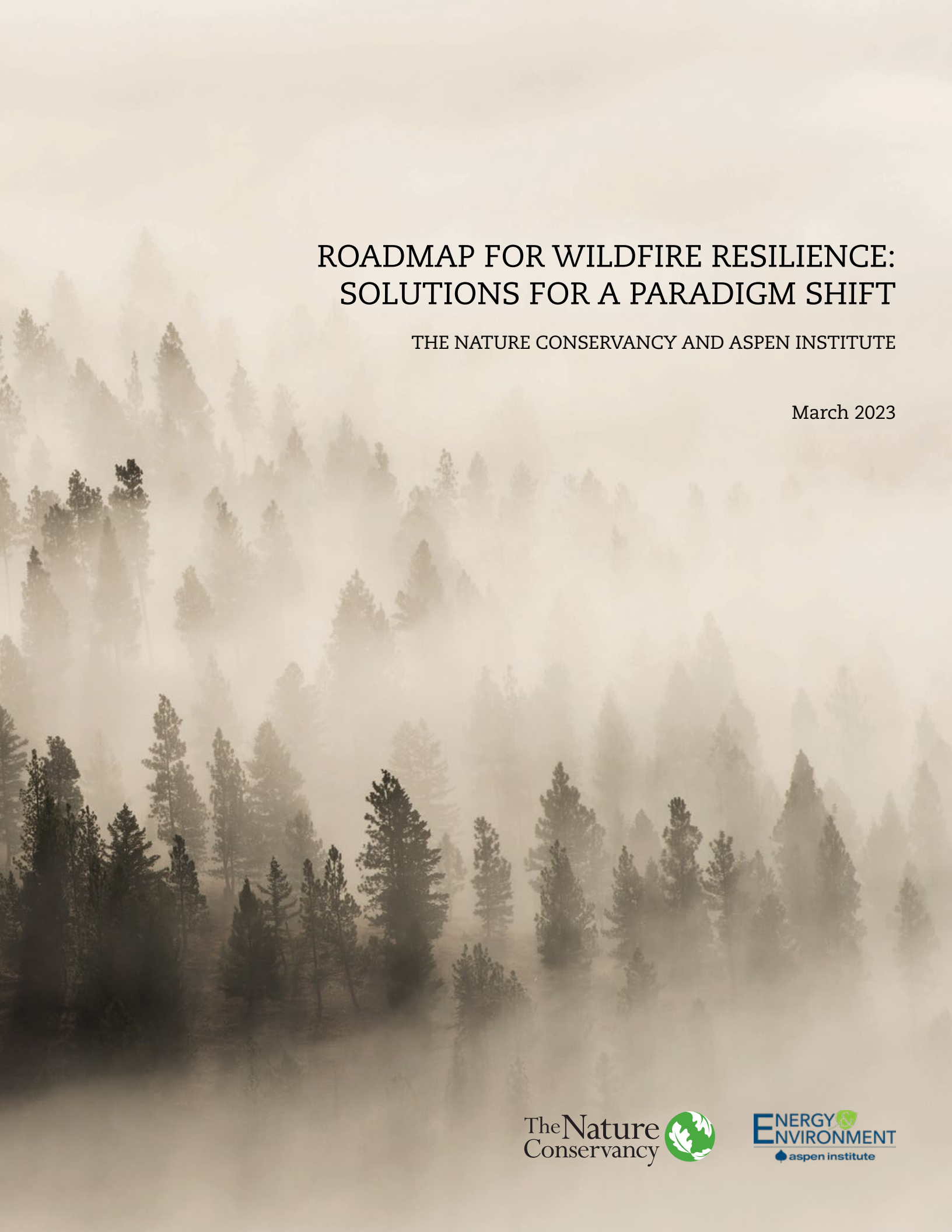

# ROADMAP FOR WILDFIRE RESILIENCE: SOLUTIONS FOR A PARADIGM SHIFT

THE NATURE CONSERVANCY AND ASPEN INSTITUTE

March 2023

The Nature Conservancy

Energy & Environment
aspen institute

*Wildfire Resilience Summit, September 2022, photo taken at Grand Tetons National Park, Jackson, WY © Maria Ortiz Perez*

The Aspen Institute and The Nature Conservancy teams would like to dedicate this Roadmap to the memory of Melanie Diaz. Her dedication contributed significantly to the work that resulted in this report. The tragic loss of someone so young with so much passion is felt by us all. We encourage you to live by Melanie's example and her motto,

***"Be fearless in the pursuit of what sets your soul on fire."***

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This *Roadmap for Wildfire Resilience* would not be made possible without the input of many partners. We appreciate the thoughtful expertise and time they gave to inform this multi-faceted set of policy recommendations.

The Aspen Institute and The Nature Conservancy thank Bob and Soledad Hurst, as trustees of the Hurst Family Foundation, and Melony and Adam Lewis, as trustees of The AdamMel Fund, for their generosity in supporting this report and the broader wildfire resilience goals of the partnership.

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*Cover: The Nature Conservancy's Great Western Checkerboards Project area, Crown of the Continent, MT © Steven Gnam*
*Above: 2021 Dixie Fire, Butte Meadows, CA © Stuart Palley*

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*Post 2020 East Troublesome Fire, in and around Rocky Mountains National Park, Grand County, CO, May 20, 2021*
*© Jason Houston*

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- Workforce capacity
- Tribal Nation partnerships & ecological knowledge
- Community capacity & collaboration
- Natural climate solutions
- Communications

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# Executive Summary

Wildfires are increasing in frequency and intensity in part because of changing climate conditions and decades of fire suppression. Though fire is a natural ecological process in many forest ecosystems, extreme wildfires now pose a growing threat to the nation's natural resources and communities. These trends will continue to worsen absent bold and transformative policy action to change the trajectory of how we manage and prepare for wildfire impacts.

Recent legislation infused historic levels of funding into federal agencies aimed at addressing this urgent need and offers a transformational opportunity to rethink the country's approach to wildfire. The Nature Conservancy and the Aspen Institute have spent the last year responding to this opportunity by hosting a series of workshops that sought input from all levels of government, Tribal Nations, the private sector, fire-prone communities, philanthropists, academics and other stakeholders, culminating in a *Roadmap for Wildfire Resilience*. The Roadmap concentrates on the two pillars of the 2014 National Cohesive Wildland Fire Management Strategy—resilient landscapes and fire-adapted communities—that require an investment commensurate with the third pillar—safe and effective wildfire response—to alter the current wildfire trajectory.

This Roadmap weaves together lessons from decades of policy and practice with forward-thinking approaches that incorporate new technology and knowledge. The eight themes are controlled burning; landscape-scale and outcome driven; resilient communities and landscapes; forest products; partnerships, finance, and insurance; equity and access; post-fire recovery; and technology. Within each theme, there are a series of problem statements and associated policy solutions requiring action from Congress, the executive branch or partners. The Roadmap also integrates the five cross-cutting themes of workforce capacity; Tribal Nation partnerships; community capacity; natural climate solutions; and communications, highlighting the importance of multi-scalar social, economic and ecological strategies.

Critically, the Roadmap makes clear that a paradigm shift requires the need for an all-of-society approach in close coordination with state and local governments, Tribal Nations and partners, in addition to durable and predictable funding at or above current levels. While some problems and solutions may be addressed individually and in the shorter-term, most are intimately connected and require long-term, strategic and cross-sector coordination.

The Nature Conservancy and the Aspen Institute invite decision makers, advocates and other interested readers to use this Roadmap to advance a more strategic and coordinated approach to wildfire resilience in ways that contribute to addressing climate change, promoting ecosystem health, advancing economic recovery and supporting historically underserved and excluded communities.

# Introduction

In August 2021, The Nature Conservancy and the Aspen Institute launched a new partnership to improve resilience to and mitigate the risk of catastrophic wildfires in the United States. In a series of regional workshops,[1] leading policymakers and partners identified barriers and surfaced solutions to inform the creation of a policy document in response to the wildfire crisis in the United States and to enable a better future with fire.

In 2021, there continued to be a surge in catastrophic wildfire events which exhausted resources at the height of wildfire season, destroying communities and claiming lives during winter when threats were once considered negligible. These uncharacteristic wildfire events have become more frequent and severe, resulting from more than a century of fuel build-up, growing populations moving into and expanding the wildland-urban interface (WUI) and a lack of funding streams to support wildfire resilience. Meanwhile, climate change is exacerbating how wildfires behave. Unfortunately, 2021 was hardly an anomaly and represents a far more troubling and long-standing trend. During the past two decades, wildfires have become larger, longer lasting, more frequent and more destructive in terms of lives lost and economic costs.[2] A 2017 report by the National Institute of Standards and Technology (NIST) concluded that the annual economic burden of wildfires was between $71 and $348 billion, including local, state and federal suppression costs.[3] The prevalence of wildfire smoke has also increased substantially since the mid-2000s, and wildfires now account for approximately 25 percent of Americans' total exposure to harmful fine particulate matter—further intensifying the impact and footprint of wildfires, directly and indirectly.[4] These trends are projected to increase under future climate scenarios with the annual area burned in the western United States forecasted to increase two to six times from current levels, depending on the geographic area, ecosystem and local climate.[5]

## Controlled Burning

Controlled burning, in the context of this Roadmap, refers to the intentional use of fire for management purposes. The term is used to include both prescribed fire planning and management actions by federal, state, Tribal Nations, local and private land managers, as well as Indigenous cultural burning, a form of place-based burning practiced by Indigenous Peoples and Tribal Nations that promotes ecosystem health and cultural resilience.[6]

From 2021 to 2022, Congress passed a series of once-in-a-generation investments through the Infrastructure Investment and Jobs Act (IIJA)[7] and the Inflation Reduction Act (IRA). Together, these acts comprise an impressive down payment on identified preventative measures and targeted recovery actions[8] addressing the mounting crisis. For the first-time, programs to reduce risk and build resilience are being funded at levels that begin to approach the scale and scope of the challenges at hand. This surge in spending holds great promise for transformational change and rebalances expenditures to more closely meet wildfire resilience investment needs in the United States.[9] It offers an opportunity to bring new strategic focus, innovation, coordination, inclusion and accountability to the programs, agencies and partners supporting wildfire resilience, while maximizing co-benefits for wildlife habitat, water and infrastructure security and economic opportunity. However, new funding alone is insufficient to advance transformational change.

The American public is increasingly aware of these escalating risks and widely supportive of large-scale investments to address longstanding problems (See infographic on following page).

The need has never been greater for community-based wildfire resilience action and proactive landscape management, including the use of beneficial controlled burning or managed fire to reduce fuel loads in ecosystems that need fire but were deprived of it for more than a century of unrealistic and counter-productive fire-suppression policies. Proactive, science-based wildfire resilience efforts, including forest restoration and fuels reduction efforts, are principle among the needed landscape scale projects.

Participants in The Nature Conservancy and Aspen Institute dialogues communicated a desire to respond to this unique moment with a paradigm shift. Participants called for efforts to strengthen an all-of-government, all-of-society, transdisciplinary and climate-informed approach to fully integrate Indigenous leadership and sovereignty; better equip and mobilize the private sector, traditional, and nontraditional partners; and overcome longstanding barriers and inequities preventing effective access to

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# BUILDING HEALTHY AND FIRE-RESILIENT FORESTS

A majority of Americans believe we should do more to restore forests, protecting human and ecological communities from wildfire.

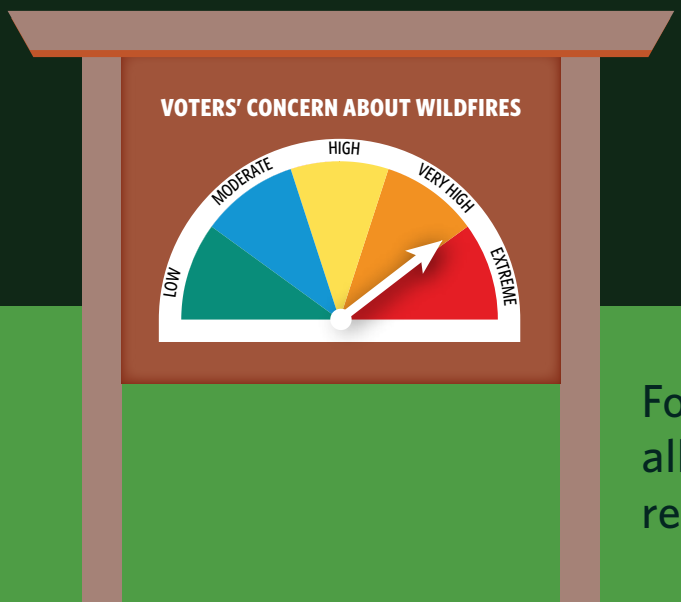
## STRONG BIPARTISAN SUPPORT

4 in 5 voters support increased federal investment to proactively reduce the threat and intensity of wildfires


REPUBLICAN


DEMOCRAT


INDEPENDENT




## SPREADING CONCERN

Wildfires and droughts are **top-tier concerns for American voters,** just behind inflation, housing, and government waste.

Voters' concern about wildfires **increased by 18%** from 2018 to 2022.

**39% of voters nationwide** know someone who has been impacted personally by wildfires or wildfire smoke.

Four out of five voters see everyone — across all of society — as bearing responsibility for reducing the risk of severe wildfire.

resources and assistance. Participants also emphasized the critical need to sustain durable and predictable funding beyond the IIJA and IRA (see Appendix A for more details on the workshops).

The Nature Conservancy and Aspen Institute have distilled and articulated the elements of this vision into the Roadmap for Wildfire Resilience: Solutions for a Paradigm Shift. The Roadmap was issued in draft form in advance of a September 2022 Wildfire Resilience Summit, which sought to further develop policy solutions in the Roadmap by convening a cross-section of partners and federal agency officials and catalyzing their partnerships for collective action. The Roadmap was then revised based on the resulting Summit input and additional partner feedback. Now in its final form, the Roadmap is meant to guide policymakers and support future coalition, advocacy and policy actions among interested parties.

**The Roadmap establishes eight policy themes or objectives that together form a framework of recommendations for implementing a comprehensive policy approach:**

| | |
|---|---|
|  | **THEME 1: Landscape Scale and Outcome-Driven.** Strengthen capacity, funding and coordination to complete wildfire resilience projects that are landscape scale and outcome-driven among federal, Tribal Nation, state, non-governmental organizations (NGOs) and local and private partners. |
|  | **THEME 2: Controlled Burning.** Scale the use of prescribed fire and cultural burning as an essential component of fuels management projects and deploy more intentional use of fire as a necessary and ongoing component of fuels project maintenance and ecosystem restoration strategies. |
|  | **THEME 3: Resilient Communities and Landscapes.** Enhance support for community mitigation and adaptation of wildfire and smoke and integrate investments in community and landscape resilience. |
|  | **THEME 4: Forest Products.** Reduce barriers and incentivize innovation and investment in hazardous fuels byproduct use and related forest products and forest product processing infrastructure. |
|  | **THEME 5: Partnerships, Finance and Insurance.** Expand the use of public-private partnerships, conservation finance and innovative insurance mechanisms to support and scale wildfire resilience efforts. |
|  | **THEME 6: Equity and Access.** Ensure access to investments and meaningful involvement in decision-making for wildfire resilience among historically underserved and marginalized communities as well as communities affected by poverty and inequality. |
|  | **THEME 7: Recover for Resilience.** Reform delivery of post-fire management and recovery assistance necessary to ensure that landscapes and communities recover in ways that foster long-term resilience to severe fire risks. |
|  | **THEME 8: Technology and Innovation.** Expand the use of innovative, emerging technologies to support wildfire resilience through improving public and private sector coordination, data and systems interoperability, and investments in applied research and technology transfer among multisector partners to include federal, university and private sectors. |

*Controlled burn practitioner, 2021 Cascadia Fire Training Exchange (TREX), Roslyn, WA © John F. Marshall*

Nested within each theme are a set of problem statements and highlighted policy solutions. This framework provides the foundation for the development and refinement of shared problem definitions and opportunities to explore and cultivate responsive policy actions.

Workshop and Summit participants also touched repeatedly on many cross-cutting topics including workforce capacity, strengthening communications and messaging, honoring Tribal Nation leadership and sovereignty, supporting community capacity and collaboration, and fostering natural climate solutions. These issues have been incorporated into the policy recommendations and are illustrative of integration opportunities across the policy themes and solutions.

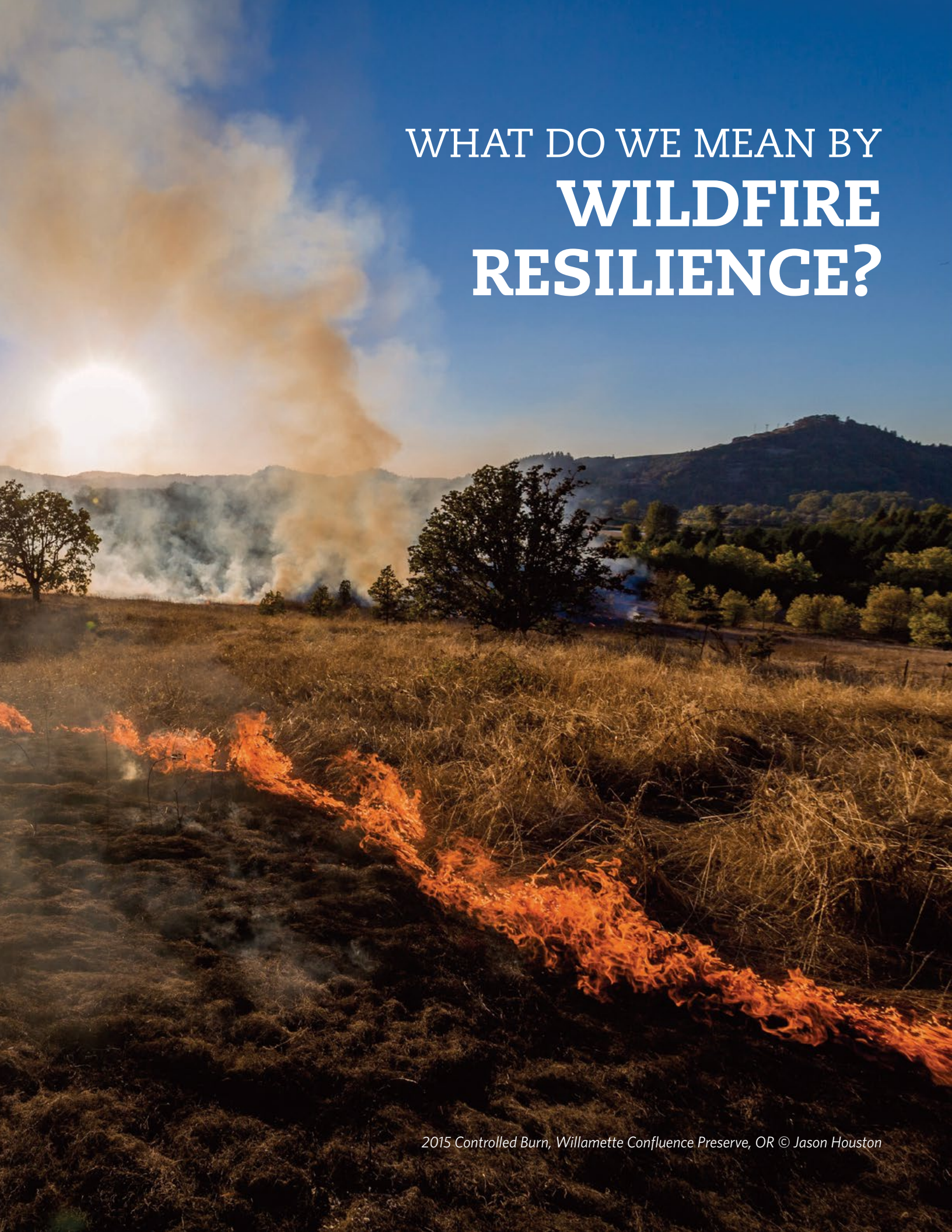
Wildfires know no boundaries, and no single entity is charged with response, prevention and recovery. In this complex, multi-jurisdictional policy environment, few silver-bullet solutions exist and often a portfolio approach can best respond to the challenges at hand. The Roadmap articulates a comprehensive set of policy solutions, establishing the architecture to better organize conversations among partners and policymakers. It also offers a starting point to consider the optimal approach and mix of policies required to advance desired wildfire resilience outcomes.

## Collaborative Effort

More than **250 individuals** involved in providing feedback and approximately **120 organizations** represented

Types of Partners:

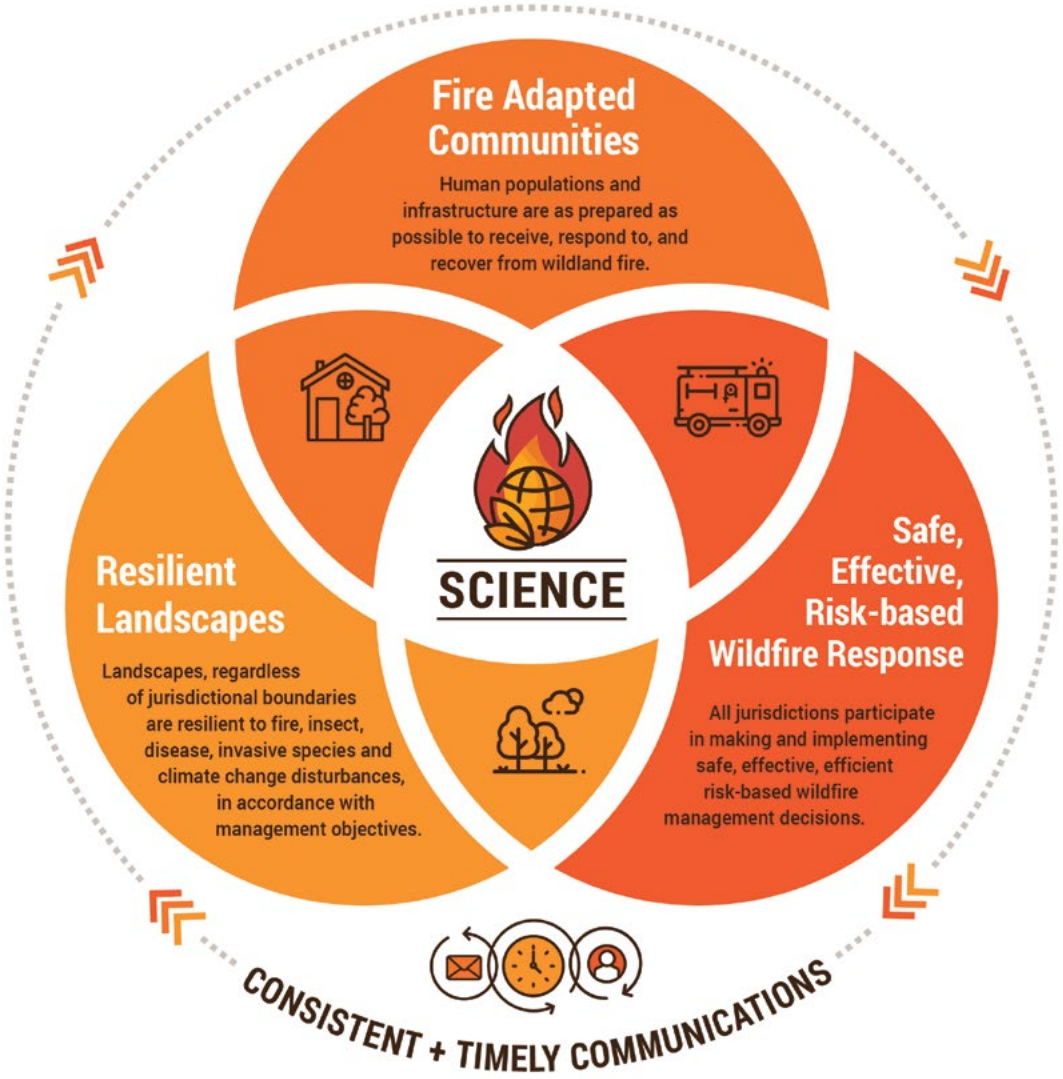
- Non-Governmental Organizations
- Community-Based Conservation and Environmental Organizations
- Recreation and Sportsmen Organizations
- Tribal and Indigenous-led Communities
- Timber and Recreation Industries
- Universities and Research Stations
- Utility, Insurance, Innovative Finance and Technology Industries
- Federal, State and Local Governments
- Subject Matter Expert Consultants



# WHAT DO WE MEAN BY **WILDFIRE RESILIENCE?**

*2015 Controlled Burn, Willamette Confluence Preserve, OR © Jason Houston*

This Roadmap adopts the terminology of wildfire resilience, in alignment with current understanding for other natural disasters, to reference a suite of actions taken to prepare for, recover from and reduce the risks and impacts of increasingly severe wildfire events. The 2014 National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) established three overarching goals aimed at fostering resilient landscapes, fire-adapted communities and a safe and effective wildfire response. The Cohesive Strategy established two pillars central to wildfire resilience: 1) restoring and maintaining landscapes—implying that landscapes are resilient to fire related disturbances in accordance with management objectives regardless of jurisdiction—and 2) supporting fire-adapted communities so that human populations and infrastructure can withstand a wildfire without loss of life and property. Wildfire resilience as used by this Roadmap focuses on actions taken before and after fires for these first two pillars.




*2014 National Cohesive Wildland Fire Management Strategy*

Decisions and actions related to the third pillar, safe and effective response, can have significant impacts on wildfire resilience. A particular example is the longstanding and sometimes controversial practice of managing wildfires for resource benefit when use of naturally ignited fires can achieve resource management goals and is deemed a safe and prudent response action. However, the Roadmap does not focus on the safe and effective response pillar of the Cohesive Strategy given that significant time and resources are already dedicated to this work. Instead, it endeavors to draw out lessons learned from wildfire suppression applicable to fostering resilient landscapes and fire-adapted communities, such as high degrees of coordination, urgent and effective action and investment at scale.

## Theme 1: Landscape Scale and Outcome-Driven.

**Strengthen capacity, funding and coordination to complete wildfire resilience projects that are landscape scale and outcome-driven among federal, Tribal Nation, state, NGOs and local and private partners.**

Landscape scale conditions and changes are setting up future fires to be more destructive and harder for people and natural systems to adapt to, especially as the climate changes. Responding to these trends requires prioritizing, planning and implementing fuels treatments to mitigate risks at large scales and across jurisdictional boundaries. Ecologically based treatments such as controlled burning, mastication, slashing and piling and mechanical forest thinning can create forest conditions that manage the risks, costs and benefits of wildfire while supporting land management goals. Similar considerations should be made for conditions on rangelands that include invasive species treatments; restoration of native shrubs, grasses and forbs; and appropriate consideration of targeted grazing practices.

For more than a decade, meaningful changes to programs and policy have begun to create the tools and coordination necessary to respond at landscape scales, ushering in a new era in collaborative forest and rangeland management. Groundbreaking programs such as the Collaborative Forest Landscape Restoration Program (CFLRP), the Joint Chiefs Landscape Restoration Partnership (Joint Chiefs), the Good Neighbor Authority (GNA) and initiatives like Shared Stewardship, when implemented in concert with collaborative approaches, have proven effective methods for successful coordination and prioritization. Notwithstanding this progress, federal, Tribal Nation, state, local and private partners continue to struggle to efficiently coordinate capacity and funding to achieve work at required scales and across ownerships, owed in large part to constrained resources, limited workforce capacities and a mix of outdated policies and procedures for planning and prioritization.[10] Too often, federal land management agencies and their partners default to projects focused on limited geographic footprints and restoration actions, where ease of implementation and ability to meet outdated, top-down performance targets, in combination with predictable funding and capacity, have long governed budget allocations, planning and progress.[11]

Limited funding has slowed progress toward landscape scale and outcome driven fuels and restoration projects. However, new funding alone is insufficient to advance transformational change. Theme 1 highlights the need for flexible and durable funding, adapting and building new workforce capacity, streamlining strategies to achieve lower cost and timelier implementation, transforming systems for assessing risks and co-benefits, allocating budgets, measuring results and coordinating and communicating shared progress. Implementing policy solutions under Theme 1 will strengthen a seamless and urgent all-of-government approach to restore and manage landscapes, reduce impacts and improve the safety of wildfire response actions and enable communities to better coexist with fire in their landscapes.

**1A: Funding for hazardous fuels treatments and related authorizations are often constrained to a particular land management agency's ownership footprint. The lack of predictable resources and inconsistent interpretation and application of grants and agreements serve as an impediment to the effective and efficient planning and implementation of fuels treatments on federal forests and across ownership boundaries.**

*CROSS-CUTTING ISSUES: Tribal Partnerships, Community Capacity*

**Policy Solutions:**

1. Congress should expand hazardous fuels authorizations allowing for a certain percentage of appropriations 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. Expanded authorizations could build upon the 2018 Farm Bill's amendment to section 103 of the Healthy Forests Restoration Act (16 U.S.C. § 6513), allowing the USDA Forest Service (Forest Service) to spend up to $20 million on grants to state foresters for hazardous fuel reduction projects that cross land ownership boundaries, which could additionally be made available to other partners including Tribal Nations and NGOs.

2. Federal agencies, particularly the Forest Service and Department of the Interior (DOI) bureaus, should explore budget allocation models that reward regional and local managers who plan for and implement fuels projects across ownership boundaries and who align federal funding programs. The agencies should also dedicate

*Shirts Lake, Boise National Forest, ID © Cecilia Clavet*

staffing and resources to analyze process improvements and recommend changes and efficiencies for planning, funding and implementing cross-boundary work.

3. Federal land management agencies should research new strategies to integrate forest and rangeland fuels reduction treatments at landscape scales. Some strategies to consider include proactively restoring degraded sites by seeding native species and controlling invasive annual species as well as examining how new technology–including unmanned aerial drones, remotely-sensed vegetation datasets, and virtual fencing–can increase the efficacy of targeted grazing practices. Agencies should also consider opportunities to plan and implement targeted grazing to support integrated approaches to drought and wildfire resilience while maintaining rangeland health.

4. Congress should establish a new cost-share authority, allowing for states, Tribal Nations and federal partners to use a certain percentage of appropriations to enter into cooperative cost-share agreements that allow for fuels projects to be implemented and funded in accordance with a cost-share formula based on a project's ownership profile and treatment types. Following treatments, the parties could then negotiate any deviation based on jurisdiction and outcomes. This model would allow for fuel treatments to adhere to the longstanding practice in wildfire suppression of effectively prepositioning resources to allow for rapid response and deployment. The model would also provide a process for after-action allowing for appropriate funding and allocation of costs. The authority could help mix and match funding resources across several budget line items and programs.

5. Federal land management agencies should develop policy to streamline grants and agreements and clarify opportunities to build efficiency for partners and cooperators by relying on programmatic agreements augmented by project-specific task orders.

6. The Natural Resources Conservation Service (NRCS) and federal land management agencies should establish clearer, more predictable and replicable processes for funding and enrolling private landowner participation in cross-boundary fuels treatments.

**1B: Workforce capacity, in terms of available workers and skill sets, is limited among agencies and partners, which constrains multi-disciplinary and collaborative actions to plan, implement and monitor wildfire resilience investments.**

*CROSS-CUTTING ISSUES: Workforce Capacity, Tribal Partnerships, Community Capacity*

**Policy Solutions:**

1. Drawing from experiences implementing the IIJA, federal land management agencies, state and Tribal Nation officials, the Department of Labor and the Office of Personnel Management (OPM) should collaborate to develop a new Wildfire Resilience Workforce Strategy. Such a strategy could identify near term solutions for training/retraining, pay increases, job classifications, performance and promotion, changes to relocation policies, shared hiring for efficiencies, providing affordable housing, and strategies to leverage underutilized federal hiring authorities. Additionally, the strategy should account for and consider the needs of temporary and seasonal workforces, including current and potential roles for migrant and incarcerated workers.

2. Federal land management agencies should explore pathways to leverage existing public service, climate and job corps programs and identify strategies to increase diversity, equity and inclusion in workforce recruitment as well as address barriers for women and other underrepresented groups. These agencies should establish longer term vocational programs, apprenticeships, higher-education partnerships and pathways for integrating technology into resilience actions.

**1C: The present surge in funding for hazardous fuels treatments through the IIJA and IRA lacks the long-term predictability required to support staffing and effective implementation and still falls short of identified needs.**

*CROSS-CUTTING ISSUES: Workforce Capacity, Tribal Partnerships*

**Policy Solutions:**

1. Reauthorize, modify and expand dedicated funding for hazardous fuels treatment and related activities authorized for the Departments of Interior and Agriculture in the IIJA and the Forestry Subtitle of the IRA. Congress should consider additional planning and accountability measures based on agency performance implementing the IIJA and IRA.

**1D: Planning, environmental analysis and decision-making practices can result in piecemeal and incomplete forest restoration treatments that fail to achieve large-scale, integrated ecological and resilience outcomes.**

*CROSS-CUTTING ISSUES: Workforce Capacity*

**Policy Solutions:**

1. Federal land management agencies, in consultation with states and Tribal Nations, should establish a list of priority large-landscape forest restoration projects for the purposes of improving collaborative engagement in project design and implementation, streamlining required environmental review and consultation processes under the National Environmental Policy Act (NEPA), improving accountability, and tracking effective and complete project implementation. Agencies should establish ambitious and achievable timelines for required analysis, consultation, decision making, project implementation and monitoring.

2. Federal land management agencies should develop new models for intergovernmental, interagency and interorganizational funding agreements; the deployment of strike teams and other strategies to create flexible capacity to support environmental analysis and decision making; and incentivize large-landscape planning, implementation and monitoring.

3. The Forest Service should develop a periodic progress report cataloging changes in business practices, guidance and policy taken to complete project decision making in a timelier manner; improve or eliminate inefficient processes and steps; reduce costs; and, where appropriate, increase the scale of analyses and the number of activities in a single analysis and decision as part of its forthcoming 10-Year Implementation Plan for the agency's Wildfire Crisis Strategy.

4. The Council on Environmental Quality (CEQ) should revise NEPA guidance to federal land management agencies to create a consistent approach for incorporating the latest climate science and forecasting to evaluate the range of threats to natural resources associated with no-action alternatives, including probable impacts from uncharacteristically severe wildfire, flooding, drought, invasive species, insects and disease.

**1E: Current annual performance measures create disincentives for strategic and coordinated deployment of resources.**

*CROSS-CUTTING ISSUES: Communications, Natural Climate Solutions*

**Policy Solutions:**

1. Federal land management agencies should develop a set of outcome-based performance measures that reflect values such as watershed restoration, habitat enhancement, community risk reduction, socio-economic impacts and community wellbeing, climate adaptation benefits, and others in a comprehensive scientific and evidence-based framework. These agencies should ensure that these metrics reflect the need for multiple, ongoing treatments–such as controlled burning–to achieve and maintain the intended outcomes and to remain dynamic in response to evolving climate conditions.

2. Agencies should ensure budget allocations reflect progress toward outcome measures over time and do not bias against annual performance—they should consider both short-term tactical measures, as well as longer-term strategic performance measures. They should also explore strategies to incentivize regions and local units to develop a portfolio approach that optimizes outcomes across goals, including community risk reduction, watershed restoration, industry recruitment and retention, and others.

3. Federal land management agencies should support collaborative efforts at multiple scales to establish decision support tools that help partners and managers prioritize the most strategic investments to reduce risks, optimize co-benefits and evaluate avoided costs (see 5B).

4. Federal land management agencies should build from state, regional and existing national efforts to develop an online dashboard to track a comprehensive suite of wildfire resilience partnerships and progress, allowing for more integrated performance measures and planning across jurisdictions. The dashboard would improve shared knowledge of current and past projects among partners and the public and could be modeled after the InciWeb system for wildfire response information. The Forest Service could lead the development of such an effort focused on implementation efforts across landownerships within priority firesheds.

5. The Forest Service, in coordination with partners, should develop a comprehensive communications framework to engage the public, and share messages regarding accomplishments and changing land management requirements under the agency's 10-Year Wildfire Crisis Strategy. This framework should allow for consistent and appropriately tailored messaging at national, regional, local forest, and unit scales, and should reflect insights from recent polling[12] and ongoing efforts to test and improve messaging.

# ROADMAP

*Controlled burning, 2013 TREX, northern CA © Lenya Quinn-Davidson*

# Theme 2: Controlled Burning.

**Scale the use of prescribed fire and cultural burning as an essential component of fuels management projects and deploy more intentional use of fire as a necessary and ongoing component of fuels project maintenance and ecosystem restoration strategies.**

In fire-adapted landscapes, controlled burning creates conditions that reduce the intensity of subsequent wildfires, while also limiting firefighter exposure and risk and enhancing the success of suppression strategies. Use of safe and appropriate controlled burning has proven to be one of the more effective and cost-efficient means of reducing the risks and impacts of severe wildfire events, restoring and maintaining ecosystem functions and wildlife habitat, and advancing silvicultural goals. Forest conditions across the West have experienced decades of intensive fire suppression and many western landscapes require prior treatments, for example hazardous fuels removals, before controlled burning can be introduced to the landscape. In many western conifer forest landscapes, a combination of treatments has achieved the most complete and enduring results.[13]

Annual controlled burning in the western U.S. has remained stable or decreased over the past two decades, with 70 percent of all prescribed fires nationwide taking place in the southeast. Topography, land-ownership patterns, differing legal and policy regimes, and cultural factors all contribute to this geographic variability in controlled burning. While limited capacity and funding were the most frequently cited barriers, air quality regulations, smoke impacts and risks to local communities, narrowing burn windows and liability concerns have been cited as obstacles to scaling prescribed fire in the West. Obscure incentives and unclear agency leadership have also been significant impediments to scaling burn practices.[14] A 2022 Forest Service Prescribed Fire Review affirmed these findings and identified changes to policy and practices to mitigate some of these barriers, including limiting the risks of escaped fires,[15] strengthening agency culture and increasing capacity.[16]

Theme 2 focuses on the need to better equip all resource managers and their partners with the trained workforces, funding, and equipment necessary to plan and successfully implement controlled burns. In this effort, coordination is crucial to effectively monitor and manage smoke to reduce its impacts, particularly among vulnerable communities. Risks should be managed through consistent and predictable liability frameworks for burn operators and private landowners, and funding is essential to manage the inherent risks associated with controlled burning. If implemented, the policy solutions in Theme 2 will more effectively utilize cooperative burn partners; leverage the capacity of state and Tribal Nations; ensure a more consistent, scalable and predictable program of work among all burn practitioners; better communicate and respond to the inherent risks of controlled burn operations; improve coordination among air quality officials; and enhance the use of Basic Smoke Management Practices as a means to address air quality impacts for vulnerable populations.

**2A: Federal, state and Tribal Nation resource managers lack dedicated planning, workforces, funding incentives and accountability measures for prescribed fire.**

*CROSS-CUTTING ISSUES: Workforce Capacity, Tribal Partnerships*

**Policy Solutions:**

1. The Forest Service should create a new State Prescribed Fire Assistance Program and a budget line item within the State and Private Forestry program designed to provide financial assistance to state foresters to increase their workforces, training processes, dedicated equipment resources, in support of their planning and implementation of prescribed fire programs (including managing certification programs for burn practitioners and supporting smoke management). This funding should also allow flexibility for states to work cooperatively with Tribal Nations; use NGOs and private contractors to fulfill core functions; and regrant or pass-through funds, as needed, to achieve fire management goals.

2. Congress should establish dedicated funding through 638 contracts or other avenues (i.e., through the DOI Office of Wildland Fire and the Bureau of Indian Affairs) for Tribal Nations to develop prescribed fire workforces and invest in the training and equipment necessary for planning and implementation.

3. The United States Department of Agriculture (USDA) and DOI should partner with Tribal Nations to create a policy strategy that integrates co-management authorities in fuels management on federal and nonfederal lands in a manner that supports Tribal sovereignty. This policy should defer to tribal constitutions and associated tribal laws and policies regarding matters of sovereign authority, including cultural burning, sustenance harvest management and resource use.

4. Congress should reauthorize, modify and expand dedicated funding for prescribed fire and related activities authorized for the Departments of Interior and Agriculture in the IIJA and IRA. Congress should also consider additional planning and accountability measures based on agency performance implementing the IIJA and IRA specific to prescribed fire outcomes.

5. Federal land management agencies should create a dedicated cross-organizational prescribed fire workforce, including year-round staffing associated with local landscapes and fuels crews or modules that can be mobilized and provide surge capacity for prescribed fire planning, unit preparation, implementation and monitoring at regional or national scales. They should create a new pay category for prescribed fire workforce that reflects risk and training requirements and reconsider deployments and other assignments, so that staff members are available during varying burn windows across the country.

6. Federal land management agencies should support existing models of prescribed fire training in the western U.S., i.e., Prescribed Fire Training Exchanges (TREX) and complement those with additional centers that facilitate training between federal and state agencies, Tribal Nations and external partners. Agencies should also support the establishment of an Indigenous-led training center that can support prescribed fire and cultural burning practitioners.

**2B: Liability issues limit the use of prescribed fire at scale. These liability concerns, insurance availability and contracting issues further limit the use of cooperative burn partners, particularly when operating on, adjacent to, or across federal lands.**

*CROSS-CUTTING ISSUES: Community Capacity*

**Policy Solutions:**

1. States should lead a collaborative effort to develop and advance model state legislation and policy for (gross) negligence standards, such as California SB926, limiting liability for certified and insured burners and reducing insurance requirements to protect burn practitioners from claims. States should further develop the partnerships and risk pools necessary to ensure private practitioners can access the insurance protections that they need to burn.

2. Congress should advance federal legislation to support a compensation fund/program for burn damages to third-parties that can quickly provide financial relief in instances where burn practitioners adhered to identified best practices. Such a fund could offer discretion to the Secretaries of Agriculture and the Interior to respond to unforeseen circumstances. Eligible damages could be capped, the fund could cover a share of first losses, and/or federal resources could be augmented by other state or private resources.

3. Federal land management agencies should streamline prescribed fire contracting for certified and insured cooperative burn partners operating on federal lands by developing model partner agreements, allowing multi-partner agreements, eliminating cost-share requirements and clarifying new pathways for assuming liability for cross-boundary work.

**2C: Federal land management agencies, states, Tribal Nations and the U.S. Environmental Protection Agency (EPA) lack a consistent set of analytical tools to compare the air quality impacts of fuels treatments and prescribed fires to the potential wildfire smoke emissions that might be associated with untreated landscapes. State and Tribal Nation officials also lack the capacity within their air quality management programs to support prescribed fire smoke management; advance the use of basic smoke management practices and monitor their efficacy; support local partners in their efforts to prepare for and respond to smoke impacts to vulnerable populations; reconcile differences between federal and state interpretation and implementation of air quality regulations including exceptional events demonstrations; or support community outreach and education on the benefits of managing smoke through prescribed fire as opposed to wildfire.**

*CROSS-CUTTING ISSUES: Community Capacity, Communications, Tribal Partnerships*

**Policy Solutions:**

1. Drawing from existing research, federal land management agencies, the EPA and research agencies such as the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) should develop analytical tools to model the air quality impacts of prescribed fire and other fuels management activities compared to wildfire, demonstrating the reduced or avoided emissions and frequency and severity of impacts. All of these data would help agencies to better communicate the benefits of prescribed fire and fuels management to the public and the role of fuels management in natural climate solutions.

2. The EPA should expand grants to states, Tribal Nations and local air pollution control agencies to support a more robust "smoke ready communities" program that assists more communities in planning for and mitigating smoke impacts from wildfire and prescribed fire and enhances state and local capacity to coordinate prescribed fire smoke management, notification systems and smoke mitigation programs. This funding should prioritize communication and outreach and investments in mitigation systems (e.g., public or in-home air filtration systems) targeted to vulnerable populations.

3. State and federal air quality agencies should explore barriers to and opportunities for advancing necessary research, technical assistance and policy solutions, including consideration for using the exceptional events rule for prescribed fire or alternatives.

4. Building from recent rulemaking efforts, the EPA should work closely with federal land management agencies, state air quality officials, state foresters and Tribal Nations to incentivize the use of prescribed fire, cultural burning and other fuels wildland fire management needs in regulatory actions. This should include clarifying the treatment of cultural burning for restoring and maintaining Tribal Nation ecological, social and cultural values as a natural emissions source. A programmatic and consistent approach would ensure that no single rulemaking creates unintended consequences for wildfire resilience.

## Theme 3: Resilient Communities and Landscapes.

**Enhance support for community mitigation and adaptation of wildfire and smoke and integrate investments in community and landscape resilience.**

Communities have a vital role in proactively preparing for fire and smoke to build wildfire resilience, in part because of their significant land and infrastructure assets. Communities manage lands critical to fire and fuels management in the WUI. They maintain and operate a diverse suite of infrastructure assets, including municipal water supply systems (e.g., surface watersheds and reservoirs), electric transmission and distribution lines, county roads and byways, and other assets, all of which are essential to community well-being before, during and after wildfire events. Communities can leverage their role as land and infrastructure managers to employ diverse wildfire mitigation and adaptation strategies, including using fire-resilient building materials, creating defensible space around homes and other structures, advancing smoke-ready strategies, planning for evacuations and driving more resilient land use planning.

### Paradise, CA

New research and after-action review of severe wildfire events such as California's 2020 Camp Fire in Paradise, CA demonstrate, communities must integrate investments in landscape and fire-adapted communities by deploying strategies targeting resilience for the built environment and strategies aimed at reducing fuels to lower risks and enhance suppression success rates. In Paradise, high winds dispersed embers almost four miles ahead of the fire front creating new fire starts within fuels and structures within the community. The resulting conflagration proved devastating as a direct hit from the fire front and multiple structure-driven fires impacted evacuation routes and destroyed over 18,000 structures, damaged hundreds more, and ultimately caused 85 fatalities.[19]

Review of the 2020 Camp Fire, in Paradise, CA, and similar events, has reinforced our understanding of fire spread, fire behavior, evacuation processes and structural responses in WUI fires and suggests that we must do more to integrate investments. Numerous federal programs provide resources to address community-identified priorities, including the Federal Emergency Management Agency's (FEMA) technical assistance and training offered through the U.S. Fire Administration, the Forest Service's investments through federal forest management and for supporting states, the DOI's bureaus and support for Tribal Nations through the Bureau of Indian Affairs and the EPA's grants for community resilience applicable to smoke. These programs, however, operate in relative isolation from one another and can struggle to integrate programs and research within their own purviews. Additionally, there is no catalogue of effective strategies with private sector entities, such as the Insurance Institute for Business and Home Safety which offers some of the most trusted technical guidelines. It is therefore unsurprising that communities struggle to access resources and to adopt and incentivize targeted resilience investments, including preparing for and mitigating smoke impacts, at various scales. To date, a limited number of states and local jurisdictions have adopted a WUI building code for wildfire resilience, and several others have limited programs establishing guidelines or funding programs. Where codes exist, enforcement of them remains a challenge.[17]

Theme 3 tackles these issues by seeking to better align technical and financial assistance across agencies and programs for communities, strengthen guidelines and research and improve program accessibility to support community-identified priorities. It explores strategies to align budgets, programs and incentives more effectively; break down silos between investments targeting wildfire-adapted communities and those aimed at restoring and maintaining landscapes; better support community smoke-ready planning and mitigation investments; and support land-use planning and open space strategies that align with community-led initiatives. If implemented, the policy solutions in Theme 3 will increase the understanding of wildfire risk–including how it is exacerbated by climate change–and of effective preparedness actions; streamline program access and delivery; and improve the strategic deployment and efficient spending of federal taxpayer expenditures.

*House in Wildland-Urban Interface, Santa Fe, NM © Cecilia Clavet*

**3A: Despite areas of progress, there remains a significant need to expand measures for home and infrastructure hardening, to increase defensible space and fuels treatments for many at-risk communities in the WUI and to clarify pathways to evaluate progress toward resilience goals.**

*CROSS-CUTTING ISSUES: Community Capacity, Communications*

**Policy Solutions:**

1. The President's budget should create a cross-cutting budget for wildfire resilience for all departments, agencies/bureaus and programs that supports investments, identifies lead and consultative roles, and highlights effective collaborations. This budget should increasingly rely upon trends and forecasts of progress based upon a shared set of outcome-based performance measures.

2. Federal land management agencies, FEMA and the U.S. Fire Administration, should develop a guidebook to federal resources for community wildfire planning, including Community Wildfire Protection Plans, and implementation, highlighting best practices for retrofits, smoke-readiness, home and infrastructure hardening, code reform, fuels treatments, defensible spaces, and other measures. The guidebook should clarify the best uses of programs such as the Forest Service's new Community Wildfire Defense Grants, FEMA's Building Resilient Infrastructure and Communities (BRIC) Program and Hazard Mitigation Grants Program (HMGP) for a cross-section of wildfire resilience needs and clarify effective systems-based approaches to mitigating risks at residential and community scales. The guidebook should make recommendations on better integrating community wildfire protection planning and all-hazards planning for local jurisdictions.

3. Federal land management agencies, FEMA, the U.S. Fire Administration, the National Institute of Science and Technology (NIST), the Joint Fire Science Program (JFSP) and partners should undertake a comprehensive review of barriers to community access to federal financial and technical assistance for community-based wildfire resilience efforts. This review should consider the best available science, including social science and tribal science, in recommending changes to federal policies to reduce barriers to program access for all communities.

**3B: Wildfire resilience investments are siloed between strategies targeting landscape resilience and fuels reductions and strategies targeting communities, land-use and the built environment.**

*CROSS-CUTTING ISSUES: Tribal Partnerships, Community Capacity, Communications*

**Policy Solutions**

1. FEMA should prioritize applications to grant programs pursuing community wildfire resilience that engage in appropriate consultation with state forestry, federal land management agencies and Tribal Nations to integrate fuels reduction efforts with built environment strategies.

2. Federal agencies should pool resources and create a single application process and technical support network for communities to access federal resources and implement wildfire resilience strategies across the high-risk WUI built and landscape environments. Modeled after successful prize competitions like the Economic Development Administration's Build Back Better Regional Challenge, such an effort could support innovation, the development of best practices, a peer network of communities, and new financial and technical assistance mechanisms that work across agencies.

3. Federal agencies should explore efficiencies in planning and environmental review for projects that integrate built and landscape resilience strategies. For instance, FEMA and the Forest Service could explore joint rulemaking, guidance or other measures to create streamlined or prioritized environmental review processes for shared federal actions in WUI communities based on the history of past analyses. Integrated planning and streamlined review could assist communities to optimize landscape and built environment resilience investments.

4. State, Tribal and federal partners, in coordination with nonprofit partners, should explore the use of capacity funding under FEMA's BRIC and HMGP programs and land management agency grant programs. This funding could be used to develop new or further advance implementation goals for existing wildfire resilience plans that could be implemented through BRIC and land management agency funding sources. To date, this capacity funding opportunity remains underutilized for wildfire resilience.

5. Congress should appropriate additional funding for NIST's Wildland Urban Interface Group's primary research and after-action reports of wildfire events to further build the knowledge base and strategies for integrating community and landscape wildfire resilience investments.

**3C: Despite strong coordination between the EPA, the Centers for Disease Control and Prevention (CDC), federal land management agencies and state and local air quality officials, no dedicated funding for research or monitoring and mitigation of wildfire smoke impacts to communities exists. This funding is necessary to guide planning and community investment decisions to address these impacts on vulnerable communities.**

*CROSS-CUTTING ISSUES: Workforce Capacity, Durable Funding, Community Capacity*

**Policy Solutions:**

1. The EPA and federal land management agencies should expand investments in research, monitoring, and mitigation mechanisms for human health impacts of wildfire and prescribed fire smoke, particularly among vulnerable communities,[18] and expand the "smoke readiness program" to reach new communities (see 2C). The EPA and partners should clarify funding availability and gaps for frequent high-priority smoke mitigation measures, such as high efficiency particulate air (HEPA) filtration purchase/cost-share programs.

2. The EPA, NOAA, the National Aeronautics and Space Administration (NASA) and federal land management agencies should continue to invest in local- and regional-scale smoke modeling to support effective and credible smoke notification and outreach for prescribed fire.

3. Building from the Interagency Wildland Fire Air Quality Response Program, air quality, public health and land management agencies (including the EPA, CDC, National Institutes of Health (NIH), NOAA, NASA, USDA and DOI) should establish an interagency smoke research, monitoring and investment coordination group in partnership with a diverse advisory panel to guide and prioritize research initiatives and investment decisions. This group should support all aspects of wildland fire smoke, including elements identified in Theme 2: Controlled Burning.

4. The EPA, CDC, and state and local air quality officials should develop a smoke resilience rating score for commercial, public and residential structures in collaboration with groups like the Insurance Institute for Business and Home Safety and others.

**3D: Rapid development of homes in the WUI limits fuels treatments, in particular controlled burning, at the scale and maintenance needed over time. Yet often the most important and highest priority locations for reducing wildfire risk to communities are in the WUI. Community planning for comprehensive land-use planning, wildfire protection planning, and all-hazards emergency planning currently fails to take an integrated approach to wildfire resilience.**

*CROSS-CUTTING ISSUES: Community Capacity, Tribal Partnerships*

**Policy Solutions:**

1. Congress should expand funding for the Community Planning Assistance for Wildfire program and create a dedicated budget line item to track program accomplishments and performance. Program funding could be expanded to support implementation, technical assistance and funding needs.

2. Federal land management agencies should expand the use of federal forest conservation easement and land acquisition programs, alongside state and local conservation finance strategies, to support conservation acquisitions that combine open space, watershed protection, habitat conservation, recreation and wildfire resilience management goals. Project prioritization criteria in federal programs like the Forest Legacy Program and Land and Water Conservation Fund should include wildfire resilience. Nonprofit partners should pursue strategies for state/local finance ballot initiatives in support of wildfire resilience, land management and acquisition needs.

3. The administration should assess the degree to which federal expenditures and financial assistance facilitates development in high-priority wildfire prone areas and evaluate whether restrictions on spending in high-risk areas are appropriate to minimize loss of life, reduce wasteful spending and protect natural resources.

# ROADMAP

*Logging Truck Haul, Colville National Forest, WA*
*© Vaagen Brothers Lumber*

# Theme 4: Forest Products.

**Reduce barriers to and incentivize innovation and investment in hazardous fuels byproduct use and related forest products and processing infrastructure.**

The diversity of the forest products industry, which includes field foresters, manufacturers, loggers, truckers and others involved in components of the forestry supply chain, underscores the myriad ways in which the health and resilience of our forests and forested communities go hand in hand. In geographies with a marketable timber base and forest products industry located within a reasonable haul distance, federal land management agencies often aim to integrate their hazardous fuels program work with forest product activities by planning, designing and delivering projects that meet multiple objectives. In many locations, combining mechanical thinning and fuels reduction treatments with prescribed fire can reduce or offset project costs while increasing the efficacy of those treatments to reduce future wildfire severity.

Many U.S. regions have lost the component parts of the forest supply chain over the past several decades because of reduced supply from federal forests, disruptions in demand from trade and macroeconomic trends, while others have retained industry at reduced capacities. Where industry currently exists, continuing to optimize appropriate timber volume production, coupled with other forest management objectives, can reduce the costs of forest restoration, while helping to retain industry capacity. Existing industry also offers the business acumen to support the development of new market segments beyond sawtimber and other traditional products into new products that can process and use the low-value biomass (i.e., slash, chips and small-diameter trees, which are the byproducts of hazardous fuels treatments). These new market opportunities include products in areas such as advanced composites, building materials, nanotechnology, forest biorefinery, and others. Where industry is no longer present in a region, an even more challenging and risky environment confronts efforts to entice reinvestment in both traditional and new market opportunities.

In the absence of markets for hazardous fuels byproducts, many regions of the West must mechanically thin and chip, or pile and burn, biomass to reduce fuels prior to any additional management actions, such as reintroducing controlled burning. These practices carry the highest cost per acre for initial treatments, have significant uncontrolled smoke and emissions impacts and require substantial time, resources, and capacity to plan, implement, and monitor controlled burns, all of which can detract from other controlled burning and hazardous fuels implementation actions.[20] In short, they present a substantial cost and liability to land managers, compared to waste streams in other industries, yet conventional policy and procedures treat hazardous fuels byproducts as a valuable asset, requiring complex processes for procurement, particularly on federal lands. There needs to be significant research, development and commercialization of new industry market segments to remove, process and use this material in ways that offers aligned air quality and meets natural resource management goals.

Theme 4 identifies this need to reimagine and modernize federal research, development and commercialization for hazardous fuels byproducts, fix outdated supply-chain policies and procedures and appropriately de-risk new investments in infrastructure aligned with management and restoration goals. The federal government's purchasing ability can help guarantee early demand, expand early-stage financing beyond grants to more dedicated programs for low interest loans and loan guarantees and address the high transportation costs associated with manufacturing. This theme also responds to the need to strengthen communications and partnerships with the existing forest products industry and to improve the predictability of forest product supplies to support strategies to retain and grow the industry. If implemented, policy solutions in Theme 4 have the potential to reduce the costs of fuels treatments at landscape scales, strengthen local and regional economies and contribute to an ongoing program of landscape-scale wildfire resilience needs over time, including forest restoration and fuels treatments.

**4A: USDA and federal agencies with existing capacity to support forest products research, demonstration, commercialization, business development and financing, workforce development and procurement lack a unifying agenda and coordinated strategy and are not aligned with private sector, institutions of higher education and nonprofit partners looking to advance the use of byproducts from hazardous fuels treatments.**

*CROSS-CUTTING ISSUES: Workforce Capacity*

**Policy Solutions:**

1. Congress should authorize new integrated grant and loan systems, loan guarantee funding and direct points of coordination to support all aspects of research and development, commercialization, business development and financing, and workforce and demand. These systems should be modeled after interagency efforts such as the Biomass Research and Development Board and other advanced research programs (see also 8A). This support could promote sustainable supply and the use of hazardous fuel byproducts from wildfire resilience treatments for markets such as mass timber, aviation biofuels, biochar and nanocellulose technologies, among others. This work should be integrated with funding and support for retaining existing forest product industries that contribute to wildfire resilience outcomes.

2. The administration should identify new strategies to advance the federal procurement of forest products that contribute to wildfire resilience and offer sustainable alternatives to conventional products and materials. Purchases by federal agencies such as the U.S. General Services Administration and the Department of Defense (DOD) could play a pivotal role in advancing market adoption and the commercialization of new products.

**4B: The appraisal and review procedures for current contracting mechanisms for the removal and use of hazardous fuels byproducts are cumbersome, similar to procedures normally ascribed to the disposition and sale of federal assets rather than a disposal or assignment of federal liabilities. New approaches that treat materials as waste products, enhance the predictability of small diameter timber and biomass supplies and eliminate barriers to incentivize new infrastructure and businesses are needed.**

*CROSS-CUTTING ISSUES: Workforce Capacity*

**Policy Solutions:**

1. Congress should authorize a new contracting mechanism for fuels treatments independent of present authorities (i.e., stewardship contracting) that streamlines and incentivizes the use and disposal of hazardous fuels byproducts not suitable for traditional market processing as an alternative to piling and burning. This new contracting mechanism and any associated appraisal process should treat hazardous fuels byproducts as a waste material (and thus a cost/liability to federal land managers). This contracting approach could create incentives for subsequent cost recovery/control through the reuse of waste streams for other market opportunities.

2. The administration should report whether the IIJA provisions providing funding to the Departments of Agriculture and the Interior are adequate to establish a working capital fund to address contract-cancellation risks and determine if other appropriations or authorizations are needed to support guarantees, or other financing necessary to secure new forest product infrastructure investments.

3. The administration should provide updated regional forecasts of anticipated hazardous fuels byproducts and biomass supplies associated with implementation actions under the 10-year Wildfire Crisis Implementation Strategy. Federal land management agencies should further clarify policies and guidelines to collaborate with interested stakeholders – such as the local forest products sector, among others – to better understand alignment with agency goals and treatments, industry and partner capacity, and opportunities and challenges. These partnership "check-ins" should occur at the local forest and regional levels, and seek to connect existing and potential partners, share information and ideas and leverage financial and human resources.

*Chip Processing Hazardous Fuels, outside Kaibab National Forest, Williams, AZ © Cecilia Clavet*

**4C: Distance to market and other wood products processing byproducts compete directly with the use of byproducts of hazardous fuels treatments for commercial uses. Market premiums are thus required to incentivize their use.**

*CROSS-CUTTING ISSUES: Workforce Capacity*

**Policy Solutions:**

1. Congress should authorize a pilot program that provides payments to new and expanding manufacturers of commercial products for using hazardous fuels materials, including compensation for transportation costs, when alternative biomass sources are demonstrated to be lower-cost options. For instance, these payments could support a manufacturer of aviation biofuels to use hazardous fuels byproducts over other accessible and economically competitive feedstocks.

## Theme 5: Partnerships, Finance and Insurance.

**Expand the use of public-private partnerships, conservation finance and innovative insurance mechanisms to support and scale wildfire resilience efforts.**

With the increasing severity and frequency of wildfire and smoke impacts, a suite of nontraditional investors and partners have emerged, eager to invest their capital, align their philanthropic giving and expertise and reimagine their core business offerings to transform and scale wildfire resilience strategies. Mobilizing, aggregating and aligning these new partnership and investment opportunities hold great potential to not only complement traditional funding for wildfire resilience among federal, state and Tribal Nation partners, but also strategically target resources to pilot new approaches in outcome-based investments.

One key partnership opportunity could be with water and electric utilities and local jurisdictions that manage at-risk infrastructure; incur emergency response, recovery and service asset replacement costs; and also face potentially devastating liability and damage costs when operations and infrastructure are determined to be the cause of ignitions. Another noteworthy partner could be the insurance industry, which, through better efforts to incorporate wildfire risks and mitigation measures into policy and pricing, holds great promise to deliver incentives for aligned wildfire resilience investments across sectors. An emergent group of philanthropic and conservation finance partners are also investing in the leg work to structure new models for co-investment in wildfire resilience and deploy blended capital to overcome limitations of the annual appropriations cycle and federal bureaucracy in scaling multi-year, strategic investments.[21] These partners are motivated by the opportunity to avoid costs; more effectively manage growing and uncertain risks; reap benefits from wildfire resilience investments that span core business operations; enhance public relations and align corporate social responsibility initiatives; and achieve a mix of impact and return commensurate with their goals and risk profiles. To date, numerous pilot initiatives have been driven by diverse partners and tailored investor interests, offering applied lessons and significant potential to scale replicable models.

Fully engaging these sectors in wildfire resilience investment strategies requires both enhancing old and building new structures to develop partnerships, assess and take risks and overcome the relatively high transaction costs of complex multiparty agreements. In some instances, policy changes to require or motivate additional risk analysis, reinforce disclosure and mitigation measures, or pilot new financing approaches could accelerate these new investment strategies. Theme 5 seeks to enhance federal land management agency capacity to facilitate these investments; strengthen underlying models for risks and avoided costs; build best practices; advance new pilot authorities and novel funding to advance early-stage work; and more fully engage insurance providers, reinsurers and insurance regulators in wildfire resilience policy development. If implemented, the policy solutions in Theme 5 will create new avenues for the private and philanthropic sectors to complement federal investments; further facilitate needed investments to mitigate public and private assets, infrastructure and values at risk from severe wildfire; and incubate new and productive investment strategies that can lead to future policy solutions.

**5A: The Forest Service's National Partnership Office (NPO) provides innovative ideas and some project support, but the current funding for these efforts, as well as for field staff and training, is limited and few other agencies have similar capabilities.**

*CROSS-CUTTING ISSUES: Workforce Capacity*

**Policy Solutions:**

1. Expand funding for federal land management agency partnership programs to allow for pilots, training and funding allocations to regions to support priority programs of work, the development of public-private partnerships and new strategies for leveraging philanthropy, congressionally chartered foundations and private finance.

**5B: Many partnerships, particularly those involving water and electric utilities, municipalities and others are predicated on avoiding risks/costs associated with future wildfire events. Credible science-based tools are needed to maintain up-to-date and consistent data, help model avoided costs and impacts from preventative wildfire resilience measures and develop more consistent approaches to risk mitigation.**

*CROSS-CUTTING ISSUES: Community Capacity*

**Policy Solutions:**

1. Federal land management agencies, led by the Forest Service, should convene a panel of public, private and university partners to develop a set of common methodologies and decision support tools for measuring avoided costs and impacts from wildfire events and to incorporate those methodologies into an online geographic system that allows for users to conduct analyses at different geographic scales on an all-lands basis. This set of methodologies and tools should integrate with outcome-based performance measures developed under 1E.

2. The Department of Energy should conduct a comprehensive review of current electric utility investments to support wildfire resilience and make recommendations for a) additional federal funding for grid-hardening, undergrounding and risk evaluation, and monitoring beyond funds allocated in the IIJA and b) opportunities to enhance utility requirements and support partnerships for wildfire risk mitigation under state and federal regulatory policies.

*2021 Dixie Fire, Plumas County, CA © Stuart Palley*

**5C: Federal land management agencies do not currently have the authority to make long-term fiscal commitments to outcome-based investments, which limits project viability. A labyrinth of contracts and high transaction costs presently limit the potential for broad use of conservation finance mechanisms.**

*CROSS-CUTTING ISSUES: Workforce Capacity*

**Policy Solutions:**

1. Congress should establish a pilot authority clarifying the ability for land management agencies to use appropriations in pay-for-performance contracts or bonding instruments. The pilot authority should consider strategies to streamline participation agreements for local utilities, municipalities and other partners to overcome the high transaction costs of current complex, multiparty agreements.

2. Federal land management agencies should explore the use of competition prize authorities to support outcome-based investment and technology innovation for wildfire resilience under the America COMPETES Act and other avenues.

**5D: The insurance industry presently lacks clear risk assessment information that demonstrates the values of fuels treatments, home and infrastructure hardening and other mitigation measures necessary to incorporate risk and pricing into policies. Wildland fire practitioners also lack an understanding of the array of potential policy and regulatory measures that can incentivize risk-management outcomes for different impacted entities.**

*CROSS-CUTTING ISSUES: Community Capacity, Communications*

**Policy Solutions:**

1. A consortium comprised of insurance industry and regulators, state and federal policy officials and nonprofits should work collaboratively to identify barriers to improved data transparency and shared-risk modeling; assess strategies for incentivizing wildfire risk management through insurance policy, reinsurance and regulation; and establish public-private models (federal or state) for community-based insurance.

2. States, federal land management agencies and the insurance industry should evaluate whether new state wildfire suppression insurance products, such as a parametric insurance approach, can incentivize states to make resilience investments. By shifting away from models of self-insurance to fund suppression, states could invest savings between current costs and insurance premiums into significant new wildfire resilience investments.

*Aspen Woodlands in the Fall, Coniferous Forest Zone of the Santa Fe National Forest in New Mexico © Alan W. Eckert*

## Theme 6: Equity and Access.

**Ensure access to investments and meaningful involvement in decision-making for wildfire resilience among historically underserved and marginalized communities as well as communities affected by poverty and inequality.**

Many communities, including Tribal Nations, are particularly vulnerable to the effects of wildfires, including smoke, because they do not have access to the resources and services necessary to adequately plan, prepare and recover. Language barriers, poverty and cultural norms, among other factors, can affect individual and community perceptions of risk and limit their ability to take preventative actions, respond to warnings, take emergency actions and tap into resources for recovery.[22] Wildfire management agencies and their partners are increasingly paying attention to these barriers to accessing resources by working to strengthen meaningful involvement in decision-making for wildfire resilience among these communities. Many federal, state and local wildfire planning efforts tend to focus on areas of high biophysical risk with less emphasis on social vulnerability. Consequently, planning efforts often overlook key social considerations that alter risk profiles and create vastly different capacities among communities preparing for and recovering from wildfire.

Social vulnerability constrains the ability of some communities to tap into resources for wildfire adaptation and recovery efforts. Many federal and state agencies have competitive grant structures and funding systems that bias high-capacity locations able to meet rigorous application requirements and effectively implement grant actions, rather than focusing on high-risk areas lacking the capacity to access the resources necessary to do preventative work. A recent trend toward rewarding collaborative processes, a norm that appropriately recognizes the importance of diverse stakeholders defining compromise and shared solutions for land management, also implicitly biases investments toward communities with the capacity to effectively organize and participate. Notably, many rural areas suffer from similar capacity constraints because the same cadre of community leaders are often tasked with essential volunteerism and civic functions, and few support organizations and services exist to service needs among a smaller population. Tribal Nations face similar constraints in dedicated staffing to navigate federal grant processes.

As federal, state and local agencies, Tribal Nations and their partners have begun to rethink systems to incorporate social science data into risk assessments, several tools have emerged to support the integration of demographic data. These include the EPA's environmental justice screen, EJScreen, CEQ's new Climate and Economic Justice Screening Tool and the CDC/ATSDR Social Vulnerability Index (SVI). The Forest Stewards Guild produced a methodology for evaluating community capacity to respond to wildfire and has since encouraged communities to incorporate this factor in their Community Wildfire Protection Plans. Others have begun to integrate socioeconomic considerations into their planning and to consider equity in their wildfire resilience preparedness and response strategies. FEMA, for example, is working to advance racial and socioeconomic equity in its planning processes and to build capacity in rural as well as environmentally and economically disadvantaged communities. The agency is building capacity through interagency and cross-sector cooperation, facilitating partner connections and implementing direct-technical assistance in collaboration with partners. FEMA is also working with communities to find data so they can share their own stories, with indicators specific to each state. More recently, the Forest Service announced a new policy allowing agency officials to consider the values partners bring when determining how and when match requirements in partner agreements are met; removing the policy requirement for "substantial cash contributions"; and identifying a process to reduce, and in some cases waive, match requirements that are not statutorily required, recognizing that the structure of these requirements was in some instances preventing socially vulnerable communities from working with the agency on shared management and wildfire resilience goals.[23]

Theme 6 identifies the need for agencies to continually assess the equity implications of their investment decisions, fund responsive capacity through process navigator and liaison positions, address match funding barriers and better support and respond to the unique sovereign interests, needs and goals of Tribal Nations. If implemented, policy solutions in Theme 6 will better identify and respond to underserved and vulnerable communities and will also help federal, state, Tribal Nations and private programs for wildfire resilience be more inclusive and responsive to the communities they serve.

**6A: Current land management and disaster assistance agency funding for wildfire resilience rewards high-capacity communities where engagement in planning initiatives and collaboratives, a record of past successes and/or the hiring of consultants, disadvantages communities who lack the resources to engage in such activities.**

*CROSS-CUTTING ISSUES: Community Capacity, Workforce Capacity, Communications, Tribal Partnerships*

**Policy Solutions:**

1. The White House should establish a policy for all agencies to identify disadvantaged communities with low-adaptive capacities and directly support those communities in applying for federal funds for climate adaptation and resilience efforts.

2. Federal agencies should conduct a periodic review of where investments in wildfire resilience have been made (i.e., grants, agreements, contracts and acres treated); whether and how those investments align with the under-resourced communities identified; and monitor and make changes in future investment approaches to ensure investments benefit high-risk and vulnerable communities. Agencies must evaluate the equity implications of their work throughout pre-fire, suppression and post-fire recovery activities, and investments should consider gaps related to downstream and indirect impacts, such as the cascading impacts of urban heat, wildfire impacts to power supplies and smoke impacts to vulnerable populations. The review should make recommendations on the program and policy changes needed to address barriers and strategies to improve access to resources.

3. Agencies should consider staffing or funding capacity through the creation of process navigator and liaison positions (in partnership with NGOs, local organizations and other appropriate entities) to work across institutional boundaries, demystify the complexity of funding availability, clarify eligibility criteria and requirements and support communities in accessing resources through trusted partners. Models such as the coordinator positions funded through DOD's Readiness and Environmental Protection Integration (REPI) Program and the network of funding and support for local community development corporations and associations in the economic development arena may be useful in designing and funding these positions.

**6B: Federal grants and agreements require non-federal matching funding from the recipient, often at a level that disadvantages communities that lack capital but are most at risk or in need of resilience work.**

*CROSS-CUTTING ISSUES: Community Capacity*

**Policy Solutions:**

1. Federal agencies funding wildfire resilience should model the Forest Service's leadership by conducting reviews to determine which match requirements may be reduced or waived and clarify policy to reduce or eliminate matches for underserved and rural communities.

2. Congress should broadly clarify the discretion of the Secretaries of Agriculture, Interior and Homeland Security to waive matching requirements for wildfire and other climate-resilience programs.

**6C: FEMA's use of benefit-cost analysis to award disaster relief and associated wildfire resilience investments fails to fully incorporate nature-based valuation and biases against low-income and rural communities.**

*CROSS-CUTTING ISSUES: Community Capacity*

**Policy Solutions:**

1. FEMA should consider additional updates to rules and procedures for calculating benefit-cost analyses for rural and low-income communities and should consider additional precalculated benefits for nature-based actions for purposes of awarding assistance. FEMA should also consider expanding technical assistance offerings for applicants to ensure nature-based benefits are being captured in a benefit-cost analysis.

**6D: Capacity constraints facing Tribal communities and Tribal fire management programs limit the implementation of cross-boundary collaboration and co-management efforts, including the use of authorities under the Tribal Forest Protection Act of 2004 (TFPA), the Reserved Treaty Right Lands (RTRL) program and opportunities outlined in the IIJA.**

*CROSS-CUTTING ISSUES: Workforce Capacity, Tribal Partnerships*

**Policy Solutions:**

1. The DOI Office of Wildland Fire should consult with Tribal Nations to determine true capacity gaps within Tribal and other underserved communities and adjust the agency's programs, funding and resources to address these gaps.

2. Federal land management agencies should commit to working with Tribal Nations and Tribal organizations to implement recommendations outlined in the Indian Forest Management Assessment Team (IFMAT) Reports (I, II, III Volume I, III Volume II and upcoming IV).

3. Federal land management agencies and the Bureau of Indian Affairs should explore cooperative agreements, program carve-outs and other flexible funding to institutionalize capacity and support administrative needs in planning and implementing Tribal wildfire resilience projects under existing programs and authorities, including dedicating funding to support co-management opportunities.

*Spanish-language fire training participants in a trust-building exercise, Santa Fe, NM © José Luis Duce*

# Theme 7: Recover for Resilience.

**Reform delivery of post-fire management and recovery assistance necessary to ensure that landscapes and communities recover in ways that foster long-term resilience to severe fire risks.**

In the immediate aftermath of wildfire events, communities must confront both acute and chronic recovery challenges ranging from providing community services to impacted individuals; rebuilding damaged homes and infrastructure; assessing and prioritizing soil erosion and flood risk reduction measures to address ongoing emergency threats to life, property and infrastructure; managing invasive species; and undertaking appropriate post-fire management and restoration actions necessary to maintain water security, wildfire habitat, and recreation values as well as reduce the risk of future high-severity reburns. Each of these recovery challenges requires coordination among multiple federal, state, local and Tribal Nation jurisdictions and the need to engage diverse technical and financial assistance programs and partnerships to undertake priority recovery actions.

Too often, as federal agencies complete their work assessing burn severity on federal lands and incident management teams demobilize from fire events, local jurisdictions are left to navigate this complex policy and funding landscape with little guidance or capacity. In 2019, the Western Governors' Association (WGA) and the Wildland Fire Leadership Council (WFLC) identified significant gaps in public awareness of funding programs and the lack of capacity for smaller communities to determine their needs and find assistance. was identified as a significant gap.[24] Subsequent policy changes in the IIJA have increased funding for burned-area landscape recovery programs and post-fire reforestation (e.g., site preparation, direct seeding and planting) through the Reforestation Trust Fund on national forests; funding for native-seed collection as well as storage and nursery production is increased through the National Seed Strategy. While these new programs are responsive to the growing needs for landscape scale post-fire emergency recovery, reforestation and revegetation, they still fail to advance solutions to key policy and capacity challenges identified by the WGA and WFLC teams. More recently, federal agency partners, through the White House Wildfire Resilience Interagency Work Group established by the Biden Administration, have begun to pilot new approaches to post-fire recovery in New Mexico and to engage stakeholders in the Southern Rockies to help conduct after-action and policy reform necessary to better support recovery needs.

Theme 7 builds on prior efforts to define challenges and solutions to post-fire recovery and identifies opportunities to advance recovery actions for landscapes and the built environment that foster long-term resilience. It tackles the needs to rebuild and modernize reforestation supply chains; accelerate reforestation and revegetation recovery for long-term resilience; infuse new funding across multiple jurisdictions to support recovery; develop strategies to confront key knowledge and capacity gaps; and better integrate funding and emergency actions for recurring post-fire flooding events. If implemented, the policy solutions in Theme 7 will improve all-of-government approaches to post-fire recovery; reform program and policy delivery; and better position local jurisdictions and their partners to undertake necessary short-term and long-term recovery actions during the brief window right after wildfire events when community engagement, partnerships and funding resources are aligned to effectively respond.

**7A: Seed collection, nursery infrastructure, workforce and programs for reforestation have been neglected for decades and are ill-equipped to respond to contemporary post-fire reforestation efforts required to preempt conditions that lead to future catastrophic wildfire events.**

*CROSS-CUTTING ISSUES: Workforce Capacity, Community Capacity, Tribal Partnerships, Natural Climate Solutions*

**Policy Solutions:**

1. USDA and DOI, in collaboration with states and Tribal Nations, should develop shared analytical tools to evaluate post-fire reforestation needs and potential on an all-lands basis and prioritize investments in seed collection, nursery infrastructure and workforce.[25] These tools and investments should take a climate-informed approach by a) identifying seed stocks and planting densities suitable for emerging and future climate conditions, b) integrating revegetation programs with long-term fuels management goals and c) evaluating the greenhouse gas mitigation benefits of reforestation and restoration efforts.

2. Federal land management agencies should establish career pathways and partnerships that build workforce capacity for landscape restoration and reforestation, building from existing Jobs Corps opportunities and various national service corps programs.

3. State, federal, private and nonprofit partners should explore the development of regional cooperatives to support seed collection across ownership boundaries and assess supply and demand for seedlings and restoration projects. A national cone-collection corps should be established to deploy crews and scale up seed collection and storage necessary to support priority climate-informed, post-fire reforestation needs.

4. The Forest Service should undertake a series of regional workshops to inform implementation of the Repairing Existing Public Land by Adding Necessary Trees Act (REPLANT Act) aimed at a) identifying regional solutions to seed, workforce and nursery infrastructure, b) setting broad direction around climate-informed planting, natural regeneration strategies and opportunities to integrate reforestation with fuels management goals and c) clarifying partnership opportunities with NGOs, states, other federal agencies, the private sector and Tribal Nations.

**7B: DOI, state, private, Tribal Nation and land grant university partners lack dedicated funding to support project implementation needs at scale, including landscape scale restoration, reforestation and revegetation seed collection, infrastructure and workforce projects.**

*CROSS-CUTTING ISSUES: Workforce Capacity, Community Capacity, Tribal Partnerships, Natural Climate Solutions*

**Policy Solutions:**

1. Congress should authorize a new competitive grants program to support seed collection, nursery infrastructure and workforce among state, private, Tribal Nation and land grant university partners to augment federal infrastructure investments made through proceeds from the National Seed Strategy and the Reforestation Trust Fund.

2. Congress should create additional Tribal Nation, as well as State and Private Forestry, funding for post-fire reforestation and revegetation project implementation and monitoring programs. Congress should also authorize and fund new authorities for relevant DOI bureaus to create similar capacities to the Reforestation Trust Fund capabilities.

3. Land management agencies should explore opportunities to incorporate post-fire burned area emergency recovery and long-term reforestation as well as invasive species and restoration needs into testing and deployment of new technologies under development to support wildfire suppression such as the use of Light Detection and Ranging (LiDAR), unmanned aerial vehicles (UAVs), sensing balloons and satellite technology.

4. Congress should authorize flexibilities in existing post-fire emergency recovery funding to support all-lands restoration and recovery.

5. CEQ should issue guidance on the use of existing emergency alternative arrangements for NEPA compliance for post-fire recovery, reforestation and revegetation efforts. Agencies are currently instructed not to delay immediate actions necessary to secure the lives and safety of citizens or to protect valuable resources in emergency situations. However, interpretations may not fully consider the likelihood of high-severity reburns or post-fire flooding in the absence of rapid and comprehensive restoration actions.

*Post-Fire Volunteer Planting Crew on 2020 Cameron Peak burn scar, CO*
*© Prylinski Productions*

**7C: After incident teams demobilize, communities often lack the capacity and coordination necessary to navigate, plan, secure and implement post-fire recovery projects that address long-term needs for community and landscape resilience.**

*CROSS-CUTTING ISSUES: Community Capacity, Communications*

**Policy Solutions:**

1. Federal agencies should publish and regularly update a set of guidance for communities on post-fire recovery resources and best practices, perhaps accessible through a current information portal such as InciWeb.

2. Federal land management agencies, FEMA and, as needed, Congress, should develop consistent frameworks to train, fund and place local community navigators who can develop and execute planning to secure federal resources for post-fire recovery after incident teams demobilize.

3. Agencies should invest in additional research on the human and social dimensions of wildfire impacts and their implications for post-fire recovery and adaptation such as identifying and addressing issues around WUI-housing stock and rebuilding, as well as monitoring long-term impacts on public health, poverty rates and displacement trends.

4. Agencies should consider reforms to better align funding and technical assistance for recurring challenges with post-fire flooding which is presently treated as an entirely separate event from wildfire.

# ROADMAP


*Drone used in 2020 controlled burning, Apalachicola Bluffs and Ravines Preserve, FL © David Prentiss*

# Theme 8: Technology and Innovation.

**Expand the use of innovative, emerging technologies to support wildfire resilience through improving public and private sector coordination, data and systems interoperability, and investments in applied research and technology transfer among multisector partners to include federal, university and private sectors.**

Technology is increasingly altering practically every facet of forest and rangeland fire management, including wildfire response, risk reduction and recovery. Real time observational data from satellites, unmanned aerial vehicles and sensors are helping wildland firefighters better detect wildfires and predict their spread, enabling more effective and safe suppression strategies. For example, a suite of modeling and predictive services is helping to improve smoke management and forecasting from wildfire and prescribed fires. New applications, coupled with handheld devices, sensors and improved networks are helping firefighters communicate better with one another and the public amid rapidly changing fire dynamics. Use of unmanned ground vehicles is also aiding in suppression and prescribed fire management, allowing access to areas not previously accessible to practitioners or vehicles. LiDAR and other imaging technology are also improving our understanding of complex forest and rangeland fuels structures, helping managers better design, implement and monitor the effectiveness of fuels strategies. In addition, new materials innovations offer the potential to ease the costs of retrofitting existing residences and infrastructure at risk from wildfire events.

Particularly in rangeland settings, use of new technologies to proactively address fine fuels can reduce the frequency and severity of wildfires. Remotely-sensed datasets can help land managers understand vegetation characteristics like biomass and composition, increasingly in real-time. Unmanned aerial drones can provide rapid field assessment of fuel conditions and potentially deliver herbicide to prevent a build-up of fine fuels, especially from invasive annual grasses. Use of technology can help land managers seasonally monitor and adapt to fuel conditions along important corridors like rights-of-way or fuel breaks to better prevent ignitions and interrupt continuous fuels beds.

As these examples illustrate, technology has significant potential to offer solutions to keep pace with the challenges of larger, more frequent and more intense wildfires. Today, no venue exists to convene stakeholders, like universities, governments, manufacturers and the private sector, to support the collaborative development of technologies. As a result, many solutions are developed in isolation rather than in collaboration with potential partners and end users and are slow to achieve effective transfer, testing and deployment. Evolving research from federal labs, universities and the private sector is similarly siloed, leaving capacity for innovation and technology transfer uncoordinated and underdeveloped. These antiquated and bureaucratic data systems and platforms are limiting the potential for integrated approaches to monitoring, assessment, forecasting and modeling and serve as barriers to innovation. In addition, many pioneering efforts supporting the adoption of new wildfire suppression technologies lack a holistic strategy to evaluate and communicate effectiveness and explore synergies to deploy the same or modified solutions for wildfire resilience goals.

Theme 8 calls for a more structured and integrated approach to wildfire technology development and deployment and specifically aims to replicate effective models for co-development and more effectively and efficiently onboard new technologies. The theme calls for new approaches to prioritize key gaps in applied technology and integrate successful lessons learned from government-backed venture funding, public-private partnerships and other effective procurement structures. The theme also tackles the need for new standards for data integration, interoperability and accessibility necessary to scale current technologies and develop new ones. If implemented, policy solutions in Theme 8 will better organize existing research and technology transfer capacity among a diverse suite of federal agency, university and private sector partners and will accelerate the development and adoption of new breakthrough technologies for wildfire resilience.

**8A: Federal agencies supporting wildfire response and resilience have limited research and development programs and collectively struggle to coordinate with the private sector to onboard innovative technology solutions. Federal agencies, academia and the private sector further lack a coordinated research agenda and therefore do not coordinate on early-stage technology development and transfer for wildfire response and resilience.**

*CROSS-CUTTING ISSUES: Workforce Capacity, Communications*

**Policy Solutions:**

1. Building from lessons learned in the development of the Defense Advanced Research Projects Agency (DARPA) and the Advanced Research Projects Agency - Energy (ARPA-E), Congress should establish and fund a new ARPA effort to advance transformative technologies to support more effective and efficient wildfire response and resilience investments. The ARPA model can better align current research capacity with federal land management agency research stations and labs; align academia and the private sector; establish structures for program development leading to more targeted and productive collaborations among partners; overcome barriers to entry in the private sector; create necessary flexibilities in federal research management and procurement; clarify pathways to innovate and test; and implement new technology solutions.

2. The JFSP, in collaboration with the WFLC, should undertake a new initiative to guide wildfire technology innovation by providing a) an annual forum to communicate technology needs and share emergent solutions, b) annual reporting to track the implementation of pilots and the procurements of new technologies, c) identification of funding sources for investment in innovative technologies, d) guidelines and points of contact with chief responsibility for vetting and piloting new public-private partnerships and e) support appropriate workforce development and training strategies. Such an initiative could reduce barriers across agencies and clarify systems, structures and funding sources for onboarding and procuring new technologies. This effort could help establish a Federal Fire Science Coordination Council–a recommendation from the 2015 National Science and Technology Council Task Force–to ensure regular exchange among the leaders of those federal organizations that either produce or use fire science. The Task Force also recommended strengthening coordination and collaboration among the organizations that produce wildland-fire science and technology; establishing mechanisms to systematically assess user needs and priorities for science, research and technology support; and defining national-level needs for federal fire science in support of the fire management community.

3. Federal land management agencies, along with partnering states, should establish clear and concise goals regarding the development of public-private partnerships. The establishment of guidelines and outcomes will be a vital aspect of shared operating environments as novel approaches to technology emerge. Clear guidelines will help to support long-term interoperability should a partnership with private industry span federal and state jurisdiction.

4. Federal land management agencies should consider the use of prize authorities, such as the America COMPETES Act, and other mechanisms to establish pooled funding and procurement structures and to create clear demand signals for priority technology solutions from the private sector. Agencies have demonstrated that prize competitions and challenges are effective tools for generating innovative ideas and conceptual designs, developing and demonstrating new technologies, scaling up an enterprise and improving a process, procedure or service of sponsoring agencies.

**8B: Federal agencies and their state, local, Tribal and private cooperators often use different data systems and digital platforms which create barriers to technology development and limit the ability of all stakeholders to not only understand the complexity of wildfire risk, but to also respond quickly before, during and after a wildfire.**

*CROSS-CUTTING ISSUES: Workforce Capacity, Community Capacity, Communications*

**Policy Solutions:**

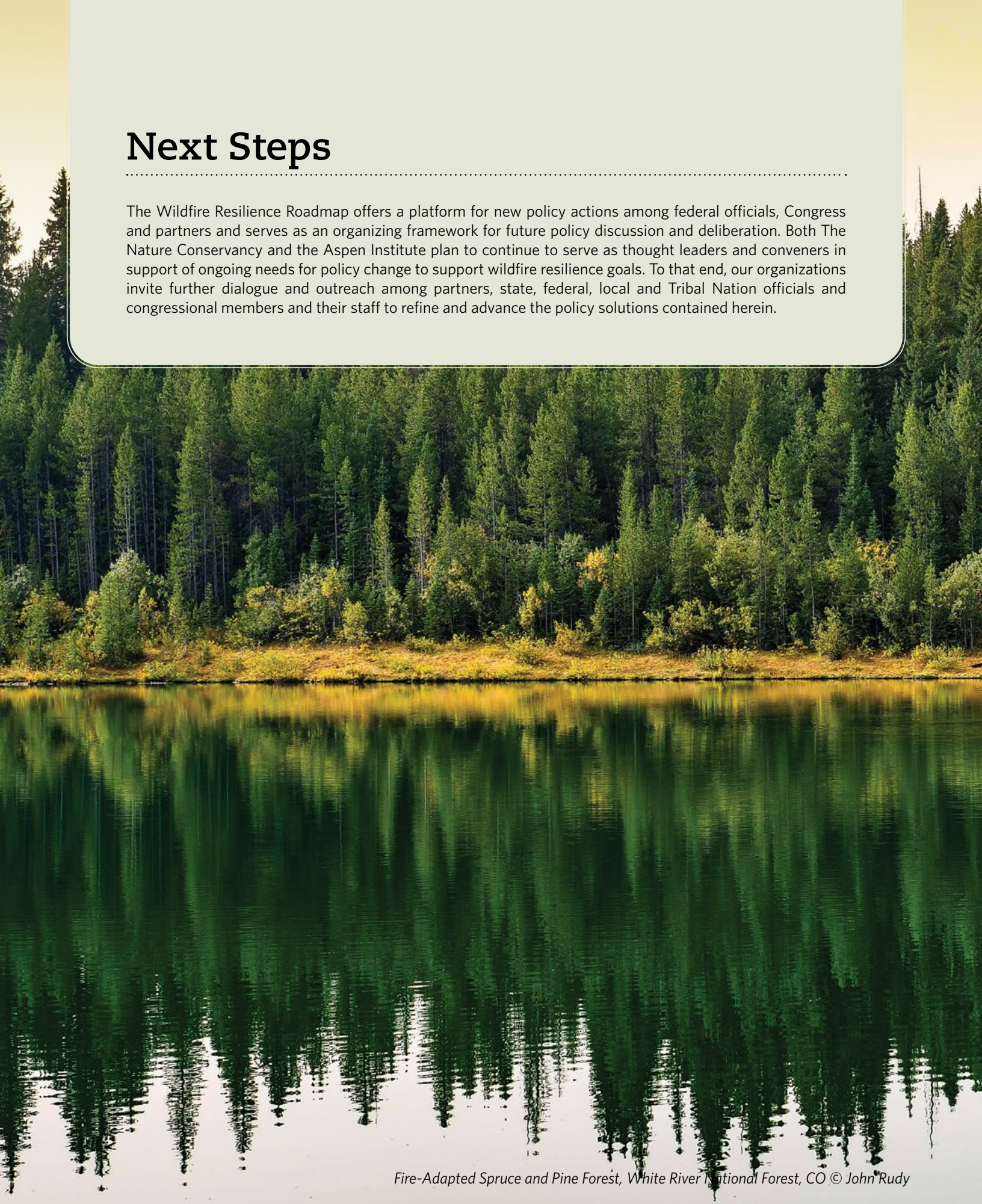
1. Land management agencies should agree to common open standards for data integration, interoperability and accessibility and should incorporate these standards into all requests for proposals and technology procurements to streamline processes of data collection, accessibility and maintenance. These new standards should be incorporated into policy solutions aimed at improving outcome-based performance measures, prioritization and decision support tools (see 1E).

2. Federal land management agencies should build internal capacity to evaluate new technologies and ensure interoperability with existing public and agency platforms by establishing technology leadership positions, building enterprise-wide service centers, supporting trainings and facilitating pilots aimed at better integrating new data and technology with current and improved business practices.

3. Federal land management agencies, along with state and local governments and Tribal Nations, should establish a clearing house of code, data, technology and all innovations in this space for the use and benefit of partners. This approach could follow the tenants of the Open-Source Movement, intended to foster additional widespread innovation and collaboration amongst partners.

# Next Steps

The Wildfire Resilience Roadmap offers a platform for new policy actions among federal officials, Congress and partners and serves as an organizing framework for future policy discussion and deliberation. Both The Nature Conservancy and the Aspen Institute plan to continue to serve as thought leaders and conveners in support of ongoing needs for policy change to support wildfire resilience goals. To that end, our organizations invite further dialogue and outreach among partners, state, federal, local and Tribal Nation officials and congressional members and their staff to refine and advance the policy solutions contained herein.



*Fire-Adapted Spruce and Pine Forest, White River National Forest, CO © John Rudy*

# Appendix A:
## Wildfire Resilience Workshop Series

The Nature Conservancy and the Aspen Institute convened a series of workshops on several topics associated with wildfire resilience. National and regional experts and practitioners were brought together for five workshops. These meetings helped contribute to the Roadmap recommendations.

**Workshop 1:**
**The US Forest Service's Effective Implementation Strategy for Expected Federal Funding Surge, November 2021**

Experts discussed the expected surge in federal funding for wildfire resilience and the ability of the Forest Service to collaboratively develop and implement a comprehensive wildfire strategy with partners. The Infrastructure Investment and Jobs Act (IIJA, P.L. 117-58) was enacted shortly after this convening. Please find the summary here.

**Workshop 2:**
**Innovative Financing of Wildfire Resilience, January 2022**

Experts discussed how innovative financing structures and private capital may be used to increase investments in wildfire resilience, highlighting effective models such as environmental impact bonds, partnerships with utilities and new insurance products as solutions to build resilience. Please find the summary here.

**Workshop 3:**
**Leveraging Partnerships for Success, March 2022**

Following the passage of the IIJA and its unprecedented levels of funding for wildfire resilience work, this convening brought together state, Tribal, federal, NGO and other experts to deepen their shared understanding of the funding available so they can prepare to access this funding and implement wildfire resilience activities. Please find the summary here.

**Workshop 4:**
**Post-Fire Restoration and Resilience, April 2022**

State, Tribal, federal, NGO and other experts came together to create a shared understanding of the scale, distribution and impacts of post-fire reforestation needs, explore what is being done to address them, and develop recommendations to address gaps and barriers. Please find the summary here.

**Workshop 5:**
**Incorporating Social Considerations into Wildfire Risk Reduction and Recovery, June 2022**

Experts explored how vulnerable communities can better prepare for, and respond to, wildfires and considered strategies to ensure resources and capacity are appropriately directed to address existing challenges within these communities. Please find the summary here.

# Appendix B:

## The Language of Wildfire: Recommendations on Communicating Effectively to Build Support for Sound Wildfire Policies November 28, 2022

The following recommendations for effective communications to build support for sound wildfire policies are based on national qualitative and quantitative opinion research commissioned by The Nature Conservancy in 2022 and conducted by a bipartisan research team: Dave Metz of Fairbank, Maslin, Maullin, Metz & Associates (D) and Lori Weigel, of New Bridge Strategy (R).[26] This memo provides a list of easy-to-follow, broad "rules" for communication. It is always prudent to re-test language and messages to ensure their effectiveness in a specific state or local area prior to investing in public communication there. In particular, communities with specific experience with controlled burns or wildfire may have unique concerns that make this broad messaging less applicable.

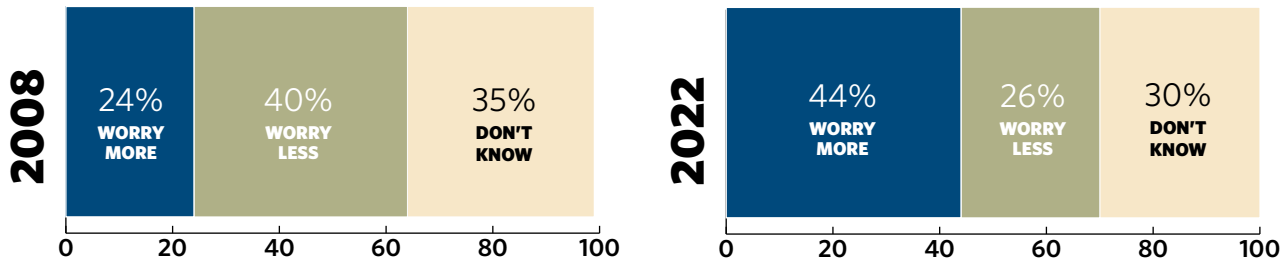
### Summary

This research shows that voters across the country see forest health as worsening, and concern about wildfires has been steadily growing even among those not directly impacted. Voters overwhelmingly support a framework to reduce severe fire risk through improved forest management and the use of controlled burns – support that cuts across geography, party, gender, age, race and ethnicity and socioeconomic status. Voters would rather invest now to reduce severe fire risk than later to address the aftermath of fires, and voters find investments in year-round, trained teams to reduce the risk of severe wildfires highly appealing. At the same time, their innate skepticism about government makes it important to document these policies' proven track record, and to highlight provisions requiring accountability and transparency in carrying out risk reduction strategies.

### Recommendations

**DO build on voters' growing concern that fires are more severe and more frequent.** The share of voters who say they personally worry more about fires than they did five years ago has increased by 20 points nationwide since 2008 Given this widespread existing concern, messaging does not need to persuade voters that a problem exists – rather, it needs to funnel their existing concern into support for action.

*Figure 1: Personal Concern about Fire: Thinking about your own safety, do you personally worry more or less about fires than you did 5 years ago?*



The message below (rated "very convincing" by 41% of those polled) effectively reinforces voters' instinct that fires have become larger and more destructive in recent years.

> **(MORE SEVERE)** Frequent fire is normal in most forests, but changes in temperatures and drought are causing wildfires to burn hotter. Severe wildfires continue to set new records for being large, damaging, and deadly; since 2015, the United States has experienced roughly 100 more large wildfires every year than the year before. Mega-fires have burned an area equivalent to the state of Oregon. We need to act now to prepare for these growing wildfire risks.

**DO NOT rely on concern about wildfire smoke to leverage action.** While poor air quality tends to be a concern when and where problems with wildfire smoke are occurring, as the winds shift and fires die down, intensity of concern does as wellFires themselves are much more durable as a concern because voters perceive their impacts on life and property as both more severe and longer-term.

**DO NOT count on using climate change as a rationale for action in communications with general audiences.** While a majority rates climate change as an "extremely" or "very serious problem" facing their community, fully 35% dismiss it. Voters rank climate change in the middle-tier of a list of factors contributing to increasingly frequent and severe wildfires. This is because deep ideological polarization continues to play a substantial role in perceptions of climate change.

**DO focus on impacts of climate change – most notably the contribution of droughts to the greater frequency and severity of fires.** "Years of drought" is seen as the biggest or a major cause of fires by 73% of voters overall and the partisan gap is only 12 points, compared with 51 points for climate change. Even without explicitly naming climate change as the cause, clearly describing its visible, tangible and current impacts on forests and pivoting to how to help them is a relatively effective framing.

**DO acknowledge the important ecological role of fire.** Highlighting the benefits of normal, healthy fire cycles can be helpful. Nearly two in five voters (37%) rated the "beneficial" message below as "very convincing" – a framing that was especially effective in the intermountain West, where this dynamic is well-understood and much more often discussed.

> **(BENEFICIAL)** We know that fire can be beneficial to the health of our forests. In fact, many types of plants and wildlife need fire to survive. Periodic fire stimulates plant growth, provides wildlife habitat, and ensures healthier natural areas near us. This plan is a step toward restoring the natural balance that fire brings to our forests.

**DO stress the need for improved forest management to prepare for fire.** There is bipartisan agreement that the current approach to forest management isn't working – 64% called "lack of adequate forest management" the biggest or a major factor in fires. And a majority (55%) nationwide also believes that the overall condition of America's forests has worsened over the last few years.

**DO NOT ignore the need for more careful public behavior in and around fire-prone forests.** Many members of the public believe that a large share of wildland fires is started by humans, whether through a discarded cigarette or a campfire left unattended. ("careless behavior by people visiting forests" is seen as a "major factor" in more severe fires by as many voters as drought is.)

**DO focus on the role of partnerships in acting to reduce fire risk**. Four out of five voters see "everyone" as bearing responsibility for reducing the risk of severe wildfire. More specifically, voters see every level of government, timber companies, and residents of fire-prone areas as bearing responsibility, along with conservation organizations and insurance companies (see Figure 2).

**DO use the term "controlled burn" in communicating with the general public**. While it may be considered less scientifically-accurate, the general public clearly prefers and better understands the term "controlled burn" in comparison to "prescribed fire." Focus group participants fully recognized that use of the term "controlled" is not a guarantee of 100% effectiveness in controlling fire; rather, to them it simply implied that responsible and knowledgeable authorities were exerting every effort to ensure the safety of any fires that they set. In contrast, many said the term "fire" was scarier than the term "burn," and many felt that the term "prescribed" – which they applied almost entirely to medication – was awkward and out of place in this context.

*Figure 2: Responsibility for Reducing Fire Risk: Here is a list of groups of people or organizations who might share some responsibility for reducing the risk of severe wildfires. Please tell me whether you think each one should have a great deal of responsibility, some responsibility, just a little responsibility, or no responsibility.*

| GROUP OF PEOPLE/ORGANIZATION | GREAT/SOME RESPONSIBILITY |
|---|---|
| State government | 91% |
| Local government | 90% |
| Public landowners such as the bureau of land management and the forest service | 88% |
| People who live in communities at risk of wildfire | 83% |
| The federal government | 83% |
| Everyone | 81% |
| Private landowners | 80% |
| Timber companies | 79% |
| Conservation organizations | 69% |
| Insurance companies | 60% |
| Native American Tribes | 37% |

**DO focus on the principle of preparation.** Voters intuitively understand and value saving money and lives by stopping unnecessary fires from happening and ensuring that ones that do occur are manageable and limited in their negative impacts. Contrasting the high financial and emotional cost of in the aftermath of a wildfire with the relatively low cost of intervention before the fact is highly persuasive. While voters understand that not every fire can or should be prevented, they like the idea of being proactive and working to avoid the worst of the potential consequences. Fully 53% of voters rated the "preparation" message below "very convincing" – the best response to any message tested by a significant margin.

> **(PREPARATION)** When it comes to reducing wildfire risk, an ounce of prevention is worth a pound of cure. Smart planning and preparation before a wildfire is a better investment than emergency response, firefighting, and clean-up afterward. Thinning one acre of dense forest costs $700 on average, whereas the cost of damaging wildfire is up to $2,150 per acre – for everything from clean-up to reduced tourism and higher insurance rates.

**DO highlight the creation and support of a year-round workforce.** While wildfires are seasonal (with some increasingly more-frequent exceptions), voters intuitively understand the value of working on forest management throughout the year. To many, it makes sense to invest more evenly throughout the year, keeping workers stably-employed, fairly-paid, and connected to the land, than to hurriedly try to assemble a competent workforce as fires occur. To that end, 46% of voters rated the message below "very convincing," the second-highest of all messages tested.

> **(WORKFORCE)** Fire season has turned into a year-round challenge. We need to ensure that fighting fires and reducing the risk of fires is no longer an intermittent, low-paying job that comes at great personal risk. This plan will ensure that we have a year-round workforce constantly working to reduce the risk of severe wildfires.

**DO call out the need to protect and support first responders whose lives are at risk in addressing wildfires.** Voters are extremely sympathetic to firefighters and emergency responders and highlighting them in messaging builds support for investments in wildfire risk reduction. Reminding voters that reducing the intensity and severity of wildfires makes a tough job less dangerous and more manageable is critical. Two in five (41%) called the message below "very convincing."

**(RESPONDERS)** Reducing the risk of severe fires helps protect our firefighters and emergency responders who save lives, homes, and communities. This plan is a critical step to protect the people who protect us.

**DO NOT use language focused generally on equity in distributing funds, but instead explain the context.** Given careful wording, voters rank communities with high risk and few resources as a high priority for funding.

**DO NOT focus on investing in protection of timber supplies or recreational areas.** Voters are less-intensely concerned about timber supplies or outdoor recreation areas, as these are things they felt could be restored or recovered more easily if need be than water supply, habitat, or human communities.

**DO NOT rely on the word "resilience" alone.** This research (and research in myriad other issue areas) has shown that voters do not readily connect this concept with the natural world or infrastructure; rather, they think it applies to people as individuals. Many also think of resilience as a quality displayed in recovery after a disaster has struck, rather than one that reflects an ability to avoid its worst harms. Preparation, safety and health are more appealing frames, because they leave open the possibility that a community could avoid the worst impacts of a disaster – rather than conceding that they will occur. Messaging should focus on concrete and desirable outcomes, such as "safe and healthy forests" or "fire-prepared communities."

**DO NOT assume that people understand how fire threatens water supplies -- but DO convey the reality and seriousness of the risks.** Our research on land conservation messaging over the past few decades has shown that few rationales for action are as compelling as protecting water quality. However, while people generally understand that healthy forests are critical to clean water supplies, the mechanisms by which fire puts water quality at risk are not especially clear. Once the process by which fires lead to contamination of survey water is briefly explained (as in the message below, which 41% rated as "very convincing"), voters find it compelling.

**DO stress provisions for public disclosure, audits, and fiscal accountability in any public spending proposal.** While the data show great confidence in specific public agencies tasked with land management (as discussed below), they also show high degrees of skepticism about "government" writ large. In any discussion of significant federal investment in wildfire risk reduction in our research, that skepticism (and related fears of waste) emerged as the biggest obstacle to winning public support – far bigger than the absolute among of the investment in dollar terms.

**DO use state and federal agencies with land management responsibility as messengers.** Voters especially trust the opinion of the US Forest Service (for some if only because "forest" is in the name), with 70% having a favorable view. They also have highly positive views of the National Park Service the Department of the Interior, and the USDA. Voters understand federal land managers as being guided by the mission of protecting the health of forests for current and future generations and wildlife, and largely trust information from these groups as being free of a profit motive or ideological agenda. The Bureau of Land Management is somewhat more divisive (39% view it favorably and 29% view it unfavorably), and less well-known than agencies like USFS or NPS. Its name likely sounds more bureaucratic than those of many of its partner agencies, and less evocative of the value of the resources being protected.

**DO also give wildland firefighters, park rangers, wildlife biologists and Tribal leaders prominent roles as messengers.** Voters trust messengers they see as neutral experts on fire issues, such as park rangers, wildlife biologists, and tribal leaders. They also value those with firsthand experience like people who have lost their homes to wildfires. Climate scientists are divisive along ideological lines and are best used for specific, climate-engaged audiences rather than the general public. Wildland firefighters were not tested as messengers in this poll, given that in all related research project firefighters are broadly trusted.

# Appendix C:

## Endnotes

1 See Appendix A for workshop summaries.

2 American Association for the Advancement of Science. (2020). *Wildfire trends in the United States.* SciLine. https://www.sciline.org/wildfires/trends/#details

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