Stress Disorder at rates that are higher than in the general public (O'Brien & Campbell, 2021). One limited study also indicated that wildland firefighters are dying by suicide at a higher rate than in the general public (Stanley et al., 2018).

Additional research is sorely needed in this space, with critical areas of focus including:

- Similarities and differences in the mental and physical health risks and exposures faced by structural firefighters, wildland firefighters, and firefighters working on fires that burn in both the natural and built environment.
- Wildland firefighter mental health, on and off season, including the impacts of nutrition and fatigue.
- Personal protective equipment to protect against hazards from both the natural and built environment as well as physiological effects of this equipment.
- Support strategies for respiratory and thermal protection, as well as decisions that can be made administratively to protect firefighters.
- The chemical characterization of smoke and ash, which would provide valuable information about firefighter exposure (inhalation and dermal) and would aid development of best practices for decontamination of personal protective equipment.

- The effects of cumulative, long-term smoke exposure.
- Differences in impacts from exposure to prescribed fire smoke as opposed to wildfire smoke.
- The effectiveness of mitigation and adaptations or both acute and cumulative exposures.

For all of these questions, research projects should be designed and implemented with input from firefighting agencies, fire managers, and firefighters. Also of note, the Joint Fire Science Program has a recent focus on firefighter physical and mental health. Research funds could be coordinated through this current effort.



A CAL FIRE firefighter working in grassy vegetation to stop fire spread.

Jordan Weber, CAL FIRE

Recommendation 99

Evaluate and expand the definition of “firefighter” as it applies to presumptive coverage.

The Fiscal Year (FY) 2023 National Defense Authorization Act (NDAA) (Pub. L. No. 117-263, 136 Stat. 2395 (2023)) provides federal firefighters with the presumption that certain health conditions are a result of the exposures they receive as a result of employment. As an example, should a current or former firefighter develop a pre-identified cancer, the presumption is that this cancer is a result of their employment and treatment costs are covered by the federal government. The legislation defines firefighters as employees who are trained in fire suppression, who have the legal authority to engage in fire suppression,

who are engaged in “prevention, control, or extinguishment of fires or response to emergency situations in which life, property, of the environment is at risk,” and who perform those activities as a “primary responsibility” of their job (Pub. L. No. 117-263, 136 Stat. 3251, at § 5305). However, as described elsewhere in this report, there are a not-insignificant number of individuals who support fire activities, including prescribed fire, outside of their primary job responsibilities. Based on the NDAA definition, these people are ineligible for presumptive coverage despite being equally exposed to fire-related hazards.

The Commission believes this eligibility for presumptive coverage should be expanded to ensure any federal employee who was exposed to hazard and risk in the wildfire environment is covered, without respect to a specific job role or title. This could be accomplished by extending eligibility to employees who perform the duties outlined in the FY2023 NDAA § 8143b(a)(1)(A)-(D), whether or not this is a primary responsibility of their job.

Recommendation 100

Invest in the completion of a human health risk assessment for worker exposure to wildland fire smoke and smoke from wildfires in the built environment to estimate the nature and probability of adverse health effects in humans who may be exposed to hazards from smoke with the intent of creating best management practices to mitigate the extent and duration of exposure.

While the negative health impacts of smoke are well known, there are no standard recommendations or guidance specific to protecting workers, including firefighters, from these impacts. Due to the lack of a wildland fire-specific standard, the Occupational Safety and Health Administration (OSHA) uses the standard for “particles not otherwise regulated” as an occupational exposure limit for smoke. However, this approach does not account for unique attributes of wildland fire smoke or from wildfires burning in the built environment, including the particle size make-up (largely PM2.5 and smaller) and the presence of other pollutants of concern. For these reasons, this existing standard is not an appropriate equivalent for smoke from wildland fires or wildfires burning in the built environment and does not provide an adequate threshold for assessing exposure mitigations or health effects from exposure to smoke. States, including Oregon, Washington, and California, have taken action to set occupational smoke standards, but without national guidance, all are slightly different and are based on public health studies rather than firefighter exposure profiles. They also contain exemptions for firefighting.

There have been growing calls for national exposure standards and mitigation guidance that are specific to wildland fire smoke or smoke from wildfires burning in the built environment. For example, the IJJA directed the Secretary of the Interior and the Secretary of Agriculture to “develop and adhere to recommendations for mitigation strategies for wildland firefighters to minimize exposure due to line-of-duty environmental hazards.” In 2022, the National Academies of Sciences, Engineering, and Medicine recommended the development of science-based, comprehensive workplace exposure standards for particulate matter indicators.

To inform the development of guidance or best management practices specific to smoke from fires in both the built and natural environments, there is a need to first assess how and at what levels workers are exposed, and the duration of their exposures. The human health risk assessment called for in this recommendation should address:

- The health problems that may be caused by exposure to smoke from fires in the built and natural environments.
- The probability that workers will experience health problems when exposed to different concentrations of wildfire smoke.
- The chemicals that workers are exposed to from smoke, as well as the overall level and duration.
- Differences in worker susceptibility to health effects from smoke exposure.
- The effectiveness of mitigation and adaptations for both acute and cumulative exposures.

The Commission emphasizes that the ability to carry out this research is heavily dependent on the development of a nationally consistent smoke monitoring system (called for in Recommendation 44 in Chapter 2: Protecting Public Health). The provision of real-time smoke monitoring will help address critical data gaps that currently hinder the ability to conduct a robust human health risk assessment. The Commission did not go so far as to recommend the establishment of a standard for wildfire smoke exposure out of concern that such a standard would hamper wildfire mitigation and response efforts.

Recommendation 101

Expand and improve Office of Workers' Compensation Programs processes.

The Office of Workers Compensation Programs (OWCP) provides necessary and critical support to workers who are injured on the job. However, the program is often reported to be challenging to navigate and may present challenges and limitations for firefighters' ability to make OWCP claims for the full scope of work-related injuries they may face. In addition, given the rural nature of much of the land management and fire response workforce, existing requirements for the level of provider required to complete OWCP paperwork can place a significant burden on the workforce. Program expansion and improvements are needed to ensure that OWCP claims processes address the hazards and impacts inherent to wildfire.

Issued in April of 2022, FECA Bulletin No. 22-07, created a new special indicator of FIR (Firefighter) within the Employees Compensation and Management Portal for federal firefighters to use when filing a workers' compensation claim. Claims created with this special indicator are processed by a Special Claims Unit to ensure consistency in adjudication. However, under the current FECA bulletin, firefighters are limited to only using the FIR special indicator for claims that have a diagnosis associated with 22 specific types of cancers, heart disease, and lung disease. These diagnoses are limited and do not encompass all fire related injuries and illnesses, such as burn rehabilitation needs or

physical injuries. The Commission recommends Congress direct the U.S. Department of Labor's OWCP Division of Federal Employees to expand the coverage of FECA Bulletin NO. 22-07 to include all injuries and illnesses of federal firefighters.

Further, the Commission recommends Congress direct OWCP Division of Federal Employees to establish a federal firefighter liaison program. This program would establish an open and transparent communication avenue between OWCP and federal agencies and bureaus and promote timely claims processes. The program would provide expedited service to all federal firefighter claims and place-specific case handling care on claims that encounter technicality events such as errant coding of procedures, approval of treatment and procedures, and payment reimbursement and collection issues. The liaison program would focus on eliminating bureaucratic issues with federal firefighter claims as well as providing exceptional customer service and response, given that timing of approval can be critical.

Additionally, the Commission recommends Congress:

- Accept paperwork completed by Advanced Practice Clinicians or Advanced Practice Providers and include behavioral health as a presumptive condition.
- Expand presumptive coverage. Language developed in Oregon could be used as a model (e.g., "Any mental disorder, whether sudden or gradual in onset, which requires medical services or results in physical or mental disability or death").
- Increase speed of claims processing both by streamlining the process and by increasing capacity of processing offices.

Members of the Tallac Hotshot Crew study a map while working on the North Complex fire.

Kye Funk, Forest Service



Housing the Workforce

Lack of affordable and available housing is a significant barrier to the recruitment, hiring, and retention of personnel throughout the wildland fire management, mitigation, prevention, and recovery workforce.

Over the last decade, housing costs have increased at a significantly faster rate than wages, pricing out employees across the public, private, and non-governmental sectors. As one example, a 2023 report evaluating the challenges to scaling up California’s forest restoration and wildfire prevention workforce, found that the state’s average housing costs have increased nearly 50 percent more than wages (Heard & Franklin, 2023). According to the authors, the cost of housing “may present the single largest barrier, felt across the workforce, from community college students to private contractors to seasonal firefighters (Heard & Franklin, 2023, p. 9). Many natural resources jobs also require employees to live in more rural areas where the availability of housing at all, regardless of price, is extremely limited, not well-maintained, and far from services and amenities. In some places, natural resource jobs are based in areas valued for recreation access and tourism. In areas like Jackson Hole, Wyoming, and Lake Tahoe, on the California and Nevada border, housing costs even more, and is in higher demand, which can further limit the available workforce. In recent years, more and more communities are seeing significant increases in housing costs, and a reduction in available and affordable housing and rental stock. Without affordable housing options, some employees are reported to live out of trailers or their cars or turn down job offers due to inability to find a place to live (Osgood, 2021). Housing for the recovery workforce can be particularly challenging if any of the available housing stock was destroyed by fire.

While federal housing for fire suppression and mitigation workers is available in some locations, these units are often not well-maintained and insufficient to meet the need. In addition, traditional housing models such as barracks or bunkhouses do not enable the recruitment and retention of firefighters with families. Given the nationwide shortage of affordable housing, the accessibility of market-rate housing is unlikely to improve in the foreseeable future.

Insights: Workforce Mobility

The Commission also discussed the geographic mobility of the landscape mitigation workforce, with opinions varying as to the benefits and drawbacks of a workforce historically reliant on frequent moves. As employees for national organizations, federal agency staff often move around the country, gaining diverse experience and pursuing promotions. Traditionally, the federal system has encouraged employee movement as individuals seek new positions in different locations – a pattern sometimes known as “moving out to move up.” These frequent moves can create both positive and negative impacts. They can be valuable in allowing employees to gain a greater diversity of experience and training. However, some Commission members also noted that such mobility hinders the ability for land managers to develop the deep social connections and direct knowledge of a landscape’s ecology and fire behavior that are often invaluable for successful outcomes.

Recommendation 102

Authorize and fund the provision of housing or a housing stipend for wildland fire mitigation and management personnel.

Congress should increase the provision of housing for a range of employees working in fire, rather than only those working in wildfire response. This should include permanent housing as well as temporary and seasonal options for staff that work part of the year and/or provide surge capacity.

The authorization of housing stipends for the wildfire mitigation and management workforce is a critical part of the solution. Currently, land management agencies have reported they lack the authority to provide such housing stipends (GAO, 2022c). Having the authority to provide stipends would support recruitment and retention, as well as mitigate escalating housing costs for the workforce.^{lxii} Where stipends are provided, Congress should work to ensure parity across the federal family as well as Tribes. Additionally, it will be important to make any necessary cost-of-living-adjustments to those stipends to reflect true housing costs.

The Commission also recommends streamlining federal agencies' ability to enter into agreements with other governments, the military, and private entities for access to existing housing facilities for the purpose of housing wildfire mitigation and management personnel. The Commission recommends the government pursue a wide variety of housing types given the diverse needs of the workforce. Bunkhouses may work for some, but those personnel who stay in the workforce long-term may need more family-oriented housing to support retention. Additionally, some in the wildland fire workforce may prefer mobile housing. Opportunities to create sites for such housing should be explored. Options and choice will be important in all cases. Any investments in housing should include funding for associated maintenance as investments are needed for the upkeep and maintenance of existing federal housing facilities to ensure they are safe and habitable.

Further, the Commission recommends allowing agencies to waive fair market value requirements for the purposes of providing affordable workforce housing. This includes the ability to waive fair market value rental rate requirements when leasing to community housing partners and, critically, the review and revision of rental rate requirements in the Office of Management and Budget (OMB) circular A-45.

Additional potential strategies include:

- Authorize interagency housing where appropriate.
- Reauthorize the Forest Service authority, originally provided in the 2018 Farm Bill, to lease administrative sites to localities based on their market value in cash or certain types of in-kind services. Extension of this authority would allow projects under development to continue. That authority also should be expanded to DOI agencies.

Recommendation 103

Enable the federal government to transfer appropriate lands and facilities to Tribes for development of workforce housing.

The lack of affordable housing in or near Tribal communities is a major impediment to establishing the workforce needed for stewardship activities. With limited available land on which to build workforce housing and lack of financial resources, some Tribes report difficulty building and retaining the wildfire workforce needed to implement many of the recommendations contained within this report.

To address this challenge, some Tribes are working with private funders and non-governmental organizations to purchase lands, construct homes, and put investments into endowments for ongoing management and maintenance costs. However, access to land continues to be a significant challenge. Providing Tribes access to appropriate land and facilities would greatly support the development of much-needed housing for local wildfire mitigation and restoration work. Federal agencies should be provided the authority to convey lands and facilities to Tribes at no cost. As part of the conveyance, agreements should ensure that income generated by workforce housing can be reinvested back into the Tribe and the perpetuation of Tribal programs and cultural practices through mechanisms such as interest-bearing accounts, endowments, opportunity funds or donor-advised funds. A number of legal avenues could be pursued to this end, such as:

- Enables the Bureau of Land Management (BLM) to sell or lease certain lands to Tribes at less than fair market value for recreational or public purposes. BLM should find that development of Tribal workforce housing qualifies as a “public purpose” under this new authority.
- Greater utilization of the 1958 Townsites Act (16 U.S. Code § 478a) authorizes the Forest Service to transfer up to 640 acres of land in Alaska or the 11 western states if the “indigenous community objectives ... outweigh the public objectives and values which would be served by maintaining such tract in Federal ownership.” However, while the Secretary may offer such an area for sale to a governmental subdivision, this does not include Tribes. Congress should adopt a 1958 Townsites Parity Act to enable the Forest Service to use its existing authority for land transfers to Tribes.

Chapter 6: Integrating Modern Science and Technology

Climate change and rapidly changing ecosystems represent fundamental shifts in conditions that current fire behavior models, and indeed the current fire management system, are not designed to meet. In a time of rapid ecological change, disparate scientific disciplines need to work in concert to successfully understand, model, and adapt to altered conditions. Furthermore, as society grapples with the complex and interdisciplinary nature of wildfire, which includes the built environment, human health, ecology, and economics, we must do more to unite research and data-driven decision-making in this space.

Fortunately, as recent reviews have noted, much of the science and technology needed to help mitigate, manage, and recover from wildfire likely already exist today (PCAST, 2023). Improved modeling, advanced technology, and better integration of research and practitioner needs can help the nation be more strategic, nimble, and intelligent in the way that we address the challenge of wildfire in both the built and natural environment.

Enhancing the use of science, data, and technology in the context of wildfire management requires investing in research (both applied and basic) and promoting the development and use of technology. On the research side, this includes funding and prioritizing research topics; disseminating findings; and establishing effective coordinating bodies. Technology enhancements include the application of new tools and products to incident response and mitigation efforts; scenario planning and modeling both during incidents and in

A fire whirl forms on the Pine Gulch Fire in Colorado in 2020.

Eric Coulter, Bureau of Land Management



planning treatments and recovery; and the procurement of such items and services. Spanning these activities, data and data management are at the heart of developing new tools, including artificial intelligence and machine learning, and underlie modeling and risk assessment efforts. Furthermore, the system should incorporate “research to operations” feedback loops between practitioners, engineers, and designers and the research community.

Wildfire science and technology is a broad, distributed sector. It encompasses numerous entities, including more than 50 federal programs spread across multiple departments, many (if not most) of the states, academic institutions, Tribes, and a wide variety of private sector entities including potential investors and vendors (Interagency Council for Advancing Meteorological Services and U.S. Group on Earth Observations, 2022; PCAST, 2023). This space has only become more complex as new partnerships have developed or deepened in the last few years, including, for example, expanded interest in wildfire science and technology from the National Aeronautics and Space Administration (NASA), the Department of Defense (DOD), and the National Science Foundation (NSF). Furthermore, many entities already in this space have recently increased investments, for example the National Oceanic and Atmospheric Administration (NOAA) and U.S. Geological Survey (USGS).

Reflecting on this distributed structure, the Commission found that **research, applied science programs, data management, and technology procurement and application related to wildfire are housed within a wide array of federal entities and academia, leading to a limited ability to set priorities, and general inefficiency.** This structure also results in the dispersed adoption of technologies and data systems across not just federal entities, but those at Tribal, state, and local scales as well, creating issues with interoperability. This limited interoperability and slower adoption of new technologies hamper wildfire management and mitigation.

Reform to promote more effective use and adoption of science, data, and technology in the wildfire mitigation and management system has emerged as a high priority, as evidenced by multiple recent reviews and reports, including internal interagency reviews, a report by external advisors to the President, and recent congressional interest and legislation. The Commission reviewed recent recommendations focused on improving federal wildfire science, data, and technology from the Presidential Council of Advisors on Science and Technology (PCAST) and believes the Commission recommendations to be additive and supportive (PCAST, 2023).

The Commission also feels that federal agencies have an important role to play in sharing information with states, Tribes, and communities. Hazard and risk maps, post-fire data collection, and predictive modeling are difficult to achieve at smaller scales and federal agencies can help coordinate and disseminate such products and sustain access to critical and large data sets for future uses.

Additionally, as identified in the Commission’s February 2023 Aviation Report, contracting and procurement laws and policies governing land management agencies can pose challenges to the adoption and improvement of new and existing technologies. Lack of certainty may disincentivize contractors from investing in improved safety and delivery systems while other competitors keep costs lower by continuing use older systems. DOD contracting authorities may offer alternative models that are longer-term and more stable. These models may allow for greater certainty and enable contractors to invest in new technologies over time. Given the

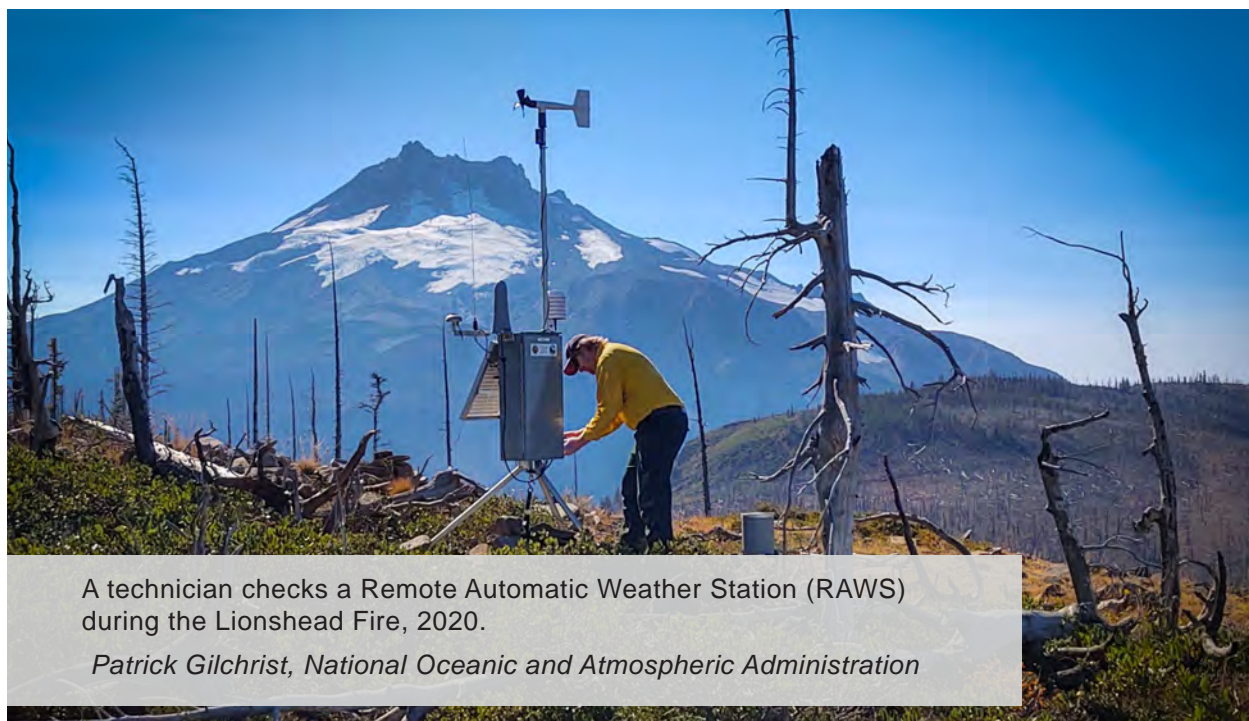
rapidly changing nature of technology, partnerships with private industry are important to the successful adoption of new technology for wildfire mitigation and management.

The Commission review of this space resulted in a set of recommendations regarding four major topics: decision support functions, research, operationalization of research, and new technologies. While these topics are deeply interrelated, the exact architecture linking the component parts may still require further refinement. Rather than be presented as a completely conceptualized whole, the recommendations should be taken as the necessary components of a transformed approach to science and technology in the wildfire space.

Supporting On-The-Ground Decisions

Fire Environment Center

Various predictive services and decision support functions currently exist to aid federal managers and decisionmakers in the wildland fire community. However, these services are fragmented across multiple agencies and suffer from both limited interoperability and dissipated priority-setting and purchasing power. The Commission believes they would greatly benefit



from increased integration. Critical functions for which current service provision has fallen short include comprehensive modeling of post-fire risks, structure-to-structure ignition, fire behavior, and air quality. With predictive modeling in particular, the limited efforts that do exist within individual agencies are narrow in scope and lack coordination and Information Technology (IT) interoperability. This siloing prevents service provision across all phases of fire, including post-fire recovery. Furthermore, federal services are poorly integrated with state and local data and inadequately serve Tribal, state, and local entities. The predictive modeling functions that are housed on the National Interagency Fire Center campus, while co-located, do not rise to the level of interorganizational (federal, Tribal, state, and local) coordination, nor do they fully integrate services across the pre-fire mitigation and post-fire recovery phases of an incident. They have also failed to keep pace with developing technology and research.

There is a need to pool service provision in a formally recognized and appropriately funded joint effort with the mandate, mission, and budget to facilitate a coordinated, intergovernmental effort focused on operationalizing science, data, and technology for practitioners across the wildfire environment, including the increasingly common intersection of the natural and built environments. Such an effort should not be duplicative of existing agency efforts. Rather, services should be unified within a jointly managed entity. Examples of this structure include the use of “fusion centers” in law enforcement.

The need for some form of cooperation in this space (though not necessarily the same recommendation as that offered by the Commission) also has been identified by multiple data reports over the last decade. As examples, the 2014 Quadrennial Fire Review noted the need for a centralized entity to help foster the adoption of new technologies while the 2023 PCAST report called for a joint-agency executive office to accelerate enterprise-level development and deployment of new technologies.

Recommendation 104

Congress should establish an interagency joint office with dedicated and separate funding to fulfill the mission of comprehensive assessment and prediction of fire in the wildland and built environment interface through data aggregation and science-based decision support services.

This joint office, which the Commission opted to refer to as a “fire environment center” for ease of reference, should be comprised of the relevant federal agencies that have either operational mission space (e.g., land management and community preparedness) or data gathering and management functions and should include representatives of other non-federal entities it serves.

The proposed center would address the widely recognized lack of timely, manager-focused models, technologies, assessments, and forecasts to support operational decision-making, and short- and long-term planning. As envisioned by the Commission, the center would bring together existing specialties within the land management, fire management, and community risk reduction and mitigation spaces in a collective entity intended to produce accessible products and services for a variety of users and uses. It would encompass all



phases of the wildfire cycle, from pre-fire mitigation, to wildfire response, to post-fire recovery and would address fires that occur in in the natural environment and those that move from the wildland into the built environment. Furthermore, the center should seek to provide relevant services to state, local, and Tribal governments as needed, offering a truly national – not just federal – approach to wildfire technology and decision support.

While a fundamental change from existing systems, the center should be seen as a reshaping of existing capacity into a model that better serves the greater universe of managers and operational decision-makers working in fire. Significant advantages of this concept include reduction of duplication; a single procurement process and cybersecurity system; and easier interoperability and sharing of data. To truly integrate efforts across agencies, management of the proposed center should be governed by a board, composed of the relevant agencies and partners, but with a single director with budgetary and decision-making authority. To realize this vision, the center would benefit from authorities similar to those provided to the DOD related to intelligence gathering and contracting to efficiently and effectively explore innovation with private entities and academia. For example, the center could enable more rapid exploration and application of new and emerging technologies.

Potential users, or customers, of this center would include Geographic Area Coordination Centers, Incident Management Teams; land managers; and air quality and water provider agencies. While the center should serve state, local, non-governmental, and Tribal entities as requested and needed, such assistance should be contingent on state and local entities sharing their data in return, where available, given the collective value of

integrating non-federal data into these services. Information and data from Tribes may require different degree of confidentiality. Unified and broadly available service provision and data management would be of particular assistance to state, local, and Tribal entities that are not currently able to field such services.

While this model would involve some unification of services, the Commission underscored that it would in no way centralize the overall decision authority of participating agencies and entities. Services would be designed to inform, preserve, and enhance decision-space that each of these entities have within their individual mission areas. Given that this would be a new approach to practitioner-focused service provision in the fire space, the fire environment center should be empowered to identify and recommend further refinements in operations to maximize this unified service center approach.

Recommendation 105

The fire environment center should provide real-time, science-based, and data-rich scientific and technical analytic services, decision support, and predictive services to inform land and fuels management, community risk reduction, and fire management and response.

Accessible, actionable tools and information are needed in all aspects of the wildfire environment and all phases of the fire continuum – before, during, and after incidents. Services addressing these aspects and phases would help inform and guide investments and activities that have the greatest chance of success and positive impact with the least risk, cost, and negative impact to the public. In this work, the center should strive to continuously incorporate new information, data, and models to drive decision-support functions.

Specific areas that the center would inform include:

- Pre-fire mitigation and risk reduction activities for landscapes and communities, including through assessments and modeling of climate conditions, fuels, home ignition, structure-to-structure spread, and values at risk. Information could help inform efforts such as the Community Wildfire Risk Reduction Program, outlined in Recommendation 1 in Chapter 1: Creating the Foundation for Success.
- Activities that better protect public health and safety during and after a fire. This includes mapping services and data provision to support evacuation decisions in communities at risk and air quality monitoring data to support health risk information that helps protect the public from smoke impacts associated with fire.
- Fire response and management, including response preparedness and initial attack readiness for new fires, deployment of response resources, and firefighter movement decisions during active fire management.
- Post-fire activities, including vegetation recovery, debris flows and flooding, watershed protection, and ecosystem health. Efforts could also support advance planning for the post-fire period, such as those outlined in Recommendation 66 in Chapter 4: Recovering for Resilience.

Recommendation 106

The fire environment center should be tasked with the development of a technological common operating environment for practitioners across the spectrum of risk mitigation, prescribed fire, response, and post-disaster response. This environment should shepherd the creation of highly dynamic artificial intelligence decision support tools.

The center's development of decision-support tools and services would be founded in a common operating environment (i.e., information technology infrastructure providing users easy access for the input and output of data) that would enable the aggregation, synthesis, and operationalization of data from across agencies and jurisdictions and including both fire response information and other relevant data. Management of such an effort could be unified in a singular office. It is essential that this effort include agencies and jurisdictions beyond the traditional land management agencies. Public health information, such as air quality forecasts, as well as information pertaining to the built environment, are essential to integrate into this common operating environment to ensure its products accurately reflect the depth and breadth of the wildfire issues.

This common operating environment would include consolidated IT and data management architecture to bring together disparate data sources, while still preserving entities' original ownership. The establishment of this common operating environment would fill what is currently an unmet need for a single tool or common operating platform that provides real-time decision support. It would also support greater interconnectivity between participating agencies. Specific elements that should be incorporated include:

- Interactive decision support tools and displays, and risk and hazard mapping.
- Geospatial data display and dissemination of fire environment observations, forecasts, assessments, and impacts.
- Utilization of low latency remote sensing, such as through prepositioned observational platforms or dedicated satellites.
- An infrastructure that supports timely adoption and utilization of proven new science and technology into operational systems.
- Establishing and adopting metadata standards to support a common operating platform, enabling mission agencies to retain control of their data while still supporting interoperability.
- Connectivity from any location with an interagency data collaboration environment, as referenced below in Recommendation 107.

While artificial intelligence (AI) and machine learning technologies are being used to a limited degree, they have not been broadly tested or evaluated. This common operating environment, and the associated integration of disparate data, would be especially valuable to inform and test the models that drive AI decision support tools. If tested and validated, AI

could be used for a variety of purposes to support managers and firefighters on the ground, including producing decision consequence data, modeling risk, and suggesting resources based on conditions at the time and place of ignition detection. These AI and machine learning tools should not, and could not, replace individual manager or incident commander discretion. Rather, these tools could be used to augment decision-making to better support decisions made in the field.

Recommendation 107

Land management, wildland fire, and built environment data should be managed through a decentralized, integrated data and modeling collaboration environment.

A new data and modeling collaboration environment should utilize coordinated data systems and computational tools to bring data sources together and improve interoperability and accessibility. Doing so would support and accelerate understanding of the full wildfire environment, including the outcomes and impacts of wildfire and associated management actions, new fire starts, and the effectiveness of wildfire risk mitigation measures. Potential models for data interoperability include the U.S. Department of Agriculture (USDA) Digital Data Commons and the U.S. Geological Survey (USGS) Earth Resources Observation and Science Center.

The desired distributed nature of this proposed data management environment is intended to preserve individual organizational and agency ownership of the data sources themselves. To help ensure accessibility and equity, data incorporated into this environment should follow the FAIR principles (findable, accessible, interoperable, reusable). This effort also could integrate with emerging work led by the U.S. Fire Administration (USFA) to better collect data and model the built environment.

In addition to serving federal agencies, this data management effort should seek to integrate state and local data and should be accessible to non-federal partners. Collaboration across federal, state, local, Tribal, and non-governmental entities increasingly relies on the sharing of data and information, necessitating the improved information technology coordination envisioned by this recommendation. In addition to creating a common technology structure, this work should include the establishment of data standards to further facilitate interoperability and the use of data from multiple sources for modeling and other functions. When working with Tribes, care should be given to ensure data sovereignty and confidentiality where requested.

As a part of this collaborative data environment, the Commission encourages the establishment of a cross-federal departmental clearinghouse for information regarding post-fire impacts including information on available programs and funding opportunities, short- and long-term mitigation best practices, ecological recovery, assessment science, emergency declaration processes, and other relevant topics. This information could be hosted on a national website (similar to [Ready.gov](https://www.ready.gov)) that consolidates information from all federal agencies, with the potential to include state resources as well. If appropriate, this

website could also handle reporting and data collection for both landscapes and community impacts, though clear guidelines would need to be established around which fires warrant inclusion.

As of summer 2023, the USFA was leading an effort known as the National Emergency Response Information System. The system is being designed to provide real-time information and analytics tools to support preparedness and response decision-making related to structure fires (USFA, 2023a). The effort aims to procure data that has already been collected or produced and consolidate it in a way that it can be used to generate new intelligence. This data procurement approach avoids putting additional data collection burdens on field staff. Pulling together disparate data sources can also feed into AI and machine learning systems, which require large amounts of data to develop predictive models. This USFA-managed platform could be one pathway to collect information on prescribed fires as well as wildfires that do not impact structures and infrastructure. If this route is pursued, the USFA system should not be the sole repository of information on prescribed fire but instead should be compatible or shared with land management agencies recording wildland fire information.

Built Environment and Public Health

Just as improved data collection, modeling, and service provision are needed for mitigation, management, and recovery work in the natural environment, similar functions are needed in the built environment. Modeling can inform evacuation route planning and predictions of fire spread in urban environments while social science service provision can help integrate the human component into decision-making throughout the fire cycle.

In addition, there continue to be important gaps in fire-related public health knowledge, including the health implications of repeated smoke inhalation over multiple days, weeks, and fire seasons; public and worker health effects in the post-fire environment; and other long-term and chronic health effects associated with smoke. There is also need for more research about compounding vulnerabilities, such as frequent smoke inhalation, the combined effects of heat and smoke, and lack of access to healthcare and the ability to address health impacts as they occur.

The Commission sees a strong need for better data procurement and analytics in the built environment. Related recommendations which support data-driven decision-making in the built environment and public health are also cross-referenced below.

Cross-referenced Recommendations

Recommendation 1: Congress should establish a Community Wildfire Risk Reduction Program via an interagency coordinating partnership including the U.S. Forest Service, the Federal Emergency Management Agency, the United States Fire Administration, the Office of Wildland Fire on behalf of the Department of the Interior's land management agencies, and the National Institute of Standards and Technology as principal agencies, to proactively address wildfire risk reduction actions and increase ignition resistance of the built environment.

Recommendation 4: Provide dedicated funding to evaluate, build and maintain existing federal, state, and local wildfire hazard data sets and identify a use case to refine and, if necessary, expand national datasets.

Recommendation 38: Support identification of public health risks associated with exposure to wildfire-contaminated water and development of evidence-based water use recommendations.

Recommendation 98: Invest in existing and new research and development to improve, and mitigate adverse physical, mental, psychological, and emotional impacts to firefighter health and safety when operating in both the built and natural environment.

Recommendation 108

Support data procurement and analytic systems that enable intelligence-informed decision-making to inform building codes and standards, and promote ignition-resistant construction and defensible space.

Congress should provide funding and other support to enable state, local, and Tribal governments, and other partners to undertake data collection, analysis, and application or deployment of systems at the appropriate scale to inform up-to-date, local decision-making and risk reduction regulations and activities. This may include, but is not limited to, parcel assessment and evaluation tools, mapping technologies, database development, and risk and hazard modeling. The resourcing of this work could include support for updates to, and ongoing maintenance of, hazard and risk maps. Updates and maintenance are critical given that community risk profiles shift over time with changes in climate, development, mitigation actions, and major wildfires or other natural disasters. Where possible, mapping efforts should look across scales and jurisdictional boundaries, incorporate collaborative processes in their development and identification of risk, and support better connection and interface with one another.

Data procurement and tool development also should consider and address the potential for unintended impacts to state, local, and, in particular, Tribal governments.

Recommendation 109

Invest in existing and new data collection, data availability, advanced technologies, and research to support use of beneficial fire while protecting human health and documenting emissions levels.

As wildfires impact increasing numbers of people both near and far from the event itself, there continue to be important gaps in fire-related public health knowledge, including the health implications of repeated smoke inhalation over multiple days, weeks, and fire seasons; public and worker health effects in the post-fire environment; and other long-term and chronic health effects associated with smoke. There is also need for more research about compounding vulnerabilities, such as frequent smoke inhalation, the combined effects of heat and smoke, and lack of access to healthcare and the ability to address health impacts as they occur.

Data, tools, and technologies should be oriented towards helping land managers, health officials, and emergency managers make decisions that balance both land management and public health goals. In line with the Commission's desire to break down silos in the fire space, health-related research should be integrated with other fire-related research, such as is recommended above in Recommendation 107. Federal agencies should also look to include participation from, and collaboration with, other non-federal partners.

Specific research actions that should receive Congressional funding and support include:

- The development of a near real-time prescribed fire database for federal, Tribal, state, and local agencies to promote the coordination of ignitions so as to minimize smoke impacts.
- Improved smoke forecasting and monitoring capabilities and new technologies to enable federal agencies and other land management partners to better inform and prepare communities for smoke events.
- Additional research into the health effects of wildland fire smoke, including comparative studies of smoke from prescribed fires, wildfires and fires that involve the built environment.
- Research and development on methods to effectively monitor pollutants from smoke, including drones and mobile platforms.
- Research into effective public health communication approaches and intervention strategies to promote community preparedness and reduce smoke exposures, with a specific emphasis on targeting those population groups at highest risk and with most frequent or prolonged exposure.

Prioritizing Research

Research related to wildfire is housed in an array of entities, including federal and state agencies, academic institutions, and the private sector. Because research functions are so widespread, it is difficult to capture a holistic picture of the gaps and needs. While the Commission sees value in maintaining a decentralized approach to research, better coordination of research priorities and dissemination of new information is needed across the various sectors related to fire. In addition to coordination of research needs and priorities, the Commission notes the need for increased funding for research to keep pace with the rapid change underway within the wildfire environment as a whole. Finally, the Commission also notes opportunities to expand research landscapes and to change policy to allow for more federal partnership with, and respect for, Tribes and Indigenous Knowledge.

Fire monitoring during wildfires on the Santa Fe National Forest, New Mexico, 2014. Fire monitoring during wildfires helps researchers understand the complex relationships among fuels, fire behavior, and fire effects.

Rachel Loehman, PhD, U.S. Geological Survey



Recommendation 110

Support the creation, chartering, or expansion of an existing venue to serve as a federal coordinating body for wildfire science that includes all relevant parties.

A wildfire research coordinating body would identify research gaps and set broader, forward-looking science priorities and strategies that are inclusive of government, academia, non-profit organizations, Tribes, and the private sector. Its work should include opportunities for managers to directly inform these research priorities. This effort also would foster improved coordination, communication, and collaboration across science and management organizations and disciplines at a level that is more comprehensive than current efforts, which generally are sector-specific (e.g., fire, natural resources, meteorology, social science). The board also should fill a strategic function, looking beyond the day-to-day to anticipate multi-year research and development needs and provide ongoing, long-term evaluation of gaps in research, science, and technology.

The Commission envisions that this research coordination body could support the proposed fire environment center (Recommendation 104) by identifying the research efforts needed to support the operational tools that are within the center's scope. Importantly, this body's role of setting out broad needs for future research would not include any direct authority over, or dictation of, the research agendas of any particular entity. Furthermore, the work of this board would need to integrate with the "research to operations" board noted below in Recommendation 116.

This coordinating body should include not only federal representatives but also those from the private and non-governmental sectors, philanthropy, Tribes, and academia. Options for operationalizing this recommendation include standing up a new subcommittee focused on wildfire within the National Science and Technology Council (NSTC) or developing an effort co-chartered by the Wildland Fire Leadership Council and the White House Office of Science and Technology Policy, of which NSTC is a part. Some Commission members noted that NSTC offers advantages in that it includes the National Institute of Health (NIH), National Institute of Standards and Technology (NIST), and the National Science Foundation (NSF) – all of which have important tie-ins to fire issues. Regardless of structure, Congress should provide dedicated funding to support this body's work.

A first task of this group should be a review of existing reports on known research needs and a review of necessary participants. Early research priorities should include the development of new fire models to better reflect scientific advancements and altered fire behavior under current and future climate conditions; improved behavioral and social science to better understand and guide public and individual decision-making; and improved organizational science to support agency administrative adaptation.

Insights: The Role of Social Science

Commission discussions related to science, data, and technology highlighted the need for engagement of social science. While social science is a short and often inadequate description for a broad and nuanced body of work, this research is critical to inform managers, decision-makers, policy-makers, and those working directly with communities. Social science is a necessary and valuable part of the wildfire mitigation and management system.

Social science findings can highlight the variability among communities and suggest that locally tailored mitigation approaches are essential (Jakes et al., 2007; McCaffrey, 2015; Paveglio et al., 2015a; Paveglio, 2021; Wollstein & Davis, 2017). Social science research can inform communication approaches both within our communities (Santo et al., 2021) and our response networks (Nowell & Steelman, 2015). Research can illuminate how residents and fire managers view risk, hazard, and mitigation actions (Brenkert-Smith et al., 2013; Champ, Donovan, & Barth, 2013; Dickinson et al., 2015; Madsen, Haynes, & McCaffrey, 2018; McCaffrey, 2015; Toman et al., 2013) and how the coupled social and ecological system can help inform our management approaches (Ager, Kline & Fischer, 2015; Smith et al., 2016).

In the natural environment, social science findings can help us understand community perceptions of fuel treatments (Toman et al., 2011), how agencies navigate engagement within collaborative groups (Butler, 2013), as well how we might build financial support for ecosystem services (Nielsen-Pincus et al., 2017).

Social science can further inform how we approach and govern the wildfire crisis in front of us (Abrams et al., 2015; Charnley, Kelley, & Fischer, 2020; Davis et al., 2021; Huber-Stearns, et al., 2022; Nowell et al., n.d.; Nowell et al., 2017; Wyborn et al., 2015) including information about collaboration and approaches that build trust (Cheng & Sturtevant, 2012; Metcalf et al., 2015; Walpole et al., 2017). Social science can inform our policy decisions, lending insight into tools to support changed outcomes (Schultz et al., 2019). Social science can also inform our approaches to vulnerability (Coughlan et al., 2019; Palaiologou et al., 2019) and the nuances present within recovery (Edgeley, 2022).

As the wildfire crisis necessitates policy action that takes into account multiple and complex needs, social science can help untangle some of our biggest challenges.

Recommendation 111

Increase and provide multi-year funding for existing research entities and programs to improve the identification of research needs and the dissemination of recent work.

Nearly all aspects of fire, from landscape treatments to response planning, are informed and guided by scientific research. However, funding for fire research has not kept pace with need and should be expanded by orders of magnitude to address both current and future conditions (Davis et al., 2021). Forest Service research stations, national research labs, U.S. Geological Survey science centers, USDA climate hubs, and the Joint Fire Science Program (JFSP) are among the entities that need expanded, multi-year funding to continue research on priority topics that can be translated into operational tools and technologies.

The Commission also discussed specific strategies for increasing funding for fire research through the JFSP, including:

- The JFSP should partner with the National Science Foundation (NSF) and its vast resources to promote scientific innovation and technology development related to fire, as well as utilize its well-established grants review process to disseminate grant funds for critically needed research.
- Agencies and programs that provide major extramural research funding for fire science (e.g., the NSF and the Department of Defense Strategic Environmental Research and Development Program and Environmental Security Technology Certification Program) should better coordinate with JFSP to fund priority fire science.

Recommendation 112

Improve incentivization of partnership with private sector researchers and foundations for the development of new science and technology.

The unique flexibilities and capabilities of the private sector are important assets in the arena of science, data, and technology. Partnerships with private foundations and researchers can be valuable for facilitating the exploration and adoption of new technologies to improve the efficacy of fire mitigation and management. Congress should look to the Department of Energy's Advanced Research Projects Agency-Energy and the Defense Advanced Research Projects Agency as excellent examples of programs that incentivize both basic research and "moonshot" efforts aimed at ambitious, long-term goals. The Foundation for Food Agriculture Research, which matches private funding for investments in agriculture, is another model that could prove valuable in the wildfire space. Enabling these partnerships may require modifying agency regulations and procurement policies. In tandem with partnership incentivization, Congress should clarify and increase support for agency authorities and capacity to engage in private sector partnerships. For example, it is important for agencies to have the internal staffing and expertise to adequately evaluate proposed partnerships and technological innovations.

Recommendation 113

Congress should provide funding to support Innovative Landscapes research areas that link scientists with land and fire managers to assess fire risk, plan fuels treatment, monitor before and after treatment and evaluate change in fire risk using the latest fire models, best data, and new and proven technology.

The Innovative Landscapes research areas concept was developed by the U.S. Geological Survey's Land Management Research Program and brings together researchers and managers with diverse expertise to develop new science and adaptive management practices. Funding for this effort would support addressing the needs of managers, and applying science, data, and technology to a given landscape's specific challenges and questions. While the focus should initially be on wildfire mitigation, impacts, and recovery (working in concert with the recommended fire environment center), it should also look to include new issues, including climate change impacts, invasive species, and post-fire hydrologic modeling. Innovation Landscapes would also support coordinated work with different land ownerships across the landscape. Workforce development should be addressed in the research focus as well.

Innovative Landscapes should include specific research positions that focus on working with managers and practitioners, rather than production and publication of academic work. Such positions (known within the federal system as "9-factor" positions) serve as boundary



spanners, bringing together and bridging different spheres or sectors to address complex problems. In the context of fire and natural resources, particularly valuable boundary spanners are those individuals who work across the science-practice interface (Davis et al., 2021). These people should have technical knowledge commensurate with the issue, as well as communication, networking, and emotional intelligence skills. They must speak the language of science to be credible to the research community, but also able to translate that science into operation or policy language.

The Innovative Landscapes program would address the need for research that is driven by practitioners and is interdisciplinary in nature, the latter of which is especially important in a time of rapid ecological change. This concept is also intended to drive research and monitoring at landscape scales, which has not received sufficient investment, but is especially needed to better guide adaptive management and inform future investments.

Recommendation 114

Expand support for the development and application of scientific research into, and monitoring of, post-fire ecological recovery and compounding disturbances, especially for wildfires featuring large high-severity patches where ecosystem type conversion is likely in absence of management interventions.

As wildfires burn larger areas and at higher severities, they are dramatically impacting landscapes in both the short and long term. Climate change is further altering post-fire recovery conditions, complicating current revegetation and restoration strategies. As these trends continue, expanded monitoring and improved information are needed to better understand strategies that can support restoration and adaptation for a changing environment.

Research in post-fire recovery can and should occur through multiple pathways. Existing programs include the Joint Fire Science Program, the Southwest Ecological Restoration Institutes, the U.S. Geological Survey wildland fire science community, the Forest Service's network of long-term Experimental Forests and Ranges, and the Forest Service's Research and Development arm, and many others. These programs support the type of applied research and monitoring called for in this recommendation and could be tasked with scaling up this work. The Forest Service General Technical Report PSW-GTR-270 "Postfire Restoration Framework for National Forests in California" offers a model of applied science that can benefit land managers in developing successful ecological recovery strategies for landscapes impacted by uncharacteristically large and severe wildfire (Meyer et al., 2021). Land managers and post-fire landscapes would significantly benefit from federal investments in the development of similar applied science tools for other ecosystems.

Post-fire research and monitoring work also could be supported through the creation of a new program or expansion of an existing program that could offer competitive grants for climate-informed strategy development and implementation. The Joint Fire Science Program could host this grant program through expanded funding, or new categories of eligible activities could be added to other existing programs. Potential applicants could include



Fire ecologists discuss wildfire impacts at a repeat fire site in Wrangells-St. Elias National Park, Alaska.

Rachel Loehman, PhD, U.S. Geological Survey

land grant universities, extension services, state forestry and agriculture agencies, non-governmental organizations, Tribes, and their partners. Any new or existing efforts should ensure that research and monitoring strategies consider Indigenous Knowledge and local knowledge. As noted previously, the creation of a fire environment center (Recommendation 104) and support for Innovative Landscapes (Recommendation 113) should also include post-fire monitoring and research.

Recommendation 115

Congress should consider the Forest Service Culture and Heritage Cooperation Authority as a baseline for expanded Tribal data sovereignty and Freedom of Information Act exemptions for Indigenous Knowledge.

The Cultural and Heritage Cooperation Authority (CHCA), passed in the Forestry title of the 2008 Farm Bill and codified at 25 U.S.C. § 32A, includes a prohibition on disclosure of sensitive information of importance to Tribes, such as locations of cultural and traditional importance (USFS, 2019). Such protections help facilitate greater cooperation between the Forest Service and Tribes by allowing information to be shared by Tribes with a degree of certainty that such information will be kept confidential by employee and partnership non-disclosure practices and protected from Freedom of Information Act (FOIA) (5 U.S.C. § 552) requests from the public (USFS, 2019).

While CHCA has provided a valuable service, the Commission recommends that the authority be expanded beyond the Forest Service to include all federal land management and science agencies. Such an expansion would provide the same protections to the DOI agencies and thus foster increased co-stewardship and co-management, including for wildfire risk reduction and other stewardship projects. In addition to an extension of existing CHCA protections, expansion of the confidentiality provisions to third parties involved in co-management should be created. Many co-management agreements between Tribes and federal land managers also include contractors or cooperators, sometimes as subcontractors to Tribes. These third parties are not, however, currently extended protections under CHCA, which can lead to project stoppages if Tribes cannot be certain that confidentiality coverage will be extended to those they choose to work with.

Operationalizing Research

The Commission feels strongly that **research efforts related to wildfire science and associated efforts should be driven by practitioner needs and ultimately be presented in such a way so as to be useful and accessible to practitioners.** Improving what is sometimes known as the “research-to-operations” pathway is critical to ensuring both that federally funded research is meeting practitioner and managerial needs, and that research is being operationalized in a way that can be used in the field.

Some coordinating bodies already address parts of the research-to-operations pathway within the wildfire science and technology space, including the Joint Fire Science Program, agency research and development programs, and university extension services. However, much as with research itself, no one coordinating body encompasses all the relevant disciplines to inform priorities, including public health, meteorological science, predictive modeling, and research relevant to fire-prone areas in both the built and natural environments. As such, there continues to be a disconnect between research and operationalized technology and models within many of these issue areas. While valuable science is being developed, it is not always being utilized or applied in a coordinated way.

Recommendation 116

Improve the research-to-operation pathway through the development of a fire science and technology advisory board to help coordinate existing research-to-operations efforts and research and development programs.

This advisory board would better define and coordinate the avenues for operationalizing research with applicability for practitioner use. In doing so, the board would help ensure valuable science does not go unutilized. This entity could help prioritize projects that should be transitioned to operations and then channel them into an entity – like the proposed fire environment center – where they could be put to use. In addition to a coordination role,



A demonstration of aircraft tracking on a tablet during Federal Technology Day.

Marc Barns, Forest Service

this board could more directly support the transition of research into operations by serving as a test bed and operational proving ground for new research, helping to bridge the gap between new research and useable operational products. This need for a central entity to help coordinate innovation priorities was also identified in the 2014 Quadrennial Fire Review.

The board itself should include relevant non-federal and private sector entities (e.g., the National Fire Protection Association, foundations, and representatives of state, local, and Tribal governments). The coordination work would bring together the entities that are directly testing, validating, and refining research to transition into the operational environment, as well those that already coordinate research for application and help identify technology needs for further consideration, such as the Joint Fire Science Program, the Southwest Ecological Restoration Institutes, and the National Wildfire Coordinating Group.

Accelerating Technology

The wildfire community must embrace new technology to meet the wildfire challenge, utilizing modern tools, including remote sensing, real-time decision support tools, high-performance computing, and updated modeling. However, the availability and existence of new technologies

are not guarantees that they will be adopted for use. Contracting and procurement laws and policies that apply to land management agencies can pose challenges to the adoption and improvement of new and existing technologies. Finding flexible means for federal agencies to partner with private sector companies and researchers is important to keep pace with new developments, given that non-governmental entities can often adapt and respond more quickly than the public sector. Agencies need additional capacity and access to subject matter experts who can support innovation, including through the assessment and development of pilots for new and emerging technologies. Furthermore, in the course of its work, the Commission identified several technologies largely existent now that are of high priority for adoption.

Recommendation 117

Procurement and contracting should allow for more flexible partnerships with private industry and non-governmental partners.

In addition to increased flexibility and agility in procurement processes, reforms are needed to enable contracts to be developed more rapidly, and with longer timelines. Private companies may also need some type of compensation, up front or via contract reimbursements, to encourage the development of technology that will provide enhanced capabilities across the fire environment.

There are several existing procurement and partnership mechanisms and approaches used in other areas of the federal government that the Commission believes could be useful if adopted by, or if appropriate authority was granted to, the wildfire related-agencies, including:

- Partnerships with Federally Funded Research and Development Centers, which serve a “quasi-governmental” role and allow a more conversational relationship with private sector researchers.
- The Department of Defense’s “Alpha” contracting, which allows for sole source purchasing.
- The National Aeronautics and Space Administration’s use of the Other Transaction Authority for innovative, small-scale partnerships. This type of contracting allows for prototype purchasing and may be usable to pilot innovative technology products.

Recommendation 118

The Commission found that numerous new and existing technologies could improve the mitigation and management of wildfire if adopted by the relevant entities.

While not a comprehensive review, the Commission notes a particular need for the following technologies be prioritized for greater development and adoption:

- Expanded adoption of interoperable communication systems and extended field connectivity to all firefighting resources.^{lxii}
- Incentivized and improved fire detection technologies including along electric utility corridors.
- The development of dynamic risk maps for the wildland environment that are updated regularly to better reflect changes in the natural environment, such as post-flood or fire alterations. While this process may take time, the development of such dynamic maps is important to better reflect rapidly changing environmental conditions.
- Improved resource tracking on wildfire incidents.
- Continued investments in innovative wood products and biomass utilization to help defray mitigation costs in the wildland environment.
- Rapid remote detection of vegetation change to inform fire risk and fire behavior models.

The Commission emphasizes that modernizing the wildfire mitigation and management space requires exploring and integrating new technology as well as more fully supporting and implementing existing technologies.

Recommendation 119

Upon the request of Tribes, entities gathering data and providing dispatch information regarding fire ignitions should have the authority to enter into agreements with such Tribes to protect the privacy and confidentiality of ceremonial and other fire use.

National efforts are ramping up to use satellite, lidar, and other forms of remote sensing to quickly detect ignitions, especially in remote locations. For example, the National Guard’s “FireGuard” program, which operates in conjunction with the National Geospatial-Intelligence Agency’s (NGA) “Firefly” capability, offers overhead visualization of initial detections on wildfires, especially in remote locations in off-hours. Such technology offers much promise for the early detection of wildfire, allowing for more management options and improved situational awareness. While currently such technology is rarely used in isolation (data analysts use a suite of tools to validate activity and avoid false reports), as technology continues to emerge, without coordination with Tribes, such initial detection efforts may trigger deployment of investigation and suppression resources to ceremonial fires, cultural burns, and prescribed fires. Such a reaction would be particularly problematic for ceremonial fire use, which often requires privacy and a controlled environment.

Data protection agreements that are put in place before such detections and occur through early and meaningful engagement between governments can help to prevent the inadvertent observation and interference with cultural or ceremonial fire and avoid the misallocation of response resources to an assumed “incident” that does not require attention. While this

recommendation should apply to all entities involved in the deployment and use of remote sensing technology for fire ignition, the recommendation is particularly pertinent for the NGA. As a federal entity, Congress has control over the manner in which NGA operates and uses the information it gathers. However, the federal government should also explore options to ensure that state, local, and private remote detection systems also do not infringe on the religious and ceremonial practices of Tribes.

Chapter 7: Investing for Tomorrow

Federal funding for wildfire mitigation, management, and recovery flows to and through several departments and agencies, including, primarily, the Federal Emergency Management Agency (FEMA), the Department of the Interior (DOI), and the U.S. Department of Agriculture (USDA). Additional funding flows through a variety of other federal entities, including science agencies such as the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS), as well those whose missions may secondarily intersect with wildfire, such as Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA). Other federal partners include public health agencies like the Environmental Protection Agency (EPA) and the Centers for Disease Control (CDC). State, Tribal, and local governments also put significant funding toward wildfire-related activities. As noted above and discussed further below, ensuring that all relevant agencies and partners receive sufficient resources is essential for addressing the enormous — and growing — footprint of wildfire in the United States.

Baseline federal budgets for wildfire programs are hard to determine as spending on wildfire is distributed across all of the agencies noted above, and across many programs within the land management agencies. Overall, the Forest Service budget for Fiscal Year (FY) 2023 totaled \$7.1 billion. Per the FY 2024 Budget Justification, the Forest Service received almost \$1 billion for Wildland Fire Management in FY 2023. The Wildfire Suppression Operations Reserve Fund (“fire funding fix”) Forest Service share was \$2.20 billion in 2023. The FY 2023 budget for the combined DOI Wildland Fire Management (OWF) program was \$1.5 billion.

Over the past two decades, both costs and investments related to wildfire have increased significantly. The nature of investments has changed as well. While the majority of funding still goes to wildfire response, recent years have seen increased investments in pre-fire mitigation activities, including land management agencies’ hazardous fuels programs, and FEMA disaster relief and mitigation programs.

The most recent infusions of fire-related funding were made through the 2021 Infrastructure Investments and Jobs Act (IIJA) and the 2022 Inflation Reduction Act (IRA). These two laws provided as much as \$24 billion in funding for conservation and wildfire activities over the course of a decade (CRS, 2022c; Goldman et al., 2022). Roughly half of this funding was intended for proactive mitigation investments in landscapes through hazardous fuels treatments, as well as commercial timber and innovative wood products.

The Lincoln Memorial and Washington D.C. shrouded in wildfire smoke from Canadian wildfires, 2023.

Adobe Stock



IIJA also provided \$1 billion for the new Community Wildfire Defense Grant program, intended to help at-risk communities and Tribes plan for, and reduce the risk of, wildfire.

Important to note, spending on wildfire exceeds these estimates, with additional funding provided by state, county, local, and Tribal governments, and even philanthropy. The total level of spending is difficult to estimate, however. Budgets at both a state and federal level are difficult to track in totality and deeply intertwined (TCaudell-Feagan et al., 2022; Taxpayers for Common Sense, 2023).

These investments, while significant, are only a part of the projected need for wildfire mitigation work across the nation's public and private lands. On federally administered lands alone, the Forest Service estimated in 2020 that restoration of national forest lands would come at a cost of \$65 billion over 10 years, while DOI estimates a need for \$20 billion to \$30 billion over the same time frame to address wildfire risk on lands within its jurisdiction (R. Jablonski-Diehl, personal communications, 2023, August 10; Woolworth & Knight, 2020). Even these estimates do not include costs of planning, private lands risk reduction work, mitigation measures in the built environment, necessary public health spending, or science and research needs.

The costs and losses associated with fire are far greater. While there is no single number representing the total cost of wildfire nation-wide, agencies estimate "on the order of tens to hundreds of billions of dollars per year" (Crowley et al., 2023, p. 1). Costs extend far beyond the direct footprint of fire to include myriad impacts to human health and wellbeing, including smoke emissions, loss of power, loss of income and tax base, and damage to drinking water systems, among other factors (Troy et al., 2022). Anticipated increases in wildfire activity will almost certainly cause those costs to grow in the coming years. The impacts of high-severity wildfire

also go far beyond monetary calculations, threatening the loss of large swaths of native forest and grassland ecosystems, entire communities, and ways of life across America.

In light of these threats, the Commission believes that **the wildfire crisis must be acknowledged as an issue of national security and a public health crisis**. As such, solutions necessitate a similar urgency and comparable levels of consistent, reliable investments as what is put toward other issues of national defense. The nation faces a wildfire threat within its borders that requires a significant and sustained investment.

While it is challenging to calculate the avoided costs associated with proactive mitigation, planning, preparedness, and recovery, there is broad agreement that investing in these activities is both effective and essential for long-term reduction of the tremendous human and ecological costs and impacts associated with high-severity wildfire (Porter et al., 2019). One study noted that every \$1 spent on structure hardening and retrofitting would save \$2 for existing buildings and \$4 for new construction (Porter et al., 2019). The Commission found that **investments in pre-fire mitigation and resilience need to be significantly increased to reduce long-term costs and risks**. This does not mean, however, that we can avoid spending on suppression.

Though federal funding can make significant progress in advancing solutions to the wildfire crisis, such work should not be wholly reliant on federal funding. Successful mitigation and management of wildfire requires adequate funding at all levels of government, including at the federal, state, local, and Tribal levels, as well as private investments. The federal government does, however, have an important role to play in encouraging and incentivizing investments from state and local governments.

In light of these findings, the Commission's discussions about fire funding converged on three overarching areas for policy improvement: changes to budget structures to facilitate reliable and flexible appropriations, priorities for increased funding, and incentives for non-federal funding.

Insights: No Unfunded Mandates

Throughout its discussions and recommendations, the Commission repeatedly underscored that congressional directives must be accompanied by the requisite funding. It is not the intention of the Commission to create competition within existing budgets, but rather to name the need and scale of required investments. No Commission recommendation is intended to result in the defunding of other existing programs. Ultimately, the determination of specific funding levels for supported and proposed programs was a problem too technical to solve in the available time and one best left to Congress. Indeed, as noted in multiple recent reports, calculating the total cost of and investments in wildfire is incredibly challenging at all levels of government.

Budget Stability and Structures

The Commission sees opportunities for changes to the structure of federal agency appropriations to provide greater certainty and flexibility in meeting the wildfire challenge. The existing system of predominantly annual appropriations can result in uncertainty for wildfire-related programs, while multiple budget line items and conditioned funding can make it difficult for agencies to conduct mitigation and post-fire recovery work.

Recommendation 120

Congress should provide advanced appropriations for wildland fire mitigation and management on a multi-year, rather than annual, cycle.

Advanced appropriations on a multi-year schedule would provide a greater level of funding reliability, affording federal agencies the flexibility to effectively plan ahead to manage the rising cost of wildfire mitigation and management while ensuring more stability for fire personnel and programs. While longer-term appropriations would be welcome, even a two-year appropriations cycle would provide more predictable funding for necessary personnel and activities. Additionally, once funding is appropriated, it should be available until expended to encourage more efficient use of appropriated funds. Some Commission members suggested an omnibus, multi-year, mandatory funding authorization and direct appropriation would also help provide a greater level of certainty for fire agencies.

Recommendation 121

Make permanent the Wildfire Suppression Operations Reserve Fund.

The Wildfire Suppression Operations Reserve Fund was created after nearly a decade of surging wildfire response costs that increasingly drew funding away from important non-fire response activities. From FY 2011 to FY 2019, wildfire-related appropriations for the Forest Service and DOI nearly doubled, with suppression accounting for nearly half of average annual wildfire appropriations during those years. A Forest Service analysis found that suppression costs were anticipated to exceed two-thirds of the agency's total budget by 2025 (USFS, 2015). At times, when regular discretionary appropriations were insufficient, agencies executed "fire borrowing" – the emergency transfer of funds from non-fire response activities to cover wildfire suppression cost overruns. The practice was widely regarded as destabilizing for agency work that was not directly related to suppression, resulting in significant inefficiencies in the use of taxpayer funds.

Recognizing these destabilizing effects, Congress passed Division O of the Consolidated Appropriations Act of 2018 (Pub. L. No. 115-141, 132 Stat. 348 (2018)), also known as the "fire funding fix." The fire funding fix authorized additional suppression funds for the Forest Service and DOI when base suppression funding is exhausted. This funding, called

the Wildfire Suppression Operations Reserve Fund, is appropriated by Congress to a separate, specific account for each agency. Unobligated balances of funding in the Wildfire Suppression Operations Reserve Fund carry forward into the next year (DOI, 2023). According to the 2018 legislation, the reserve fund is set to expire in 2027.

By creating a consistent funding source for wildfire response that is separate from other fire and non-fire budgets, the Wildfire Suppression Operations Reserve Fund has been vital to the stabilization of Forest Service and DOI budgets and more efficient and effective program implementation. It creates a mechanism by which funding for response does not come at the expense of pre- and post-fire efforts, nor at the expense of non-fire programs within relevant agencies, both of which are high priorities for the Commission. Keeping these other budgets whole and creating overall budget stability enables land management agencies to perform their full missions. The Commission sees the potential for an expiration of the Reserve Fund to have substantial adverse consequences if no other solution were to be in place.

Insights: Funding Flexibility

Recommendation 122 (below) reflects the Commission's desire for greater flexibility in spending across all phases of fire, allowing resources and personnel to more easily be shifted between response, proactive mitigation, and post-fire recovery activities. However, this sort of model should not create circumstances similar to years past when the immediate need to prioritize wildfire response spending prevented important mitigation work.

Several Commission members raised significant concerns that creating more flexibility to reallocate funding between fire-related budget categories would further deprive important mitigation and recovery work of sufficient and predictable funding because those activities would be competing with ballooning response costs. Any option that would potentially put pre- and post-fire work in a more precarious financial situation would be antithetical to the core Commission priority of increasing funding for these activities.

Recommendation 122

Congress should authorize U.S. Department of Agriculture and the Department of the Interior, within their respective Wildland Fire Management appropriations, to fund pre- and post-fire project work using the current "fire response" sub-activities in each department.

The Forest Service and DOI both have wildland fire management accounts that are separate from their respective Wildfire Suppression Operations Reserve Funds and from spending on other land management activities. Congress allocates funding within the accounts for specific activities and reallocation is subject to specific guidelines. Allowing for wildland fire management account funds to be available for all fire program requirements,

depending on need, would provide the federal fire management agencies with greater flexibility in allocating resources across the phases of wildfire and related budget line items. This flexibility could potentially provide agencies with more responsive funding than current budget structures. The Commission sees this modification as an avenue that could enable agencies to undertake many types of wildfire-related work in a more holistic manner across their areas of responsibility. Such an approach reflects the fact that many activities can have multiple functions and benefits related to fire. Post-fire planning and restoration activities, for example, can also benefit pre-fire mitigation and preparedness outcomes.

As noted above, the Commission does not intend for this greater fluidity between funded activities to reduce the funding available for risk reduction and post-fire planning and recovery work. Therefore, in making this change, Congress should ensure sufficient funding is available to support necessary pre- and post-fire projects. Appropriate coding within the new, more inclusive budget approach would still allow review and oversight of obligations across activities. Finally, the Commission recommends that wildland fire management personnel to be funded separately from pooled project funding.

Recommendation 123

Congress should fund budget offices to create “crosscuts” to better track all federal wildfire spending.

As previously noted, federal agency spending on wildfire is largely distributed among agencies within USDA, DOI, and the Department of Homeland Security (DHS), each of which have different processes for allocating funding. Within the USDA, the Forest Service is the primary agency to undertake wildfire-related activities. Within that agency’s current budget structure, however, it is difficult to track what is being spent on wildfire and where. Almost every account contains a program that conducts activities related to wildfire mitigation and management but because many of these programs have scopes that are not exclusive to wildfire – and because investments often have multiple benefits – the ability to isolate wildfire-related spending via accounts or programs can be a challenge. DOI’s Office of Wildland Fire coordinates all wildfire management funding and spending across the department’s land management bureaus. This approach makes it much easier to track and understand wildfire management funding. Within DHS, tracking how FEMA funds wildfire-related activities from a budget-line-item standpoint can be very difficult (Wang & Blackband, 2023). For example, FEMA’s budget documents do not specify how disaster relief funding is appropriated to the Hazard Mitigation Grant Program and Building Resilient Infrastructure and Communities programs and do not discern how funds allocated to those programs are distributed based on different types of disasters (e.g., fires, floods, or hurricanes).

Congressional subcommittee jurisdictions for wildfire-related appropriations similarly lack consolidation. Multiple appropriations subcommittees allocate budgets for wildfire and do not necessarily coordinate their efforts. There is no way to determine, for example, how much federal wildfire funding has gone to each state or how much has been allocated to prescribed fire nationally. The inability to answer these questions can make it challenging to efficiently allocate or request new funding.

The Commission believes that a government-wide crosscut would provide a number of benefits. It would enable a better understanding of total federal wildfire funding expenditures, which could help inform and validate future funding requests. This comprehensive cross-agency tracking would increase transparency and accountability about how federal dollars are being spent on wildfire, including where investments are being focused. The crosscut could, for example, show how federal spending is being allocated across pre-fire, post-fire, and response-related activities, which the Commission sees as important to support a much-needed rebalancing in funding priorities toward proactive mitigation and post-fire recovery. It could also help with tracking spending on wildfire-related activities overseen by different congressional committees. Additionally, this approach would better highlight gaps or areas of underinvestment and thus help ensure that some geographic areas, programs, or activities do not get left behind.

This sort of crosscut, which has been implemented by entities such as the U.S. Agency for International Development, would not change existing budget line items, but rather could create a standard method of reporting to show how much funding within federal programs are going to wildfire, for which activities, and where they are being spent. The provision of funding at a scale necessary to effectively address the current wildfire crisis should be accompanied by greater detail about how money is allocated and the impact it creates.

Though there is value in developing such a tool, the Commission acknowledges that producing a crosscut budget is labor intensive and would require substantial time on the part of budget personnel. Therefore, funding for this effort is critical.



Activating a Modular Aerial Fire Fighting System (MAFFS)-equipped C-130 aircraft from the 146 Airlift Wing of the California Air National Guard.

Forest Service

Investment Priorities

Several federal agencies contribute to aspects of wildfire management in different ways. Funding must be increased for all of these agencies in order to implement the ambitious changes needed to shift the current trajectory of wildfire's impacts across the nation. Furthermore, this funding must be sustained over time.

Recommendation 124

Congress should ensure balanced, robust funding for pre-fire mitigation and post-fire restoration is included as part of the wildland fire budget.

Within the two primary federal wildland firefighting entities, the DOI and the Forest Service, budgets are heavily weighted toward wildfire response. In FY 2023, the DOI's Office of Wildland Fire Management received \$855 million in funds for suppression and preparedness operations (plus an additional \$340 million in the Wildfire Suppression Operations Reserve Fund), while fuels reduction treatments received \$247 million in funds; less than a third as much as suppression (R. Jablonski-Diehl, personal communications, 2023, August 10). Post-fire burned area rehabilitation received \$20.5 million that year; a mere three percent relative to the suppression budget. It is more difficult to track Forest Service spending on fire-related mitigation activities as they are spread across many programs, but, in 2015 it was anticipated that suppression would make up two-thirds of the Forest Service budget by 2025, which precipitated the creation of the Wildfire Suppression Operations Reserve Fund to provide separate, dedicated funding for DOI and Forest Service wildfire response (USFS, 2015).

Even with this reserve fund in place, there is a need for significant additional investments in proactive wildfire mitigation and post-fire recovery activities that reduce risks and address impacts of catastrophic fires to provide a balanced approach to wildfire management. As noted above, the Commission does not intend this to mean a reduction in immediate spending on response and preparedness. Rather, in time, as mitigation work progresses, the proportional need for response and post-fire recovery expenses are anticipated to decline.

The Wildfire Suppression Operations Reserve Fund, addressed above, has been beneficial for maintaining funding for activities apart from response. Outside of reauthorizing that reserve fund, efforts should be made to ensure that these other land management activities are not impacted by response funding needs.

Recommendation 125

Congress should comprehensively fund a wildfire management workforce comparable to total compensation provided to other national security personnel.

The Commission's view of wildfire mitigation and management as an issue of national security extends to the workforce. Many in this workforce are taking on responsibilities and risks that are comparable to those faced by national security personnel. However, it is widely acknowledged that these workers – wildland firefighters in particular – face numerous challenges including low pay, poor work-life balance, remote or expensive work locations, and physically and mentally taxing work environments (GAO, 2022c). These challenges are discussed in further detail in Chapter 5: Building a Comprehensive Workforce.

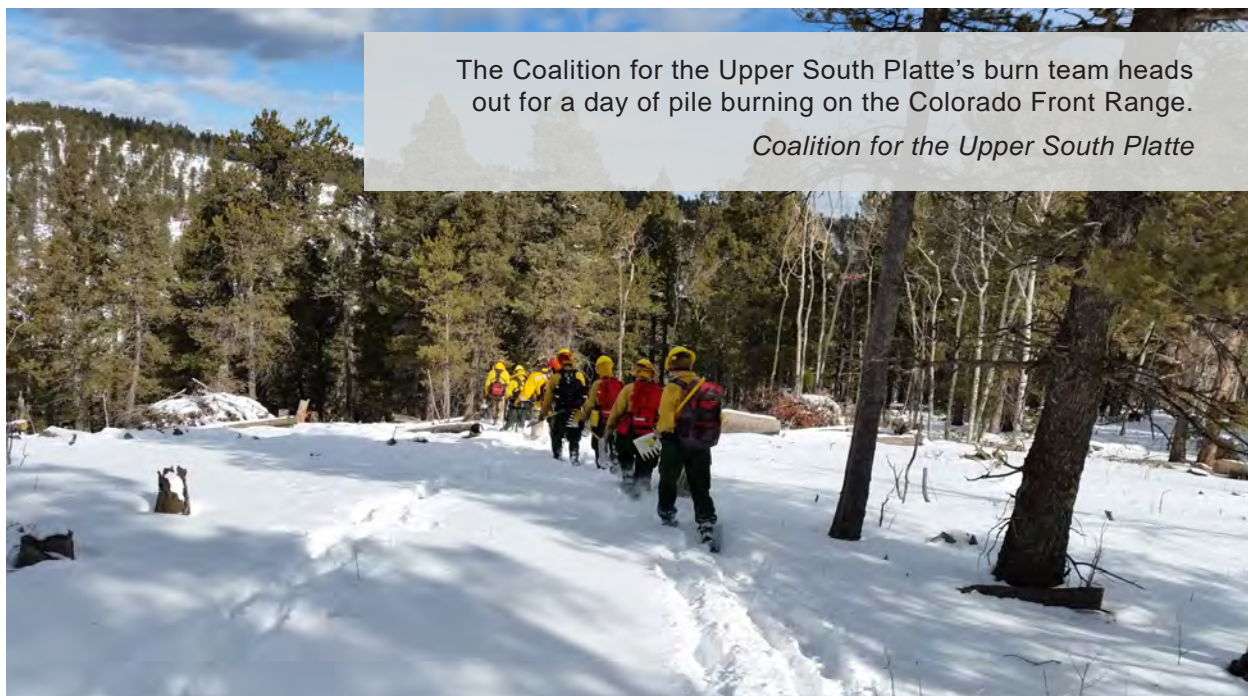
To help address these issues, Congress should provide funding that enables comprehensive compensation for the wildland fire management workforce that is similar to what is provided to other national security personnel. Elements of this total compensation should include benefits that address the long-term impacts of fire-related work such as health care (including mental healthcare) for active duty and retired personnel, retirement benefits, location transfer pay, long-term disability support, and housing and subsistence allowances. This would make careers in wildfire more in line with the holistic lifestyle-employment of military service.

Recommendation 126

Congress should authorize and appropriate funds to support new and existing partnership programs to reduce wildfire threats, support landscape-scale, multi-jurisdictional mitigation, and post-fire recovery efforts on all lands impacted by wildfire.

Partnership programs and agreement mechanisms serve an important role in enabling cooperative work between federal agencies and entities working at other scales, and with different capabilities and capacities. Non-federal partners can, for example, bring additional resources to a project (financial, place-based knowledge, and otherwise), can often operate with greater flexibility, and may be able to advance certain processes or activities on faster timelines than federal agencies (Cowan et al., 2022). Partnership tools are also a means of deploying funding to the state, local, and Tribal levels, all of which must be adequately resourced to successfully address wildfire issues.

Strong partnerships are often fundamental to cross-boundary, all-lands management efforts, which themselves are critical to reducing wildfire risk in a holistic way. Working across jurisdictional boundaries is in line with the National Cohesive Wildland Fire Management Strategy's emphasis on strategic alignment and collaborative engagement and can bring important benefits in terms of overall efficacy, leveraged resources, and ability to make strategic investments. Furthermore, some portion of funding for these cooperative efforts should not be constrained by current adjacency requirements to avoid hindering important



partnerships. In addition, investments should be designed to ensure equitable access to partnership programs, in recognition that capacity building may be needed to enable partnerships with underserved communities.

Recommendation 127

Congress should provide direct funding to Tribes for capacity for consultation, coordination, co-stewardship, and co-management, and should establish flexible, reliable, and regenerative funding mechanisms and processes.

As previously noted, the United States has a complex political and legal relationship with federally recognized Indian Tribes, as established in the U.S. Constitution, treaties with Tribes, statutes and regulations, Executive Orders, court decisions, and international law (GSA, 2017). Tribal consultation is the formal, government-to-government dialogue between official representatives of Tribes and federal agencies to seek input on federal policies and actions (BIA, n.d.c). Consultation is one means by which federal agencies can meaningfully recognize the sovereignty of Tribes and their long-standing ties to lands now administered by the federal government. For example, Executive Order 13175 charges all executive departments and agencies with engaging in “regular, meaningful, and robust consultation” with Tribal officials in the development of policies that have Tribal implications (Executive Order 13175, 2000.)

Consultation only works, however, to the extent that Tribes have sufficient capacity and resources to meaningfully engage in the process. Unfortunately, many Tribes are limited in their engagement in consultation by a lack of capacity and insufficient resources. To remedy

this, the Commission recommends funding be provided to support Tribes in consultation processes. Such funding would also enable and promote the revitalization of Indigenous stewardship, resulting in improved fire regimes and forest health conditions across multi-jurisdictional landscapes.

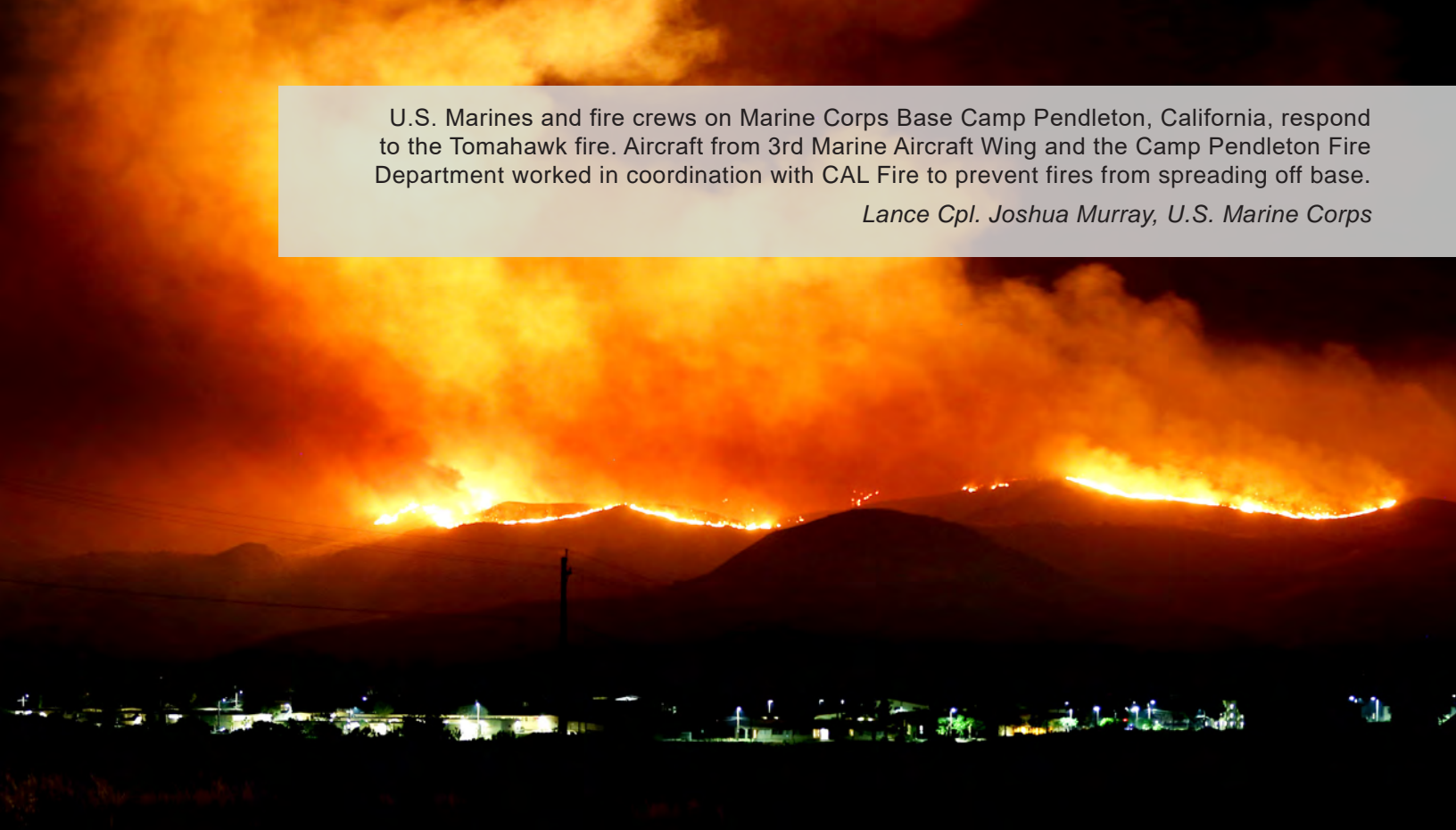
More generally, but perhaps of greater urgency, current funding sources for Indigenous stewardship across jurisdictions are insufficient in amount, unreliable, and cumbersome for Tribes to administer. Many Tribes are reliant on project-specific grants with short timelines and significant restrictions on use, preventing the establishment of stable Tribal programs focused on wildfire mitigation and management. Enabling Tribes to build regenerative economic systems that are stable and sufficient for the operation of robust Tribal stewardship programs is necessary to address the wildfire crisis and meet the true needs of Tribal communities. Funding should, when possible, enable Tribes to build long-term economic stability through investments that can, over time, become self-sustaining, particularly given insufficient Tribal taxing authority.

Recommendation 128

To ensure Tribes have adequate base funding and staffing to accomplish management goals on Tribal lands, Congress should consider the results of the Indian Forest Management Assessment and National Congress of American Indians Resolutions when creating new laws, regulations, or other authorities.

Stable funding for basic expenses of Tribal governments is needed to help ensure Tribes can participate in wildfire mitigation work on Tribal trust lands in co-management with federal agencies. By ensuring stable base funding, Tribes are better able to provide capacity and allocate resources for such projects. Furthermore, while some funding allocations under self-determination contracts are tied to equivalent federal agency costs to perform similar work, Tribes may require additional funding as a matter of practicality and equity. In addition, as noted above, Congress should provide funding and staffing support to ensure Tribes have the capacity needed to engage in co-management and co-stewardship of federally administered lands.

The fourth Indian Forest Management Assessment Team IV (IFMAT IV) was released in the summer of 2023 (Intertribal Timber Council, n.d.). The periodic IFMAT assessments are mandated by the National Indian Forest Resources Management Act, enacted as Title III of Public Law 101-630 on November 28, 1990, and provide guidance on a range of challenges and objectives for Federal trust administration to support sustainable management of Indian forests (Intertribal Timber Council, n.d.). This review provides an important source of information on Tribal needs. Additionally, the National Congress of American Indians issues resolutions regarding needed funding levels related to co-management, data sovereignty, and other issues. These should also be consulted when reassessing Tribal funding needs.



U.S. Marines and fire crews on Marine Corps Base Camp Pendleton, California, respond to the Tomahawk fire. Aircraft from 3rd Marine Aircraft Wing and the Camp Pendleton Fire Department worked in coordination with CAL Fire to prevent fires from spreading off base.

Lance Cpl. Joshua Murray, U.S. Marine Corps

Recommendation 129

Congress should ensure the U.S. Fire Administration and the Federal Emergency Management Agency have the resources necessary to support efforts to reduce wildfire risks to communities and the threat of urban conflagrations related to wildfire and provide post wildfire mitigation and recovery in communities.

FEMA coordinates across federal agencies to help state, local, Tribal, and territorial governments, communities, and organizations to prepare for, respond to, and recover from disasters. While the agency has traditionally focused on anticipating and responding to hurricanes, floods, and tornadoes, it has come to play a larger role in the wildfire space in recent years due to the increase in wildfire disasters. Several FEMA accounts and programs fund activities that help state, local, Tribal, and territorial entities mitigate, respond to, and recover from wildfires. Relevant programs include the Hazard Mitigation Grant Program, the Building Resilient Infrastructure and Communities Program, and the Fire Management Assistance Grant Program. In the case of wildfires that are Presidentially declared disasters, FEMA also provides Public Assistance and Individual Assistance to support recovery activities (Reese, 2018). See Chapter 4: Recovering for Resilience for more information.

FEMA also houses the U.S. Fire Administration (USFA). USFA coordinates with federal, state, Tribal, and local emergency services, colleges and universities, and the private sector to develop and deliver training, professional development, and other programs for emergency responders. These programs are delivered through the USFA's National Fire

Academy. USFA also oversees the legacy national fire incident reporting system (known more commonly as NFIRS) that collects data from fire and other emergencies to which U.S. fire departments respond. The USFA also plays an important role in structural fire prevention and public fire education efforts and supports research addressing the nation's fire challenges. USFA is a member of the National Wildfire Coordinating Group and acts as an important conduit to state and local fire departments.

Increased wildfire activity near and within communities necessitates increased federal funding to FEMA and USFA to support state, local, Tribal, and territorial efforts to reduce wildfire risk to communities and to facilitate post-fire response, recovery, and mitigation activities. Funding to USFA in particular would support the continuation and expansion of services to structure fire departments including wildfire training for structural firefighters. USFA training could also help address public education for community planning and preparedness activities for wildfires that originate in or move into the built environment. This includes education regarding building codes and standards, use of ignition-resistant building materials, evacuation preparedness and planning, and reduction of vegetation around structures. As noted elsewhere in this report, the Commission sees value in an expanded role for USFA in providing mitigation and response training for all career and active volunteer structural firefighters and in helping support more comprehensive data procurement efforts that enhance interoperability. For more information, see Recommendation 56 in Chapter 3: Responding to Fire and Recommendation 107 in Chapter 6: Integrating Modern Science and Technology.

The Commission supports additional funding to FEMA disaster mitigation, relief, and recovery programs but as noted in previous sections, this body sees significant room for improvement in existing FEMA programs to better reach communities. That includes greater accessibility, timeliness, and expansion of program scope to fund critical post-fire recovery activities and state, Tribal, and local capacity-building. Commission members specifically pointed to the time-intensive and burdensome processes involved with FEMA disaster relief programs and hazard mitigation programs that can contribute to protracted timelines in deployment of important recovery funding to communities in need.

Recommendation 130

While funding levels in the Inflation Reduction Act and the Infrastructure Investment and Jobs Act are historic contributions to wildfire risk reduction, investments at a similar and sustained scale in federal land management agencies and programs are needed to successfully and proactively reduce growing wildfire risk.

Five federal land management agencies have missions related to wildland fire management: USDA's Forest Service and DOI's Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service. These entities have large wildland fire response programs that together employ thousands of wildland firefighting personnel across the country and include both ground-based and aerial firefighting personnel and equipment. Additionally, these agencies fund and directly implement fuels reduction work

such as thinning and prescribed burning to reduce the risk of high-severity wildfire on private and public lands. In support of the wildfire response mission, these agencies also support central coordinating entities, provide predictive services to better support decision-making, and support research that promotes overall efficacy. In the post-fire realm, several agencies also conduct assessment of burned landscapes and undertake reforestation and revegetation activities to promote ecological recovery. Though less frequently associated with wildfire mitigation and management, the USDA Natural Resources Conservation Service also supports wildfire mitigation via conservation practices funded through its private lands programs and post-fire recovery on non-federal land through its Emergency Watershed Protection program.

Significant funding is needed to support and increase the full suite of wildfire mitigation and management activities undertaken by these agencies, especially proactive work to reduce the risk of high-severity wildfire. Most mitigation activities also require regular follow-up treatments, necessitating sustained investments, as noted previously. While the IRA and the IIJA provided a combined \$24 billion in funding for wildfire mitigation and management and related activities, the Forest Service and the DOI estimate a combined need of \$85 billion to \$95 billion over 10 years to effectively address wildfire risk (Woolworth & Knight, 2020; R. Jablonski-Diehl, personal communications, 2023, August 10). The total cost of this work is likely to exceed even these partial estimates.

Recommendation 131

Congress should ensure that mission-critical support agencies, such as the U.S. Geological Survey, National Oceanic and Atmospheric Administration, and Environmental Protection Agency have the necessary resources to support wildfire risk reduction, recovery, and response efforts.

A number of agencies play critical roles in supporting the wildfire mitigation and management mission through science support, decision support tools, and predictive modeling. The U.S. Geological Survey, for example, produces tools to support decision-making before, during and after wildfires and generates information about the causes of wildfires, the impacts and benefits of fire, and prevention and management of larger, high-severity fires (United States Geological Survey [USGS], n.d.b). As the nation's leading weather and climate science agency, the National Oceanic and Atmospheric Administration also serves an information and data provision role, producing fire weather outlooks, forecasts, and early warning products as well as satellite ignition identification. The Environmental Protection Agency provides guidance and information about smoke impacts from wildland fire as well as disposal of disaster debris that is produced when wildfires burn through the built environment (EPA, n.d.b). Funding is needed for these agencies and others that support various aspects of wildfire mitigation and management.

Recommendation 132

Congress should ensure that agencies have sustained funding to maintain wildfire risk and resilience improvements.

In addition to increases in overall funding for fire-related work, the Commission emphasizes that funding must be sustained over the long term. In regard to wildfire mitigation in particular, steady funding is necessary to support the ongoing “maintenance” work required to maintain the efficacy of many fuel reduction and ecological restoration activities. Studies of the longevity of fuels treatments in several western forest types, for example, found that treatments in some places may lose their effectiveness in mitigating subsequent fire intensity and severity after roughly 10 to 15 years, though there is substantial variability based upon ecosystem productivity (Yocom, 2013). Without sustained funding to support necessary follow-up treatments, valuable investments in initial wildfire mitigation activities will eventually be lost.

Shared Investments

Federal investments and agencies have a critical role to play in wildfire risk reduction, response, and recovery, but state, local, and Tribal governments also share the responsibility for addressing wildfire. However, as this report previously noted, state budgets have lagged behind actual costs and needs related to wildfire. Funding solutions should therefore come from a diversity of sources, including increased state and local spending, philanthropy, and the private sector, as well as federal funding. Importantly, federal funding can be used to encourage and incentivize investments from other sources. Incentives for ignition-resistant construction and retrofitting (discussed in Chapter 1: Creating the Foundation for Success) can encourage investment at the individual scale, while incentives for land-use planning and innovation can encourage investment at the community scale and within the private sector (Recommendation 2 and Recommendation 6, respectively). In other cases, federal action can be used to create procedural ease and facilitate shared investment (e.g., easing the ability of electric utilities to invest in ignition-resistant infrastructure through possible development of wildland fire mitigation plans as discussed in Recommendation 7).

Recommendation 133

Foster the use of conservation finance agreements on federal land.

Conservation finance is an evolving approach to bringing private capital to bear in ways that benefit nature (London School of Economics and Political Science, 2023). Specific mechanisms vary, but the general concept is to align environmental, social, and economic outcomes (Martin, 2015). As an example, a wildfire risk reduction project may be planned by

a land management agency, but subsequently require multiple years to implement due to the current rate of federal appropriations. However, multiple private entities could invest private capital to accomplish the project faster and be paid out, with some return on investment, over time (Blue Forest, 2023). In this way, conservation finance may offer a pathway to bring additional resources to federal lands projects quickly. However, because conservation finance efforts involving federal land management agencies are largely focused on projects that provide a return on investment, they may not represent a permanent infusion of new money (USFS, 2020a). Even so, these efforts can provide a pulse of funding from non-federal sources at places and times most needed.

Some agreements and contracts require the Forest Service to allocate the total costs anticipated across the life of an agreement (CRS, 2019b). The Commission believes this may be a barrier to agencies' ability to enter into longer term contracts and agreements. Cancellation ceilings, which are often used on contracts, set the maximum amount a contractor may recover if the government terminates a contract or agreement for convenience before its expiration (Riddle, 2022). Modifying cancellation ceilings for long-term contracts and agreements may lower the amount of funding the government must have on hand to enter an agreement, thus reducing the barrier to entry. Congress has authorized modified cancellation ceilings for other mechanisms in the past, most notably stewardship contracts (Riddle, 2022). In making this recommendation, the Commission hopes to facilitate conservation finance as a means of supporting important activities and projects in new ways.

Recommendation 134

Congress should incentivize state, local, and Tribal government development of dedicated revenue streams to support wildfire mitigation and management. The Commission encourages more states and localities to provide approval of such local revenue streams to bring more dedicated resources into play in reducing the risk of wildfire.

Successful mitigation and management of wildfire requires adequate funding at all levels of government, including federal, state, local, and Tribal governments. In some cases, it is challenging for governments to fund these activities. For example, states play a critical role in supporting wildfire mitigation and management activities and staff capacity, but recent reports have found that many state budgets are strained by the costs of wildfire (e.g., Caudell-Feagan et al., 2022). For many, this is due to budgeting practices in which mitigation and management are funded based on past wildfire severity, rather than forward-looking projections, leaving these activities underfunded relative to current (and future) needs (Caudell-Feagan et al., 2022).

The Commission believes that while federal funding can make significant progress in advancing solutions to the wildfire crisis, investments should not be wholly reliant on federal funding. To this point, the Commission sees promise in efforts by a number of states, counties, regions, and municipalities to generate sustained local revenue streams for the implementation and maintenance of proactive wildfire mitigation work. Example mechanisms include bond measures, sales taxes, and pooling private investments.

Delivery of successful wildfire mitigation and management programs greatly depends on engagement and funding from all scales of government. Congressional incentives, such as matching funds, could help encourage more Tribal, state, and local governments to fund wildfire mitigation and management or seek other sources of support, such as philanthropic funding.

While federal matching funds are promising to incentivize local investments, it also must be noted that they can pose equity concerns. In requiring increased support and revenues from local residents, matching funds can favor higher-income communities that are better able to absorb tax increases or other revenue-generation measures, thus perpetuating disparities between communities with different income levels. Federal investments should seek to address this issue by providing greater support for communities with fewer financial resources that may face more challenges in pursuing local revenue generation. For Tribes, this recommendation should also be developed together with Recommendation 127, listed above, as tax bases are limited for many Tribes, and some may have limited ability to contribute funding to wildfire risk reduction.

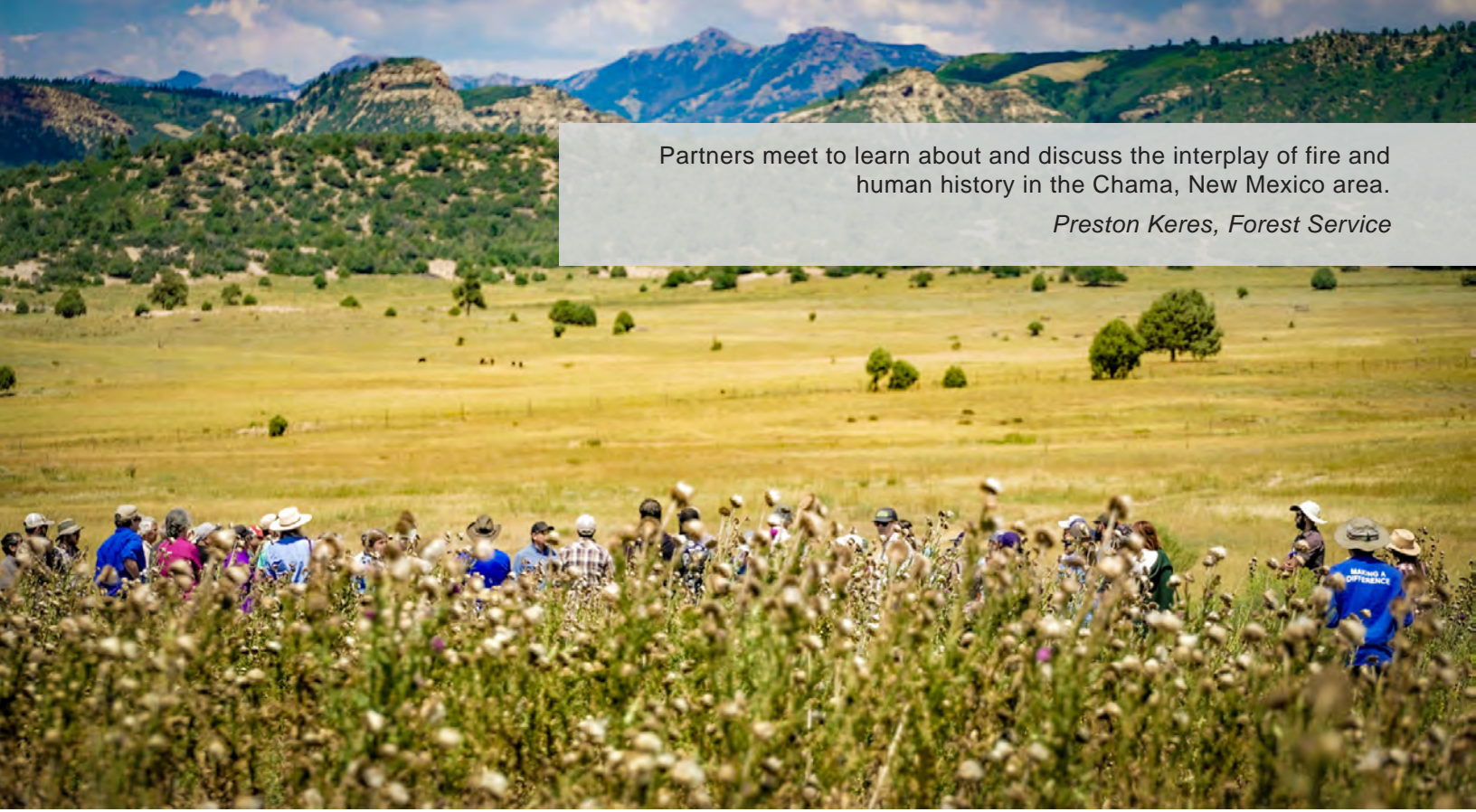


Chapter 8: Frameworks for the Future

Wildfire is a complex, multi-jurisdictional issue, that is challenging our systems before, during, and after fire. As a natural process, fire occurs in many ecosystems and often moves across multiple land ownership boundaries. It is common for a wildfire to start in one jurisdiction or ownership but quickly spread to neighboring areas, sweeping additional impacted and interested entities into response and decision-making. Wildfire smoke similarly knows no bounds and frequently impacts people hundreds or thousands of miles away from the fire itself. Effective pre-fire mitigation also requires working across jurisdictions, both administratively and conceptually: homes must be ignition-resistant at the neighborhood and community scale, governments must plan and prepare in coordinated ways, agencies must forge the frameworks and practices for cooperation, and landscape treatments must align to have maximum impact. Wildfire recovery is just as crosscutting, with rainfall on burned hilltops in one jurisdiction leading directly to flooding and water quality degradation in another jurisdiction downslope. The successful management of wildfire is a collective action problem and failure to act in concert means failure to act successfully (Charnley et al., 2020).

As with any shared hazard and collective action problem, appropriate governance is critical to achieve success (Niemiec, McCaffrey, & Jones, 2020). Solutions must be interagency, cross-boundary, strategic, and holistic. All scales of government – from the local to the federal – must be included in planning, action, and, critically, decision-making (Carroll et al., 2007; Cheng & Sturtevant, 2012). But wildfire is not just an issue for governments to address – the whole of society must be involved. This requires meaningful inclusion of communities, private homeowners and landowners, non-governmental organizations, private industry and contractors, and the research community. Achieving this collective action requires governance frameworks for successful cooperation, collaboration, and accountability (Bodin, 2017; Davis et al., 2021).

The need for collaboration is well established, as is the recognition that governance needs related to wildfire are complex. In addition to research literature, past policy reviews of the wildfire space have repeatedly called for changes to governance. The 1995 Federal Wildland Fire Policy and Program Review noted that “[b]ecause it is prudent to manage consistently across agency boundaries, uniform cooperative programs and policies are critical to efficient and effective fire management” (p. 1). This same review established as a guiding principle the standardization of policies and procedures among federal agencies as an ongoing objective. The 2009 Quadrennial Fire Review made the clarification of existing federal, state, and local roles, responsibility, and authorities for protecting the wildland-urban interface a core strategy (p. 22). And the 2014



Partners meet to learn about and discuss the interplay of fire and human history in the Chama, New Mexico area.

Preston Keres, Forest Service

National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) set forth a roadmap for success which included three necessary components: strategic alignment between all parties on goals, principles, and a strategic course of action; collaborative engagement, including information sharing, monitoring, and accountability; and programmatic alignment, where agency and organizational objectives are explicitly supportive of shared goals (p. 68). The Cohesive Strategy further called for a set of “national outcome performance measures” and noted the need for both a top-down and bottom-up flow of information.

The Commission was specifically charged with a review of the Cohesive Strategy, but also saw need for improvement in other aspects of governance. The Commission believes these additional governance recommendations provide principles upon which to build programs and policy approaches to address wildfire as the complex, collective action problem it is. Broadly, the Commission strongly reaffirms the principles that wildfire policy must be interagency, collaborative, and inclusive and that long term change requires ongoing accountability and adaptive management – even in the policy arena.

Cohesive Strategy

The 2021 Infrastructure Investment and Jobs Act (IIJA) tasked the Commission with reviewing the National Cohesive Wildland Fire Management Strategy, more informally known as the Cohesive Strategy, and making any recommendations for changes to improve its effectiveness. The Commission began with this review to help ground its work in existing approaches to wildfire

mitigation and management and to better understand the multiple scales at which strategic action occurs.

The Cohesive Strategy was a product of the 2009 Federal Land Assistance, Management, and Enhancement Act (FLAME Act) (Pub. L. No. 111-88, 123 Stat. 2904 (2009)). The legislation directed the U.S. Department of Agriculture (USDA) and the Department of the Interior (DOI) to develop a “cohesive wildland fire management strategy” that addressed seven key elements including the use of federal resources for wildland fire management and mitigation, assessment of community risk, and the impacts of invasive species and climate change on wildfire behavior and risk. From 2010 to 2014, numerous federal, state, and local partners; Tribal governments; non-governmental organizations; and members of the public worked collaboratively to fulfill the charge of this legislation. The final product, titled “The National Strategy: The Final Phase of the Development of the Cohesive Wildland Fire Management Strategy,” intended to set “broad, strategic, and national-level direction as a foundation for implementation of actions across the Nation” (The National Strategy, 2014, pg. 2).

The Cohesive Strategy establishes a central vision for wildland fire: “[t]o safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and collectively, learn to live with wildland fire” (National Cohesive Wildland Fire Management Strategy Addendum Update, 2023). It also outlines three goals necessary to achieving this vision: resilient landscapes; fire-adapted communities; and safe, effective, risk-based wildfire response. The Cohesive Strategy goes on to identify four key national challenges related to those goals and 19 management options that respond to the challenges.^{lxiii} Implementation of the Cohesive Strategy through those management options can occur at multiple scales, from the individual resident up to multi-state and national collaborations, with the assumption that approaches will be tailored to meet local and regional needs.

Insights: Cohesive Strategy as a Framework

While the name of the Cohesive Strategy implies a shared strategy for implementable priorities, the body of work is perhaps best understood and most effective as a guiding framework that can house the collective strategies of multiple agencies, entities, and individuals. The Cohesive Strategy’s vision and goals in particular have come to serve as ideological pillars that provide high-level and broadly applicable structure and direction for the development of implementation strategies at various scales. The Forest Service’s “Confronting the Wildfire Crisis: A Strategy for Protecting Communities and Improving Resilience in America’s Forests” (2022b) and the DOI’s “Infrastructure Investment and Jobs Act Wildfire Risk Five-Year Monitoring, Maintenance, and Treatment Plan” (2022) represent good examples of these more specific implementation-related strategies.

Throughout its discussions, the Commission found the consistency and durability provided by the Cohesive Strategy framework, together with its function as an overarching structure for tailored implementation strategies, to be an essential part of our national approach to mitigating and managing wildland fire.

The Wildland Fire Leadership Council (WFLC) led the development of the Cohesive Strategy via a multi-year, multi-partner process that included a significant science-based component. WFLC has been the de facto steward of the Cohesive Strategy framework since that time. WFLC, established in 2002, is an intergovernmental committee with federal, state, local, and Tribal members with a mission to support the consistent implementation and coordination of wildland fire policies, goals, and management actions. The national-scale WFLC, along with three chartered Regional Strategy Committees, undertake a variety of activities to facilitate implementation of the Cohesive Strategy, including outreach and communications, education, peer learning, networking, and connecting practitioners across scales and jurisdictions.

WFLC also spearheaded the most recent revision of the Cohesive Strategy, which occurred in 2023, per requirements set out in the FLAME Act.^{lxiv} That revision effort identified, and developed an addendum to address, new critical emphasis areas, additional management options, and emerging implementation challenges to reflect changing conditions, needs, and priorities such as climate change and workforce capacity, health, and wellbeing.

WFLC's role has never extended to direct involvement in implementation of the framework on the ground. While the Cohesive Strategy establishes a set of common goals related to wildfire, the framework itself is not a vehicle for actual implementation of wildfire mitigation and management. Responsibility for acting upon the goals of the Cohesive Strategy falls to the public at large, as well as a multitude of state, local, Tribal, and federal entities across the country, each with their own implementation strategies, mandates, and practices.

The Cohesive Strategy promotes multi-party engagement, collaborative approaches, shared decision-space, and alignment of strategy – all elements that are important to wildfire mitigation and management writ large. The framework also has proven useful for articulating a shared vision and common vocabulary for federal, state, Tribal and local community partners working at multiple scales. As a case in point, the Cohesive Strategy and its vision and goals have been woven into strategic plans at the national and state scale, the regional or watershed collaborative scale, and the local level (through Community Wildfire Protection Plans, for example).

The Commission found **the Cohesive Strategy (including its 2023 addendum) serves us well today and its vision and goals are well-positioned to serve us into the next decades.** The Commission made three recommendations designed to support the Cohesive Strategy and its continued service to the nation. Recommendations are focused on the endurance and stewardship of the Cohesive Strategy, in addition to broader communication.

Recommendation 135

Adopt the vision and goals of the Cohesive Strategy as the national framework for wildfire mitigation and management.

While the 2009 FLAME Act required the development of the Cohesive Strategy and its routine revision, it did not explicitly establish the Cohesive Strategy as the national framework for wildland fire.

Given the Cohesive Strategy's current and future value, the Commission sees a need to integrate the framework more formally into national fire approaches via inclusion of the broad vision and goals of the Cohesive Strategy in statute. Codifying the vision and goals of the Cohesive Strategy in statute would also impart greater long-term certainty and sustainability, which the Commission sees as important to provide consistency for agencies and practitioners tasked with applying its principles on the ground.

Importantly, the Commission determined that development of statutory language should be limited to the broad vision and goals of the Cohesive Strategy, rather than its specifics, to avoid inadvertently constraining or creating conflict with existing policies, budgets, and strategies or future policymaking. This approach also would more easily allow for subsequent revisions and modifications to specific elements of the Cohesive Strategy and preserve the inherent flexibility of the framework that enables its adoption and adaptation at various scales and over different timelines. Commission members underscored that a key benefit of the Cohesive Strategy is its ability to be tailored to local and regional needs.

Recommendation 136

The Wildland Fire Leadership Council should be considered custodian of the Cohesive Strategy, responsible for its evaluation and revision.

Through its evaluations, the Commission found that to be effective, the Cohesive Strategy needs a custodial body to steward the Strategy over time, performing such functions as Cohesive Strategy-related evaluation, revision, and communication. WFLC has taken on this stewardship role since the initial release of the Cohesive Strategy, though it has been an ad hoc responsibility with no clear designation of duties provided in statute.

The Commission sees value in WFLC continuing to serve as custodian of the Cohesive Strategy and recommends Congress formalize this role in statute. Codification would not only reinforce WFLC as an enduring body, but also provide important clarity about its relationship to the Cohesive Strategy.

Additionally, the capacity of WFLC to effectively facilitate implementation of the Cohesive Strategy may be limited. The Commission recommends providing increased funding for WFLC to coordinate associated efforts at the regional and national level. Commission members emphasize that such funding should not come at the expense of appropriations for existing programs. However, Commission members expressed a desire for funding increases to be accompanied by greater specificity and increased accountability around WFLC's role as a steward of the Cohesive Strategy, as well as outcomes or accomplishments that could be expected with additional dollars. Commission members did not want to see expansion of WFLC's role (e.g., expanded oversight or direct involvement in the implementation of Cohesive Strategy principles) as a result of codification or budget increases.

In addition to the formalization of this stewardship function, support for periodic revision of the Cohesive Strategy will be critical for its continued efficacy and relevance. The FLAME Act mandates these regular revisions, but Congress did not provide funding to undertake

that task. Without dedicated funding, the most recent revision and addendum effort in 2023 was limited in its ability to engage partners. Future revisions should be informed by more robust multi-party engagement. To enable a more inclusive process, Congress should appropriate dedicated funding to the regular revision of the Cohesive Strategy without compromising the budgets of other important agency efforts in this arena.

Recommendation 137

Support development of a strategic communications plan that advances implementation of actions under all three goals of the Cohesive Strategy.

Implementation of the Cohesive Strategy, as a framework for how we can collectively learn to live with fire, fundamentally depends on actions taken at a variety of geographic and jurisdictional scales, and by a diversity of entities and individuals. However, the Commission found the vision and the goals of the Cohesive Strategy are not explicitly nor evenly understood by partners working in different landscapes and contexts. Even where basic understanding is present, the Commission believe the interdependence of the goals of the Cohesive Strategy is often undervalued. At present, there is no specific entity identified to discuss the Cohesive Strategy with states, local governments, Tribes, non-governmental organizations, private entities, or other partners, nor is there dedicated funding for such work. WFLC has taken on some communications responsibilities as part of its role but while generally recognized by the Commission as successful, these efforts have had to be relatively limited in scale due to existing staff capacity. Other work that shares the vision and goals of the Cohesive Strategy exists at different scales across the nation, but it is not explicitly focused on the framework and is similarly capacity-limited.

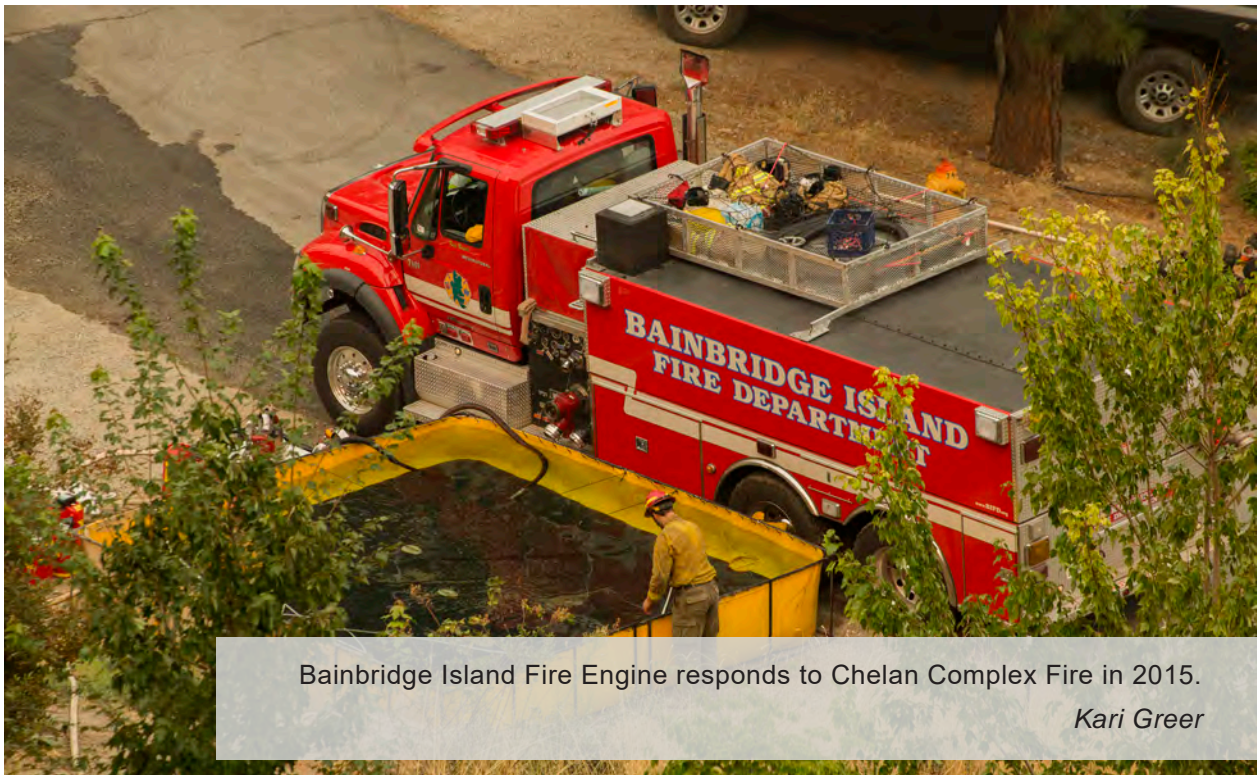
Upon consideration of these existing efforts, Commission members recognize a need for strategic efforts to promote better understanding of the Cohesive Strategy, its relevance, and its utility to a variety of audiences, while also creating and enhancing connections between entities working at different scales.

Given WFLC's work in this space and its deep experience with the Cohesive Strategy, it is most logical and efficient to facilitate expanded transmission of the framework through increasing WFLC's capacity. The strategy should recognize and build upon WFLC's involvement in regional and national outreach efforts and partnerships to coordinate messaging across local, regional, and national scales. The Commission also emphasizes the need for plans to be developed by a diverse group of interested and affected parties and to consider the multi-scalar and multi-organizational coordination and implementation of not only the strategic communications plan but the actions it will be helping to advance. Along with focused outreach, Commission members see a need to promote broad, aligned narratives about the interdependence between goals of the Cohesive Strategy. Along with focused outreach, some members of the Commission see the need to promote general public awareness of the collective need to learn to live with wildfire. While this did not rise to the level of a recommendation, some members of the Commission felt that elevating the national discourse related to wildfire was a useful and worthwhile endeavor.

Interagency Coordination

A strong theme in Commission discussions was the need to improve coordination, including in the areas of community resilience, public health, response, post fire recovery, and science and technology. In the post-fire environment, for instance, the Commission found that while recovery of ecosystems and communities are fundamentally linked, the approach to recovery is fragmented, and that multiple agencies play important roles, but are rarely well coordinated and often exist within silos. The Commission's exploration of public health found that key federal agencies charged with protecting public health, including the Environmental Protection Agency (EPA), the Centers for Disease Control (CDC), and National Institute for Occupational Safety and Health (NIOSH), lack the funding required to productively coordinate with the relevant land management agencies. The Commission also found that research, applied science programs, data management, and technology procurement and application related to wildfire are housed within a wide array of federal entities and academia, leading to a limited ability to set priorities and general inefficiency. In addition, the Commission found that current coordination between federal agencies and Tribes could be improved with more specific directives and provision of funding.

Delivery of successful wildfire mitigation and management programs that are actionable at all scales requires improved coordination across all layers of government. This was noted time and again in Commission deliberations and is reflected in the recommendations throughout this document. As a general rule, changes intended to address any given issue should be grounded



Bainbridge Island Fire Engine responds to Chelan Complex Fire in 2015.

Kari Greer

in, and seek to support, programs and agencies working in coordination with one another. Increased coordination was noted as being especially needed in community preparedness and risk mitigation, post-fire recovery, and national incident response. However, the Commission also notes the limitations of coordination, finding that at times, more comprehensive approaches to federal program simplification and policy reform are required to create durable, and in some cases transformative, changes in community wildfire resilience. Two recommendations related to interagency coordination have been discussed previously (Recommendation 1 in Chapter 1: Creating the Foundation for Success and Recommendation 60 in Chapter 4: Recovering for Resilience) but are included below for reference. Additionally, many of the recommendations discussed in Chapter 3: Responding to Fire contain strong elements of interagency coordination. The section below features one additional recommendation focused on legislation to address science and policy.

Cross-referenced Recommendations

Recommendation 1: Congress should establish a Community Wildfire Risk Reduction Program via an interagency coordinating partnership including the U.S. Forest Service, the Federal Emergency Management Agency, the United States Fire Administration, the Office of Wildland Fire on behalf of the Department of the Interior's land management agencies, and the National Institute of Standards and Technology as principal agencies, to proactively address wildfire risk reduction actions and increase ignition resistance of the built environment.

Recommendation 60: Create the organizational and financial structures necessary to better integrate the national response to wildland fires and post-wildfire impacts across agencies and scales.

Recommendation 138

Legislation to mitigate the impact of wildfires through the use of science, data, and technology should be collaboratively developed by congressional committees with responsibility across science and natural resources, when appropriate and feasible.

The need for interagency coordination is also, to some degree, applicable to the Congressional Committees tasked with addressing the sprawling and complex topic of wildfire policy. Legislation related to the use of science, data, and technology for wildfire mitigation and management can suffer from a lack of crosscutting awareness among the committees with primary jurisdiction over land management agencies and emergency response. To create solutions that are effective and workable for both the producers and the users of science, data, and technology, policy must be developed with direct engagement and input from people in both of those spaces.

As such, the Commission recommends greater collaboration and communication among committees with jurisdictions relevant to wildfire science, data, and technology; land management; and emergency response when developing legislation that cuts across these topics. This recommendation is not suggesting that committees' jurisdictional authority be changed, nor is it advising the joint development of legislation, which would add undesired process complexity. Rather, legislation that addresses the science, data, and technology needs of the wildfire community will be improved with greater collaboration with other relevant committees.

Insights: Accountability and Interagency Coordination

There are numerous agencies and jurisdictions responsible for wildfire mitigation and management, each with distinct missions, authorities, and programmatic areas that steer them toward addressing only some components of the full problem. The Commission recognized that fragmented and often siloed approaches can create critical gaps and barriers and, in some cases, duplication of effort. In addition to recommending greater coordination and integration between agencies and scales to address these shortfalls, many Commission members discussed the need for greater accountability and responsibility across relevant agencies to ensure the fire system as a whole is meeting the scale and scope of need. While this issue was echoed in numerous conversations, Commission members diverged on how it should be addressed.

With respect to wildland fire response, fire management responsibilities are shared between five federal agencies from two departments: the Forest Service, National Park Service, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, and Bureau of Land Management. Several Commission members articulated the need for a comprehensive review of duplications and inconsistencies between the federal agencies. Member questions focused on whether administrative systems such as aviation management, human resources, information technology, and appropriations should be consolidated. Several members felt the current system of operations is not the system that would be designed if we were building it today and is, in fact, a product of an era we are unlikely to ever see again. While the Commission was unable to reach consensus on the specific issue of consolidating wildfire response, the conversations highlighted the fundamental tension between coordination and consolidation as we rethink the needed roles and elements of a modernized approach to wildfire.

Commission discussions specific to the post-fire period further illustrate the tension. With respect to the post-fire period, some Commission members advocated assigning a single coordinating entity with the responsibility, authority, and accountability for implementing an effective recovery system. These Commission members held that the necessary change will not occur within the current system, with agencies operating side by side but

with no overarching entity looking at, and responsible for, the full suite of recovery needs. A different viewpoint expressed by other Commission members focused on the need for more collaboration and coordination between agencies, rather than a move toward centralization of post-fire responsibilities. These comments emphasized the need to align expectations and priorities across agencies and create a common accountability structure, but generally supported the continuation of the existing distribution of agency programs and authorities.

In both cases, the Commission acknowledged the divergence of approaches and reached consensus on suites of recommendations designed to address key barriers and challenges within the system. These recommendations tended to use an “all of the above” approach, as opposed to exclusively favoring one approach over another.

Collaboration

Improved and increased interagency coordination is important, but it alone is not sufficient to remove the silos inhibiting our collective approach to wildfire. While the Commission found a strong practice of collaboration among individuals, communities, entities, and agencies, it also urged greater and more meaningful collaboration and shared decision-making by federal agencies with non-federal partners. Many Commission recommendations affirm the need for federal programs and agencies to work collaboratively with states, communities, non-governmental organizations, and in particular, Tribal governments.

Recommendations to foster increased collaboration focus on supportive process and policies, as well as increased capacity that supports the ability of interested and affected parties to engage. Broad participation is essential as effective wildfire solutions will require action at multiple scales (Fisher et al., 2016). Further, the actions taken by one individual or entity can have a significant impact on the success of the whole. This is particularly true when considering pre-fire community wildfire risk reduction (McCaffrey, 2015; Pludow & Murray, 2023; Warziniak, 2018). Federal agencies also increasingly rely on working with a range of entities as a part of their land management duties. Recent research has shown that working collaboratively can have tangible benefits to the efficiency and scale of project planning and can enable more complex projects in terms of unique activities (Davis et al., 2021; McIver & Becker, 2021). Collaborative processes that involve multiple interested parties also can help produce solutions that better balance multiple social, political, economic, and ecological values. These interactions should be threaded through all phases of the project lifecycle (planning, implementation, and monitoring) and are particularly important between federal agencies and community partners in order to develop local support and connection to federal land management.



The Commission felt that in order to fully and effectively work with communities and individuals, federal agencies should work to improve the accessibility of programs and equitably lower barriers to participation and eligibility, particularly for disadvantaged communities. As discussed in the recommendations below, this can be achieved through such changes as reducing or eliminating match requirements, streamlining program applications, and providing more up-front recovery funding.

The following recommendations in particular exemplify policy changes needed to foster improved collaboration, increased accessibility, and greater ability for federal agencies to engage in co-management with communities and Tribes.

Recommendation 139

Provide financial and technical assistance to support existing and emerging wildfire resilience collaboratives that currently lack adequate capacity to effectively participate in planning, implementation, and monitoring.

Though collaborative processes and groups have become integral in many areas, they often lack stable and reliable funding. There is a need to invest in collaboration via several avenues: building capacity within local partners that are either collaborating entities or that



Learning together in the field, a group of people examine a tree core. Tree cores can show the age, growth patterns, and fire history of a tree.

Watershed Research and Training Center

support such efforts, funding the development and support of structures and processes that enable collaboration, and increasing agency staff positions focused on partnership. Technical assistance can be another valuable source of support, such as provision of professional facilitation to help enable a fair and effective process. Collaborative groups may also benefit from support to ensure that collaboration is respectful of Tribal sovereignty. These investments are often essential for equity, since collaboration can be either a threshold for, or provide a significant advantage to, enabling access to resources and program or project investments. Some agencies have expressed that they are unable or unauthorized to fund collaboration or directly invest in partner capacity for collaboration, despite receiving direction to do so through, for example, the 2021 IIJA.^{lxv} If new authorities are required to enable agencies to directly fund collaboration, Congress should provide them.

Tribal Equity

The relationship between federally recognized Tribes and the federal government is unique. Tribes possess inherent sovereign powers, with self-governance and self-determination as foundational principles of this sovereignty. At the same time, the United States has an inherent trust responsibility with respect to federally recognized Tribes, which broadly includes a duty to protect both Tribal lands and Tribal self-government, and to provide federal assistance to ensure the success of Tribal communities (BIA, 2017). While federal agencies possess some authorities to work in partnership with Tribes, these authorities can be underutilized for a number of reasons and are ultimately insufficient.

A growing body of evidence consistently highlights the positive impact Indigenous stewardship historically had and continues to have in maintaining balanced ecosystem processes and functions. The fire exclusion paradigm has, however, led to a diminishment of Native American cultural identity and the separation of Indigenous Knowledge, practice, and belief systems from

land stewardship with harmful consequences for ecosystems and the human communities that depend on them. Enabling federal agencies to better partner with Tribes and providing Tribes with equitable support is an important element of reducing fire risk. Moreover, **overcoming historic injustice and recentering the role of Indigenous communities in the history of wildfire is paramount for effectively reversing the effects of fire exclusion on ecosystem health and the health and welfare of both Indigenous and non-Indigenous communities.**

Recommendations related to improved co-management with Tribes are found throughout the Commission's report. Tribes are important implementors of mitigation and risk reduction projects, including the use of beneficial fire and mechanical treatments. Consideration for the needs of Indigenous people and Tribal governments should be considered holistically in redesigned programs and policy initiatives. These recommendations address needs specifically related to governance.

Recommendation 140

When authorizing and funding programs related to wildfire, Congress should directly recognize the historic role and continued importance of Indigenous stewardship related to fire.

Both western science and Indigenous Knowledge establish that cultural burning and other forms of Indigenous stewardship have played and continue to play a fundamental role in establishing and maintaining the fire-dependent ecosystems that characterize the western United States today. Tribes are therefore critical partners in addressing the wildfire crisis.

However, for too long Tribes have been excluded from decision-making, access to funding, and implementation of the tools and strategies that would help collectively address these issues. Forest and fire management on federal lands have been largely left to federal agency staff, despite the fact that these lands are the ancestral homelands of many Tribes.

This report includes many specific recommendations that begin to remedy this imbalance, and to begin the process of creating conditions conducive of Tribal stewardship on lands administered by both Tribes and federal agencies. However, this recommendation is intended to remind Congress and other decisionmakers that Indigenous stewardship should be broadly considered whenever decisions related to fire are made.

Recommendation 141

Congress should identify an appropriate venue for continued work towards Tribal self-governance, self-determination and federal co-stewardship and co-management with Tribes.

The Commission believes the recommendations it has offered would help increase federal co-stewardship and co-management with Tribes. However, recognizing the complexity of this issue, both legally and given the diversity of involved and affected Tribal governments,

the Commission sees value in continued efforts to explore related reform. Specifically, work to empower Tribes should take the form of commissioning a study, forming a blue-ribbon panel, or requesting a joint agency and Tribal report to Congress that addresses barriers and strategies to improve co-stewardship, co-management, self-determination, and self-governance.

Successful examples of improved co-management exist within both federal and state policy and include the Tribal Forest Protection Act and recent efforts in the State of California to support prescribed and cultural burning. Given the importance of this issue, the Commission urges timeliness and the completion of such work no later than one year following the start of the process. Furthermore, although agency reviews may yield important information, any such effort should include robust consultation and engagement with Tribes, if not a Tribally-led process.

Accessibility and Inclusivity

During the Commission's assessment of federal programs, the Commission found that **individual and community action to mitigate hazard and risk is essential and should be empowered.**

Empowerment of individual and community action means supporting community capacity development through technical assistance, financial assistance, access to information, removal of barriers to programs, and recognition that not all communities and individuals are the same. Different communities will need different tools and approaches to better mitigate, manage, and recover from the impacts of wildfire. The Commission found that **there is no “one size fits all” answer; policies, systems, and solutions must be flexible enough to be informed by community and local needs.**

Support for diverse individuals and communities can be grounded in the whole community approach. As defined by the Federal Emergency Management Agency (FEMA), this approach is “a means by which residents, emergency management practitioners, organizational and community leaders, and government officials can collectively understand and assess the needs of their respective communities and determine the best ways to organize and strengthen their assets, capacities, and interests” (FEMA, 2011, p. 3). The approach is centered on shared learning by all community members as opposed to a more traditional, top-down, information distribution model. The whole community refers to all individuals and families (including those with access and functional needs), businesses, faith-based and community organizations, non-governmental organizations, schools and academia, media outlets, and levels of government. The whole community approach seeks to 1) understand and meet the actual needs of the whole community; 2) engage and empower all parts of the community; and 3) strengthen what works well in communities on a daily basis. Approaches that serve the whole community and leverage the full range of perspectives, assets, and lived experiences are important; research has shown that wildfire impacts are often borne disproportionately by certain groups or individuals (Coughlan et al., 2019; Davies et al., 2018). Yet, many organizations and agencies continue to struggle with effective engagement of the whole community.

Significant accessibility barriers in federal programs can present challenges to effectively serving all individuals and communities. These barriers can negatively impact the ability of individuals and communities to mitigate hazard and risk and often perpetuate disparities in the impacts of wildfire. While federal grant application requirements are based upon statutory, policy, or regulatory eligibility requirements, subject matter experts interviewed by the Commission indicated that application processes are so time-consuming or cost-intensive that some potential applicants often decide to opt out of even applying for a needed grant. In other cases, applicants who successfully received a federal grant were overwhelmed by the substantial administrative requirements related to grant documentation, reporting, and other excessive paperwork. This can create significant hurdles for many communities, particularly in rural, fire-prone areas and for underserved or disadvantaged communities. The overall complexity of these funding programs and processes favors well-resourced, well-staffed applicants over disadvantaged applicants. As one example, a review of FEMA's Building Resilient Infrastructure and Communities (BRIC) program found that despite the program focus on equity, project selections in 2021 were found to benefit areas with highly valued property, rather than capacity-limited and disadvantaged communities (Weber, 2021). The ability of applicants to bring in the necessary personnel and expertise to develop applications was flagged as a continued barrier for many communities (Smith & Hernandez, 2022).

Research has shown that populations with social vulnerabilities are more susceptible to harmful wildfire impacts (Davies et al., 2018; Palaiologou et al., 2019). These vulnerabilities go beyond income level and race and include characteristics such as English proficiency, gender, age, mobility, functional needs, and other considerations. These social conditions – which can be co-occurring – reduce the ability of households and communities to proactively manage risk, respond and adapt to environmental hazards, and minimize losses from those hazards. Disparities in the ability to adapt to and mitigate hazards can be compounded over time as inability to recover from one hazard event makes people more vulnerable to future events. Federal agencies have taken recent action to improve program accessibility. For example, after a 2021 Government Accountability Office (GAO) analysis of FEMA's four hazard mitigation programs reported that application processes were described as “complex and lengthy,” the agency undertook efforts to develop a common application portal for its Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), and BRIC programs and began revising grant awards process for FMA and BRIC (GAO, 2021a).

These efforts notwithstanding, there continues to be a need to simplify and streamline federal programs so communities can more easily apply for grants, receive funding, coordinate projects, and implement much-needed wildfire risk reduction projects on the ground. There is also a need to provide support structures that take the burden off individuals and communities to wade through a complex web of federal programs and funding sources in the post-fire recovery process. Federal programs must avoid further burdening disadvantaged, or socially vulnerable, communities with additional demands they do not have ability or capacity to meet. In sum, the Commission found that **fundamental changes to federal programs are needed to meaningfully improve accessibility and overall efficacy of programs intended to reduce wildfire risks to communities**. Broadly speaking, the Commission recognized the need to balance accountability with accessibility. However, the focus on accountability at the expense of accessibility has limited our collective ability to achieve resilience as a nation. The Commission made several recommendations designed to increase accessibility in order to improve overall wildfire resilience.

Recommendation 142

Increase accessibility of federal grants for community wildfire risk reduction and post-fire recovery efforts.

The Commission favors approaching the need for increased accessibility from two directions. First, the Commission identified a need to reduce the complexity of federal grant processes through simplification and redesign. This need for simplification was also one of several options identified by GAO's analysis of opportunities to improve federal disaster response (GAO, 2022b). Second, the Commission identified opportunities to support communities to build the capacity necessary to successfully access funds through the provision of technical assistance. These two core approaches are reflected in the Commission's recommended strategies for program accessibility improvements. Potential actions include:

- Reduce the complexity of application processes, including the overall quantity of required information.
- Consider redesigning grant programs to enhance access for disadvantaged^{lxvi} populations in the highest risk areas in particular.^{lxvii} This could include modifying traditional scoring rubrics, broadening data metric qualifications to be more flexible with community conditions, and considering stratified funding programs with dedicated funding to underserved communities. Because needed changes will likely vary by program, agencies should be given flexibility to determine the most appropriate modifications.
- Reduce administrative redundancy at multiple scales. This can include the alignment of different programs to reduce the need of communities to apply to multiple federal programs. This could also include developing a common section for applications to address duplicative questions that are often asked in slightly different ways to reduce the workload burden for applicants.
- Increase provision of technical assistance for applicants, recipients, and subrecipients, including authorizing and funding appropriate dedicated staff to help individuals and communities identify and apply for resources that would address their recovery needs. Technical assistance can help communities connect with applicable resources and opportunities, meet baseline application requirements, write, and develop successful grant proposals, and more strategically and effectively utilize and manage, the dollars received. Such positions should include training about how to improve access to programs and should foster professional learning.
- Technology could also support making applications easier and more accessible, for example by enabling auto-populating fields, or notifying applicants of eligibility and open application seasons.
- Consider opportunities to redesign grant programs as block grants to enable more rapid deployment of funding.

- Expand the range of eligible applicants for programs such as the BRIC program.^{lxviii}
- Align the Justice40 initiative into statute for programs that address community wildfire risk reduction.

To support a systematic approach to program reforms, Congress could also direct agencies to conduct a comprehensive review across agencies of existing wildfire-related grant programs to identify common application challenges and potential changes, both in statute and via other avenues that would enable more rapid deployment of funds to communities and enhance equitable access.

Recommendation 143

Congress should expand equitable access to funds, including by providing agencies the authority to reduce or waive match requirements when needed.

Broadly speaking, the Commission found that costs associated with wildfire mitigation, response, and recovery can be significant and can exceed the resources of residents, homeowners, businesses, local jurisdictions, and Tribal governments. Yet, many programs that provide critical resources for community wildfire risk reduction or disaster recovery include local match or cost-share requirements that can prove difficult to meet, especially for applicants with fewer financial resources (Smith et al., 2023). As a result, communities that may be most in need of wildfire mitigation resources may also be less likely to be able to access them. Methodologies for determining match levels can exacerbate this problem. For example, match requirements that are structured as a percent of project costs, regardless of the community's population size, wealth, or tax base, can create disproportionate burdens on rural communities where there are fewer people to shoulder the expense (Smith et al., 2023).

Enabling cost-share and match reductions or waivers would increase the accessibility of federal programs and provide needed acceleration of national efforts. **Given the workforce challenges faced by federal agencies at this time, the additional capacity brought by partners should outweigh the need for matching funding.** In addition to reducing required cost-share or match levels, Congress could consider further enabling diverse approaches to cost-share and reimbursement requirements, including expanding the type of contributions that meet cost-share requirements to include other types of community resources besides up-front cash, such as donated resources (in-kind materials and services), home modification expenses, and leveraged state and federal funds.^{lxix} The 2022 Inflation Reduction Act (Pub. L. No. 117-169, 136 Stat. 1818 (2022)) provided broad discretion to waive match requirements, which is a model Commission members feel could be replicated and expanded. As another potential model, the Forest Service developed its own policy guidance in 2022 that reduces match requirements and enables other flexibilities intended to improve accessibility of partnership and cooperator agreements.^{lxx}

Recommendation 144

Ensure alternatives to reimbursable funding mechanisms are available and accessible.

In addition to expanding availability of cost-share waivers, Congress should explore alternatives to reimbursable funding mechanisms. This is particularly relevant in the post-fire space, where disadvantaged communities are often disproportionately impacted by wildfires. Federal programs' use of reimbursable funding models risks perpetuating inequities between communities as they recover. Requiring the recipient to provide up-front funding to cover the cost of project work before reimbursements are provided is a model that favors jurisdictions with available cash on hand, effectively putting federal resources out of reach for some communities.

More accessible alternatives to reimbursements that should be considered include short-term loans, cost-share waivers, use of intermediary organizations that can provide advance payments, or other innovative financing structures. In addition to making these other funding options available – which some agencies and programs are already doing – there must be a priority on ensuring such options are truly accessible to applicants who need this assistance.

Recommendation 145

Ensure funding prioritization includes socioeconomic demographics for populations disproportionately impacted by wildfire who reside in high hazard areas.

Programs must ensure funding and other assistance does, in fact, reach populations that are most in need of resources – a task that requires a more deliberate incorporation of socioeconomic demographics in funding prioritization processes. This effort should account for income variability not only across, but also within, communities, potentially as granular as at the parcel scale. Recent agency actions, such as the Forest Service 2022 policy changes for partnership agreements and the Community Wildfire Defense Grant (CWDG) Program, provide models and lessons learned.^{lxxi}

In addition to incorporation of demographic data that is currently available for assessing social vulnerability, additional research is likely needed to better understand the existing gaps in who is served by federal resources compared to expectations for program outcomes. Program criteria should then be aligned to those underserved groups and their capabilities to undertake funded activities. As a note, this recommendation applies to the prioritization of wildfire-related projects but does not mean to imply that wildfire must be prioritized over other hazards.

Recommendation 146

Broaden the definition of “Small Impoverished Community.”

The Commission was asked to evaluate the definition of “Small Impoverished Community” as defined by the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act). The Stafford Act provides the statutory authority for many FEMA programs.

Within the Stafford Act, the term “small impoverished community” is defined as “a community of 3,000 or fewer individuals that is economically disadvantaged, as determined by the State in which the community is located and based on criteria established by the President.” Additional definition guidance is provided by 44 CFR § 201.2 which defines small and impoverished community as:

“a community of 3,000 or fewer individuals that is identified by the State as a rural community, and is not a remote area within the corporate boundaries of a larger city; is economically disadvantaged, by having an average per capita annual income of residents not exceeding 80 percent of national, per capita income, based on best available data; the local unemployment rate exceeds by one percentage point or more, the most recently reported, average yearly national unemployment rate; and any other factors identified in the State Plan in which the community is located.”

The definition of “small and impoverished community” impacts grant matching fund requirements and is one of the factors used to determine project competitiveness. As an example, qualification as a “small impoverished community” is one of 12 criteria listed for consideration for FEMA’s Pre-disaster Hazard Mitigation projects. If awarded, Small Impoverished Communities are responsible for 10 percent of the total project costs, while all non-Small Impoverished Communities are responsible for 25 percent of the total.

Through its evaluation, the Commission found the current definition of Small Impoverished Communities is too narrow, restricting the number of communities that can benefit from lower-cost share requirements. To broaden the definition of Small Impoverished Community, the Commission recommends Congress address both the definition of “small” and “impoverished.” The population threshold should be raised from 3,000 to 50,000 people to expand access to match waivers.

With respect to the definition of impoverished, the Commission recommends communities have the ability to use a number of different possible metrics to meet the criteria of “impoverished” (as opposed to the single metric currently identified by statute). Critically, at least one metric should be a socio-economic metric. Existing metrics for social vulnerability can be challenging to apply and may not accurately reflect local conditions, particularly in areas with lower population density. Shifting from a single qualifying metric to a menu of available metrics can help communities use the most appropriate and representative metric of impoverished. Additionally, it should be noted that vulnerable populations can exist within larger jurisdictions. Efforts to ensure access to resources for those populations who meet the criteria for impoverished but are located within larger geographic units could be explored.



View of Wilson Creek Fire near Pioche, Nevada.

Ben Hoke, Bureau of Land Management

As communities work to balance the environmental, economic, and societal needs unique to their location, federal programs should be flexible enough to account for these unique conditions. Metrics can be pre-identified and could include those metrics aligned with Justice40 initiatives, the Climate and Economic Justice Screening Tool, National Risk Index, or others. Metrics should provide multiple, clear pathways for communities but should not create an application process so complex that it limits access. Several examples of multiple metrics exist, including the evaluation of hazard in the recent CWDG program. Additionally, the portion of the definition of impoverished that specifies that communities must be economically disadvantaged as determined by the State in which the community is located should be removed.

Importantly, expanding the definition of Small Impoverished Communities does not guarantee more equitable distribution of federal resources; accessibility must also be expanded. Simply making more communities eligible will not ensure funding or access by the most at risk and most in need. Previous recommendations discussed in this section speak to the importance of accessibility. Additionally, as noted in Recommendation 142 above, stratification of grant programs to provide dedicated funding for vulnerable, low-capacity, or other underserved communities can increase access. These “set asides” should be considered for communities meeting the definition of Small Impoverished Communities. Additionally, the Commission found that the provision of technical assistance can also support successful applications from communities and should be supported in meaningful ways.

Accountability

Accountability is a core component of good governance, allowing decision-makers an understanding of the outcomes of policies and investments. Performance measures – one key element of accountability – offer feedback loops between decision-makers and implementors and programs that can help indicate success or problems, allowing for adaptive change. As previously noted, multiple past strategic reviews have included calls for improved accountability in the wildfire system including improved or expanded performance measures, particularly outcomes-based measures, increased transparency, and monitoring.

Commission discussions also recognized the need for improved accountability, touching on it as a theme in many topics. For example, Commission support for the Collaborative Forest Landscape Restoration Program was based, in part, on the role the program plays in providing accountability through outside monitoring of project implementation (Derr et al., 2005) (see Recommendation 18 in Chapter 1: Creating the Foundation for Success). Accountability was also noted as a core governance need in the post-fire recovery phase, with the Commission finding that increased accountability is critical to improve the recovery process for both landscapes and communities (see Recommendation 60 in Chapter 4: Recovering for Resilience).

Specific to performance measures, current agency practices, including a prioritization of output-focused metrics such as timber volume sold and acres treated for fuel reduction, often incentivize treating areas that can be reached at low cost rather than those with the highest risk or highest restoration priority (GAO, 2019). The Commission was concerned that most existing land management agency performance measures do not adequately capture or promote important outcomes such as achievement of wildfire hazard reduction and the creation of ecosystem structures, functions, and processes that are resilient to changing environmental conditions. The ability to demonstrate accountability and success towards desired outcomes have been identified as important to collaborative partnerships, in particular (Butler & Schultz, 2019; Davis et al., 2017a). The Commission found that **federal policies and practices should be guided by improved performance measures focused on creating resilience in both communities and the natural environment.**

In the context of landscape mitigation, the Commission found it important to identify the desired outcomes of restoration work in order to establish appropriate funding and performance measures that drive towards and report accomplishments. Similar calls to strategically identify desired outcomes and set appropriate performance measures are found in the previous Commission's Aerial Equipment Strategy Report as well. That said, the Commission also recognized the limitations of performance measures and cautions that while policy matters, significant culture change is needed in the wildfire mitigation and management system.

As noted in previous chapters, the Commission recommends establishing a prescribed fire target in the absence of outcomes-based performance measure (see Recommendation 13 in Chapter 1: Creating the Foundation for Success). The Commission also recommends the development of budget crosscuts for improved accountability and transparency in wildfire spending (see Recommendation 123 in Chapter 7: Investing for Tomorrow). Additionally, to

support increased accountability in the wildfire system, the Commission recommends the adoption of outcomes-based performance measures and a periodic review of the wildfire system so that Congress can continue to monitor and respond to evolving circumstances and policy needs.

Cross-referenced Recommendations

Recommendation 13: Establish a prescribed fire target based on natural fire regimes as determined locally.

Recommendation 123: Congress should fund budget offices to create “crosscuts” to better track all federal wildfire spending.

Recommendation 147

Change the system of land management agency performance metrics beyond acres treated, timber volume output, or acres burned to measure success. Success should be measured by outcomes such as the number of protected assets, values, and resources, and the degree to which forests and rangeland are returned to and maintained in a more resilient state.

The Commission sees a need to improve performance measures that guide federal land management policies and practices to better incentivize preferred activities. To achieve this more expansive approach, agencies should start by identifying the desired outcomes of their work and then use those outcomes to establish appropriate performance measures and funding levels. Emphasis should be on creating resilience, including biodiversity, ecosystem services, watershed conditions, and restoration and fuels reduction outcomes. Furthermore, the Commission sees value in developing outcomes-based performance measures focused on social metrics, such as meaningful collaboration, community empowerment, partnership, and equity. It will be important to consider that desired outcomes will vary between ecosystems and communities. Current and ongoing efforts to reform performance measures also should be considered when undertaking this task.

Additionally, the Commission feels strongly that identifying high priority acres must be based upon the benefit to wildfire risk reduction, as opposed to the timber harvested metric that currently seems paramount within existing agency policies. Though there was support for commercial work when and where possible and appropriate, the Commission agreed that treatments should not depend upon nor be prioritized based on commercial viability. Indeed, some on the Commission see the practice of prioritizing commercial outputs as a significant distraction from and impediment to strategic wildfire mitigation and management. Outcome-based metrics based on risk reduction, community need, partnership, and reintroduction of fire should be the primary touchstone to guide land management decision-making.

Recommendation 148

Develop a periodic quantitative review of the comprehensive wildfire environment to assist adaptive management.

A comprehensive, periodic review of the wildfire environment would enable much-needed evaluation of performance, progress, and needed adjustments across the system. While the work of this Commission provided a more holistic review of wildfire than typical, efforts to look across the breadth of the wildfire mitigation and management system should not be approached sporadically or in an ad hoc manner. Adaptive management is especially critical given the rapid pace of change in numerous facets of the wildfire environment, including changes driven by rising global temperatures. A periodic review of the wildfire mitigation and management system should include a quantitative analysis of changes in both the built and natural environments, the intersection between wildfire and public health, and the impact of those changes to pre-fire mitigation, incident response, and proactive recovery. Such a review should assess anticipated changes over the coming decades (two decades was one suggested timeline) and identify the need for future adjustment and adaptation. This undertaking should include both qualitative and quantitative assessments of progress and should include a feedback mechanism to the relevant committees of Congress to ensure that needed policy changes are elevated to decision-makers. Potential pathways for this recommendation include renewal of the externally-led Quadrennial Fire Review or an enhancement of the Wildland Fire Leadership Council's periodic updates to the Cohesive Strategy (as noted in Recommendation 136, above). Without such a regular, thorough, and holistic review, it will be more difficult to create proactive changes in a rapidly evolving and complex system.

Conclusion

At the direction of Congress, the Wildland Fire Mitigation and Management Commission brought together a rare diversity of backgrounds, experiences, and expertise to address the wildfire crisis. The resulting recommendations reflect one of the most sweeping and comprehensive reviews of the wildfire system to date. Throughout its deliberations, the Commission sought to address the wildfire system holistically, with a goal of creating communities and landscapes that are resilient to wildfire as a natural and integral part of our nation's future. While the resulting recommendations are extensive and diverse, they are also complementary and interrelated.

Across these recommendations, several themes emerged, including the need for immediate action and investment at a scale commensurate with the crisis at hand; the need to enhance and expand proactive mitigation in both the built and natural environment; the need to utilize science, data, and technology to inform our decisions for the best outcomes possible; and the need to embrace beneficial fire and prepare communities to live safely with it. An expanded and diverse workforce, inclusive and accountable governance systems, and greater collaboration and coordination across agencies, governments, scales, and sectors are needed to ensure everyone affected by wildfire is empowered to be part of the solution.

Rather than selecting one or more potential recommendations to carry forward for implementation, the Commission urges audiences of this report to take an “all of the above” approach. There is no single solution to the wildfire crisis; the scale of the issues necessitates solutions that are integrated, comprehensive, and broad in scope. The urgency of this need cannot be overstated. Severe wildfires are creating overwhelming losses, damages, and costs to communities and ecosystems across the country. The solutions are in hand, it is now incumbent upon us all to act upon them.



One year prior to this photo, in 2021, the Devils Creek Fire burned in Charles M. Russell National Wildlife Refuge in Montana. This photo shows the recovery that has occurred since the incident.

Jen Jewett, U.S. Fish and Wildlife Service



Endnotes

i Throughout this report, the terms “severity” and “intensity” are used with respect to fire. Fire severity describes the impact of a fire on the ecosystem (including vegetation and soils) and, as such, must be considered in the context of the ecosystem itself (Keeley, 2008). Fire severity can range from unburned/low severity to moderate severity, to high severity. High-severity wildfire in forested ecosystems generally means a high percentage of tree mortality and extensive exposure of mineral soil due to vegetation loss, though approaches vary as to the exact thresholds used. For example, Parks & Abatzoglou (2020) define high severity as greater than 95 percent canopy mortality, while Berger et al. (2018) define high severity as greater than 75 percent tree mortality. Importantly, not all high-severity wildfire is atypical or unnatural. There are a number of ecosystems in which high-severity wildfire is a normal part of the fire regime (e.g., lodgepole pine dominated forests) (Heyerdahl et al., 2014). In contrast, fire intensity does not consider the impact of the fire, but instead describes characteristics of the fire such as flame length, rate of spread, or energy released from the fire (Keeley, 2008).

ii While a “community” can be defined in multiple ways, from the traditional concept of people living in a defined area to the more expansive idea of a shared sense of belonging or purpose, in the context of the Commission’s work, the term may be best defined as “a network of individuals and families, businesses, governmental and non-governmental organizations and other civic organizations that reside or operate within a shared geographical boundary and may be represented by a common political leadership at a regional, county, municipal or neighborhood level” (FEMA, 2020b).

iii It is important to note that while structure location and density has been shown to influence the risk of structure loss, studies have shown both increased risk of loss where houses are closely spaced (e.g., Knapp et al., 2022; Quarles et al., 2013; Spyrtatos et al., 2007) and increased risk of loss where houses are less closely spaced (e.g., Syphard et al., 2012). Other factors such as ingress and egress, presence of vegetation, slope etc. are likely all part of the local context which must be considered when engaging in land use planning decisions. Research generally indicates that land use planning decisions provide opportunities for local jurisdictions to proactively address their wildfire risk (Alexandre et al., 2015) and that no one size fits all (Syphard et al., 2021).

iv A Community Wildfire Protection Plan (CWPP) is a collaborative planning document that helps communities reduce wildfire risk. Outlined by the Healthy Forests Restoration Act (P.L. 108-148), CWPPs are signed by the local fire district, government, and state forestry agency. Requirements of CWPPs include collaborative development, prioritization of hazardous fuels treatments, and the consideration of structural ignitability.

v Hazard Mitigation Assistance is comprised of three main FEMA programs: the Hazard Mitigation Grant Program (HMGP), the Building Resilient Infrastructure and Communities (BRIC) program, and the Flood Mitigation Assistance program. Two of these programs, BRIC and HMGP, are often used to support community wildfire mitigation. The Safeguarding Tomorrow through Ongoing Risk Mitigation Act of 2020, or the STORM Act (P.L. 116-284), created an additional program to support mitigation actions through a state revolving fund.

vi Even though these Hazard Mitigation Assistance programs (e.g., Hazard Mitigation Grant Program, Hazard Mitigation Grant Program-Post Fire) are tied to the occurrence of a declared disaster or approved Fire Management Assistance Grant, Section 1235a of the Disaster Recovery Reform Act does enable Hazard Mitigation Assistance programs which improve resilience, and not just reduce risk, to be funded.

vii Building Resilient Infrastructure and Communities program modification opportunities that the Commission discussed include, but are not limited to, creating a set-aside for wildfire within program funding. While there was also discussion of expanding some Hazard Mitigation Assistance programs to include prescribed fire, the Commission was ultimately not able to reach consensus on this point.

viii There are many definitions of hazard and risk throughout the broader wildfire community. As defined by the National Wildfire Coordinating Group, hazard can be defined as “Any real or potential condition that can cause injury, illness or death of personnel, or damage to, or loss of equipment or property. The root cause of an unwanted outcome.” In terms of wildfire and, more specifically, wildfire mitigation, examples of hazards can include the fuel present on the landscape, the condition of a structure and its surrounding area, or even the presence of a standing dead tree. Hazard is considered to be part of, but not synonymous with, the definition of risk. At its most basic level, risk is often viewed as a function of hazard and exposure. For example, building on one of the example hazards presented previously, too much fuel on the landscape is a hazard but becomes a risk when the possibility of ignition in that place is taken into account. The standing dead tree becomes a risk when there is a human exposed to the potential of the tree falling. More complicated definitions account for the likelihood of adverse impacts and the susceptibility of a value to harm, but central to the definition of risk is the concept that it is a compound value. Across the wildfire community, the terms “hazard” and “risk” can be used imprecisely. This is particularly true when referring to hazard or risk maps. Some maps produced at the state or national level are truly risk maps, as they account for the probability of a community being exposed to wildfire. Some maps are more accurately “hazard” maps, as they do not account for exposure, but instead only quantify conditions on the ground such as topography or fuel type. Within this document, the Commission has attempted to use the terms “hazard” and “risk” to distinguish between a focus on just conditions (hazard) and a focus on conditions and exposure (risk).

ix Examples of the “stick” approach include tying federal risk mitigation funding to adoption of, and implementation of, wildfire hazard-related building codes in wildfire-exposed regions or premising recovery dollars, or higher amounts of recovery dollars, on commitments to rebuild to new ignition-resistant building standards and/or to rebuild outside of high-risk areas.

x One such tool is the [Wildfirerisk.org](https://www.wildfirerisk.org) platform, an existing federally funded wildfire mapping/assessment tool that can be used to identify areas of high wildfire risk, exposure, and populations disproportionately impacted by wildfires. The platform was developed as a requirement of the 2018 Consolidated Appropriations Act and maps the relative wildfire risk profile of communities across the country but cannot – and was not intended to – be used to assess risk at more granular scales such as at the parcel level.

xi Ideally, all-hazard risk disclosures should be made available up front before an offer on a property is made (rather than after a property is under contract) and identify both the hazards and the costs of necessary mitigation. These statements should be signed in a recorded document. Disclosures should be made available from or verified by a third-party with expert knowledge of the issues. The risk identification mechanisms and data sources used to inform this hazard disclosure would need to be carefully selected, given the challenges inherent to the identification of a map or maps to inform disclosures. One strategy could involve coordination with state hazard maps.

The type of sale disclosure envisioned by this recommendation would be separate from and would not impact the cost or ability to access property insurance, nor would it otherwise inhibit the transaction. Insurance companies use their own highly detailed risk maps and calculations during underwriting and rating decisions. However, because hazard disclosures depend on accurate and up-to-date risk assessment information, carrying out this recommendation could be complicated by the rapid pace of climate change and its implications for wildfire risk.

xii According to the Congressional Research Service (Lawson, 2023), the three main ownership models and related implications for regulation:

- “Investor-owned utilities (IOUs) are private companies that operate on a for-profit basis. State governments allow them to act as monopolies in their service territory, with no competition for electricity distribution. In return, IOUs are subject to regulation and oversight by state public utility commissions (PUCs). Such regulation includes the profits IOUs may earn.
- Publicly owned utilities (POUs, sometimes called municipal utilities or munis) are owned by local governments and operated on a not-for-profit basis. They are not generally regulated by PUCs. Instead, local governments regulate POUs and provide oversight.
- Electric co-operatives (co-ops, sometimes called rural co-ops) are member-owned organizations and operated on a not-for-profit basis. They are located in rural areas and are not generally regulated by PUCs. Instead, co-op members or their elected boards regulate co-ops and provide oversight.”

xiii Cooperative burning is the practice of pooling qualified staff resources, equipment, and/or funds among multiple partnering entities to implement prescribed fire.

xiv The Forest Service released their National Prescribed Fire Resource Mobilization Strategy (USFS, 2023a) during the course of the Commission’s deliberations. This mobilization strategy was not discussed by the Commission, however, the Commission recommendation to identify specific targets, assess the scope and scale of current efforts, and be inclusive of partners remains largely unaddressed in the Mobilization Strategy.

xv In addition to annual agency appropriations that can be used for prescribed fire, the 2021 Infrastructure Investment and Jobs Act provided the United States Department of Agriculture and the Department of the Interior a total of \$500 million for prescribed fire planning and implementation.

xvi Fire regime, as defined by the National Wildfire Coordinating Group, is the “[d]escription of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects as well, in a given area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval.”

xvii One study out of the Blue Mountains area in Oregon that modeled thinning prescriptions on densely stocked acres found that commercial removal (i.e., the value of the timber harvested exceeding the cost of the harvesting, hauling, road maintenance, and contractual requirements) was possible on less than 10 percent of those acres (USFS, 2008).

xviii The Biomass Research and Development Initiative (BRDI) provides grants to companies, universities, and government research centers to research and develop and demonstrate new ways to refine various types of feedstocks and crops into biofuels or biobased chemical and products. The program was originally created in the Biomass Research and Development Act of 2000 and was later modified and extended in the 2002, 2008, and 2014 farm bill energy titles (Taxpayers for Common Sense, 2014).

xix An animal unit month is the amount of forage required by one animal unit for one month.

xx Good Neighbor Authority allows the Forest Service and BLM to authorize states, counties, and Tribes to conduct restoration on federal land. The Tribal Forest Protection Act (P.L. 93-638) authorizes the United States Department of Agriculture and Department of the Interior to enter into agreements and contracts with Tribes on Forest Service or Bureau of Land Management managed lands to protect the Indian trust lands and resources from threats such as fire, insects and disease. The Healthy Forest Restoration Act (P.L. 108-148), amongst other actions, allows for stewardship contracts and agreements with Tribes to reduce hazardous fuels and restore forest and rangeland health.

xxi For purposes of this report, the term “Indigenous stewardship” encompasses all relevant forms of wildfire mitigation and management undertaken by Tribes under the principles of self-government and self-determination.

xxii Co-stewardship generally implies the shared implementation of decisions already made by a federal agency. Co-management generally implies shared decision-making between a federal agency and Tribe.

xxiii The Environmental Analysis and Decision Making (EADM) effort intended to “reduce the time and cost of [the Forest Service’s] environmental analysis and decision-making processes to produce efficient, effective, and high-quality land management decisions to accomplish more work on the ground and be more responsive to the public” (USFS, n.d.). The agency hosted a series of roundtable discussions in 2018 to gather feedback on this topic and has since identified a number of priority actions across three focal areas. In January 2018, the Forest Service published an Advanced Notice of Proposed Rulemaking to update agency NEPA procedures in the Code of Federal Regulations (CFR) at 36 CFR 220.

xxiv A specific suggestion to increase Tribal participation in planning is to increase baseline funding to Tribal Historic Preservation Offices so that Tribes are ready and able to take on work such as archaeological and cultural resource surveys.

xxv According to the United States Geological Survey, debris flows are “fast-moving landslides that are particularly dangerous to life and property because they move quickly, destroy objects in their paths, and often strike without warning. They occur in a wide variety of environments throughout the world, including all 50 states and U.S. Territories. Debris flows generally occur during periods of intense rainfall or rapid snowmelt and usually start on hillsides or mountains. Debris flows can travel at speeds up to and exceeding 35 mph and can carry large items such as boulders, trees, and cars. If a debris flow enters a steep stream channel, they can travel for several miles, impacting areas unaware of the hazard. Areas recently burned by a forest fire are especially susceptible to debris flows, including the areas downslope and outside of the burned area. Debris flows are a type of landslide and are sometimes referred to as mudslides, mudflows, lahars, or debris avalanche” (United States Geological Survey [USGS], n.d.a). Increased peak flows refers to the maximum instantaneous flow of water discharged from a surface water body (such as a stream). According to Neary et al., 2005, “Following wildfires, flood peak flows

can increase dramatically, severely affecting stream physical conditions, aquatic habitat, aquatic biota, cultural resources, and human health and safety. Often, increased flood peak flows of up to 100 times those previously recorded, well beyond observed ranges of variability in managed watersheds, have been measured after wildfires.” [p.117]

xxvi This is largely consistent with the recommendations contained within the U.S. Government Accountability Office report “Wildfire Smoke: Opportunities to Strengthen Federal Efforts to Manage Growing Risks,” (GAO, 2023) which contained recommendations to better align air quality and land management goals for wildfire risk mitigation.

xxvii The U.S. Government Accountability Office (GAO, 2023) notes that “...according to EPA officials, the agency faces constraints in what it can do to provide incentives for and support wildfire risk mitigation” [p.42] and “As EPA officials stated, implementing many of these options for providing incentives for and supporting wildfire risk mitigation would require close coordination with Tribal, state, and local partners. Further, EPA officials said that some options may fall within EPA’s existing authority, while others might require congressional action. By working with its Tribal, state, and local partners to evaluate options and establish a plan for implementing appropriate options, including by seeking additional authority from Congress, if necessary, EPA could more proactively help reduce disaster risks from wildfire smoke over the long term” [p. 44].

xxviii This joint effort would build upon the work convened previously by the Wildland Fire Leadership Council around joint messaging between USDA, DOI, EPA, and the Centers for Disease Control and Prevention (CDC). The need for greater coordination in this arena was also acknowledged by the U.S. Government Accountability Office (GAO, 2023). The report advised the Administrator of the EPA and the Secretaries of Agriculture and the Interior to work more closely together to better align air quality and land management goals for wildfire risk mitigation and establish joint strategies for achieving those goals. However, public health agencies such as the CDC and the EPA currently do not have staff or budgets dedicated to smoke and other wildfire-related public health issues, hindering their ability to fully address these recommendations.

xxix It is important to note that while the Commission prefers the definition and framing of beneficial fire, collectively including prescribed fire, cultural burning, and wildfire managed for resource objectives, there is no statutory or legal definition for beneficial fire. The Exceptional Events Rule may not apply to all fires covered within the Commission’s definition of “beneficial fire.” See EPA, n.d.a for more information.

xxx Community mitigation and preparedness actions include actions such as:

- Distribution of air filters or portable air cleaners.
- Exposure guidance and supplies such as masks to reduce smoke impacts when outdoors.
- Coordinated communication strategies and networks to inform residents of smoke conditions and options for reducing or avoiding inhalation of smoke.
- Building retrofits and construction that reduces the potential for smoke intrusion through poorly sealed doors or windows, vents, or gaps and encourages or facilitates the use of effective HVAC filters or small, portable air cleaners.
- Creation or identification of cleaner air spaces where people can seek relief. The creation of these spaces in public places such as schools, libraries, malls, and theaters can have widespread benefits including for students vulnerable to the impacts of smoke, for the land management workforce, and for members of the public for whom opportunities to gather in social spaces can help mitigate the mental and physical health impacts of long-duration smoke events.

xxxi This research could build upon previous joint efforts identified through the Wildland Fire Leadership Council.

xxxii Wireless Emergency Alerts (WEAs) are short emergency messages sent by federal, state, local, Tribal, and territorial authorities. These messages can be broadcast to any WEA-enabled mobile device in a locally targeted area.

xxxiii The Federal Emergency Management Agency's Common Alerting Protocol is a digital format for exchanging emergency alerts, that allows a consistent alert message to be disseminated simultaneously over multiple communications pathways.

xxxiv The Ready, Set, Go! Program was launched nationally by the International Association of Fire Chiefs in 2011. Primarily used as an educational tool for local fire departments, the Ready, Set, Go! Program was not intended to be used as a substitute for evacuation levels (Ready, Set, Go!, 2020). However, some local jurisdictions across the nation have adopted the three-tiered system established by Ready, Set, Go! to more easily and effectively communicate with residents (Ready, Set, Go!, 2020).

xxxv Response in the context of this section refers to suppression or active fire management. Responders, or those who respond to wildfires, are also known as firefighters or, in the case of federal land management agencies, wildland firefighters.

xxxvi While the Commission did not define vulnerability, and different case studies do use different metrics, vulnerability in the general sense can be understood as "the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt" (Adger, 2006).

xxxvii The Disaster Recovery Reform Act of 2018 amended the Stafford Act in several important ways, including the creation of the Building Resilient Infrastructure and Communities program, increased management costs for state, local, Tribal, and territorial partners receiving Public Assistance or Hazard Mitigation Grant Programs, and importantly, made activities which improve resilience, and not just reduce risk, eligible for cost share.

xxxviii Fire Management Grants are declared through a "quasi-declaration" in which declaration authority has been delegated to the Federal Emergency Management Agency (FEMA) by the President (CRS, 2023b). When a fire represents a "threat of major disaster" the state can request a Fire Management Assistance Grant (FMAG) from FEMA to support management of fires regardless of land ownership. The FMAG declaration process is relatively quick; processes are in place to enable immediate verbal requests to FEMA personnel with written documentation. Once awarded, the FMAG program provides 75 percent federal cost-share for eligible costs incurred during the incident period. Declarations are based on threats to lives and property (including threats to hospitals, prisons and schools, police and fire stations, water treatment facilities, public utilities, and major roadways), availability (or lack thereof) of firefighting resources, fire danger conditions, and potential economic impact.

xxxix The USDA Natural Resource Conservation Service Emergency Watershed Protection Program funds post-fire assistance including structures (e.g., levees, sandbags, nature-based features for watershed protection) that are installed to limit the impacts of floods or debris flows postfire. It does not require federal disaster declaration, but funds must be requested by a "sponsor" (i.e., city, county, conservation district, or federally-recognized Tribe) before they can be deployed.

xl The Farm Service Agency's Emergency Forest Restoration Program (EFRP) provides financial assistance to help the owners of non-industrial private forests restore the health of forests damaged by natural disasters.

xli Other options which may support a more rapid deployment of the post-fire Hazard Mitigation Grant Program (post-fire HMGP) include expanding the categories of projects with pre-calculated benefits under the post-fire HMGP and, more generally, directing agencies to conduct an analysis of the complete HMGP process, through closeout, and determine ways to shorten the process, complete projects within the 48-month period of performance, and close out hazard mitigation disaster grants faster.

xlii The National Disaster Recovery Framework (NDRF), part of the National Preparedness System, outlines the strategy and doctrine for how the “whole community builds, sustains, and coordinates delivery of Recovery core capabilities identified in the National Preparedness Goal in an integrated manner with the other mission areas.” (FEMA, 2016, p. 1)

xliii A Community Wildfire Protection Plan (CWPP) is a collaborative planning document that helps communities reduce wildfire risk. Outlined by the Healthy Forests Restoration Act, CWPPs are signed by the local fire district, government, and state forestry agency. Requirements of CWPPs include collaborative development, prioritization of hazardous fuels treatments, and the consideration of structural ignitability. Evaluation of CWPP development has revealed diverse organizational participation and an important “bottom up” approach to risk mitigation (Palsa et al., 2022). Research has also identified building community capacity and learning communities as well as developing social networks, and new capacities to support successful wildfire planning as key benefits derived from a CWPP (Williams et al., 2012; Jakes et al., 2007; Williams et al., 2009); these benefits are in addition to the wildfire risk reduction benefits derived from completed CWPP projects.

xliv Hazard Mitigation Plans are planning documents approved by the Federal Emergency Management Agency which include a description of the planning process, a risk assessment for natural hazards, a mitigation strategy, a plan maintenance process, a plan adoption process, and assurances that all applicable Federal statutes and regulations in effect during the period of performance for any grant funding. The requirements for Hazard Mitigation Plans are contained within 44 CFR Part 201 and derive their authority from the Stafford Act.

xlv Tribal Hazard Mitigation Plans are also Federal Emergency Management Agency-approved documents which are requirement for certain types of Federal funding. The 2019 Tribal Mitigation Planning Guidebook provides an overview of the Tribal Hazard Mitigation process, though it is largely similar to the state Hazard Mitigation Plan process.

xlvi Building Resilient Infrastructure and Communities (BRIC) Direct Technical Assistance (DTA) aims to provide holistic hazard mitigation planning and project support for communities that may not have the resources to begin climate resilience planning and project solution design on their own. The Federal Emergency Management Agency provides this technical assistance support for up to 36 months.

xlvii The Federal Emergency Management Agency’s Hazus Program provides standardized tools and data for estimating risk from earthquakes, floods, tsunamis, and hurricanes.

xlviii For more information on federal support after disasters, see Federal Assistance for Wildfire Response and Recovery (Riddle, 2023). For more business-specific information, see Federal Disaster Assistance for Businesses: Summaries and Policy Options (Lawhorn et al., 2023).

xlx The Individual Assistance-Individuals and Households Program is part of a suite of programs available through Individual Assistance. Other programs include Disaster Case Management, Crisis Counseling Assistance and Training, and Disaster Unemployment Assistance.

I According to the Federal Emergency Management Agency, a Temporary Housing Unit “is defined as a house, apartment, cooperative, condominium, manufactured home, or other dwelling FEMA acquires by purchase or lease and makes available to eligible applicants for a limited period of time” (FEMA, 2019, p. 1).

li For a detailed history of Burned Area Emergency Response teams, see Neary et al., 2005, pages 179-182.

lii Rehabilitation of landscapes impacted by fire is typically considered to occur within five years of fire containment. Department of the Interior fire agencies and the Forest Service can provide funding for Burned Area Rehabilitation (BAR) which expands the focus of actions beyond immediate stabilization actions. Funded activities can include spreading native plant seeds or planting native seedlings; applying herbicides to kill invasive plants, removing them by hand, or introducing bacteria to control them; and using heavy equipment to disrupt the growth of targeted plant species or contour landscapes to control runoff.

liii The Congressional Research Service report on Post-Wildfire Debris Flows: Federal Role in Assessment and Warning (2023d) provides more detailed information on the current status of debris flow assessment and warning, including the status of implementation of the 2021 National Landslide Preparedness Act.

liv In wildfire response alone, the total workforce may number as high as 1.26 million people, with federal agencies fielding approximately 19,000 members as a dedicated workforce. This includes both year-round and seasonal firefighters, though it almost certainly undercounts other federal employees whose skills and time are utilized on incidents (GAO, 2022c). One subject matter expert estimated that there are approximately 24,000 private contractors that can be mobilized within this workforce, which may include logistics support roles (personal communication). Local fire departments are a significant part of the wildfire management workforce as well, though their overall staffing does not represent the level of staffing specific to, or always available for, wildfire response. Local fire departments registered with FEMA field an estimated 1,215,800 personnel, however only 1,063,900 are active career, volunteer and paid per call firefighters (USFA, 2023b). Of the active firefighting personnel, 34 percent were career firefighters, 53 percent were volunteer firefighters, and 12 percent were paid per call firefighters. Of the fire departments registered with FEMA, approximately 63 percent report providing specialized services to wildland fire or the wildland urban interface (USFA, 2023b).

lv IJJA required the Department of the Interior and the United States Department of Agriculture to increase the base salary of federal wildland firefighters by \$20,000 per year or 50 percent of salary, whichever is less, within specified geographic areas where it was determined to be difficult to recruit or retain. The legislation appropriated \$600 million for the departments to fulfill this request.

lvi An employee may not reach the actual cap during a fire assignment, but they will become ineligible to continue work on fire assignments if their remaining regular duties and pay cannot be covered under the remaining salary under the cap. In other words, they will be told to stop work to preserve the ability to pay them for the remainder of their regular duties for the year.

lvii The Secretary should be authorized to provide advance payments to cover estimated travel, per diem and incidental expenses. Travel should be consistent with existing Federal transportation guidelines and regulations and should meet GSA standards for the reimbursement of costs associated travel, local per-diem limits, and incidental expenses.

lviii Family Liaisons should be professionally trained in grief counseling and available at the family's request.

lix Successful examples of non-governmental entities providing significant wildfire mitigation on federally administered land include for-profit companies providing prescribed burn services, and nonprofits such as The Forest Stewards Guild, Lomakatsi Restoration Project, and The Watershed Research and Training Center that have developed robust mitigation programs of work.

Ix Minimum training for wildland fire includes the S-190, S-130, L-180, and IS-100 courses, with at least 30 hours of classroom time, 8-12 hours of field training, and about 12 hours of either online or classroom training. Structure fire estimates include NFPA Firefighter 1001, Firefighter 1002, and hazmat training.

Ixi Office of Management and Budget circular A-45 was noted by some Commission members as a critical barrier to Agencies' authorities with regard to housing. While, broadly speaking, the Commission endorses a review and revision of the circular, the Commission did not want to confine its recommendations only to the review and revision of the circular. Key to the Commission's recommendation is the provision of authorities necessary to enable agencies to provide housing or a housing stipend and other options (such as the waiver of fair market value rental rate requirements) to increase housing availability and accessibility for the workforce, regardless of the method Congress uses to achieve those outcomes.

Ixii Some efforts in this direction are already underway through a public-private partnership managed by the Department of Commerce.

Ixiii The four key national challenges identified in the 2014 Cohesive Strategy are: vegetation and fuels; homes, communities, and other values at risk; human-caused ignitions; and effective and efficient wildfire response.

Ixiv According to the FLAME Act, "—At least once during each five-year period beginning on the date of the submission of the cohesive wildfire management strategy under subsection (a), the Secretary of the Interior and the Secretary of Agriculture shall revise the strategy to address any changes affecting the strategy, including changes with respect to landscape, vegetation, climate, and weather" (Sec. 3(c)).

Ixv The IJJA made \$100 million available to the Secretary of Agriculture for "collaboration and collaboration-based activities including facilitation, certification of collaboratives, and planning and implementing projects under the Collaborative Forest Landscape Restoration Program."

Ixvi While the Commission did not specifically define "disadvantaged" communities or populations in the context of its work, it did use the term generally to denote those communities which are underserved, marginalized, or historically overburdened. In some cases, the term "disadvantaged" is used to indicate specific agency policy definitions, such as Economically Disadvantaged Rural Communities or within the context of specific statutory tasking to the Commission, such as in the case of Small Impoverished Communities (Recommendation 146). Throughout its work, the Commission recognized that the impacts of wildfire are often borne disproportionately, and that specific action should be taken to direct funding and resources to those populations both at risk and in need.

Ixvii Needs and limitations faced by underserved communities are not only financial in nature. For example, another resource that low-income communities tend to lack is time. Practitioners involved in the Firewise USA® program have noted this is the case in residential communities where many people work multiple jobs or work on shifts, are juggling work and childcare, or are caring for older adults.

Ixviii More specifically, the Commission discussed the potential to authorize state entities outside of State Emergency Management Agencies (such as State Resiliency offices, Natural Resources, State Fire Marshal Offices, and other state departments) to be additional eligible primary applicants for Building Resilient Infrastructure and Communities mitigation grants in order to increase accessibility of funds. However, this action alone is likely to be insufficient to increase access for communities.

Ixix In determining eligibility for cost-share reductions, waivers or other offerings, consideration should be given to the potential for income variability within communities. It may be necessary to take a family unit or parcel-scale approach rather than using units of measurement such as census tracts to ensure individuals that need such assistance aren't improperly disqualified by virtue of where they live.

lxx In July 2022, the Forest Service released interim policy changes for partnership and cooperator agreements that included greater flexibility in the contributions considered eligible to meet match requirements, a waiver of policy match requirements for all agreements with Tribal governments, and a process to waive or reduce policy match requirements for agreements with other partners such as those serving underserved communities.

lxxi The Forest Service's 2022 interim policy changes for partnership and cooperator agreements (Forest Service, 2022d) waive policy match requirements for all agreements with Tribal governments and create a process for waiving policy match requirements for partners serving underserved communities. The Community Wildfire Defense Grant program allows for communities meeting the definition of underserved to request a waiver of the match by providing documentation.



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Walker Craig

Camille Crain

Angela Cunningham

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Kate Dargan Marquis

Pat Dolwick

Griffin Dombay

Jozie Donaghey

Kevin Donham

Paul Duarte
Mike Dudley
Chris Dunn, PhD
Catrin Edgeley, PhD
Brian Ferebee
Frank Frievall
Matt Gall
Erika Goldman, PhD
John Gould
Doug Grafe
Sarah Heard
Arielle Hesse
Randy Howard
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Jon Hurst
Matt Hurteau, PhD
Bill Imbergamo
Antonio Jones
Justice Jones
Jim Karels
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Joel Kerley
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Jennee Kuang
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Brett L'Esperance
Pete Lahm
Ayuthea LaPier
Neal Laugle
Krystal Leymon
Katie Lighthall
Kathryn Lipiecki
Nick Love

Mia Mayberry
Sarah McCaffrey, PhD
Laura McCarthy
Michelle Medley-Daniel
Stephani Michelsen-Correa
Riaz Mohammed
Larry Moore
Travis Paveglio, PhD
Virginia Petersen
Matt Piccarello
Elizabeth Pickett
Ryan Pietramali
Molly Pitts
Jolie Pollet
Stephen Poux
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Katherine Rowden
Jeffery Rupert
Charles Russell
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Jason Saks, MPH
Ken Schmid
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Becca Shively
Jake Sjolund
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Thomas Smith
Katherine Spomer
Christopher Swanston, PhD
Erin Swiader

Sara Terry
Kyle Trefny
Thomas Troy
Sally Tucker
David Van Holde, P.E.
Molly Walsh
Sonia Wang
David Wear, PhD
Todd Wells
Katherine White
Christopher Wilcox
Matt Woodwick

Appendix B: Chapter Header Photography Credits

In order of appearance:

Forest Service

Staff Sgt. Tate Petersen, U.S. Air Force

Roni Fein, Forest Service

Cecilio Ricardo, Forest Service

Bureau of Land Management

Austin Catlin, Bureau of Land Management

Crystal Welch, Bureau of Land Management

Lance Cheung, USDA

Neal Herbert, U.S. Department of the Interior's Office of Wildland Fire

M. Gue, National Park Service

Preston Keres, Forest Service

Lance Cheung, USDA

National Park Service

Appendix C: Abbreviations

Abbreviation	Definition
BAER	Burned Area Emergency Response
BARC	Burned Area Reflectance Classification
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BRIC	Building Resilient Infrastructure and Communities
Cohesive Strategy	National Cohesive Wildland Fire Management Strategy
CBO	Congressional Budget Office
CDC	Centers for Disease Control and Prevention
CFLRP	Collaborative Forest Landscape Restoration Program
CWPP	Community Wildfire Protection Plan
CWDG	Community Wildfire Defense Grant
CRS	Congressional Research Service
DOI	Department of the Interior
DOL	Department of Labor
DHS	Department of Homeland Security
DOD	Department of Defense
DOE	Department of Energy
EFRP	Emergency Forest Restoration Program
EPA	Environmental Protection Agency
EWP	Emergency Watershed Protection Program

Abbreviation	Definition
FEMA	Federal Emergency Management Agency
FLAME Act	Federal Land Assistance, Management, and Enhancement Act
FMAG	Fire Management Assistance Grant
FMA	Flood Mitigation Assistance
FSA	Farm Service Agency
Forest Service	U.S. Forest Service
GAO	Government Accountability Office
GNA	Good Neighbor Authority
HHS	Department of Health and Human Services
HFRA	Healthy Forests Restoration Act
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HUD	Housing and Urban Development
IA-IHP	Individual Assistance Individuals and Households Program
IIJA	Infrastructure Investments and Jobs Act
IPAWS	Integrated Public Alert & Warning System
IQS	Incident Qualification System
IQCS	Incident Qualifications and Certification System
IROC	Interagency Resource Ordering Capability
IRA	Inflation Reduction Act
ITARA	Indian Trust Asset Reform Act
IWG	White House Wildfire Resilience Interagency Working Group
JCLRP	Joint Chiefs Landscape Restoration Partnership
JFSP	Joint Fire Science Program
NASA	National Aeronautics and Space Administration
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act

Abbreviation	Definition
NIH	National Institutes of Health
NIMS	National Incident Management System
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NDRF	National Disaster Recovery Framework
NSF	National Science Foundation
NSTC	National Science and Technology Council
NWCG	National Wildfire Coordinating Group
NWS	National Weather Service
OSHA	Occupational Safety and Health Administration
OMB	Office of Management and Budget
OWCP	Office of Workers Compensation Programs
OWF	Office of Wildland Fire
PCAST	President's Council of Advisors on Science and Technology
PODs	Potential Operational Delineations
REPLANT	Repairing Existing Public Land by Adding Necessary Trees
RFPA	Rangeland Fire Protection Association
SWERI	Southwest Ecological Restoration Institutes
TFPA	Tribal Forest Protection Act
USGS	U.S. Geological Survey
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USFA	U.S. Fire Administration
WFLC	Wildland Fire Leadership Council

Appendix D: Enabling Legislation

TITLE II—WILDFIRE MITIGATION

SEC. 70201. SHORT TITLE.

This title may be cited as the “Wildland Fire Mitigation and Management Commission Act of 2021”.

SEC. 70202. DEFINITIONS.

In this title:

(1) **APPROPRIATE COMMITTEES OF CONGRESS.**—The term “appropriate committees of Congress” means—

- (A) the Committee on Energy and Natural Resources of the Senate;
- (B) the Committee on Agriculture, Nutrition, and Forestry of the Senate;
- (C) the Committee on Homeland Security and Governmental Affairs of the Senate;
- (D) the Committee on Appropriations of the Senate;
- (E) the Committee on Environment and Public Works of the Senate;
- (F) the Committee on Natural Resources of the House of Representatives;
- (G) the Committee on Agriculture of the House of Representatives;
- (H) the Committee on Homeland Security of the House of Representatives;
- (I) the Committee on Appropriations of the House of Representatives;
- (J) the Committee on Ways and Means of the House of Representatives; and
- (K) the Committee on Natural Resources of the House of Representatives.

(2) **COMMISSION.**—The term “Commission” means the commission established under section 70203(a).

(3) HIGH-RISK INDIAN TRIBAL GOVERNMENT.—The term “high-risk Indian tribal government” means an Indian tribal government, during not fewer than 4 of the 5 years preceding the date of enactment of this Act—

(A) that received fire management assistance under section 420 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5187); or

(B) land of which included an area for which the President declared a major disaster for fire in accordance with section 401 of that Act (42 U.S.C. 5170).

(4) HIGH-RISK STATE.—The term “high-risk State” means a State that, during not fewer than 4 of the 5 years preceding the date of enactment of this Act—

(A) received fire management assistance under section 420 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5187); or

(B) included an area for which the President declared a major disaster for fire in accordance with section 401 of that Act (42 U.S.C. 5170).

(5) INDIAN TRIBAL GOVERNMENT.—The term “Indian tribal government” has the meaning given the term in section 102 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5122).

(6) SECRETARIES.—The term “Secretaries” means—

(A) the Secretary of the Interior;

(B) the Secretary of Agriculture; and

(C) the Secretary of Homeland Security, acting through the Administrator of the Federal Emergency Management Agency.

(7) STATE.—The term “State” has the meaning given the term in section 102 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5122).

(8) WILDLAND-URBAN INTERFACE.—The term “wildland-urban interface” has the meaning given the term in section H. R. 3684—824 101 of the Healthy Forests Restoration Act of 2003 (16 U.S.C.6511).

SEC. 70203. ESTABLISHMENT OF COMMISSION.

(a) ESTABLISHMENT.—Not later than 30 days after the date of enactment of this Act, the Secretaries shall jointly establish commission to study and make recommendations to improve Federal policies relating to—

(1) the prevention, mitigation, suppression, and management of wildland fires in the United States; and

(2) the rehabilitation of land in the United States devastated by wildland fires.

(b) MEMBERSHIP.—

(1) COMPOSITION.—The Commission shall be composed of—

- (A) each of the Secretaries (or designees), who shall jointly serve as the co-chairpersons of the Commission;
- (B) 9 representatives of Federal departments or agencies, to be appointed by the Secretaries, including—
- (i) not fewer than 1 representative from each of—
 - (I) the Bureau of Land Management;
 - (II) the National Park Service;
 - (III) the Bureau of Indian Affairs;
 - (IV) the United States Fish and Wildlife Service; and
 - (V) the Forest Service;
 - (ii) a representative of or liaison to the Mitigation Framework Leadership Group of the Federal Emergency Management Agency;
 - (iii) a representative to the National Interagency Coordination Center, which is part of the National Wildfire Coordination Group;
 - (iv) a representative from 1 of the coordinating agencies of the Recovery Support Function Leadership Group; and
 - (v) if the Secretaries determine it to be appropriate, a representative of any other Federal department or agency, such as the Department of Energy, the Environmental Protection Agency, or the Department of Defense; and
- (C) 18 non-Federal stakeholders with expertise in wildland fire preparedness, mitigation, suppression, or management, who collectively have a combination of backgrounds, experiences, and viewpoints and are representative of rural, urban, and suburban areas, to be appointed by the Secretaries, including—
- (i) not fewer than 1 State hazard mitigation officer of a high-risk State (or a designee);
 - (ii) with preference given to representatives from high-risk States and high-risk Indian tribal governments, not fewer than 1 representative from each of—
 - (I) a State department of natural resources, forestry, or agriculture or a similar State agency;
 - (II) a State department of energy or a similar State agency;
 - (III) a county government, with preference given to counties at least a portion of which is in the wildland-urban interface; and
 - (IV) a municipal government, with preference given to municipalities at least a portion of which is in the wildland-urban interface;

(iii) with preference given to representatives from high-risk States and high-risk Indian tribal governments, not fewer than 1 representative from each of—

(I) the public utility industry;

(II) the property development industry;

(III) Indian tribal governments;

(IV) wildland firefighters; and

(V) an organization—

(aa) described in section 501(c)(3) of the Internal Revenue Code of 1986 and exempt from taxation under section 501(a) of that Code; and

(bb) with expertise in forest management and environmental conservation;

(iv) not greater than 2 other appropriate non-Federal stakeholders, which may include the private sector; and

(v) any other appropriate non-Federal stakeholders, which may include the private sector, with preference given to non-Federal stakeholders from high-risk States and high-risk Indian tribal governments.

(2) STATE LIMITATION.—Each member of the Commission appointed under clauses (i) and (ii) of paragraph (1)(C) shall represent a different State.

(3) DATE.—The appointments of the members of the Commission shall be made not later than 60 days after the date of enactment of this Act.

(c) PERIOD OF APPOINTMENT; VACANCIES.—

(1) IN GENERAL.—A member of the Commission shall be appointed for the life of the Commission.

(2) VACANCIES.—A vacancy in the Commission—

(A) shall not affect the powers of the Commission; and

(B) shall be filled in the same manner as the original appointment.

(d) MEETINGS.— (1) INITIAL MEETING.—Not later than 30 days after the date on which all members of the Commission have been appointed, the Commission shall hold the first meeting of the Commission.

(2) FREQUENCY.—The Commission shall meet not less frequently than once every 30 days.

(3) TYPE.—The Commission may hold meetings, and a member of the Commission may participate in a meeting, remotely through teleconference, video conference, or similar means.

(4) QUORUM.—A majority of the members of the Commission shall constitute a quorum, but a lesser number of members may hold hearings.

SEC. 70204. DUTIES OF COMMISSION.

(a) REPORT ON RECOMMENDATIONS TO MITIGATE AND MANAGE WILDLAND FIRES.—

(1) IN GENERAL.—Not later than 1 year after the date of the first meeting of the Commission, the Commission shall submit to the appropriate committees of Congress a report describing recommendations to prevent, mitigate, suppress, and manage wildland fires, including—

(A) policy recommendations, including recommendations—

(i) to maximize the protection of human life, community water supplies, homes, and other essential structures, which may include recommendations to expand the use of initial attack strategies;

(ii) to facilitate efficient short- and long-term forest management in residential and nonresidential at-risk areas, which may include a review of community wild- fire protection plans;

(iii) to manage the wildland-urban interface;

(iv) to manage utility corridors;

(v) to rehabilitate land devastated by wildland fire; and

(vi) to improve the capacity of the Secretary of Agriculture and the Secretary of the Interior to conduct hazardous fuels reduction projects;

(B) policy recommendations described in subparagraph

(C) with respect to any recommendations for—

(i) categorical exclusions from the requirement to prepare an environmental impact statement or analysis under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.); or

(ii) additional staffing or resources that may be necessary to more expeditiously prepare an environmental impact statement or analysis under that Act;

(D) policy recommendations for modernizing and expanding the use of technology, including satellite technology, remote sensing, unmanned aircraft systems, and any other type of emerging technology, to prevent, mitigate, suppress, and manage wildland fires, including any recommendations with respect to—

(i) the implementation of section 1114 of the John D. Dingell, Jr. Conservation, Management, and Recreation Act (43 U.S.C. 1748b–1); or

(ii) improving early wildland fire detection;

- (E) an assessment of Federal spending on wildland fire-related disaster management, including—
- (i) a description and assessment of Federal grant programs for States and units of local government for pre- and post-wildland fire disaster mitigation and recovery, including—
 - (I) the amount of funding provided under each program;
 - (II) the effectiveness of each program with respect to long-term forest management and maintenance; and
 - (III) recommendations to improve the effectiveness of each program, including with respect to—
 - (aa) the conditions on the use of funds received under the program; and
 - (bb) the extent to which additional funds are necessary for the program;
 - (ii) an evaluation, including recommendations to improve the effectiveness in mitigating wildland fires, which may include authorizing prescribed fires, of—
 - (I) the Building Resilient Infrastructure and Communities program under section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5133);
 - (II) the Pre-Disaster Mitigation program under that section (42 U.S.C. 5133);
 - (III) the Hazard Mitigation Grant Program under section 404 of that Act (42 U.S.C. 5170c);
 - (IV) Hazard Mitigation Grant Program post-fire assistance under sections 404 and 420 of that Act (42 U.S.C. 5170c, 5187); and
 - (V) such other programs as the Commission determines to be appropriate;
 - (iii) an assessment of the definition of “small impoverished community” under section 203(a) of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5133(a)), specifically—
 - (I) the exclusion of the percentage of land owned by an entity other than a State or unit of local government; and
 - (II) any related economic impact of that exclusion; and
 - (iv) recommendations for Federal budgeting for wildland fires and post-wildfire recovery;
- (F) any recommendations for matters under subparagraph (A), (B), (C), or (D) specific to—
- (i) forest type, vegetation type, or forest and vegetation type; or

(ii) State land, Tribal land, or private land;

(G)

(i) a review of the national strategy described in the report entitled “The National Strategy: The Final Phase in the Development of the National Cohesive Wildland Fire Management Strategy” and dated April 2014; and

(ii) any recommendations for changes to that national strategy to improve its effectiveness; and

(H)

(i) an evaluation of coordination of response to, and suppression of, wildfires occurring on Federal, Tribal, State, and local land among Federal, Tribal, State, and local agencies with jurisdiction over that land; and

(ii) any recommendations to improve the coordination described in clause (i).

(2) SPECIFIC POLICY RECOMMENDATIONS.—To the maximum extent practicable, the report described in paragraph (1) shall include detailed short- and long-term policy recommendations, including any recommendations for Federal legislation.

(3) INTERIM REPORTS.—Before the submission of the report under paragraph (1), on approval of all members of the Commission, the Commission may submit to the appropriate committees of Congress 1 or more interim reports, as the Commission determines to be appropriate, relating to any matters described in paragraph (1).

(b) REPORT ON AERIAL WILDLAND FIREFIGHTING EQUIPMENT STRATEGY AND INVENTORY ASSESSMENT.—

(1) SUBMISSION OF INVENTORY TO THE COMMISSION.—Not later than 45 days after the date on which the Commission holds the first meeting of the Commission, the Secretary of Defense and the heads of other relevant Federal departments and agencies shall submit to the Commission an inventory of surplus cargo and passenger aircraft and excess common- use aircraft parts that may be used for wildland firefighting purposes, excluding any aircraft or aircraft parts that are—

(A) reasonably anticipated to be necessary for military operations, readiness, or fleet management in the future; or

(B) already obligated for purposes other than fighting wildland fires.

(2) SUBMISSION OF REPORT TO CONGRESS.—Not later than 90 days after the date on which the Commission receives the inventory described in paragraph (1), the Commission shall submit to the appropriate committees of Congress a report outlining a strategy to meet aerial firefighting equipment needs through 2030 in the most cost-effective manner, including—

(A) an assessment of the expected number of aircraft and aircraft parts needed to fight wildland fires through 2030;

(B) an assessment of existing authorities of the Secretary of Defense and the heads of other relevant Federal departments and agencies to provide or sell surplus aircraft or aircraft parts to Federal, State, or local authorities for wildland firefighting use, including—

(i) a description of the current use of each existing authority; and

(ii) a description of any additional authorities that are needed for the Secretary of Defense and the heads of other relevant Federal departments and agencies to provide or sell surplus aircraft or aircraft parts to Federal, State, or local authorities for wildland firefighting use; and

(C) recommendations to ensure the availability of aircraft and aircraft parts that the Commission expects will be necessary to fight wildland fires through 2030 in the most cost-effective manner.

(3) CONSIDERATIONS FOR ACCESSING AIRCRAFT AND AIRCRAFT PARTS.—

In developing the strategy in the report required under paragraph (2) and the recommendations under paragraph (2)(C), the Commission shall consider all private and public sector options for accessing necessary aircraft and aircraft parts, including procurement, contracting, retrofitting, and public-private partnerships.

(4) UNCLASSIFIED REPORT.—The inventory and report submitted under paragraphs (1) and (2), respectively—

(A) shall be unclassified; but

(B) may include a classified annex.

(c) **MAJORITY REQUIREMENT.—**Not less than 2/3 of the members of the Commission shall approve the recommendations contained in each report submitted under subsection (a) or (b) (2).

SEC. 70205. POWERS OF COMMISSION.

(a) **HEARINGS.—**The Commission may hold such hearings, sit and act at such times and places, take such testimony, and receive such evidence as the Commission considers advisable to carry out this title.

(b) **INFORMATION FROM FEDERAL AGENCIES.—**

(1) **IN GENERAL.—**The Commission may secure directly from a Federal department or agency such information as the Commission considers necessary to carry out this title.

(2) **FURNISHING INFORMATION.—**On request of the Chairpersons of the Commission, the head of the department or agency shall furnish the information to the Commission.

(c) **POSTAL SERVICES.—**The Commission may use the United States mails in the same manner and under the same conditions as other departments and agencies of the Federal Government.

(d) GIFTS.—The Commission may accept, use, and dispose of such gifts or donations of services or property as the Commission considers necessary to carry out this title.

SEC. 70206. COMMISSION PERSONNEL MATTERS.

(a) NO COMPENSATION.—A member of the Commission shall serve without compensation.

(b) TRAVEL EXPENSES.—A member of the Commission shall be allowed travel expenses, including per diem in lieu of subsistence, at rates authorized for employees of agencies under subchapter I of chapter 57 of title 5, United States Code, while away from their homes or regular places of business in the performance of services for the Commission.

(c) STAFF.—

(1) IN GENERAL.—The Chairpersons of the Commission may, without regard to the civil service laws (including regulations), appoint and terminate an executive director and such other additional personnel as may be necessary to enable the Commission to perform its duties, except that the employment of an executive director shall be subject to confirmation by the Commission.

(2) COMPENSATION.—The Chairpersons of the Commission may fix the compensation of the executive director and other personnel without regard to chapter 51 and subchapter III of chapter 53 of title 5, United States Code, relating to classification of positions and General Schedule pay rates, except that the rate of pay for the executive director and other personnel may not exceed the rate payable for level V of the Executive Schedule under section 5316 of that title.

(d) DETAIL OF GOVERNMENT EMPLOYEES.—A Federal Government employee may be detailed to the Commission without reimbursement, and such detail shall be without interruption or loss of civil service status or privilege.

(e) PROCUREMENT OF TEMPORARY AND INTERMITTENT SERVICES.—The Chairpersons of the Commission may procure temporary and intermittent services under section 3109(b) of title 5, United States Code, at rates for individuals that do not exceed the daily equivalent of the annual rate of basic pay prescribed for level V of the Executive Schedule under section 5316 of that title.

SEC. 70207. TERMINATION OF COMMISSION.

The Commission shall terminate on the date that is 180 days after the date on which the Commission has submitted the reports under subsections (a) and (b) of section 70204.

Appendix E: Recommendations List

Chapter 1: Creating the Foundation for Success	
Recommendation Number	Recommendation Text
1	Congress should establish a Community Wildfire Risk Reduction Program via an interagency coordinating partnership including the U.S. Forest Service, the Federal Emergency Management Agency, the United States Fire Administration, the Office of Wildland Fire on behalf of the Department of the Interior’s land management agencies, and the National Institute of Standards and Technology as principal agencies, to proactively address wildfire risk reduction actions and increase ignition resistance of the built environment.
2	Integrate wildfire risk reduction measures and technical assistance into existing programs.
3	Congress should explore, expand, and create incentives to encourage state, local, and Tribal governments to improve land use planning to reduce the risk of wildfires to homes and other community development.
4	Provide dedicated funding to evaluate, build and maintain existing federal, state, and local wildfire hazard data sets and identify a use case to refine and, if necessary, expand national datasets.
5	Require all-hazard risk disclosures for real estate transactions, including both sales of newly constructed homes and existing homes, involving all federally backed mortgages such as Fannie Mae and Freddie Mac.
6	Encourage and reward innovation in the fields of affordable building material design, subdivision design, landscape architecture, and safe and sustainable building practices to create more ignition-resistant structures and communities.

Recommendation Number	Recommendation Text
7	Congress should consider development of federal standards for electric utility wildland fire mitigation plans and should encourage the adoption of those plans by all transmission and distribution electric utilities.
8	Congress should direct agencies to support implementation of consistent rules and processes for federal rights-of-way and develop a guide for states to adopt similar rules and processes.
9	Continue federal investments in energy infrastructure systems at the generation, storage, transmission and distribution levels for reliability and resilience of the whole system.
10	Congress should advance legislation to support a compensation or claims fund for burn damages to third parties that can quickly provide financial relief in instances when burn practitioners adhere to identified best practices.
11	Congress should consider and clarify the extent to which the Federal Tort Claims Act provides protection to Tribes and non-federal cooperators burning on federal lands.
12	Federal agencies should work with Tribes, states, and local partners to develop a strategic plan for the implementation of prescribed fire at a national scale.
13	Establish a prescribed fire target based on natural fire regimes as determined locally.
14	Congress should instruct the agencies to develop the necessary administrative systems to allow resource ordering for prescribed fire to be as seamless as it is for wildfire response.
15	Congress should require the Bureau of Indian Affairs to acknowledge that federally recognized Tribes may develop fire programs on Tribal trust lands under approved Tribal laws, regulations and policy, or other Tribal decision-making processes.
16	Congress should acknowledge Tribal cultural burning in federal law, ensure it is not confused with prescribed fire, and grant agencies the authority to coordinate with Tribes on the conduct of Tribal cultural burning on federally administered lands.
17	Invest in fuels reduction treatments.
18	Congress should support and expand the Collaborative Forest Landscape Restoration Program.
19	Congress should invest in wood processing facilities and the wood utilization sector more generally.

Recommendation Number	Recommendation Text
20	Fund more research and pilot projects for biofuels and biomass utilization technologies and opportunities through a new collaboration between the Forest Service Research & Development and the Department of Energy.
21	Incentivize the adoption of new technologies and processing systems to produce value added, and demand-driven innovative wood products.
22	Manage fine fuels and shrubs through the expanded use of flexible, targeted grazing when it aligns with wildfire impact reduction objectives and desired environmental conditions and landscape goals in a specific ecological system.
23	Federal agencies should expand the use of existing authorities and develop new, nimble ways to apply targeted, off-season grazing to treat invasive annual grasses on landscapes to reduce the role these invasives play in the uncharacteristic frequency and severity of wildfire, thus helping to restore ecosystem function.
24	Increase the flexibility of federal funds to move across boundaries.
25	Congress should allow for a certain percentage of hazardous fuels funding above agency base levels to be used across ownership boundaries – including through voluntary engagement of private landowners – based on demonstrated needs for integrated project implementation to address risks.
26	Expand Good Neighbor Authority to more federal entities, including the U.S. Fish & Wildlife Service and National Park Service.
27	Increase resources for programs to help private landowners dispose of woody biomass.
28	Congress should reinforce federal agency requirements for coordination with Tribes when engaging in land management planning.
29	Congress should ensure that federal agencies have the directive, capacity, and authority to enter into equitable and meaningful co-stewardship and co-management agreements for multi-jurisdictional lands, and to support Tribal self-governance in order to address wildfire risk reduction, management, and recovery, and to enable beneficial fire practices.
30	Congress should provide the U.S. Department of Agriculture stand-alone authorities to enter into co-management agreements with Tribes that would allow the Forest Service to share, defer or transfer decision-making authority with or to a Tribe or Tribes for management of Forest Service programs or activities.

Recommendation Number	Recommendation Text
31	Congress should make permanent the Indian Trust Asset Management Demonstration Project by eliminating the 10-year sunset, allowing continued participation in the Indian Trust Asset Reform Act.
32	Expand funding and staffing for planning and Interdisciplinary Teams of federal land management agencies.
33	Explore mechanisms to make planning more effective and efficient, such as improved information gathering, training, staffing, collaboration, and programmatic analyses for restoration and hazardous fuels reduction activities.

Chapter 2: Protecting Public Health

Recommendation Number	Recommendation Text
34	Expedite funding to support water utilities in both immediate and long-term wildland fire recovery to maintain water delivery to consumers.
35	Authorize and incentivize flood mitigation, water quality, and source water protection projects in existing wildfire mitigation and wildfire recovery programs to protect community water supplies.
36	Increase funding and technical assistance to state, local, Tribal and territorial public health agencies and water provider partners to increase local capacity for wildfire preparedness and resilience planning.
37	Equip state, local, Tribal and territorial public health agencies and water provider partners to provide resources and support to residents to ensure access to safe drinking water after wildfire.
38	Support identification of public health risks associated with exposure to wildfire-contaminated water and development of evidence-based water use recommendations.
39	Congress should provide funding for federal public health agencies to address the impacts of wildland fire and should authorize and fund cooperative programs between federal public health, emergency, and land management agencies to better align programs and goals.
40	Provide resources to state, local, and Tribal public health authorities to work with wildland fire agencies, the public, and healthcare providers to promote wildland fire and smoke readiness, mitigate risks, and reduce level of potential impact per event.

Recommendation Number	Recommendation Text
41	While enabling proactive use of beneficial fire, Congress should increase the capacity of federal agencies, including Environmental Protection Agency, Health and Human Services, the U.S. Department of Agriculture, and Department of the Interior to work with state, local and Tribal governments to ensure that air quality, public health, and land management programs work toward minimizing impacts of smoke to human health and to ensure communities and individuals are better prepared for anticipated smoke from all forms of wildland fire.
42	Direct the Environmental Protection Agency, the Department of the Interior, and the U.S. Department of Agriculture to work together to expeditiously evaluate current federal regulations and guidance around the treatment of smoke from wildland fire in air quality management programs with the intent of ensuring the programs can accommodate increased use of beneficial fire. Such an evaluation includes the exceptional events pathway and making any necessary changes to enhance programmatic and procedural ease and clarity while ensuring protection of public health, in a manner consistent with the Clean Air Act. Further, Congress should provide resources to ensure federal, state, and local authorities can expand their capacity to document and exclude wildfire and beneficial fire smoke from regulatory significance.
43	Invest in existing and new community and individual preparedness efforts, infrastructure development, public communication and engagement opportunities, and mitigation programs at the federal, state, local, Tribal, and territorial level to reduce smoke impacts to human health.
44	Invest in a nationally consistent smoke monitoring and alert system to provide consistent, real-time information and forecasts on air quality impacts from wildland fire.
45	Local entities should be empowered and supported federally to utilize the best available technology to develop a consistent method or methods for evacuation.
46	Congress should direct that a national standard of evacuation terminology and product type per the Federal Emergency Management Agency’s Common Alerting Protocol be established and utilized for fire purposes. This product should include the use of “Ready, Set, Go!” terminology and be supported with national communications products.

Chapter 3: Responding to Fire

Recommendation Number	Recommendation Text
47	Congress should help advance efforts by the Alliance of Forest Fire Compacts, State Foresters, and others to update regional compacts to meet modern fire management needs and to submit the updated compacts for congressional approval.
48	Congress should enhance Tribal participation in fire management compacts with states and foreign nations.
49	Revise the Weeks Act to include Tribes in the management and restoration of fire on equal footing to states.
50	Changes are needed to allow for more rapid reimbursements to response entities to enable greater participation and increase the pool of potential response capacity.
51	In order to facilitate the prioritization of public safety in response resource ordering, Congress should establish a task force of relevant entities to review eligible costs for the purposes of expedited resource deployment and reimbursements processes.
52	Some locations offer positive examples of more effective resource mobilization and should serve as models for other areas.
53	Congress should direct a task force to explore the potential to improve the national resource ordering and status system and ensure that it is more accessible to qualified entities and individuals.
54	Increase access to qualifications and training opportunities for all partners.
55	Create and fund more training opportunities for the mitigation and management response workforce.
56	Congress should increase support for the U.S. Fire Administration to provide expanded community-based wildfire training and engagement of the nation's non-federal fire service; promote fire-adapted communities to build community resilience; and improve coordination with wildland fire management as a critical and necessary partner in wildfire risk reduction.
57	Congress and agencies should expand support for the further development and utilization of pre-fire response planning, such as the Potential Operational Delineations methodology, as a science-based, collaborative, and interdisciplinary framework for improving wildfire management and mitigation, integration of land management objectives with wildfire management objectives, and collaborative engagement.

Recommendation Number	Recommendation Text
58	Increase and foster local participation in collaborative pre-fire planning and management through pre-fire planning initiatives like the Potential Operational Delineations process.
59	Congress should examine whether Farm Service Agency and Natural Resources Conservation Service programs can be used to compensate producers for forage losses due to the use of beneficial fire to reduce the threat of catastrophic wildfire and make statutory changes if needed to support this use.

Chapter 4: Recovering for Resilience	
Recommendation Number	Recommendation Text
60	Create the organizational and financial structures necessary to better integrate the national response to wildland fires and post-wildfire impacts across agencies and scales.
61	Increase the deployment speed of mitigation and recovery funds.
62	Expand the support available through Fire Management Assistance Grants.
63	Expand Federal Emergency Management Agency Public Assistance-eligible activities to cover downstream risks caused by wildfire.
64	Enable multiple events stemming from the same cause to be treated as additive under federal wildfire and disaster recovery programs.
65	Expand the National Disaster Recovery Framework under Presidential Policy Directive 8 for the Recovery Support Function.
66	Authorize funding for integrated planning and management across all phases of fire management (including planning for post-fire impacts).
67	Provide funding to local entities (e.g., community-based organizations, collaboratives, public utilities, watershed coalitions, fire departments and districts, Tribes, and local government) to proactively complete assessments of values at risk susceptible to post-fire impacts.
68	Increase funding and technical assistance to state, local, Tribal, and territorial partners to manage post-fire recovery and incentivize the development of state and local post-fire recovery capacity.
69	Congress should request a comprehensive study on the relationship between financial protection solutions available through the private market and federal disaster recovery to support federal efforts to modernize federal post-disaster recovery benefits that ensure resources are complementary rather than conflicting.

Recommendation Number	Recommendation Text
70	Amend the Stafford Act to allow section 1206 funding for code enforcement for up to 24 months rather than the current 180 days.
71	Establish a new grant program to fund local, state, Tribal, and territorial entities to build disaster sheltering, expand housing capacity, undertake pre-event planning, and support community readiness.
72	Enable more flexible use of existing disaster grant funding and expansion of agency authorities in order to increase local, state, Tribal and territorial capacity to design and implement post-disaster and permanent housing solutions.
73	Establish a separate category of federal assistance with enhanced flexibilities for sheltering.
74	Utilize existing sources of mitigation funding to reduce future loss to housing resources and build community resiliency post-fire.
75	Authorize and fund the interdisciplinary, cross-jurisdictional assessment of burned areas.
76	Establish dedicated funding for the Natural Resources Conservation Service Emergency Watershed Protection Program.
77	Increase authorizations and appropriations for watershed rehabilitation programs post-wildfire.
78	Develop the seed capacity necessary to support post-fire restoration and revegetation in a manner considerate of historic and future disturbance regimes, biodiversity, and ecosystem process and function.
79	Direct agencies to review existing programs for statutory and administrative barriers that prevent distribution of funds to local jurisdictions to mitigate impacts from higher flows as a result of wildfire and amend statutes as necessary.
80	Authorize and fund the maintenance, deployment and monitoring of a national cache of rapid-deployment rain gauges, stream gauges and weather stations.
81	Encourage the Department of Homeland Security to work with the Federal Emergency Management Agency to expand existing Categorical Exclusion N12 to include activities associated with post-wildfire soil stabilization and erosion control measures and/or work with FEMA to create a new categorical exclusion that addresses post-wildfire soil stabilization and erosion control measures.

Recommendation Number	Recommendation Text
82	In developing and executing post-fire landscape recovery policies, authorities, oversight, and funding, Congress should support the collaborative development and use of landscape-scale post-fire assessments and recovery plans that are based on the best available ecological and climate science to identify and prioritize restoration projects.
83	Support emerging best practices and agency actions to improve planning, response, and collaboration in the post-fire period.

Chapter 5: Building a Comprehensive Workforce

Recommendation Number	Recommendation Text
84	Increase wages and benefits for the federal wildland fire workforce.
85	Create efficient hiring pathways which support development of a larger, more diverse, and inclusive workforce.
86	Address “break in service” rules and retirement benefit portability.
87	Authorize the Secretary of the Interior to develop a Wildland Fire Management Casualty Assistance Program in order to provide assistance to next-of-kin of critically injured, ill or deceased firefighters or support personnel injured or killed in the line of duty; to include emergency family member travel, benefits counseling, and casualty assistance and notification training.
88	Congress should provide funding and authorization for expanded recruitment strategies.
89	Invest in the creation of a workforce primarily focused on restoration and mitigation.
90	Improve the contracts, grants and agreements process and expand investments in the non-federal workforce.
91	Federal agencies should build on the successful model of Rangeland Fire Protection Associations and provide more federal surplus equipment to RFPAs and other volunteer fire response entities.
92	Tribes should be supported to expand mitigation, response, and restoration workforces.
93	Congress should support implementation of a Reservist Program to increase both planning and implementation capacity for increasing the pace and scale of planning for and applying wildland fire.
94	Authorize emergency medical care providers to operate on all hazard responses, including wildland fires.

Recommendation Number	Recommendation Text
95	Create and fund more training opportunities for the mitigation and management workforce.
96	Ensure that fire mitigation and management personnel are trained in and respectful of Tribal sovereignty and cultural practices.
97	Invest in a comprehensive approach that addresses mental and physical health.
98	Invest in existing and new research and development to improve, and mitigate adverse physical, mental, psychological, and emotional impacts to firefighter health and safety when operating in both the built and natural environment.
99	Evaluate and expand the definition of “firefighter” as it applies to presumptive coverage.
100	Invest in the completion of a human health risk assessment for worker exposure to wildland fire smoke and smoke from wildfires in the built environment to estimate the nature and probability of adverse health effects in humans who may be exposed to hazards from smoke with the intent of creating best management practices to mitigate the extent and duration of exposure.
101	Expand and improve Office of Workers’ Compensation Programs processes.
102	Authorize and fund the provision of housing or a housing stipend for wildland fire mitigation and management personnel.
103	Enable the federal government to transfer appropriate lands and facilities to Tribes for development of workforce housing.

Chapter 6: Integrating Modern Science and Technology

Recommendation Number	Recommendation Text
104	Congress should establish an interagency joint office with dedicated and separate funding to fulfill the mission of comprehensive assessment and prediction of fire in the wildland and built environment interface through data aggregation and science-based decision support services.
105	The fire environment center should provide real-time, science-based, and data-rich scientific and technical analytic services, decision support, and predictive services to inform land and fuels management, community risk reduction, and fire management and response.

Recommendation Number	Recommendation Text
106	The fire environment center should be tasked with the development of a technological common operating environment for practitioners across the spectrum of risk mitigation, prescribed fire, response, and post-disaster response. This environment should shepherd the creation of highly dynamic artificial intelligence decision support tools.
107	Land management, wildland fire, and built environment data should be managed through a decentralized, integrated data and modeling collaboration environment.
108	Support data procurement and analytic systems that enable intelligence-informed decision-making to inform building codes and standards, and promote ignition-resistant construction and defensible space.
109	Invest in existing and new data collection, data availability, advanced technologies, and research to support use of beneficial fire while protecting human health and documenting emissions levels.
110	Support the creation, chartering, or expansion of an existing venue to serve as a federal coordinating body for wildfire science that includes all relevant parties.
111	Increase and provide multi-year funding for existing research entities and programs to improve the identification of research needs and the dissemination of recent work.
112	Improve incentivization of partnership with private sector researchers and foundations for the development of new science and technology.
113	Congress should provide funding to support Innovative Landscapes research areas that link scientists with land and fire managers to assess fire risk, plan fuels treatment, monitor before and after treatment and evaluate change in fire risk using the latest fire models, best data, and new and proven technology.
114	Expand support for the development and application of scientific research into, and monitoring of, post-fire ecological recovery and compounding disturbances, especially for wildfires featuring large high-severity patches where ecosystem type conversion is likely in absence of management interventions.
115	Congress should consider the Forest Service Culture and Heritage Cooperation Authority as a baseline for expanded Tribal data sovereignty and Freedom of Information Act exemptions for Indigenous Knowledge.
116	Improve the research-to-operation pathway through the development of a fire science and technology advisory board to help coordinate existing research-to-operations efforts and research and development programs.

Recommendation Number	Recommendation Text
117	Procurement and contracting should allow for more flexible partnerships with private industry and non-governmental partners.
118	The Commission found that numerous new and existing technologies could improve the mitigation and management of wildfire if adopted by the relevant entities.
119	Upon the request of Tribes, entities gathering data and providing dispatch information regarding fire ignitions should have the authority to enter into agreements with such Tribes to protect the privacy and confidentiality of ceremonial and other fire use.

Chapter 7: Investing for Tomorrow

Recommendation Number	Recommendation Text
120	Congress should provide advanced appropriations for wildland fire mitigation and management on a multi-year, rather than annual, cycle.
121	Make permanent the Wildfire Suppression Operations Reserve Fund.
122	Congress should authorize U.S. Department of Agriculture and the Department of the Interior, within their respective Wildland Fire Management appropriations, to fund pre- and post-fire project work using the current “fire response” sub-activities in each department.
123	Congress should fund budget offices to create “crosscuts” to better track all federal wildfire spending.
124	Congress should ensure balanced, robust funding for pre-fire mitigation and post-fire restoration is included as part of the wildland fire budget.
125	Congress should comprehensively fund a wildfire management workforce comparable to total compensation provided to other national security personnel.
126	Congress should authorize and appropriate funds to support new and existing partnership programs to reduce wildfire threats, support landscape-scale, multi-jurisdictional mitigation, and post-fire recovery efforts on all lands impacted by wildfire.
127	Congress should provide direct funding to Tribes for capacity for consultation, coordination, co-stewardship, and co-management, and should establish flexible, reliable, and regenerative funding mechanisms and processes.

Recommendation Number	Recommendation Text
128	To ensure Tribes have adequate base funding and staffing to accomplish management goals on Tribal lands, Congress should consider the results of the Indian Forest Management Assessment and National Congress of American Indians Resolutions when creating new laws, regulations, or other authorities.
129	Congress should ensure the U.S. Fire Administration and the Federal Emergency Management Agency have the resources necessary to support efforts to reduce wildfire risks to communities and the threat of urban conflagrations related to wildfire and provide post wildfire mitigation and recovery in communities.
130	While funding levels in the Inflation Reduction Act and the Infrastructure Investment and Jobs Act are historic contributions to wildfire risk reduction, investments at a similar and sustained scale in federal land management agencies and programs are needed to successfully and proactively reduce growing wildfire risk.
131	Congress should ensure that mission-critical support agencies, such as the U.S. Geological Survey, National Oceanic and Atmospheric Administration, and Environmental Protection Agency have the necessary resources to support wildfire risk reduction, recovery, and response efforts.
132	Congress should ensure that agencies have sustained funding to maintain wildfire risk and resilience improvements.
133	Foster the use of conservation finance agreements on federal land.
134	Congress should incentivize state, local, and Tribal government development of dedicated revenue streams to support wildfire mitigation and management. The Commission encourages more states and localities to provide approval of such local revenue streams to bring more dedicated resources into play in reducing the risk of wildfire.

Chapter 8: Frameworks for the Future

Recommendation Number	Recommendation Text
135	Adopt the vision and goals of the Cohesive Strategy as the national framework for wildfire mitigation and management.
136	The Wildland Fire Leadership Council should be considered custodian of the Cohesive Strategy, responsible for its evaluation and revision.

Recommendation Number	Recommendation Text
137	Support development of a strategic communications plan that advances implementation of actions under all three goals of the Cohesive Strategy.
138	Legislation to mitigate the impact of wildfires through the use of science, data, and technology should be collaboratively developed by congressional committees with responsibility across science and natural resources, when appropriate and feasible.
139	Provide financial and technical assistance to support existing and emerging wildfire resilience collaboratives that currently lack adequate capacity to effectively participate in planning, implementation, and monitoring.
140	When authorizing and funding programs related to wildfire, Congress should directly recognize the historic role and continued importance of Indigenous stewardship related to fire.
141	Congress should identify an appropriate venue for continued work towards Tribal self-governance, self-determination and federal co-stewardship and co-management with Tribes.
142	Increase accessibility of federal grants for community wildfire risk reduction and post-fire recovery efforts.
143	Congress should expand equitable access to funds, including by providing agencies the authority to reduce or waive match requirements when needed.
144	Ensure alternatives to reimbursable funding mechanisms are available and accessible.
145	Ensure funding prioritization includes socioeconomic demographics for populations disproportionately impacted by wildfire who reside in high hazard areas.
146	Broaden the definition of “Small Impoverished Community.”
147	Change the system of land management agency performance metrics beyond acres treated, timber volume output, or acres burned to measure success. Success should be measured by outcomes such as the number of protected assets, values, and resources, and the degree to which forests and rangeland are returned to and maintained in a more resilient state.
148	Develop a periodic quantitative review of the comprehensive wildfire environment to assist adaptive management.



Prescribed fire in Yosemite National Park, 2021.
National Park Service