HIGH ROADS TO RESILIENCE

Building equitable forest restoration economies in California and beyond

August 2022

climate + community project

THE UNIVERSITY OF BRITISH COLUMBIA
Centre for Climate Justice

ACKNOWLEDGMENTS

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The **Climate and Community Project (CCP)** works to connect the demands of the climate justice movement to the policy development process. We aim to do this by developing new, investment-forward public policy proposals under the framework of the Decade of the Green New Deal that target the intersection of climate justice and the built environment. We support efforts to address the climate emergency at the scale, scope, and pace needed to confront our overlapping crises.

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LAND ACKNOWLEDGMENT

Traditional cultural regions of California, based on the State of California Native American Heritage Commission Digital Atlas of California Native Americans. This map is for general educational purposes and is not for use in determining locations of cultures, boundaries or people for recognition, consultation or any other legal or policy purpose. The Atlas and more information on its use can be found at https://nahc.ca.gov/cp/.

Our study area covers the ancestral territories of numerous Indigenous peoples, including the Maidu, Mechoopda, Miwok, Nisenan, Patwin, Konkow, and Washoe. The land management practices of these peoples, including cultural burning, were integral to maintaining the resilience of Sierra Nevada forests for millennia. The criminalization and attempted eradication of these practices in the interests of settler colonization and extractive industries, along with the genocide and ongoing dispossession of Indigenous peoples from their ancestral lands, is at the root of the current wildfire crisis.

Many Tribes and Indigenous organizations are at the forefront of restorative forest management across the state. There is also now increased interest from settler institutions in traditional knowledge, and a growing recognition of its value for land management. However, this interest has not always entailed substantive political empowerment and territorial control for Indigenous peoples. If current efforts to enhance forest resilience in the face of the climate crisis are to succeed, state and federal agencies, private sector contractors, and non-Indigenous communities at the wildland-urban interface must confront these legacies and advance approaches that support the self-determination of Indigenous peoples.

We are grateful to the Indigenous experts and practitioners who have shared their experiences and knowledge with us in the creation of this report. We hope this report will help to amplify and support their efforts.

LIST OF ACRONYMS

BioMAT	Bioenergy Market Adjusting Tariff
BioRAM	Bioenergy Renewable Auction Mechanism
CalFire	California Department of Forestry and Fire Protection
CEQA	California Environmental Quality Act
CHIPS	Calaveras Healthy Impact Product Solutions
FFRP	The Forestry and Fire Recruitment Program
FRB	Forest Resilience Bond
GGRF	Greenhouse Gas Reduction Fund
LTBMU	Lake Tahoe Basin Management Unit
NEPA	National Environmental Protection Act
NFF	National Forest Foundation
NGO	Nongovernmental Organization
NRC	Natural Resources Conservation
PAL	Project Activity Level
PG&E	Pacific Gas and Electric
PSC	Product or Service Code
SPI	Sierra Pacific Industries
TCSI	Tahoe Central Sierra Initiative
TEK	Traditional Ecological Knowledge
USFS	United States Forest Service
WIP	Watershed Improvement Program

EXECUTIVE SUMMARY

> **This pivotal moment offers a major opportunity for transformative forest management that is socially and environmentally restorative.**

California wildfires have become emblematic of the climate crisis and a harbinger of a dangerous future. Climatic changes are producing drier, hotter conditions and prolonged drought that make forests more vulnerable to seasonal high-wind events, accelerating burning and increasing wildfire severity.[1] The 2020 fire season consumed over 4 million acres across the state, and took at least 31 lives.[2] Fires larger than 100,000 acres (i.e., "megafires") have now become so frequent that the National Interagency Fire Center no longer tracks them as exceptional events.[3] Record-breaking fire seasons have pushed suppression costs upward on a steep curve, with firefighting costs in 2020 exceeding the annual average from 2000 to 2005 by tenfold.[4] The stakes could not be higher for communities across California and the US West: in addition to the existential risks and air quality impacts posed by severe wildfire, functional forest ecosystems are critical for regulating water supplies and trapping carbon dioxide.

To mitigate these risks, there is broad consensus that forest restoration is urgently needed—that is, ecologically informed thinning, burning, and planting to increase forest resilience. Restoration is often aims to create historic forest conditions prevalent prior to widespread fire suppression, while considering unprecedented and uncertain pressures on forest ecosystems resulting from climate crisis.[5] Forest

1 Park Williams et al., "Observed impacts of anthropogenic climate change on wildfire in California," *Earth's Future*, 7(8) (2019): 892-910; Adrian Cardil et al., "Coupled effects of climate teleconnections on drought, Santa Ana winds and wildfires in southern California," *Science of The Total Environment* (2021): 765, 142788.

2 Kimiko Barrett, "Federal Wildfire Policy and the Legacy of Suppression." Headwaters Economics (April 2020), https://headwaterseconomics.org/natural-hazards/federal-wildfire-policy/

3 USFS, *Confronting the Wildfire Crisis: A Strategy for Protecting Communities and Improving Resilience in America's Forests* (Washington, DC: USFS, 2022), FS-1187a, 9. https://www.fs.usda.gov/sites/default/files/Confronting-Wildfire-Crisis.pdf.

4 CalFire, "Emergency Fund Fire Suppression Expenditures" (June 2022), https://www.fire.ca.gov/stats-events/.

5 USFS forest restoration strategies are generally informed by Malcolm North et al., *An ecosystem management strategy for Sierran mixed-conifer forests*. Gen. Tech. Rep. PSW-GTR-220. (Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, 2009). See also Malcolm North, ed. *Managing Sierra Nevada forests*. Gen. Tech. Rep. PSW-GTR-237. (Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, 2012). Further details on prospects for recreating historic conditions in our study area are provided in Kevin McGarigal et al., *Modeling historical range of variability and alternative management scenarios in the upper Yuba River watershed*,

restoration has the potential to reduce catastrophic risk but accomplishing this work at the pace and scale necessary to address the crisis will require substantial investments by state and federal agencies. Those investments are beginning to materialize through new funding programs, but money is only one side of the equation: restoring forests is going to require a huge mobilization of labor with distinctive skills and place-based knowledge. Without increased capacity in the public and private workforce and specific efforts to improve conditions for workers and forest communities, restoration investments are unlikely to achieve their goals, and certainly will not deliver on their transformative potential.

This pivotal moment presents a major opportunity for transformative forest management that is socially and ecologically restorative. A dramatic increase in the pace and scale of forest restoration promises not only to reduce wildfire severity and enhance forest resilience, but also to sustain long-term employment and reinvigorate forest-based industries in areas that have suffered from the decline of the timber industry. Vibrant economies in resilient rural communities will require workers with an array of skills: sawyers and large-equipment operators who thin overstocked forests; truckers who move cut material off forests; permitting professionals to take projects through the approval process; staff at state, federal, and Tribal agencies who can manage partnerships, oversee contract work, and help define restoration priorities; and an array of workers in other industries, from construction to catering to health care, who can build the necessary physical and social infrastructure. This effort will require a diverse range of expertise, including Traditional Ecological Knowledge implemented by Indigenous practitioners according to principles of self-determination.

For many of the community-based nonprofits, Tribal governments and organizations, and public agencies working toward shared goals in forest stewardship, new resources for forest restoration offer an opportunity to build rural "restoration economies" that will sustain critical forests and watersheds as well as local communities. **These efforts are part of a "high road" approach to forest restoration, or one that prioritizes benefits for disadvantaged communities, begins to redress past harms, and offers workers livable wages in dignified working and living conditions**. However, this high road path will not be achieved simply by increasing the pace and scale of forest management as it is currently undertaken: deliberate policy interventions are essential to ensure the sustainability and resilience of forests, forest economies, and the communities that are situated in this increasingly dangerous landscape.

This report offers concrete recommendations for state, federal, and nongovernmental actors to build an equitable and sustainable forest restoration workforce. Focused on California's Tahoe and Central Sierra region, the lessons offered here have implications for public lands management nationwide. Climate adaptation efforts will require massive mobilizations of labor across the United States. This labor will be necessary not only to respond to future disasters, but also to address ecological damage that contributes to social vulnerability. California's forest and fire management practices are on the frontlines of emerging issues regarding how forest restoration and other "nature-based solutions" for climate mitigation and adaptation will be implemented. Lessons learned in this pivotal moment for the state will have broad relevance for climate adaptation in other jurisdictions.

The qualitative and quantitative evidence in this report shows that effective climate policy must deliberately prioritize holistic, restorative solutions for both forests and communities. It is possible to envision a "low road" approach to restoration that relies on lowest-cost labor, poor working conditions, and contracting decisions that send the economic benefits of restoration to faraway cities. But a high road approach to forest restoration is also within reach, which could create new industries in communities suffering the impacts of past economic decline, and deliver quality, long-term employment in diversified forest-based economies. **The vision we offer here is a program of transformative, systemic investments in public lands and the communities that care for them**.

The findings and recommendations in this report draw on research from 2018 to 2021 on forest restoration in the Tahoe and Central Sierra region of California, including interviews with practitioners in the forest restoration industry across federal, state, Tribal, private, and nonprofit sectors, and a survey of the existing forest restoration industry local to the study area. The interviews shed light on challenges facing local practitioners in the restoration industry, including interconnected issues of wages, housing, and access to health care and transportation. Our interviews also highlight key gaps in US Forest Service (USFS) capacity and practices, and their impacts on workforce development as well as the ability to implement restoration work in the sector as a whole. We further analyze trends in public spending on forest restoration in the study area from 2008 to 2021, showing that a large proportion of local spending goes to a few large fire suppression businesses. We also assess available data on grant making by the state of California,

Tahoe National Forest, California. Gen. Tech. Rep. RMRS-GTR-385. (Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Stations, 2018). However, these approaches do not encompass Indigenous practices of forest management rooted in Traditional Ecological Knowledge. As this report argues, expanding and diversifying the range of expertise guiding management interventions is essential to a high road approach to restoration.

pointing out gaps in transparency of these data that leave us unable to trace where these revenues ultimately go. A series of case studies highlight emerging, grassroots models for building workforce capacity while addressing linked social and ecological goals.

Based on this research, we offer findings across four main areas.

First, **California's grant programs that fund forest restoration offer essential resources, but key changes to the grant system, as well as increased transparency and accountability, are needed to ensure grant funds are supporting local workers and workforce development**. Simply putting more money into the current system will not advance key environmental or social goals, including workforce development and equity. State grants pose challenges for small operators, which are exactly the kinds of businesses that will need to flourish to support rural economic revitalization based on forest restoration.

Second, **labor shortages are being felt across the restoration sector** as a result of low wages, difficult working conditions, loss of forestry knowledge as a result of industrial decline, competition with low-wage employers in other sectors, and structural problems for rural communities, including high costs of housing, transportation, and health care.

Third, **limited USFS capacity poses challenges for implementing restoration work and building the workforce, and limits the effectiveness of new state and federal funding coming into the system.** High workforce turnover at the district and forest levels, coupled with widespread staff shortages, limits USFS's ability to make optimal use of partnerships and new funding, and has a detrimental impact on workforce development by inhibiting relationship-building with the local communities.

Fourth, **an array of structural political and economic factors limit the pace and scale of forest restoration** in ways that contribute to local economies. Rural and Indigenous communities especially suffer the impacts of poverty, including limited access to housing, health care, transportation, and telecommunications, and increased exposure to the criminal justice system—all of which pose challenges in workforce development and equity for workers. **Policy learning and equity in forest work must include greater collaboration between Tribes and state and federal agencies**, which requires increased commitment by federal agencies to engaging in government-to-government relations, increased education for public employees and forestry practitioners on Tribal law and sovereignty, and greater support for consultation on living cultural resources. Other political-economic issues include the high costs of insurance for forestry businesses; difficulties accessing capital for small businesses; short grant funding windows coupled with shortening working seasons; and the lack of wood processing infrastructure that limits commercial opportunities to utilize sub-timber biomass coming off of forests. Many of these issues can only be rectified through broad-based, investment-forward policy responses grounded in a holistic industrial policy that can reshape public lands management and rural economic development.

To intervene in these conditions, we offer policy recommendations targeted at both the state and federal level to achieve four key goals:

1: **Increase the effectiveness of state funding for forest management and workforce development**

State funding for forest restoration comes mostly through a patchwork system of grants which many contractors and nonprofit organizations, particularly small operators, find to be inflexible, cumbersome, and opaque. To remedy the problems discussed in detail throughout the report, we offer specific recommendations to **increase the flexibility of state grant funds for forest restoration while developing non-competitive and coordinated funding approaches to a variety of forest restoration practitioners**. These reforms will facilitate long-term investment in essential infrastructure for sustaining forest economies, and will enable organizations and businesses to spend more time and resources accomplishing necessary work and less time writing grants or waiting for payment. We also offer recommendations to state and federal agencies regarding best practices to increase equity in the bidding process by prioritizing workforce development, fair labor practices, and the social and economic benefits of forest restoration for local communities. Finally, we recommend increased transparency and improved communication that creates a single-point source of information on grant-funded projects available for bid while redressing inequity in the bidding process. These recommendations will benefit small operators and organizations focused on workforce equity, and will improve data availability on the workforce development impacts of state grant funds.

2: **Build an equitable and sustainable workforce**

Forest restoration work in the Central Sierra and across the West is often dangerous, underpaid, and unpredictable, and prior research has demonstrated racial and ethnic disparities in working conditions. The industry relies heavily on incarcerated labor in fire suppression, but formerly incarcerated firefighters face numerous barriers to employment post-release. As a result, there is a serious labor shortage that is limiting capacity for forest restoration. **To remedy these problems, the state of California and the USFS should develop cross-agency**

approaches to increasing wage standards, harmonizing training requirements, and improving enforcement of labor law as part of ongoing collaborations for forest management. Further, living wage costs should be integrated into planning and budgeting for public lands restoration work, particularly to ensure that wages for proactive forest management are competitive with those for disaster response, and guidelines for considering best value in USFS contracting processes should be updated to prioritize high labor standards and local workforce development. **The state should also facilitate career pathways for formerly incarcerated firefighters and provide state funding to increase financial and human resources for essential skills and safety trainings to all workers**, including know-your-rights trainings, certifications to recognize on-the-job training, and paid apprenticeship programs linked to specific career paths. Government-to-government relations among federal and Tribal institutions that support Indigenous land stewardship are essential to getting forest restoration on a high road; to this end, state and federal agencies should provide staff with education on Tribal law and sovereignty. Colleges and universities should partner with Indigenous-led education programs in order to cultivate awareness about Traditional Ecological Knowledge (TEK) in forestry and related educational programs, while ensuring that such engagements support Indigenous sovereignty over TEK and self-determination.

3: **Rebuild key capacities in the Forest Service**

After years of attrition, reorganizations, and overarching austerity, the Forest Service and other federal land management agencies are critically understaffed and lack the necessary capacity to manage forest restoration at the level of ambition articulated in state and federal policy. **While more emphasis has been placed on partnerships and contracting to fill capacity gaps, we find that understaffing also limits the agency's ability to work effectively with restoration partners**. To rectify this situation, USFS should focus hiring efforts on the following permanent positions: project management, oversight, and coordination for large partnerships; well-compensated Tribal Liaisons in partnership with local Tribal governments and other Indigenous leadership; and experts in planning, permitting, compliance, and monitoring. The agency should also explore options to increase retention in key leadership and public-facing positions, and address barriers to employment for formerly incarcerated firefighters in agency policy and culture. Finally, new economic assessments should be conducted to consider the full costs of contracting to determine which functions are better served by permanent staff positions, and which can be jointly funded or contracted with NGO, industry, and philanthropic partners.

4: **Build restoration economies**

A renewed focus on forest management that follows these recommendations represents a generational opportunity to invest in communities and landscapes that are suffering from environmental degradation and long-term under-investment. However, the inverse is also true: **failure to invest in environmental and social well-being beyond the narrow bounds of fire risk reduction will limit the potential of those initiatives to ensure a livable future**. To make the most of a growing forest restoration industry, state and federal governments should develop a suite of policies that put whole communities on the high road to resilience. There must be policy support for local utilization of non-timber biomass beyond existing subsidies, with appropriate environmental protections, driving new industries while reducing wildfire risk. A high road trajectory for forest management will require increased state support for consultation with Tribes over living cultural resources and non-timber forest products, and the launch of new state and Tribal partnerships in order to enable policy learning from Tribes exploring new forest management, housing, transportation, and biomass energy solutions. These initiatives must ensure that the needs of rural and Tribal communities are addressed in policy interventions aimed at increasing equity in housing, health care, and transportation.

Ultimately, this report lays out a road map for reinvestment in rural communities and landscapes by a range of stakeholders—including community nonprofits, Tribal organizations, and state and federal agencies—that can put forest restoration on the high road to a safer, more vibrant future in a warming world.

I. INTRODUCTION

California wildfires have become emblematic of the climate crisis and a harbinger of a dangerous future. The 2020 fire season consumed over 4 million acres across the state, and took at least 31 lives.[6] Fires larger than 100,000 acres (i.e., "megafires") have now become so frequent that the National Interagency Fire Center no longer tracks them as exceptional events.[7] Fifteen out of the top 20 most destructive fires in the state's recorded history have occurred since 2010, and suppression costs in 2020 exceeded the 2000–2005 annual average by tenfold.[8] Even California's landscapes that are not historically fire-adapted, like the eastern Mojave, have seen unprecedented fire activity in recent years.

Climate impacts on fire behavior are exacerbated by long-standing practices of fire exclusion and timber extraction that have decreased forest resilience.[9] New approaches to forest management are urgently needed if California and other fire-prone regions are to forge new ways of living with fire.

California and the federal government have sought to meet these challenges with unprecedented quantities of new funding to forest and fire management, even while contending with the impacts of the COVID-19 pandemic. This has included a record $2.7 billion four-year investment in wildfire resilience programs,[10] including further support for a suite of grant programs to support proactive forest restoration, many of them funded through the state's carbon markets via the Greenhouse Gas Reduction Fund (GGRF). In 2020, California entered into a Shared Stewardship Agreement with the US Forest Service (USFS) with the goal of implementing restoration activities on 1 million acres a year—half on state responsibility areas and half on USFS lands—and building the necessary infrastructure and workforce to accomplish these goals. Such activities include thinning of smaller trees and brush, often in combination with commercial timber harvesting, as well as prescribed fire treatments and (less often funded through existing sources) Indigenous cultural burning. This commitment is part of the USFS's 10-year plan to treat an additional 50 million acres of federal, state, Tribal, and private lands nationally—approximately a 160 percent increase above current levels[11]—with a focus on Western states, and to develop strategies for their long-term maintenance.[12] The California Air Resources Board has further proposed restoration treatments across 2–2.5 million acres of forest and shrublands every year, in order to reduce carbon emissions in keeping with state climate policy goals.[13] This level of ambition represents an almost tenfold increase above current state levels.[14]

A significant increase in the pace and scale of forest restoration promises not only to reduce wildfire severity and enhance forest resilience, but also to sustain long-term employment and reinvigorate forest-based industries in areas that have suffered from the decline of the timber industry. USFS anticipates that its 10-year plan will create between 300,000 and 575,000 jobs. For many of the community-based nonprofits, Tribal governments and organizations, and public agencies working toward shared goals in forest stewardship, new resources for forest restoration offer an opportunity to build rural restoration economies that will sustain forests, watersheds, and local communities. The ability

6 CalFire, "2020 Fire Siege" (2020). https://www.fire.ca.gov/media/hsviuuv3/cal-fire-2020-fire-siege.pdf

7 USFS, *Confronting the Wildfire Crisis: A Strategy for Protecting Communities and Improving Resilience in America's Forests* (Washington, DC: USFS, 2022), FS-1187a, 9. https://www.fs.usda.gov/sites/default/files/Confronting-Wildfire-Crisis.pdf.

8 CalFire, "Emergency Fund Fire Suppression Expenditures" (2021, Nov), https://www.fire.ca.gov/media/px5lnaaw/suppressioncostsonepage1.pdf; CalFire, "Top 20 Most Destructive California Wildfires" (2022, Jan), https://www.fire.ca.gov/stats-events.

9 Brandon M. Collins et al., "Impacts of different land management histories on forest change," Ecological Applications, 27(8) (2017): 2475–2486.

10 Fire Districts Association of California, "Governor's Proposed 2022-23 State Budget, Wildfires, and Emergency Services." (10 Jan 2022), https://www.fdac.org/news/593075/Governors-Proposed-2022-23-State-Budget-Wildfires-and-Emergency-Services.html.

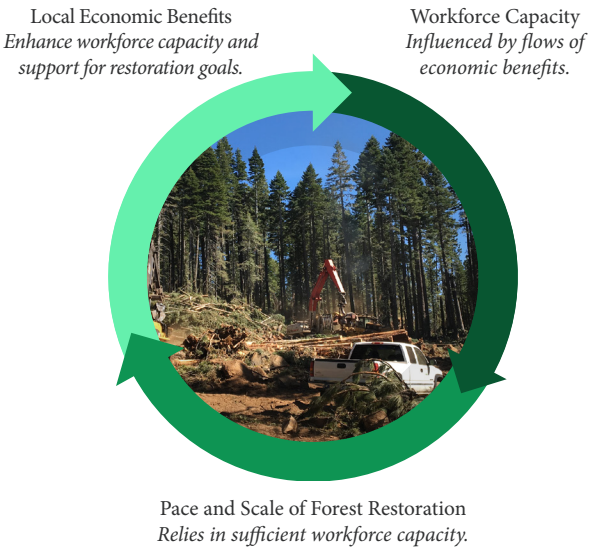
11 T*estimony of Christopher French, Deputy Chief, National Forest System Service, USDA, before the United States Senate Subcommittee on Energy and Natural Resources. Concerning Infrastructure Needs, Western Water and Public Lands, and the Discussion Draft of the Energy Infrastructure Act*. (24 June 2021), page 2. https://www.energy.senate.gov/services/files/AAF7DF40-2A47-4951-ADA4-4B124AD3894F; *USFS Acquisition Mechanisms and Potential for Increased Local Contracting*, Sierra Institute, n.d. https://scale.sierrainstitute.us/scale/uploads/Local_Contracting.pdf

12 USFS, *Confronting the Wildfire Crisis*, 11.

13 California Air Resources Board (CARB). *Draft 2022 Scoping Plan Update*, (10 May 2022), https://ww2.arb.ca.gov/sites/default/files/2022-05/2022-draft-sp.pdf.

14 CARB, *Draft 2022 Scoping Plan Update*.

to capture restoration contracts locally, build workforce capacity and jobs, and increase the pace and scale of restoration should ideally be mutually supportive.



Ideal relationship between workforce capacity, pace and scale of forest restoration, and local economic benefits of restoration activities. Image by authors.

However, increased spending on restoration activities in a given area does not automatically create high quality local jobs, which ultimately are essential for increasing the capacity to accomplish restoration goals. Prior research has shown wide variation in local capture of economic benefits from forest restoration work,[15] and despite unprecedented levels of financial and political support, workforce capacity presents a widely acknowledged challenge to forest management goals.[16] Moreover, there is no guarantee that the resulting jobs will produce livable wages or career paths for workers. A 2020 report from the University of California, Berkeley Labor Center highlighted difficult working conditions across the natural and working lands sector, including agriculture, logging, and forest management.[17] This sector has the highest fatality rate of any in the state and median hourly wages among the lowest, ranging from $10.66 for forest and conservation workers to $19.77–$24.43 for logging workers. The industry is also heavily reliant on incarcerated and migrant workers utilizing the H2B visa program.[18] Migrant workers are often paid less than non-migrant workers and are more vulnerable to labor abuses because of a lack of legal protections, while incarcerated workers are paid a few dollars a day, and are subject to increased rates of injury and limited employment opportunities upon release.[19] Additionally, enforcement of wage and safety standards is inadequate across the industry.[20]

Given the realities of low-paid, high-risk work in the sector and the overall decline of more lucrative logging jobs, it is no surprise that the industry faces a labor shortage. Rising housing and transportation costs across many rural areas in California increase these challenges. If California is to meet its ambitious goals for scaling up and transforming forest management into a climate solution, state and federal policy and funding must support a sustainable and equitable forest management industry. Current funding increases and policy support in the state present a rare and valuable opportunity to address the linked social and environmental degradation at the root of climate vulnerabilities, and to advance truly transformative solutions.

This report is intended to provide actionable lessons for stakeholders—including community nonprofits, Tribal organizations, and state and federal agencies—to realize that opportunity.

15 Allison Reeves Jolley, Jonathan Kusel, and Eric Hann. *USFS Collaboratives and Local Benefit: What's Local Anyway?* (Sierra Institute, 2016); Allison Ellison, Ann Moote, Heidi Huber-Stears, and Kelly Jacobson. *Investments and Local Capture on the Ochoco National Forest: Restoration and Timber Contracts, 2006-2015*. Ecosystem Workforce Program Working Paper No. 74. (University of Oregon Ecosystem Workforce Program, 2017); Chelsea P McIver, Alexander L Metcalf, and Erik C Berg. "Procurement Contracting and Forest Communities: Factors Affecting Local Business Utilization in the Inland Northwest," *Journal of Forestry*, Volume 116, Issue 5, (2018): 412–419.

16 Forest Climate Action Team. *California Forest Carbon Plan: Managing Our Forest Landscapes in a Changing Climate*. (Sacramento, CA: 2018), 2.

17 Robert Collier, "Ch. 11: Natural and Working Lands." In Carol Zabin, ed., *Putting California on the High Road: A Jobs and Climate Action Plan for 2030*. (Berkeley, CA: UC Berkeley Labor Center, 2020).

18 Collier, "Ch. 11: Natural and Working Lands."

19 Nicole Goodkind, "California is facing a wildfire fighter shortage because prisoners are getting sick with COVID," Fortune (15 Jul 2020).

20 Collier, "Ch. 11: Natural and Working Lands."

WHY TAKE THE HIGH ROAD?

Climate impacts across the United States—rising seas and temperatures, changing precipitation patterns, and extended fire seasons—are already prompting adaptive changes to policies, infrastructure, and industries. Adaptive actions can take one of two paths, or a course in between. A high road approach to climate adaptation prioritizes redress of environmental injustices, substantive participation from frontline communities, and quality employment. Alternatively, a low road approach prioritizes already-privileged communities, sidelines the history and needs of vulnerable populations, and seeks lowest-cost solutions that create a race to the bottom for workers' rights and wages.

A report commissioned in 2020 by the California Workforce Development Board outlining high road approaches for California's climate action recognized that "well trained workers are key to delivering emissions reductions and moving California closer to its climate targets," and that "deliberate policy interventions are necessary in order to advance job quality and social equity as California transitions to a carbon neutral economy, just as such efforts are required to reduce pollution, protect human and environmental health, and to safeguard communities from an already-changing climate."[21] That report identified troubling "low road" trajectories in California's path to forest resilience, given prevalent low-wage, high-risk working conditions and little job security across the sector. There are a number of risks associated with increasing the pace and scale of restoration along this low road approach. First, it risks exacerbating existing injustices to workers, while creating low-quality jobs that offer little benefit to forest-adjacent communities. Second, it risks undermining the success of forest restoration efforts, as certain parts of the industry with higher pay (state fire suppression, unionized line-clearance work for utilities, emergency response) attract a greater share of the workforce, while proactive forest management and maintenance work suffers. Without higher wages and increased labor protections for this essential work, the vicious circle of increasingly costly fire suppression will continue.

This report argues that a high road approach is necessary in order to support key public agency goals for successful forest management, including:

- Building workforce capacity in federal and state agencies as well as in local, Tribal, nongovernmental, and other organizations to coordinate and accomplish the work
- Building a large multijurisdictional coalition, including broad public and community support for the work at the scale necessary to make a difference[22]
- Developing a robust, beneficial fire workforce
- Expanding cultural burning and Tribal engagement[23]

But this approach also has the potential to take us further, toward transformative social and ecological resilience in forest and fire management that supports broader public investment agendas. Rather than focusing on sustaining systems with their current characteristics, the ecological concept of transformative resilience entails "an intentional transition to a new system that will be desirable under future conditions." In order to achieve this "profound shift in the human relationship with wildfire [toward] one that embraces the dynamic and rapidly changing role of fire in social–ecological systems,"[24] an equally profound shift is necessary in the economic systems that have shaped relationships to wildfire.

A high road approach begins with a holistic view of climate vulnerability, addressing the social and environmental impacts of industrial activity, fire exclusion, and genocide against Indigenous peoples. It foregrounds solutions that are both socially and environmentally restorative, addressing interconnected challenges facing the rural workforce like the cost and availability of housing, transportation, and health care, especially prioritizing support for Indigenous self-determination and Tribal stewardship of ancestral lands. Crucially, it entails ecologically sound management that is not focused only on reducing wildfire risk, but also on supporting biodiversity and watershed health. While this report does not make ecological recommendations for forest management, we do highlight the importance of place-based knowledge and skilled labor in ecologically sensitive forest restoration work. That is, a high road approach must be good for workers, communities, and the land, and achieve its objectives in inclusive and equitable ways.

It is not too late to put forest restoration, and climate adaptation more broadly, on a high road. California and the federal government have environmental justice mandates for key agencies, but these commitments will need to be taken seriously and integrated into sweeping policy and regulatory changes across the country.

21 Tim Rainey and Kim Gordon, "Foreword," in Carol Zabin, ed., *Putting California on the High Road: A Jobs and Climate Action Plan for 2030*, (Berkeley, CA: UC Berkeley Labor Center, 2020).

22 USFS, *Confronting the Wildfire Crisis: A Strategy for Protecting Communities and Improving Resilience in America's Forests* (Washington, DC: USFS, 2022), FS-1187a,11, https://www.fs.usda.gov/sites/default/files/Confronting-Wildfire-Crisis.pdf.

23 California Wildfire and Forest Resilience Task Force, *California's Strategic Plan for Expanding the Use of Beneficial Fire*, (Sacramento, CA: 2022), 4-5. USFS, *Confronting the Wildfire Crisis*, 30.

24 McWethy et al., "Rethinking Resilience to Wildfire," *Nature Sustainability* 2 (2019): 797–804.

About this Report

This report provides insight into linked social, political, and economic issues impacting workforce capacity across the sector in the Tahoe and Central Sierra region of California, a key area both for the forest restoration industry and for forest management priorities in the state. Hosting watersheds that supply 60 percent of the state's drinking and irrigation water, the forests of the Sierra Nevada play a particularly critical role in determining resilience to both drought and wildfire.[25] This study aims to inform actions by contracting agencies and policymakers to ensure that investments in restoration are supportive of both local workforce capacity and forest health, through greater understanding of:

1: The current trends in local capture of restoration-related contracts;
2: The capacities, experiences, and needs of contractors local to the study area, especially with regard to contracting on USFS lands;
3: The interconnections among workforce capacity and fundamental issues of equity, housing, health care, and transportation.

We use a survey, interviews, and analysis of data on state and federal spending on forest management to develop targeted recommendations for building local workforce capacity and increasing the effectiveness of collaboration among federal, state, Tribal, and nongovernmental organizations (NGOs), while advancing equity and sustainability in the forest restoration industry. See the Appendix for a detailed description of our methods. Our methodology and approach was developed in consultation with a steering committee of partners from local organizations involved in forest management (see Acknowledgments).

Our approach is both backward- and forward-looking: the first section, **Forests and Fire in the Central Sierra**, situates the current wildfire crisis in the larger context of settler-colonial land management in California, demonstrates the historical roots of interconnected social and environmental vulnerabilities, and charts broad shifts in public lands management to the present day. The section on **Patterns in Local Capture of Federal and State Restoration Funding** uses public data on spending of federally appropriated dollars on forest management in the study area to examine the distribution of USFS contracts between Fiscal Years 2008 and 2021. This section explains the distribution of both the frequency and value of contracts going to local, in-state, and out-of-state contractors, to describe trends in the local capture of restoration contracts.[26] We focus specifically on capture of restoration contracts, rather than economic benefits more broadly, in order to highlight the relationship between local contracting and workforce development. This section also examines available data on spending and jobs created through CalFire grant programs funded through the GGRF. We highlight data gaps that prevent deeper analysis of local capture of GGRF funds through these programs.

The following sections about **Private Sector Workforce Capacity and Needs** and **USFS Capacity and Partnerships** use data from a survey of contractors local to the study area (n=46), follow-up interviews with a self-selected group of these contractors (n=22), and interviews with USFS staff at the forest and district levels (n=11). These interviews are given deeper context through background conversations with 14 staff from local and state organizations and observation of the North Yuba Forest Partnership from 2020 to 2021.

The survey data offer a snapshot of the local industry, showing the wide range of capacities in the local private sector while also highlighting barriers to scaling up work and competing for contracts on USFS lands. While other public lands form crucial parts of California's approach to forest and fire management, we focus specifically on USFS as the largest manager of forest lands in our area and of more than half of forest lands in the state.[27] Interviews offer further insight into the experiences of local contractors navigating changes in the industry, including the recent influx of grant-based state funding, and the challenges of competing with low-cost, high-volume companies often based out of state. Lastly, interviews with USFS staff shed light on issues of staffing capacity within the agency and its critical importance to enabling effective partnerships and utilization of state funding opportunities.

A pullout section features **Case Studies** that highlight emerging models for building workforce capacity for landscape management while also addressing linked social goals. These can be read separately and include relevant recommendations. The final section synthesizes **Recommendations** from across all sections, which are targeted at local, state, and federal entities.

This report augments and complements existing research highlighting various dimensions of workforce capacity in the forestry sector, including a 2020 report from The Watershed Center focused on capacity and needs of regional, local, and Tribal

25 Sierra Nevada Conservancy, *The State of the Sierra Nevada's Forests: From Bad to Worse.* (Auburn, CA: Sierra Nevada Conservancy, 2014); California Department of Water Resources. *Estimates of Natural and Unimpaired Flows for the Central Valley of California: Water Years 1922-2014.* (Sacramento, CA: CDWR 2015).

26 See Appendix for more details on defining local economic benefit.

27 USFS "Ecological Restoration and Partnerships – Our California Story" https://www.fs.usda.gov/detail/r5/landmanagement/?cid=stelprdb5412095#:~:text=National%20Forests%20play%20a%20critical,one%2Dfifth%20of%20California's%20landscape

entities engaged in forest management,[28] and a 2021 statewide quantitative assessment of workforce capacity and needs, in development simultaneously with this report.[29] This report adds to these assessments, with qualitative insight into the experiences of local contractors and the intersecting issues affecting workforce capacity and labor markets in rural communities, including housing, health care, access to transportation, impacts of the criminal justice system, and equity issues.

More specifically, building on the 2020 High Roads report from the Berkeley Labor Center,[30] this report highlights working conditions and wages as key issues affecting capacity in the sector. We call attention to downward pressures on wages across the sector, and detail emerging models for socially and environmentally restorative solutions via our case studies. **Our findings show that rebuilding public capacities for land management and re-valuing woods work—a term that conventionally refers to logging, but which we use to name a broad range of labor engaged in forest management and restoration—is key to building social and ecological resilience in the face of climate crisis.**

Study area and Approach

Research informing this project began in 2018 by Nelson and Bigger, focused on the Forest Resilience Bond pilot project on the Tahoe National Forest.[31] From that initial research, we determined the need for a more holistic understanding of workforce-related issues affecting the forest restoration industry and how they impacted, and were impacted by, new ways of funding and financing forest work.

In fall of 2020, we recruited steering committee members through outreach to the Yuba Forest Network and the North Yuba Forest Partnership. We also attempted to recruit members from groups in the southern part of the study area, but were not successful. Steering committee members were staff from organizations local to our study area engaged in forest and fire management, and knowledgeable of the forestry industry (see Acknowledgments for a list of steering committee members). These partners helped to determine the scale of the study, hone research questions, and design the survey. They were also invited to provide feedback and comments on the draft of this report.

Study area: Tahoe Central Sierra Initiative (TCSI) and adjacent counties

Our study is independent and not affiliated with the Tahoe Central Sierra Initiative (TCSI) group. However, we used the TCSI area to determine our scale of analysis for a few reasons. The TCSI is the first pilot program under the Sierra Watershed Improvement Program (WIP),[32] a large-scale restoration program designed to restore the health of the Sierra Nevada forests, which supply most of California's water, while creating resilient communities. Goals outlined in the WIP Roadmap to Resilience include reducing risk from wildfires, fostering wood products infrastructure and new markets for biomass and wood products, developing employment opportunities in rural areas, reducing carbon emission, increasing water quality and quantity, improving air quality, and helping the state adjust to a changing climate.[33] As the pilot project of the WIP, the TCSI is focused on developing innovative planning, investment, and management across a 2.4-million-acre landscape and secured over $30 million in grants by 2022.

The TCSI is an example of the kind of large-scale collaborative management envisioned in USFS's 10-year plan, which relies heavily on collaboration with partners to prioritize forest health treatments at the fireshed scale—referring to landscapes of around 250,000 acres in which ignitions can spread to communities.[34] Existing partnerships and large-scale collaborations within the TCSI area, supported by state grant funds, provide valuable lessons for future efforts to support broad-based social and ecological resilience in forest-dependent communities across the West. Because many communities in this area are also historically timber-dependent, the TCSI offers a window onto how the local forest management industry might respond to new public funding for forest management, and the track record of current public grant programs.

28 Emily Jane Davis, Allison Jolley, and Nick Goulette, *Investment Opportunities for Increasing Forest and Fire Management Capacity in California: A Capacity and Needs Assessment of Local Groups, Non-Profits, and Tribes* (Hayfork, CA: The Watershed Center, 2020).

29 North State Planning and Development Collective, *Forest Sector Workforce Study Report*, (Chico, CA:, Chico State University, 2021)

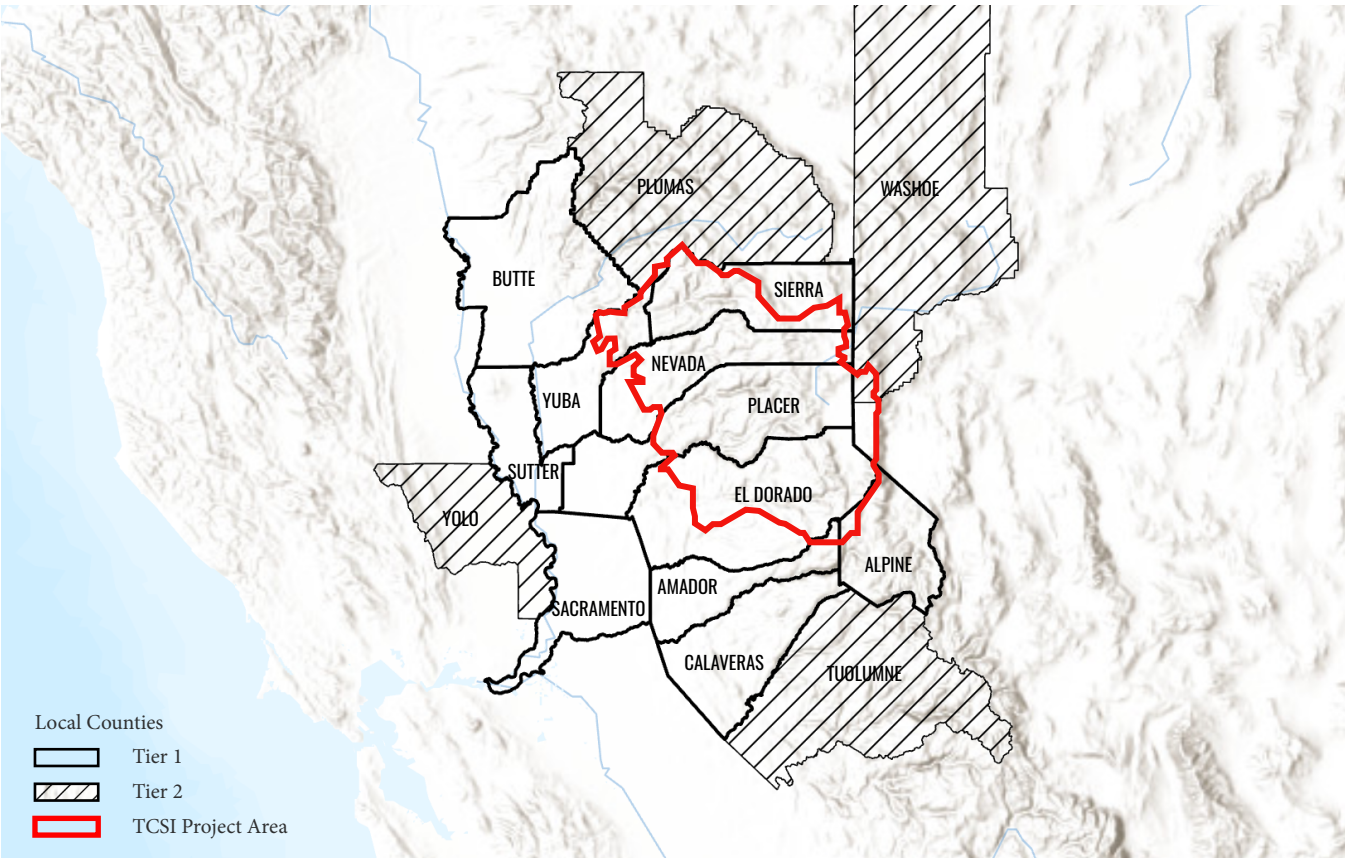
30 Collier, "Ch. 11: Natural and Working Lands."

31 See case study 'Finance and Investment for Forest Restoration Economies' in Section VI of this report.

32 "Sierra Nevada Watershed Improvement Program, "What We Do, Sierra Nevada Conservancy," https://sierranevada.ca.gov/what-we-do/.

33 "Sierra Nevada Conservancy, "Tahoe-Central Sierra Initiative Roadmap to Resilience," https://sierranevada.ca.gov/what-we-do/tcsi/roadmap-to-resilience/.

34 USFS, *Confronting the Wildfire Crisis*, 3.



Map 1.1: Study area overlaid with the TCSI project area.

Defining "local"

The definitions of "local" used in this report were developed in conversation with our steering committee, building on existing research by the Sierra Institute and the Ecosystem Workforce Group at the University of Oregon.[35] We developed a two-tiered approach to assessing the local capture of contracts using federally appropriated funds on USFS lands. We looked at counties overlapping or immediately adjacent to the TCSI, and discussed with our steering committee what boundaries might be most appropriate for the analysis. We included Butte, Sacramento, and Sutter counties in the first tier as important centers for local industry, and Plumas in the second tier as a result of the perception that this area may be over-represented in existing research. Calaveras County was also perceived as being integral to the local area. We included additional counties with locally important businesses or industries in the second tier. Map 1.1 shows the outlines of Tier 1 and Tier 2 counties. See the Appendix on this report's methodology for more details about study area definition, data analysis, and survey and interview methodology.

County-level analysis offers a useful overview of the proportion of work going to contractors based in the area versus those based in adjacent counties, elsewhere in California, or out of state, with the recognition that counties are internally diverse and may not be contiguous with communities with "shared interests, values, and identities" and shared institutions such as schools or community organizations.[36] Because much of our study area is rural, with a few significant urban hubs (Sacramento and Tahoe-Reno), a two-tiered approach allows us to capture a range in which contractors may travel for work (while some may travel farther), and include businesses based in urban centers who operate throughout the area. Our survey dissemination employed these same boundaries. We disseminated the survey only to contractors in first-tier counties, but we nonetheless received a few responses from those in second-tier counties, which were included in the survey results.

35 Allison Reeves Jolley, Jonathan Kusel, and Eric Hann, *USFS Collaboratives and Local Benefit: What's Local Anyway?* (Sierra Institute, 2016); Allison Ellison, Ann Moote, Heidi Huber-Stears, and Kelly Jacobson. *Investments and Local Capture on the Ochoco National Forest: Restoration and Timber Contracts, 2006-2015*. Ecosystem Workforce Program Working Paper No. 74. (University of Oregon Ecosystem Workforce Program, 2017).

36 Elinor Ostrom, quoted in Jolley et al., *USFS Collaboratives and Local Benefit: What's Local Anyway?*, 10.

II. FORESTS AND FIRE IN THE CENTRAL SIERRA: HISTORICAL ROOTS OF SOCIAL AND ENVIRONMENTAL VULNERABILITIES

California's modern landscapes have been shaped as much by fire exclusion as by fire itself. Across the state's many biomes—over half of which are fire-dependent, and virtually all of which are fire-adapted—efforts to extinguish fire and traditional fire practices have been central to the colonial settlement of California, alongside equally transformative efforts to reengineer the state's hydrological systems. The traditional burning practices of California's many Indigenous peoples, which sustained diverse culturally and ecologically significant ecosystems across the state, were first curtailed by the Spanish and later outlawed by the US federal government in 1850, coinciding with Californian statehood.[37] In various ways and shifting through the decades, fire suppression has been integral to the colonial settlement of California and its agricultural, natural resource, and real estate development. **Many of the iconic California places that are now threatened by climate-induced changes in fire activity—from the vineyards of Napa and Sonoma Counties to the palatial homes of the Malibu Hills—are the result of these interconnected processes of terraforming in pursuit of control over fire and water**.

The forests of the Sierra Nevada exemplify the combined role of extractive economic development and fire exclusion in transforming landscapes and, ultimately, deepening climate vulnerability. Beginning in the 1850s, hydraulic mining for gold transformed the watersheds of the Feather, Bear, Yuba, Mokelumne, and American rivers, unleashing over 1.5 billion cubic yards of debris and creating environmental impacts that persist today.[38] Capital-intensive mining prompted the construction of water infrastructure that, when later converted to agriculture and hydroelectric applications, "permanently altered Sierran stream systems." It also increased the capacity and demand for commercial timber development in the region.[39] With the establishment of the Division of Forestry and, later, the US Forest Service, managing these timber resources became a crucial part of US nation building, justifying the extension of federal power over massive Western territories.[40] **Over time, the growth of commercial forestry changed the composition of forests, reducing species diversity and increasing vulnerability to disease, infestation, and high-severity fire**. In the process, the suppression of fire became a structural pillar on which the institutional system for the management of public lands in California was constructed, with implications for the rest of the country.[41]

Following the devastating fire season of 1910, total fire suppression became agency policy in an effort to protect timber resources and other assets. The USFS "10am rule," enacted in 1933 and not dismissed until 1971, mandated that any natural ignition on Forest Service land was to be extinguished by 10am the next day.[42] Starting in the 1960s and 1970s, a growing realization among forest ecologists and land managers that fire exclusion was unsustainable and, ultimately, destructive led to greater provisions for managing fire in the National Park Service and Forest Service. **But while agency policies have fluctuated in the following decades, the overriding imperative of fire suppression has largely remained dominant, primarily because of the obligation to protect communities and assets**. Fire has been vilified as a dangerous aberration, rather than an essential ecological process, through a decades-long public relations campaign featuring Smokey Bear. Increasingly militarized following World War II, fire suppression is now a multi-billion-dollar industry.[43]

In the Sierra Nevada, timber extraction and attendant fire suppression have changed the structure and composition of conifer forests throughout the region and pushed

37 Susie Cagle, "'Fire is medicine': The tribes burning California forests to save them," The Guardian (21 November 2019).

38 David Beesley, "Beyond Gilbert: Environmental History and Hydraulic Mining in the Sierra Nevada" *Mining History Journal* 7 (2000), 71-80.

39 Beesley,"Beyond Gilbert," 74. Emily Jane Davis, Allison Jolley, and Nick Goulette, *Investment Opportunities for Increasing Forest and Fire Management Capacity in California: A Capacity and Needs Assessment of Local Groups, Non-Profits, and Tribes* (Hayfork, CA: The Watershed Center, 2020).

40 Jake Kosek, *Understories*, (Durham, NC: Duke University Press, 2006).

41 Barrett, "Federal Wildfire Policy and the Legacy of Suppression". Jamie Lowe, "The Incarcerated Women Who Fight California's Wildfires," *New York Times*, (31 August 2021).

42 Barrett, "Federal Wildfire Policy and the Legacy of Suppression."

43 Barrett, "Federal Wildfire Policy and the Legacy of Suppression."

them far outside of their historical range of variability,[44] increasing the density of smaller-diameter trees, reducing crown height, and allowing non-fire-adapted species to proliferate. Coupled with climatic changes prompting longer and hotter fire seasons, drought, more frequent dry lightning, and increased high wind events, these "overstocked" forest conditions are now fueling increasingly intense and destructive fires that exceed the thresholds of forest resilience. **2020 saw the largest acreage burned on state record; but it was also the first year that fire extent approached estimated historical averages prior to large-scale fire suppression**.[45] The problem is that fires are now burning more severely and covering massive amounts of territory in a single fire complex, with devastating impacts on forests, watersheds, communities, and public health.[46]

Current efforts to expand the pace and scale of forest management can be seen in the longer political and economic history of federal land management. These can be characterized in four broad eras of public forest management, each of which has, to greater and lesser extents, reflected tensions between urban populations, resource owners, and rural communities. During the early settlement of the West, the genocide against Indigenous peoples unfolded alongside extensive, unregulated exploitation of forests and degradation of watersheds through mining. This era was followed by the first large-scale regulatory interventions that led to the creation of the National Forest System under the Department of Agriculture in the 1890s. This formative period of federal land management was marked by conflict among industrial resource extraction, conservationists like Gifford Pinchot concerned with managed use of public resources, and preservationists like John Muir who advocated for the protection of "wilderness" without human inhabitation (a policy program that also resulted in the forced removal of Indigenous peoples from protected lands). The outcome of this conflict was regulated but extensive extraction on national forests, alongside preservationism within the National Park System. The industrial public forest, typified by an orientation to forests as a crop for commodity timber, was the overriding management regime from about 1900 to 1970. This era also saw the increasing professionalization of the USFS as a timber management organization whose budget was tethered to the volume of timber extracted from public lands.

In the 1970s, that management regime began to break down, with a decline in logging that would accelerate in the 1980s and 1990s owing to a combination of factors related to industry dynamics, competition, and consolidation. During this time, the Timber Wars among environmentalists, workers, and industry interests constituted a transformative moment in US environmental politics and regulation. Environmental wins from these efforts to protect remaining stands of old growth forest prompted changes to timber export rules and increased protection for endangered species; these wins, while not solely responsible for industry decline, were divisive among many forest-dependent communities.

The result of these combined economic and political factors has been a consolidation of the industry approaching a single-buyer market for trees, a decrease in mill capacity and infrastructure across the state, and associated declines in woods work, with devastating impacts for timber communities. This pattern is consistent and ongoing across the western United States, where total logging employment fell by more than 40 percent from 1997 to 2017.[47] In California alone, total employment in logging and mining fell from more than 33,000 jobs in 1990 to less than 19,000 in 2021.[48] The loss of these jobs has an outsized impact on the communities that have depended on them, as formerly high-paying jobs disappeared and took supporting businesses with them. The resulting increase in socioeconomic vulnerability and poverty-related health impacts and social issues affects current efforts to build today's restoration workforce (see Case Study on Calaveras Healthy Impact Product Solutions [CHIPS]).

44 Historical Range of Variability describes changes, over time and space, in ecological conditions and vegetation types that would be expected prior to large-scale European settlement. Kevin McGarigal et al, *Modeling historical range of variability and alternative management scenarios in the upper Yuba River watershed, Tahoe National Forest*, California. Gen. Tech. Rep. RMRS-GTR-385. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Stations (2018).

45 "[E]stimates of Californian prehistoric fire area are between 1.8 and 4.8 million ha [4.5-11.8 million acres]/year – which resulted in 4.5–12.0% of the state's lands burning annually." Scott Stephens, Robert E. Martin, and Nicholas E. Clinton, Prehistoric fire area and emissions from California's forests, woodlands, shrublands, and grasslands. Forest Ecology and Management 21(3) (2007): 205-216; 212; California Wildfire and Forest Resilience Task Force, *California's Strategic Plan for Expanding the Use of Beneficial Fire*, 7.

46 Teresa J. Feo et al. *The Costs of Wildfire in California: An Independent Review of Scientific and Technical Information* (Sacramento, CA: California Council on Science & Technology, October 2020).

47 Including Arizona, New Mexico, Oklahoma, Alaska, Colorado, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. Mingtao He, Mathew Smidt, Wenying Li, and Yaoqi Zhang. "Logging Industry in the United States: Employment and Profitability." *Forests* (2021): 12, 1720.

48 U.S. Bureau of Labor Statistics, All Employees: Mining and Logging in California [CANRMN], Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CANRMN (5 May 2022).

There is now a near consensus among state and federal policymakers, land management agencies, and the scientific community that forest restoration is essential to climate adaptation and mitigation in the state. The ultimate goal is to return forest structures to something closer to their pre-suppression ranges, in part by reintroducing beneficial fire to maintain resilient forest conditions. This shift can be described as part of a fifth era of forest management, shaped both by innovations in wildfire ecology and by the collaborative approaches to forest management that arose from impacted communities in the aftermath of the Timber Wars. Groups such as the Amador-Calaveras Consensus Group and the Quincy Library Group sought to bridge divisions between environmental and economic objectives to develop socially and environmentally restorative forest management approaches. These efforts have formed the foundations for current initiatives to meet climate adaptation and mitigation objectives by reducing the risks of catastrophic wildfires.

If many scientists and policymakers largely agree on the broad direction of forest management, why have management practices been so slow to reflect this consensus? The institutional structures for land management in California have been built around the goal of fire suppression, designed to protect communities and standing stocks of timber. Efforts to change these practices must therefore contend with the legacies of these approaches, and the difficulties of transforming institutional cultures, industries, and regulatory systems in light of new scientific understandings of nature and its effective management. Further, the social and environmental degradations of past management practices pose multi-layered challenges, like how to fund proactive forest management given escalating suppression costs and the US Forest Service's continued reliance on timber revenues. Recent state and federal policy shifts suggest that these systems are changing; the question is whether the pace of this change will be sufficient to address accelerating environmental risks. A longer historical view on these challenges shows the depth and breadth of change that will be necessary to transform how Californians live with fire.

III. PATTERNS IN LOCAL CAPTURE OF FEDERAL AND STATE RESTORATION FUNDING

Spending of federal funds for restoration work

Key findings:

- A large proportion of total spending on work in the study area—75 percent—goes to local contractors.
- Local contracting is dominated by a few companies: 41 percent of contract value going to local companies went to a single helicopter company for fire suppression, and the top 10 local contractors accounted for 80 percent of contract values in the study area.
- For natural resource conservation work, local capture was lower: 31 percent of spending in this category went to contractors in Tier 1 counties, and 49 percent to contractors in Tier 1 and 2 counties.
- Of the top 10 contractors (in terms of total contract value) performing natural resource conservation work, four were local.

Much of the advocacy from local governments and organizations for greater investment in forest restoration emphasizes its job benefits for local communities. USFS anticipates that its 10-year plan to increase annual acres treated by 160 percent will create between 300,000 and 575,000 jobs nationally. **However, there is no guarantee of the quality of these jobs, nor that they will employ local people in the areas where this work is performed.**

The USFS can consider local economic benefit in its contracting;[49] however, there is little transparency or consistency in the consideration of these criteria, and they do not necessarily entail local employment. Instead, local benefit may include spending by non-local businesses at restaurants or hotels. This spending may be beneficial, but may not by itself support economic diversification or sustainable local industries. **Overall, evidence has shown that benefits from public procurement of resource management services "are more likely to accrue to local communities when local businesses are contracted to do the work."**[50]

In order to better understand the potential for new spending to support sustainable local industries in our study area, this section assesses past trends in the local capture of USFS contracts. Our data cover spending of federally appropriated dollars via a range of contract types,[51] but do not include work performed through agreements or timber sales. Importantly, these data also do not capture subcontracting, which is widely used in the industry. Therefore, these values do not represent the full extent of economic benefits from forest restoration, but focus on contracting in order to highlight workforce development. Our research on the geography of forest restoration spending is centered on central and eastern California, overlapping or adjacent to counties that contain forests in the Tahoe Central Sierra Initiative (TSCI), a large-scale restoration program designed to restore the health of the Sierra Nevada forests, which supply most of California's water, while creating resilient communities. Our study is not affiliated with TSCI, but it is a useful scale for understanding the scope and variation in needs for forest restoration in this broad region. See the Introduction and the Appendix on this report's methodology for more details about the study area definition and data analysis.

We also examine trends for different types of spending, with varying potential for local employment—for instance, expenditures on fire suppression activities with high equipment costs (like aviation) have less impact on local job creation than expenditures for proactive forest management and natural resource conservation. Here, "total spending" refers to the total value of contracts in the study area for the types of work included in our data (see the Appendix for more details on these categories). "Local spending" refers to the total value of contracts going to locally headquartered businesses in Tier 1 and 2 counties (see the Introduction, Study area and approach, for our definitions of Tier 1 and 2 counties).

As a result of USFS accounting practices, it is difficult to accurately track trends in spending over time using these data; we have therefore focused on showing proportions of spending to local and non-local businesses, in order to establish a general understanding of how restoration spending impacts local workforce development. Local spending may be over-represented, as the data may include firms with local offices and headquarters elsewhere.

49 See Jolley, Hahn, and Kusel, "USFS Acquisition Mechanisms and Potential for Increased Local Contracting."

50 Chelsea P McIver, Alexander L Metcalf, Erik C Berg, Procurement Contracting and Forest Communities: Factors Affecting Local Business Utilization in the Inland Northwest, Journal of Forestry, Volume 116, Issue 5 (September 2018): 413.

51 USFS, *Confronting the Wildfire Crisis*.

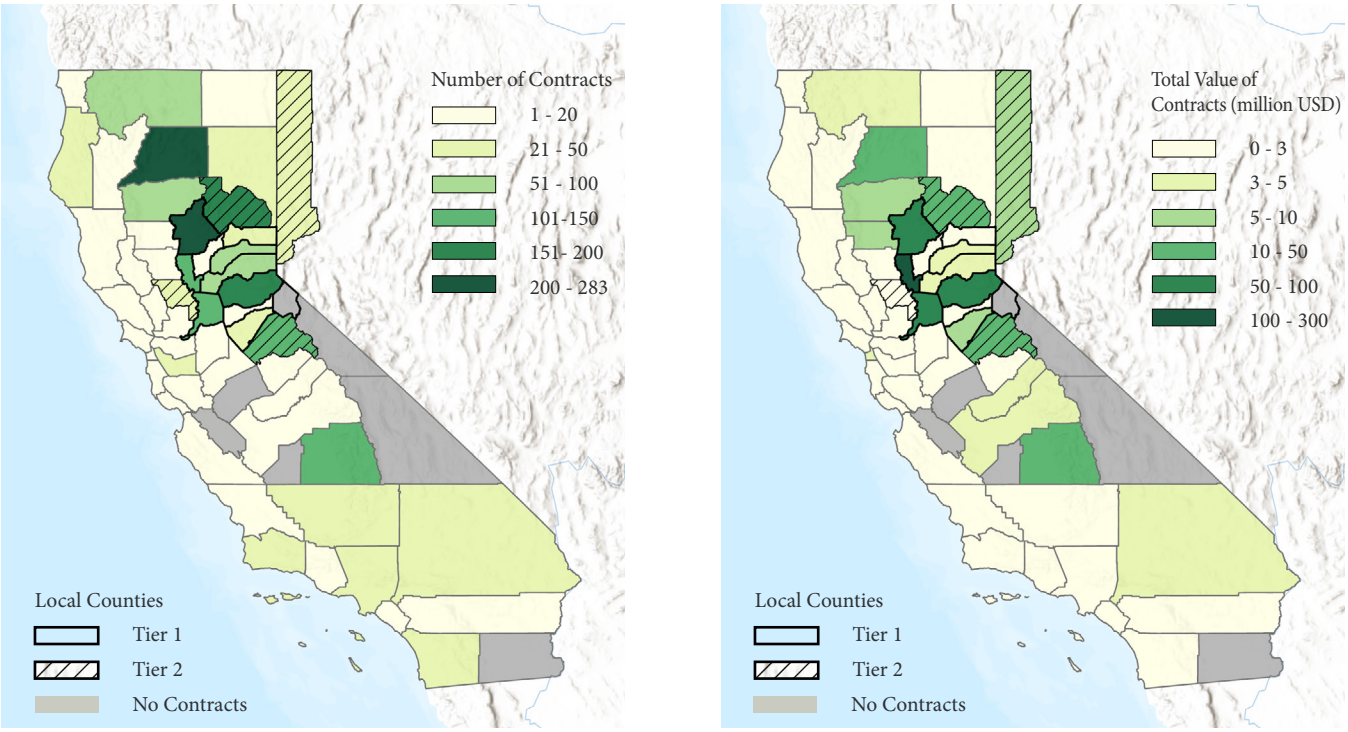


Figure 3.1: Frequency (L) and value (R) of contracts by county, California only, FY 2008–2021.

Table 3.1, along with Figures 3.1 and 3.2, shows the overall distribution of spending for work performed in our study area, in terms of contractor location. We found that a large proportion (75 percent of total spending) went to contractors in Tier 1 and 2 counties, and 87 percent of spending went to in-state contractors. However, local spending is distributed highly unevenly: as shown in Table 3.2, 36 percent of local spending went to a single helicopter company for fire suppression, and the top three companies (all aviation) accounted for 61 percent of local spending in Tier 1 and 2 counties. Across all categories of work, the top 10 local contractors accounted for 80 percent of local spending. For all areas, out of approximately 1,000 contractors listed in the datasheet, the top 10 contractors accounted for 61 percent of total spending overall. In other words, **the majority of forestry spending was distributed unevenly, going predominantly to a few companies for equipment-intensive (rather than labor-intensive) fire suppression activities**. This unevenness is important for considering the impact of spending on job creation and workforce development, in terms of both the diversity of industries included (aviation, firefighting services such as catering and facilities rental, as well as mechanical and hand restoration work) and the type and number of companies capturing contracts.

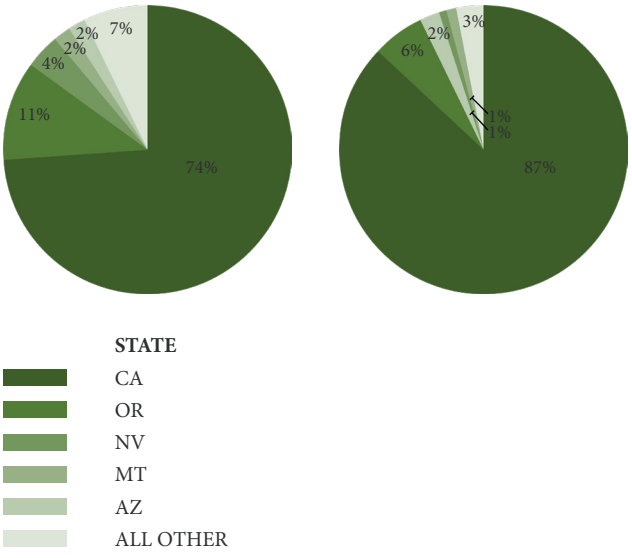


Figure 3.2: Frequency (L) and value (R) of contracts by state for work performed in study area, FY 2008–2021

Tables 3.3 and 3.4 show the distribution of spending in the study area by type of work.[52] Table 3.3 includes total spending in the study area, while Table 3.4 shows a breakdown of spending only on local contractors. For both local and non-local spending, the majority of funds were spent on fire suppression work; this proportion was higher for local spending.

52 These categories are based on PSC codes. A full list of PSC codes is included in the Appendix.

Focusing more closely on contracting for natural resources and conservation work provides a better sense of the potential for increases in the pace and scale of restoration work to benefit local workforce development. Table 3.5 shows that local capture of contract values for natural resources spending was lower than for all contracts; roughly half of spending on natural resources conservation (NRC) in the study area goes to contractors located in the broader local area (Tier 1 and 2 counties), while only 31 percent goes to contractors located in Tier 1 counties.

Spending in the NRC category was also unevenly distributed, with a few companies capturing a large proportion of spending. Table 3.6 shows the top ten contractors in the NRC category in terms of total contract values from 2008 to 2021. The top 10 contractors in this category accounted for 47 percent of total NRC spending overall.

In summary, while a significant portion of spending of federally appropriated dollars through USFS contracts goes to contractors located in the broader area, this spending is unevenly distributed. **The large majority of spending still goes to fire suppression, and a few large companies dominate in fire suppression and natural resources conservation**, suggesting that some companies have established pathways for USFS contracting. While these discrepancies are to be expected in an industry where capacity for large projects may vary widely among contractors, our interview data in Section III sheds further light on barriers that some, mainly smaller operators face to increased contracting on USFS lands.

Table 3.1: Local capture of contract values for forest restoration–related work in the study area, 2008–2021

Contractor location	Value of contracts	Percentage of total spending
Tier 1 counties	$470,776,128.41	66%
Tier 1 + Tier 2	$534,159,102.05	75%
CA businesses	$621,004,262.14	87%
Out-of-state businesses	$93,518,302.58	13%
Total spending	**$714,522,564.72**	**100%**

Table 3.2: Top local contractors, 2008–2021

Business type	Location (county)	Work category	Percentage of total spending
Top 3 contractors			
Aviation company 1	Sutter	Fire suppression and pre-suppression	36%
Aviation company 2	Sacramento hangars (HQ in MI)	Fire suppression and pre-suppression	17%
Aviation company 3	Butte	Fire suppression and pre-suppression	8%
Total top 3 overall (all local)			**61%**
Total top 10 local contractors			**80%**

Table 3.3: Distribution of federally appropriated spending in study area by work type, 2008–2021		
Studies and analysis	$3,937,040	0.55%
Roads design, construction, and maintenance	$53,499,469	7.49%
Other construction, maintenance, or restoration of real property	$4,782,983	0.67%
Environmental systems protection, including water quality support, hazard remediation, surface mine reclamation facilities	$1,146,766	0.16%
Natural resources and conservation, including thinning, planting, site preparation and treatment	$158,907,046	22.24%
Fire suppression and response	$492,249,261	68.89%
Total value of contracts	**$714,522,565**	**100.00%**

Table 3.4: Distribution of federally appropriated spending in study area by work type, to local[(a)] contractors		
Studies and analysis	$1,573,739	0.29%
Roads design, construction, and maintenance	$28,411,089	5.32%
Other construction, maintenance, or restoration of real property	$782,980	0.15%
Environmental systems protection, including water quality support, hazard remediation, surface mine reclamation facilities	$368,516	0.07%
Natural resources and conservation, including thinning, planting, site preparation and treatment	$77,692,833	14.54%
Fire suppression and response	$425,473,126	79.65%
Total value of contracts	**$534,302,283**	**100.00%**

(a) Including Tier 1 and 2 counties.

Table 3.5: Local capture of revenue from natural resources conservation

Natural resources conservation (NRC)	Value of contracts	Percent of total NRC spending
Top 10 contractors in NRC category	$81,566,187	51%
Contractors from Tier 1 and 2 counties in NRC category	$77,692,833	49%
Contractors from Tier 1 counties in NRC category	$49,886,647	31%
Total NRC spending	**$158,907,046**	**100%**

Table 3.6: Top 10 contractors in NRC category, location, value, and frequency, 2008–2021

	County	State	Frequency of award	Total value of contracts	Percent of top 10
NRC contractor 1	Tulare	CA	97	$15,833,471.61	21%
NRC contractor 2	Butte	CA	21	$11,732,236.13	16%
NRC contractor 3	El Dorado	CA	**32**	**$10,829,859.03**	**15%**
NRC contractor 4	Tuolumne	CA	7	$7,933,726.14	11%
NRC contractor 5	Jackson	OR	68	$5,588,373.29	8%
NRC contractor 6	Sutter	CA	88	$5,295,016.12	7%
NRC contractor 7	Madera	CA	**9**	**$4,535,673.00**	**6%**
NRC contractor 8	Tuolumne	CA	10	$4,472,449.58	6%
NRC contractor 9	Jackson	OR	26	$3,979,128.74	5%
NRC contractor 10	Jackson	OR	50	$3,883,301.43	5%
Total				**$ 74,083,235.07**	**100%**

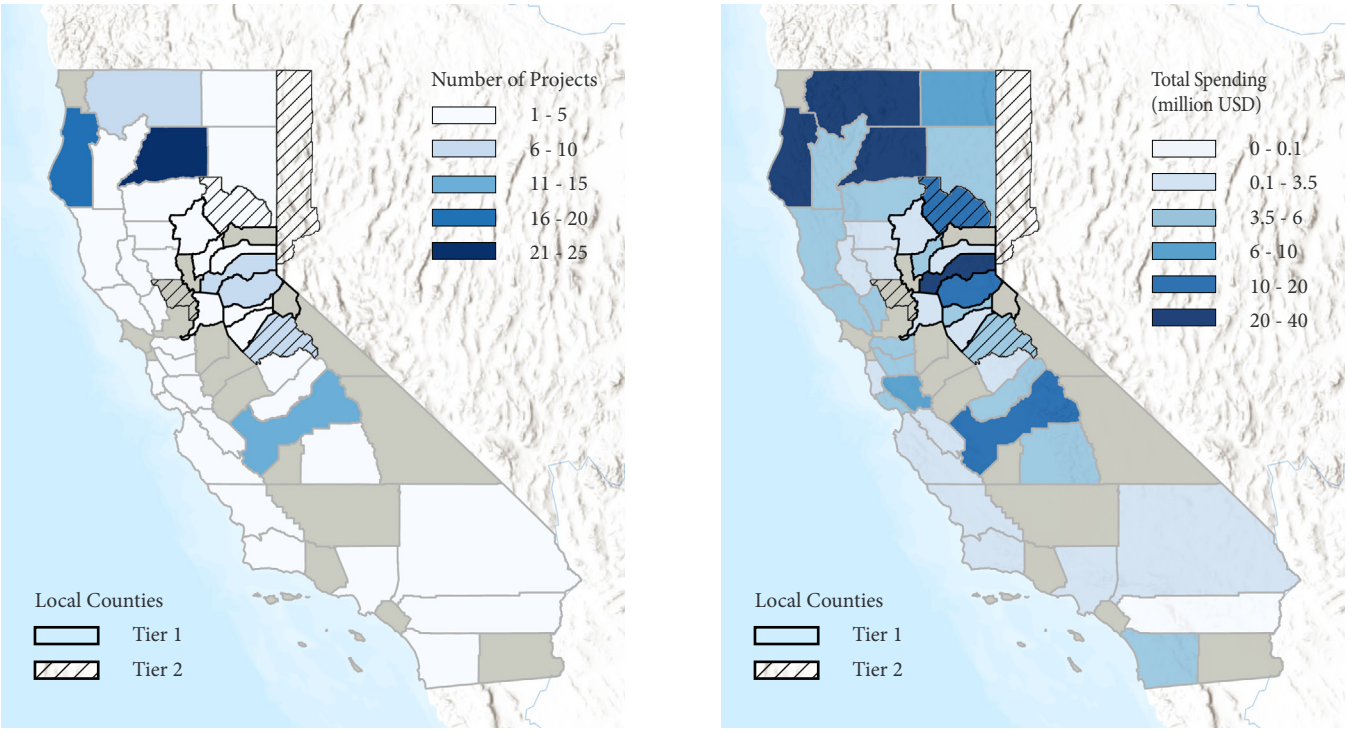


Figure 3.3: Frequency (L) and value (R) of GGRF-funded projects statewide, by county, 2015–2021.

Spending of state grant funds for restoration work

Key findings:

- A large portion of state grant funds were spent in the study area, providing partial to full funding for projects that supported an estimated 198 direct jobs from 2015 to 2021.
- However, there is little transparency on what businesses ultimately benefit from state grant spending on restoration. This lack of information leaves us unable to identify which kinds of jobs were created or whether they benefit local workers.
- Better understanding of who is contracted to perform work on state grant-funded projects is necessary in order to understand the impact of state funding on workforce development.

California's state grant programs have provided a dramatic increase in resources available to forest restoration, through a suite of California Climate Investments programs funded through the state's Greenhouse Gas Reduction Fund (GGRF), which directs revenue from California's carbon market to land management and emissions reduction programs. These programs are intended to help scale up restoration in line with the joint state and federal goal of treating 1 million acres annually across the state. California state grants are distributed as reimbursable funds, meaning that grantees must submit documentation of payment for services performed in order to receive funds. Grantees are required to report outcomes of project spending, such as acres treated and estimated numbers of direct, indirect, and induced jobs created using the methodology specified by the California Climate Investments program.[53] In order to investigate the impact of these programs on workforce development in our study area, we requested data from CalFire showing details of spending for work performed in our study area, for the Forest Legacy, Forest Health, and related grants for landscape management (we did not request data for grant programs focused on increasing fire suppression capacity, and CalFire's new workforce development grant program was still in process during the final writing of this report).

However, while receipts are submitted to the agency by grantees, detailed information on spending is tracked by the agency in any detail. We therefore know which programs and organizations received funds, but not who ultimately was paid to perform land management services. Figure 3.3 below represents total funding spent on projects through the following programs utilizing GGRF funds: Forest Health, Forest Legacy, California Forest Improvement Program, Governor Newsom's

53 California Air Resources Board, "Job Co-benefit Assessment Methodology" (2021), https://ww2.arb.ca.gov/resources/documents/cci-methodologies

Table 3.7: Top 10 contractors in NRC category, location, value, and frequency, 2008–2021

	Total GGRF funds[(a)]	Estimated direct jobs (total project)	Estimated direct jobs (GGRF funds)[(b)]	Acres restored/treated
California	$317,979,896	1228	741	408,215
Study area (Tier 1 and 2 counties, excluding Washoe, NV)(c)	$85,294,604	150	73.35	188,832
Study area as % of California total	27%	12%	**10%**	**42%**

(a) Some projects are only partially funded by GGRF dollars.
(b) Direct jobs funded by GGRF dollars are determined using the methodology in the CCI Job Co-benefit Assessment Methodology, 6.

Priority Projects, Fuels Reduction, and Demonstration State Forest Research. Table 3.7 shows estimated jobs created through programs located in our study area, based on CalFire reporting.

While a substantial proportion of acres treated statewide through CalFire's GGRF-funded programs were located in our study area (42 percent), the proportion of jobs supported through these projects was far smaller (12 percent). Moreover, without more information on the companies performing the work on these projects and wages paid by these jobs, we know little about job quality or whether jobs are going to local populations. CalFire has recently initiated a Workforce Development grant program, which could provide crucial support for local high road initiatives. However, specific criteria are necessary to ensure that the programs supported through these grants are pro-worker; for instance, the agency could prioritize worker-owned cooperatives, Tribal enterprises, and other models that prioritize living wages and job protections. The agency can also assess the impacts of its existing programs on workforce development by collecting more detailed data from the reporting materials it already has, and incorporate additional criteria into its existing grants, including best practice guidelines for grantee organizations to prioritize local benefit in their contracting processes.

IV. PRIVATE SECTOR WORKFORCE CAPACITY AND NEEDS

In order to understand the existing capacity for forest restoration work and the prospects for increasing the pace and scale of work, we conducted a survey of restoration-industry businesses in the study area. Data in the following section is based on 46 survey responses from business owners and crew leads, and 22 follow-up interviews with survey participants. While there is significant diversity in the type and size of business active in the industry, the survey and interviews offer a snapshot of broadly held concerns. Figure 4.1 below shows the location of survey respondents by county.

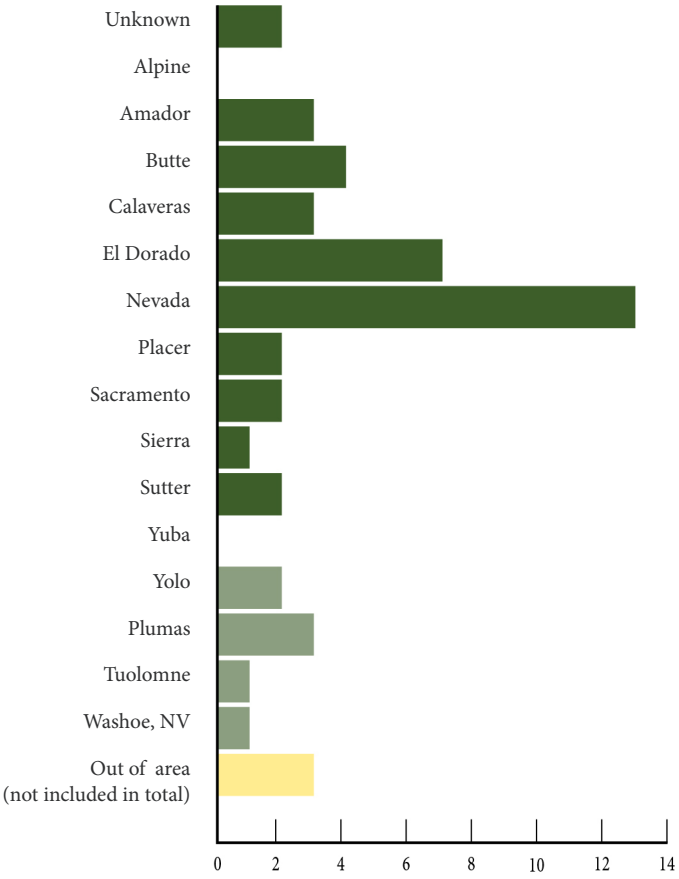


Figure 4.1: Location of survey respondents by county. Dark green denotes Tier 1 core local counties; light green denotes Tier 2, semi-local counties. Results described in this report do not include out-of-area responses. This distribution roughly reflects the dissemination of the survey, with an under-representation of contractors in El Dorado and Placer counties. See the Appendix for more details on methods.

Capacities of local forest restoration businesses

Our survey included contractors with wide-ranging capacities relevant to the planning, implementation, and monitoring of forest management. The most well-represented capacities were in implementation of natural resources management and conservation, primarily defensible space clearance, commercial timber harvest, mastication, and hand cut/hand piling (93 percent); scientific studies and analysis (42 percent); and fire suppression (40 percent). Within these areas, the least-represented capacities were in cultural burning (7 percent), environmental engineering (2 percent), and socio-economic monitoring (2 percent).

Compared with the breakdown of local spending by work category in Section III above (Tables 3 and 4), where only 15 percent of local spending went to natural resource conservation, virtually all of the contractors we surveyed had capacities in this category (93 percent), followed by studies and analysis (42 percent) and fire suppression (40 percent). Most of our respondents worked on small to medium-sized projects, with 76 percent stating that they tended to work on projects under 1,000 acres. A majority (64 percent) were established enterprises more than 15 years old, and 64 percent worked within a 100-mile radius of their home base, demonstrating a primary focus on the local area. Businesses were fairly evenly split in terms of average annual revenue, with 40 percent operating between $250,000 and $999,000 annually. Respondents also worked across all land tenure types, with a majority of projects on private and federal lands. Respondents working on public lands contracted with a range of entities, with a majority (60 percent) contracting directly with federal agencies. A few respondents stated they were increasingly contracting with nonprofits when working on federal lands.

Of the 38 respondents who answered a question describing their employees, 23 employed mostly seasonal workers, and an equal number employed mainly workers living within 25 miles of their home base. The prevailing age of workers in most businesses was under 40 (30 out of 39 respondents). Among our respondents, no businesses employed mainly foreign workers, while two businesses reported employing some workers through the H2B visa program. This again suggests a more locally oriented business model with high seasonality of employment.

Issues identified in the survey were explored in more detail through follow-up interviews with 22 contractors across 19 organizations. Below, we provide key findings from the survey and interviews. Synthetic recommendations across these topics appear at the end of the section.

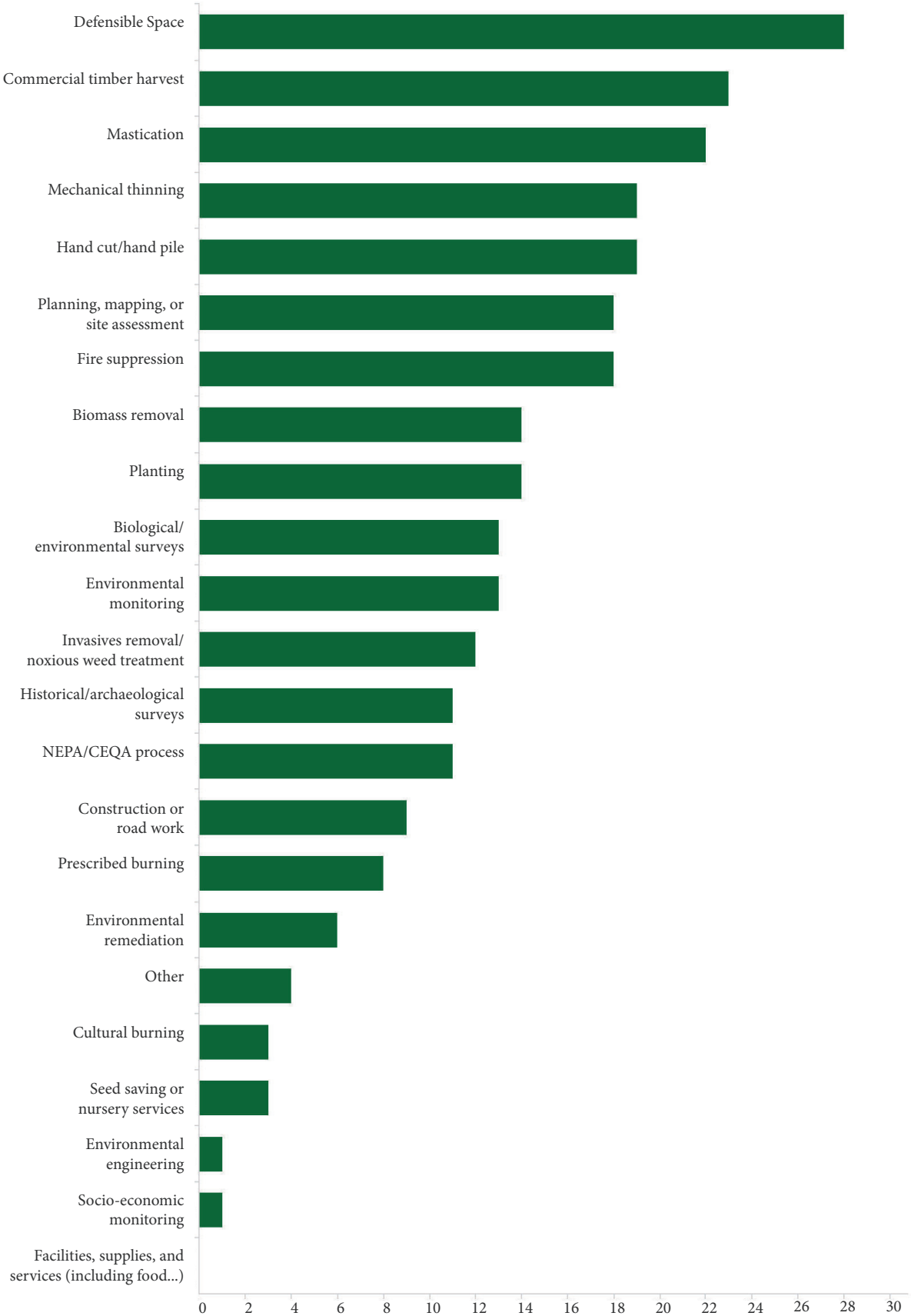


Figure 4.2: Work focus of contractors surveyed, in detail.

Table 4.1: Work focus of contractors surveyed, by category	
Work category	**% of local contractors surveyed**
Studies/analysis	42%
Road design, construction, and maintenance	20%
Other construction, maintenance, or restoration of real property	20%
Environmental systems protection, including water quality support, hazard remediation, surface mine reclamation facilities	13%
Natural resources and conservation, including thinning, planting, site preparation and treatment	93%
Fire suppression	40%

Perceptions of the industry and future planning

Key findings:

- Despite increased public funding, there is still considerable uncertainty among contractors as to the future of the industry and the flow of projects.
- Challenges to increasing capacity include access to capital, labor shortages, high costs of insurance, and difficulties competing with high-volume and out-of-state competitors.

Respondents were split on their perception of the trajectory of public and private investment in forest restoration and management, with 47 percent not anticipating or uncertain about increased investment.

Considering state efforts to direct large additional resources to forest management, this suggests that, **while some contractors are gearing up for more work, there is still considerable uncertainty and skepticism as to how this funding will affect the industry and their business's ability to win contracts**. Respondents who were adjusting their business planning in anticipation of increased future work (24 percent) had invested in additional capacities, including equipment and retraining to pivot from fire suppression toward forest management. Others noted the need for capital to invest in new equipment and anticipated increased competition and increased demand for services following massive wildfire seasons.

Although not necessarily in response to anticipated funding, half of respondents were planning to expand the forest restoration part of their business in the next five years, while 37 percent were uncertain. When asked to name the biggest barriers to expansion, finding and retaining employees was the most frequent response, mentioned by 14 respondents (out of 32 who submitted written comments). As one respondent stated:

> *The skilled labor to perform forest restoration work needs to be paid at higher rates to attract good employees. Currently with the union fire and utility jobs, most laborers choose that line of work. The rates we have to pay to keep quality employees is greater than most forestry budgets allow for.*

Respondents also noted the difficulty of competing with large, high-volume companies and the low prevailing rates for work on public lands (mentioned in 11 responses), the need for a more reliable and predictable flow of work, the high costs of doing business in California, and difficulties accessing capital and insurance. When asked what forms of support would best support their business plans, a majority of those who answered named an increase in available projects (64 percent), followed by more flexible funding (46 percent) and more flexible contract timelines (41 percent).

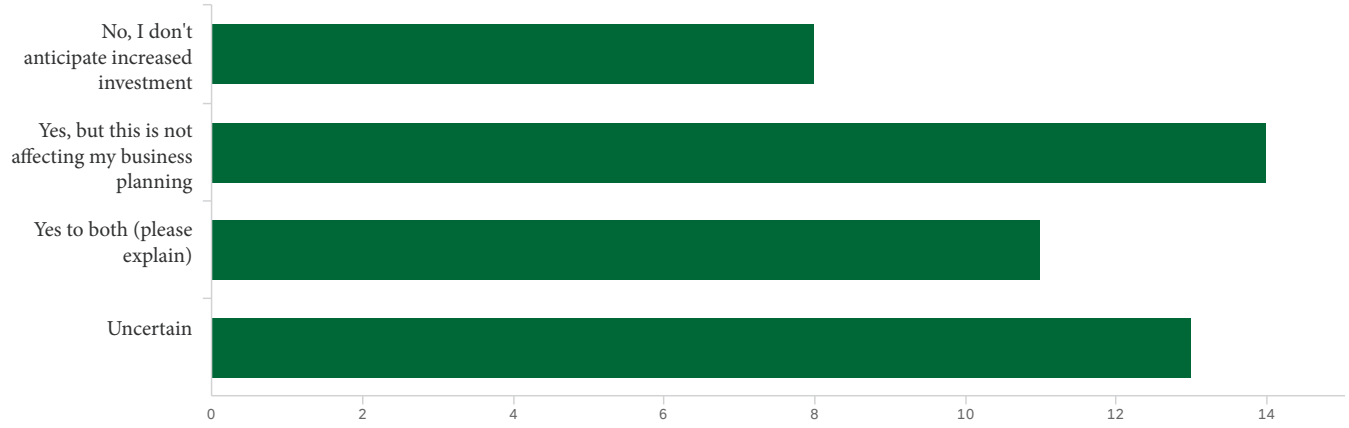


Figure 4.3: Do you anticipate increased public and/or private investment in forest restoration in coming years, and is this affecting your business planning?

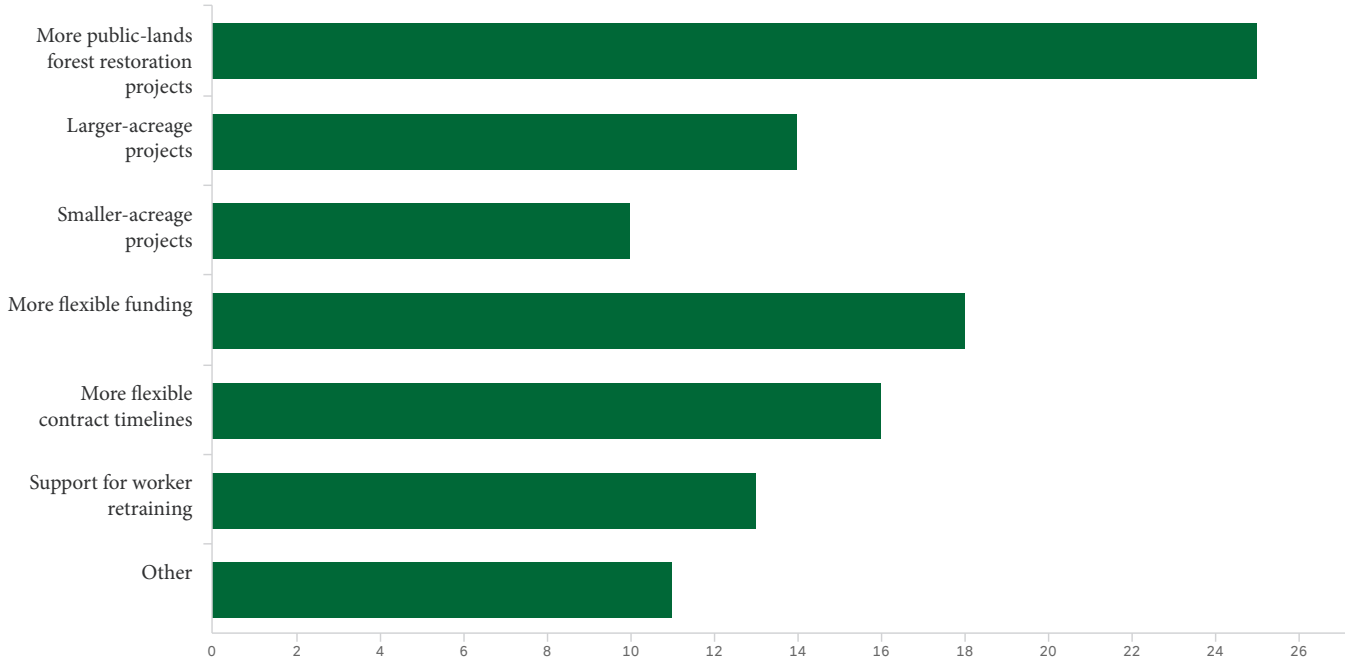


Figure 4.4: What types of support would enable you to sustain or expand your business (depending on your goals)? Select all that apply.

Workforce- and employment-related issues

Key findings:

- Labor shortages are felt across the sector, resulting from low wages, difficult working conditions, a combination of competitive and seasonal pressures on labor markets, and low rates for forest work.
- Forestry companies are competing with warehouse, retail, and fast food employers for workers, as well as unionized entities such as utilities.
- Forestry labor requires skilled, often placed-based knowledge that is undervalued and in limited supply.
- Skilled equipment operators are especially in demand, requiring significant on-the-job training.
- Increases in wages, and therefore costs of treatment, are necessary to build a robust workforce.

As stated above, workforce availability was the number one-mentioned barrier to business sustainability and expansion. Relatedly, 27 respondents (59 percent of total respondents, and 66 percent of those responding to this question) said it was somewhat difficult or very difficult to hire and retain local workers. Only two respondents replied that it was easy or very easy. The prevailing challenge to hiring or retaining local workers was in offering competitive wages (21 respondents), followed by a need for skills and experience not available in the area (20 respondents). Other responses noted a lack of instructors necessary to certify workers, as a result of fire-related draws on personnel, and competition for workers with higher-wage industries (including utility work) combined with competition for bids against larger firms employing visa workers that drive down prevailing rates. In follow-up interviews, 18 out of 23 interviewees discussed overall labor shortages impacting their work, and six interviewees discussed difficulties finding and retaining skilled workers.

Survey and interview results revealed that local contractors are caught between a combination of competitive pressures that limit labor availability: on the one hand, they are competing with other entities both within and outside of the industry for employees. Federal Emergency Management Agency–funded work was described by a number of respondents as a draw on already-tight labor markets, as these emergency response contracts pay more than preventive management. A major source of competition for employees is now coming from utilities and other unionized entities, including in the building trades, who are increasingly expanding their forest-related work. Much of this work is happening via PG&E, where workers are represented by the International Brotherhood of Electrical Workers Local 1245, in response to new mandates to increase clearance around power lines.

> *Up until two years ago, a tree worker was making 15 to 20 dollars an hour; and you know, you're removing 40-ton trees over high-voltage power lines with a crane—and these guys were way underpaid. And then the pendulum just swung, and PG&E is paying billions of dollars a year now for this enhanced veg[etation] management work. But what it did was it took anybody who knew how to run a chainsaw and work with a chipper, and now . . . a groundsman's making $90,000 a year.*

At the same time, competition with large, high-volume companies employing H2B visa workers keeps per-acre rates low in other parts of the industry, as these employers are typically able to pay lower wages to migrant workers with minimal labor protections. Often located out of state, these companies are also able to avoid many of the costs of doing business in California because of the temporary nature of their contracts. Another important feature of the California timber industry is the position of Sierra Pacific Industries (SPI) as the major purchaser of saw logs in the state. Fuel treatments are typically required as part of timber sales, and SPI is often able to provide these services and therefore win timber auctions at very low bids. SPI's role did not come up directly in most of our interviews with contractors, although one contractor working with SPI described accepting lower per-acre rates offered by the company in favor of the more reliable and steady work, as opposed to contracting with public agencies. SPI's influence over rates for work and wages in the industry, via its control over timber harvesting, transportation, and processing in the region, deserves further research. **Legislative intervention may be required to ensure adequate wages and protections for independent contractors, as with other "gig" industries, along with state investment to expand transportation and processing infrastructure**. Unions have raised wages dramatically in parts of the industry where they are now active, and contrasting low wages in other parts of the industry shows the need to expand forest workers' organizations and organizing. Policies and legislative action to facilitate worker organizing – including unions as well as worker cooperatives and other employee-ownership structures- or otherwise raise wages could be complemented with other holistic policy actions that support the creation of timber processing infrastructure where the market is failing to provide this investment.

Depending on their business location and work focus, many employers in our study area described competing with fast food, warehouse, retail, and tourism-related businesses for employees. We also interviewed representatives from two California Conservation Corps offices, both of whom named Amazon warehouses as their biggest competitor for recruits. As one interviewee stated:

> *You can go down the road and work at Walmart for more than what we're making, you know; or you can work at McDonald's for pretty much what our supervisors are making . . . If you're a really highly skilled*

individual, a dedicated individual, you're not going to want to work for pennies on the dollar, especially in a job that's extremely laborious and dangerous . . . I don't know how to explain it, it's just really undervalued.

Six interviewees specifically mentioned low wages as a limiting factor in recruiting employees, and many described the difficulty of finding employees willing to do strenuous labor for long hours in difficult conditions far from their homes, when there are "easier ways to make money." Data on injuries and fatalities from forestry-related work are often aggregated with the agricultural industry, in a category that consistently has the highest fatality rates among industries.[54] Logging and related work, including tree falling for landscaping and defensible space maintenance, are widely described as among the most hazardous occupations.[55] It is therefore not surprising that many entry-level workers gravitate to less hazardous industries.

Further underscoring the issue of wages, six interviewees also mentioned housing costs as a barrier to attracting recruits to their area, especially in high-tourism areas near Tahoe, Truckee, and Nevada City. These trends impact employers differently depending on their business model. Some large operators rely on a workforce whose limited employment options will keep a steady flow of seasonal employees into entry-level jobs. High turnover in this model is not necessarily a problem for employers, as long as there is sufficient labor supply. However, longer-term economic changes have increased options for entry-level work in retail, warehouse, service, and unionized trades such as construction, while the more lucrative logging jobs to which previous generations of forestry workers may have aspired have declined. **These trends have contributed to what many interviewees described as a generational gap in the workforce, caused by mill closures and associated industry decline**. With fewer kids exposed to the industry while growing up as a result of structural economic change, some interviewees focused on recruiting youth out of high school and from agricultural backgrounds who are "used to working hard" and are not planning on seeking higher education.

While some large operators rely on a large entry-level workforce, the majority of our interviewees were smaller operators who described the need for employees with specific skills, experience, and place-based ecological knowledge. The most commonly mentioned need was for skilled equipment operators, and several interviewees described the high costs of training these operators and difficulties retaining them given the seasonal nature of their work. These smaller businesses also tend to have a smaller working range and are especially impacted by the combined pressures driving down bidding rates and also drawing employees to other parts of the industry.

Our interviews demonstrated the wide range of skills and specialized knowledge involved in the implementation of forest management, including climbing; tree falling; large equipment

54 In the US in 2020, the rate of fatal injury for agricultural, forestry, fishing, and hunting work was 21.5 per 100,000 employees. The next highest category, construction, had a rate of 10.2 fatal injuries for 100,000. US Bureau of Labor Statistics, "Number and rate of fatal work injuries, by industry sector, 2020," https://www.bls.gov/charts/census-of-fatal-occupational-injuries/number-and-rate-of-fatal-work-injuries-by-industry.htm. In California, these rates were lower, with 11.2 fatalities per 100,000 full-time workers. State of California Department of Industrial Relations, Fatal Occupational Injuries in California 2013 -2019, (Sacramento, 2021).

55 Judd Michael and Serap Gorucu, "Occupational tree felling fatalities: 2010–2020," *American Journal of Industrial Medicine* 64 (2021): 11; Robert Collier, "Chapter 11: Natural and Working Lands."

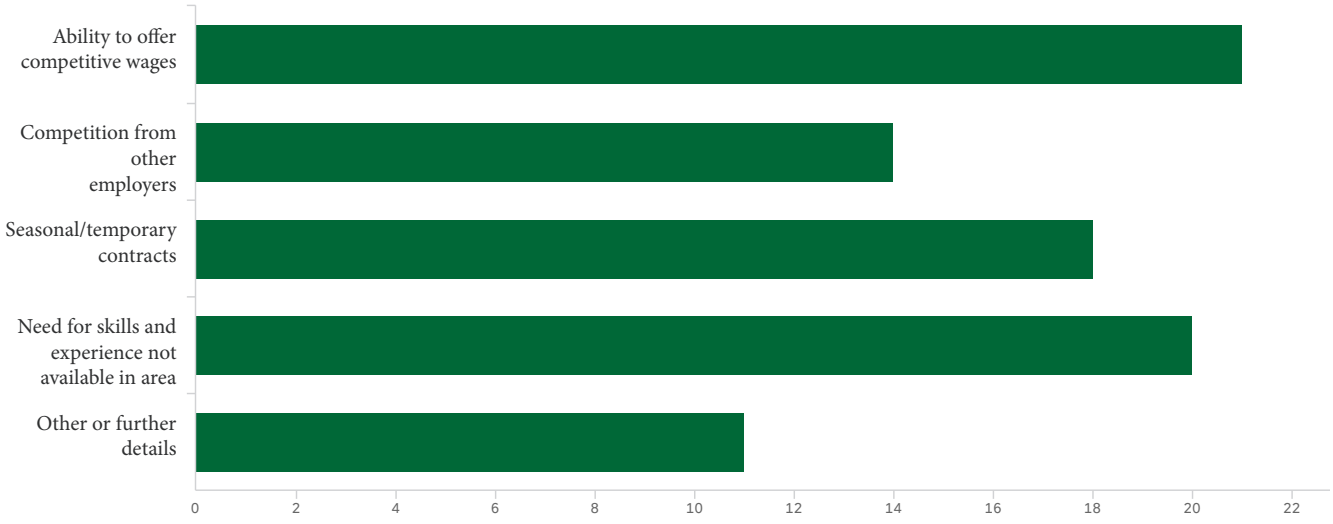


Figure 4.5: What challenges, if any, do you face in hiring or retaining local workers?

operating, especially in steep or otherwise-difficult terrain; plant identification and care, including seed and cone collection, and working appropriately around sensitive ecological areas (such as aspen stands); knowledge of the diverse ecological values of different plant species, including Traditional Ecological Knowledge (TEK); and skills related to beneficial burning. These are in addition to the basic skills and experience required to safely operate tools while navigating difficult terrain. Several interviewees working locally discussed their personal knowledge of the forest types prevalent in the Central Sierra that enhanced their ability to judge key ecological conditions and tailor treatments accordingly, often in contrast to their perception of out-of-state firms used to working in the Pacific Northwest. Not surprisingly, many long-term practitioners take great pride in their work and prioritize educational and training pathways for their employees. One owner of a tree service, who is working to expand into vegetation management on federal lands, described educational opportunities through his professional association:

> *I find the TCIA [Tree Care Institute of America] just to be invaluable in that respect . . . It's kind of a self-driven course, so you can do as little or as much as you want. And we find a lot of these guys are just hungry for information. You know, they don't necessarily want to be in a school setting, but they want to continue their education. And so we're really happy for that . . . I tell the guys, I know [the material is] really repetitious, but that repetition is going to save your life. And one day, it can save somebody else's life.*

Most interviewees described support for increased training opportunities, and some said they would participate in externships and other programs designed to provide certificates for on-the-job training, or would pay employees to participate in these programs. These testimonies stand in contrast to perceptions of forestry labor as low-skilled, a perception that contributes to its undervaluing as well as a tendency in some parts of the industry to rely on other workers to train new recruits without specific standards or supervision.[56] They also demonstrate the importance of on-the-job training in addition (or as an alternative) to classroom-based programs. Overall, there is a need for efforts—including by professional associations, unions, or other workers' organizations—to increase recognition and appropriate compensation of skilled work across the industry.

56 Carl Wilmsen, A. Butch de Castro, Diane Bush, and Marcy J. Harrington, System Failure: Work Organization and Injury Outcomes among Latino Forest Workers, Journal of Agromedicine, (2019). DOI: 10.1080/1059924X.2019.1567421; Carl Wilmsen et al., "Healthy Forests, Abused Workers: Safety, Health and Working Conditions among Forest Ecosystem Restoration Workers in Southern Oregon." (The Alliance of Forest Workers and Harvesters and the Labor Occupational Health Program, UC Berkeley, 2012). *Improving Resilience in America's Forests*. (Washington, DC: USFS, 2022).

Experience and challenges with public lands contracting

Key findings:

- Local workforce development is supported by local USFS capacity and relationships with district-level staff.
- USFS contracting processes are perceived as complicated, and the degree to which local benefit is prioritized in the bidding process is not transparent.
- An increased reliance on state grant funding for projects on federal lands increases resources for forest management, but also poses challenges for small operators, including:
    - Slow payment timelines
    - Inflexible project schedules
    - Inconsistent and non-transparent practices for assessing bids across nonprofits and other organizations administering grants
    - Inability to protest the bidding process
    - Lack of a single-point source of information on projects available to bid

Survey respondents noted several barriers particular to working on public lands contracts, predominantly slow payment timelines (59 percent of those answering the question) and difficulties making cost-competitive bids (53 percent). Project size and location were more rarely chosen, although 21 percent noted that projects were often too large. When asked to name further details, four respondents discussed complicated bidding and reporting processes for public lands work, while others mentioned a lack of wood processing facilities and the need for a single-point information source for projects available to bid. These issues echoed respondents' views on challenges to the industry more broadly, especially with regard to the availability of wood processing facilities and markets for forest products.

Interviews illuminated the importance of relationships between district-level USFS staff and the local workforce in helping contractors to navigate the bidding process and maintain a reliable and continuous flow of work. District offices serve as a key point of contact for local contractors seeking work on federal projects, and interviewees noted the importance of building trust and relationships with USFS staff to gain access to contracts and to ensure successful completion of work. Some interviewees noted that these relationships had eroded over past decades, due to high turnover and limited USFS staff capacity. Others described challenges posed by high USFS staff turnover for accomplishing work on the forest, with some perceiving staff to be inexperienced or lack site-specific knowledge about forest conditions. Interviewees described the difficulties this posed accomplishing time-sensitive activities like burning or cone collection. For instance:

The foresters really being on top of and knowledgeable about the maturity of cones [is important.] And this is a huge problem, because so many of the foresters don't have that knowledge yet, they're young, they've never done a cone collection crop before . . . They've gone out and surveyed and then they come back, and we go to collect for them, and they show us trees that don't have that many cones on them . . . The forester is not understanding how to assess how many cones are in the tree, how many bushels are up there, and that's a huge problem. And it goes on year after year, because they don't have the knowledge of what they're really looking for. And so that only comes with experience . . . There are a couple areas where people have been there long-term and that's really great, because they understand what I do and I don't have to educate them, right. I educated them long ago and they're good with it.

Relatedly, interviewees in the private sector and in nonprofit partner organizations described how a lack of staff continuity in some USFS offices creates a lack of follow-through on burning and other planned activities that may pre-date current staff. While USFS staffing issues are explored in more detail in the subsequent section, **these testimonies emphasize the importance of site-specific knowledge on local ecological conditions, and the value of long-term experience in a given area for building that knowledge and relationships with the local workforce**.

The influx of grant-based funding for forest management has not only introduced new resources for federal lands work, but has also changed the way this work is contracted and administered. State grants operate through reimbursable funds, meaning that grantees need to submit receipts for work performed before getting paid back by the grant. While some larger grantee organizations may be able to float payment to contractors, many smaller organizations cannot, leaving contractors to cover their payments on equipment and payroll while waiting weeks or even months for payment. As noted above, in our survey the most-cited challenge to bidding on public lands work was slow payment timelines. As two interviewees stated:

One issue that we're coming across right now is that we're running out of funds to be able to pay our payroll, simply because sometimes when we're invoicing against our projects, the amount of time for them to release that payment is longer than our payroll periods. Sometimes it takes up to six weeks for an invoice to get processed, and the payment to be released. And in that six-week period, we have, you know, three pay periods.

We've been 60 days out, 90 days out before [waiting for payment], and it makes it really difficult to, you know, pay your employees and make it all happen, pay fuel and all that. So that's really kind of the big hiccup occasionally with doing these big jobs, is whoever you're getting contracted through getting reimbursed.

These timelines seem to be shortening as CalFire makes efforts to streamline the reimbursement process. However, one CalFire employee told us that an optimistic timeline for reimbursement was 60 days; and while the programs do allow advances of up to 25 percent, an entire advance must be spent before a new one is requested, which requires another 60 days to disperse.

In addition to slow payment timelines, inflexible contract deadlines, especially on grant-funded projects, were discussed by many participants. Nineteen survey respondents said more flexible funding would enable them to better support and sustain their business, while 16 said more flexible contract timelines. Interviewees described multiple challenges to completing work on the three-year timeline required of state grants, in particular when this involved any kind of burning, due to limited burn windows. One staff member at a national nonprofit who partners with USFS to secure and utilize grant funding stated that, in his opinion, including burning in grant-funded projects was not productive, because it was virtually impossible to get all necessary elements lined up on time to take advantage of limited burn windows in a three-year period. Increasingly restricted working days throughout the year add to this difficulty; the USFS restricts certain implementation activities on its land according to its Project Activity Level (PAL) tool, depending on local fire risk. This limits the number of working days operators have in a given contract period, but grant timelines do not accommodate these limits. As climate impacts accelerate, contractors have seen an increase in PAL-restricted days earlier in the year:

We typically see high fire danger days in August, September, October . . . We've already had eight, in May . . . And on those days, we have to shut down at one. And so the crew ends up doing a reverse graveyard. They go out there, they get started at four or five in the morning. They get up at two to get out there . . . Of all the things that's making it hard to stay in this business, that is the one thing that's making it really hard. This particular summer, we're significantly concerned that we're going to be able to work consistently.

Another challenge has been the changes to established networks and ways of working introduced by new funding sources. With an increasing share of work on federal lands now funded by state grants and administered by nonprofit partners, local contractors now need to build connections with a broader range of actors to find out about available projects to

bid. Staff at these nonprofits may, but do not necessarily, have existing connections with the local workforce. These changes are significant, as most of our interviewees described word-of-mouth networks and personal relationships as their main ways of getting access to projects for bid. One interviewee described attempting to contact an organization accepting bids for grant-funded work on her local National Forest, where her company had existing relationships, and being told that she needed to drive several hours to where the organization was headquartered to meet in person before being given the Request for Proposals. This was because the grant administrator "liked to work with people he knew." This posed an extra barrier and prevented her from bidding on the project. A related issue was the lack of a single-point source of information on available projects:

> *What's frustrating for me is that . . . there's no central point where all these nonprofits have to post these jobs, which are taxpayer-funded, and many of them by grants, public monies. So if I'm not on their bidders list, if I'm not on their contractor or vendors list, I have no idea that the job is even out there. And it could be in my own county, and I wouldn't know.*

Relatedly, this interviewee noted that nonprofits do not have to follow the same procedures ensuring transparency and accountability of the bidding process; in particular, to submit a protest if they feel a contract was wrongly awarded. As there are no standard best-practice guidelines in place for nonprofits to consider best value, local benefit, or other criteria in the contracting process, the criteria for selection may not be transparent and may vary greatly from one organization to the next. Other interviewees described difficulties working with nonprofit staff who may not have the expertise or experience in forestry to write effective contract language, and noted wide variety in the degree of oversight offered by contracting organizations:

> *If the Forest Service was running this job, they're hands on. The CORs, contracting officer representatives, are out there every week checking in with the operators, checking in on the operation. Now you've got this whole other intermediary . . . they don't ever come out, check on the jobs . . . I even emailed them about a week into this project and said, you know, we need somebody to come out to make sure that we're implementing this the way everyone understands it should be done.*

These issues may be part of the overall learning process, as all players in the system adapt to changing roles and responsibilities that accompany new funding sources. They speak to the need, however, for additional measures to facilitate this adaptation, including guidelines and best practices for contracting processes and measures to ensure accountability and transparency in the use of state grant funds.

Broader industry challenges

Key findings:

- High costs of insurance in California increase the difficulty of competing with out-of-state firms.
- Fear of wildfire liability inhibits work, especially burning
- Lack of available wood processing infrastructure limits markets for wood products.
- A more reliable and steady flow of work would enhance confidence and investment in new training and equipment.

Contractors also faced a variety of issues linked specifically to the forest industry, and more broadly relevant to related trades. The high cost of insurance, including workers compensation and loggers broad form, were discussed by several interviewees as posing a challenge, especially given low going rates for work. One interviewee stated that his rates for workers compensation were equal to the $35/hour wages he paid his employees, plus benefits. Several contractors described this as a particular difficulty when competing with out-of-state firms, who do not have to pay higher California rates for workers compensation if they work a limited number of days in the state per year—which is common, given the seasonality of forest restoration work. But although out-of-state competition was often mentioned by interviewees, our data (discussed in the previous section) showed that, for natural resources conservation work (excluding fire suppression) in the study area, 78 percent of spending went to California-based firms.

Contractors also cited issues with state liability laws that both inhibit certain kinds of work and raise the costs of insurance. Under state law prior to 2022, operators involved in prescribed burning could be held liable for damages under conditions of simple negligence. A new state law (SB332) raises the standard for liability to gross negligence, when a certified burn boss supervises the operation. Based on our conversations with contractors and one air quality control district regulator, this will likely be an important step toward supporting more beneficial fire on the landscape.[57] However, liability laws also impact other types of work, as operators may be held liable for any damages from unintentional ignitions caused by equipment

57 The recent Hermits Peak Calf Canyon fire in New Mexico, ignited by a prescribed burn that escaped control, is already having serious policy impacts that are inhibiting the use of beneficial fire. See Andrew Hay, "U.S. stops controlled burns nationwide after New Mexico disaster" Reuters (20 May 2022), https://www.reuters.com/world/us/us-stops-controlled-burns-nationwide-after-new-mexico-disaster-2022-05-21/

in the course of work (for instance, if a spark is created by contact between metal equipment and stone).[58] Anecdotal accounts from our interviews suggest that fear of liability has discouraged some landowners and contractors from undertaking proactive forest management. The recently released Strategic Plan for Expanding the Use of Beneficial Fire addresses some of these challenges.[59] **But there is need for a comprehensive assessment and streamlining of policy pertaining to wildfire liability and beneficial burning**, including liability for inadvertent ignitions, and the combined impact of USFS PAL restrictions, timelines on state grants, and state funding requirements and policy to limit possibilities for burning.

When asked what they perceived as the biggest barriers to increasing the pace and scale of forest restoration in the state, six respondents mentioned a lack of wood processing infrastructure. Twenty-seven respondents chose biomass subsidy or investment as one of the most effective policy strategies for increasing the local economic benefit of forest management.

Issues related to timber processing capacity, low prices for saw logs (even given the impact of the pandemic on lumber prices globally), and the impact of historic mill closures came up in nine interviews. These issues all pertain, more or less directly, to the current role of SPI as the almost sole buyer in the California timber market and largest private landowner in the state, and its historic role in purchasing and closing mills throughout the region. This role gives the company outsize influence over rates for work across the industry as well as over the timing of timber harvest and associated vegetation management on public lands. Another set of market conditions also poses challenges to expanded biomass utilization, as biomass demand is limited and prices are driven downward by the abundant and accessible resources provided by agricultural waste (see Case Study on Finance and Investment for Forest Restoration Economies).

58 In 2007, the Moonlight Fire started when a subcontractor for Sierra Pacific Industries inadvertently caused an ignition in the course of work. The company paid a $122.5M settlement for damages from the fire. See Reuters, "California: Logger Will Pay Penalty For Fire". *New York Times*. (18 July 2012). https://www.nytimes.com/2012/07/18/us/california-logger-will-pay-penalty-for-fire.html

59 Key interventions include establishing a Prescribed Fire Claims fund for private burners and Tribes.

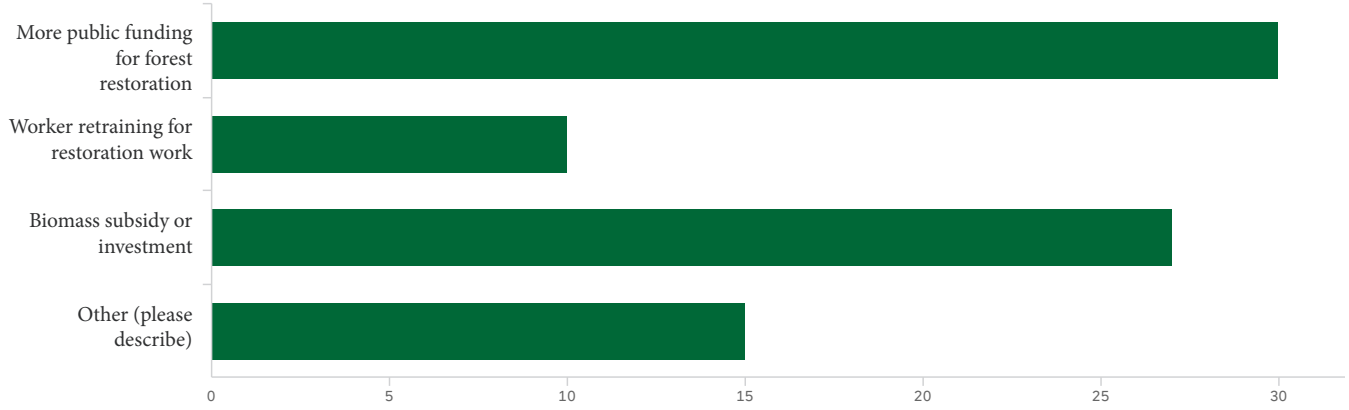


Figure 4.6: Based on your experience, what policy strategies do you think would be most effective for increasing the local economic benefit of forest restoration in your area?

V. USFS CAPACITY AND PARTNERSHIPS

Key findings:

- Partnerships with external organizations provide critical resources and capacities for land management, including access to state grants, greater flexibility in hiring and contracting via partners, and public relations benefits.
- However, partnerships also impose new burdens on USFS staff, and staffing shortages at USFS may limit the ability to take full advantage of new funding and financing opportunities, and new partnerships. Effective use of partnerships and new funding requires building key capacities in the agency, including project management and oversight.
- Employee burnout, from both understaffing and the impacts of severe fire seasons, affects morale, retention, and recruitment.
- In order to adapt to changing management needs and wildfire impacts, USFS needs to build redundancy of key functions via internal staffing and strategic engagement with partners.

A major component of workforce capacity for forest management and restoration lies within the public sector. In addition to playing a central role in planning, implementing, and monitoring forest restoration and management, local USFS staff also maintain relationships with private organizations and businesses that help contractors to maintain a reliable flow of work. While our study focuses primarily on local private sector contractors, we also conducted interviews with USFS staff at the district and forest levels in order to highlight capacity issues within the agency and their impact on the effectiveness of new funding and partnerships.

Our interviews and responses to our questionnaire on USFS staffing needs testified to the already well-known staffing shortages impacting work in the agency. Resource staff we interviewed were routinely in a position that had historically been the job of two or more people and described performing their own budgeting and other administrative work due to a lack of support staff. As one resource specialist covering two districts told us:

> ***The only consistent thing I've seen in this agency in my 19 years is that our workforce has continued to shrink. I think nothing else has been consistent with this agency, other than the shrinking, the slow and steady decline of the workforce.***

Causes of this trend highlighted by interviewees included limited Congressional appropriations and the impacts of inflation, issues with retention, and difficulties recruiting and hiring new employees in a timely manner, especially in higher-level positions. Budget modernization reforms begun in 2018 were described as having simplified some internal labor allocation processes, but also established a new baseline for staffing based on already-understaffed levels. One district ranger estimated that the forest he manages had around 40 vacancies at the time when that baseline was drawn. Thus, new positions that will need to be funded in order to enable the agency to accomplish its work on the scale required by current goals are, in most cases, replacing positions that existed in the past rather than meaningfully additional to the historical baseline. [60]

This long-term trend has been accompanied by a parallel and complementary trend toward an increased use of contractors and partners to perform key planning and implementation functions. Staff described how these partnerships had provided critical resources and additional capacities for land management, including access to state grants, greater flexibility in hiring and contracting via partners, and public relations benefits from having a broad range of stakeholders working in collaboration. However, they also introduce new demands on already-strained agency staff, including writing and managing contracts, attending partnership meetings, and communicating with an expanded group of stakeholders. **Agency staff members described the need for additional personnel to help manage current partnerships, and expressed concerns that internal limits on capacity were preventing the agency from making full use of available funding, including grants, and partner capacities**:

> *We often have conversations about how there may be a grant opportunity, but even if we got that money we don't have the capacity to do our part to support that project so even though it's a worthwhile project, and we have grant funding, we might not pursue it because we just don't have capacity. We're always trying to do more with less. And I feel like we're at the point, you know, at some point you can't. If you have less you're going to do less. And we can maximize using external partners for our planning and implementation and grant funding, but I think we're often crippled by our internal capacity… it still takes quite a bit of work on our side to coordinate that and manage it, you know, we still have to plan the projects which requires quite a bit of support on our side.*

60 For more details, see USFS, "The Rising Cost of Fire Operations: Effects on the Forest Service's Non-Fire Work," (Washington, DC: USDA, 2015), which shows that non-fire Forest Service staffing levels decreased by 39% from 1998 to 2015.

I think just the internal capacity of us to be able to handle a lot of additional revenue to get our projects implemented, would be challenging for us. No matter what.

What is challenging, our biggest challenge at the forest level is just keeping tabs on it all, and having that kind of program manager, project manager, a person that can really… help kind of guide [our partners] through the planning and implementation… And therefore the communication would be a little cleaner as well, because right now, I'm not sure if I'm supposed to be at this meeting or that meeting; what level of involvement do I need to do I need to play here? Because if I'm involved in everything, that's all I'm doing.

Some interviewees described the additional quality control required to work with partners who hire their own temporary staff:

We have external partners do our surveys, which can be really good; it supports other groups like local businesses, and some of that data can be used for research purposes. But I've found that often, it still requires a lot of effort on our part to ensure that the partners or contractors are up to speed and have everything they need to successfully conduct the surveys, and then it's a pretty mixed bag on the quality of work… some of these partners use really inexperienced crews and the quality is questionable. But there's definitely some advantages… we can have them survey a much larger area than maybe we would be able to do in house. [Also] we often have trouble with our temporary hiring system, so… using external partners kind of helps alleviate that.

We have found that the partners do not have the skillset and, when [we have] contracted assistance, we still need experts within the [US]FS to guide, and it does not reduce our workload. It actually increases it.

We're adding capacity with the partnership; they're better than us at getting funding... But we still need a project manager or somebody that's kind of overseeing the whole thing, and is able to get out and really spend some time on the ground and make sure things are going the way we want them to go... I think, as a public agency, and a public landowner, we need to have some level of oversight and have final say as to how things are done, and what is acceptable and what is not.

External partners, including nonprofits and other agencies, also reported that gaps in USFS capacities—particularly lack of National Environmental Protection Act (NEPA) specialists—limited their ability to partner with the agency:

*Some Forest Service [sic] do not have the needed personnel to complete survey work, or review third party NEPA… **We consistently avoid working on Forest Service land because it is not possible to complete the necessary environmental documents needed to implement treatments**. We have had funding, and were not able to work on public lands due to this issue… It would be better to fund full time USFS staff that would focus only on completing NEPA work, or reviewing third party NEPA. This would allow partnering entities to focus on seeking funding and implementing projects."*

As a state agency with Water Quality Permitting requirements that differ from [the] federal process, we often find that USFS staff are taxed to engage with permit compliance and development processes. If permitting-related duties were added to a joint position, or a partnership position, compliance with state regs would be facilitated. A position with duties specific to the facilitation of state/local compliance would further streamline project implementation, as noncompliance-related issues would be potentially avoided.

The increase in grant-based funding for forest management in California has increased the imperative to work with partners and has provided critical additional resources. But it has also introduced new challenges. One contracting officer estimated that 70 percent of funding for implementation on his forest was now coming from state grants. Staff members described working creatively to utilize available funding, and the benefits of greater flexibility through working with partners to modify contracts and bring in additional personnel. Time limits on this funding—grant funds need to be spent within a period of three years—were described as extremely challenging, but also prompted partners to complete implementation more quickly. Additionally, project-based grants may increase pressure to be funding-driven in focus, at the possible expense of more holistic and long-term issues affecting forest health. As one hydrologist working across two districts told us:

The outside funding to a large degree has directed what gets done. And then it's kind of the same thing with the partners; if those partners are focused on some component of the landscape that's their primary mission, then that gets prioritized.

The increased use of partners has also placed added pressures on those organizations, particularly the National Forest Foundation (NFF), a federally chartered nonprofit that partners with the USFS to access and utilize state grant funds. NFF's role in forest management is growing quickly with the increase in state funding, because its nonprofit status gives it access to additional sources of funding and the ability to enter different kinds of partnerships than USFS. But the organization is

challenged to increase capacity while continually fundraising to sustain staff positions. One NFF staff person suggested that waiving the requirement from USFS for a 20 percent match to federal funds, and providing federal seed funding for three years to cover two full-time NFF staff positions, would help to create the stability necessary for the organization to secure more grant funding and sustainably scale up its work. This could create additional capacity of direct benefit to USFS at a lower cost, as NFF would have adequate time to fundraise to sustain staff for the longer term.

Staffing shortages within USFS have numerous effects on the agency's ability to accomplish work, retain employees, utilize external resources and partnerships, and undertake monitoring necessary for adaptive management. Staff described pervasive burnout and unsustainable work environments, exacerbated by the personal and professional impacts of increasingly severe fire seasons.

> *Folks are overworked. Folks are doing two, three, four jobs, and they're not getting compensated for it… In a nutshell, why would somebody want to come for work for an agency where you're going to be stressed out, you're going to be working all the time to accomplish work, you're not going to get the recognition for doing the job that you're doing, and you're going to start really feeling bad about yourself, when you can go get that same job somewhere else and make two maybe three times what you're making, and you can survive? . . . You can't say, 'I need you to do more, and I need you to get all these engines and the crews filled with all these people, but we're gonna pay them less than people are making at McDonald's that don't risk their lives, we're gonna pay them less, but they're going to risk their lives, because they enjoy doing that'—that only goes so far. But then we're going to take their entire summers away, and they can't do anything else. And the only way they're going to be able to survive and make money is that they do a lot of overtime."*

> ***All of these megafires are exhausting. That's a huge component of it. So we exhaust all these firefighters and fire staff and then in the fall, we're like 'Okay, we want to burn now.' And they're kind of like, 'I got to spend some time with my family.' And they're exhausted. It's kind of a self-perpetuating or -exacerbating challenge.***

These issues may increase staff turnover and thereby exacerbate existing capacity constraints, especially given the often-lengthy process of filling vacant positions. Interviewees reported difficulties hiring new recruits into the agency, even into temporary positions, and a lack of clarity around career pathways to higher-level positions. Wages were described as insufficient in relation to housing costs and other cost-of-living increases, as well as competition from adjacent agencies. One interviewee described an increased practice of hiring temporary staff at lower-level positions, involving significantly more staff time in managing repeated hiring processes than would be required for permanent staff. Another interviewee linked the decline in applicants for higher-level positions to a change a few years prior when the agency stopped offering transfer-of-station benefits as part of a hiring package. Several interviewees described using "workarounds" to hire additional staff via partners, though they were not able to use grant funds to hire directly into the agency. But as one District Ranger described, he did not have the resources to create career paths for those recruits:

> *But most of the people that we're hiring through these independent alleys or byways, you know, a lot of them would prefer to work for the Forest Service, to be government employees, and then see that . . . as a career path. It's great to try it out to be a 1039 employee, or seasonal employee, or to be an [intern]. But once you do one season with that, if you like it, you want to be on the inside. And we clearly need entry-level people . . . we need new young talent.*

Another staff member focused on workforce development stated:

> *The agency is evolving, but we're not changing the way that we're doing business and it's getting harder to do work, and the need for it is growing. So I focus a lot of my time, my free time, on workforce development, and growing our agency for a diverse agency, because* ***we want people who don't think all alike, we want new strains of thought, we want people to think differently and think outside the box****.*

USFS staff we interviewed believe in the reputation and experience of the agency to accomplish its mandate to increase the pace and scale of restoration but feel that these abilities are hampered by limits to capacity. USFS staff are creative in accessing and utilizing resources, and recognize the need for a new, more diverse workforce to meet current challenges. In the current funding system, a great deal of effort and staff time are spent competing for, managing, and reporting on state grants in order to utilize state funds to support management of federal lands. A more coordinated funding system based on collaborative statewide prioritization among state, federal, and Tribal governments, incorporating block grants and non-competitive funding for infrastructure investment, might be more efficient and effective in sustaining restoration economies in the long term.

VI. CASE STUDIES

The case studies below demonstrate emerging models of socially and environmentally restorative "high road" approaches to forest management. These grassroots models for workforce development and public land stewardship collaborations offer lessons for essential policy reforms and scalable programs for increasing diversity and equity in the workforce and supporting Indigenous land stewardship and Traditional Ecological Knowledge–informed management. This section can be read independently of the whole report, and relevant recommendations are referenced for each case.

Verbena Fields and Mechoopda Resource Strategy[61]

At a former gravel mine site in north Chico, Ali Meders-Knight, Master Traditional Ecological Knowledge (TEK) Practitioner with the Mechoopda Tribe, has led the development of a pioneering ecological restoration, education, and workforce development project. Every Friday, Ali hosts community members for land tending and educational activities at the 17-acre site. The groups plant, tend, and learn about key native species such as California mugwort (munmuni), grey pine (to:ni), blue oak (c'awk'awi), and several types of willow (c'upy). "What Verbena Fields also teaches is the importance of plant communities," says Meleiza (Mel) Figueroa, a partner on the project.[62] In contrast to native plant gardens where arrangements are based primarily on aesthetic considerations—as in a "zoo," as Ali puts it—Verbena Fields develops restoration strategies and education based on multi-generational Mechoopda knowledge of the relationships among plants, as well as their interconnected histories with Mechoopda people under settler colonialism. As Ali says, "I'm always teaching everyone the correlation between Native-loved plants, and them being ripped and removed." The site is now a seed bank generating and storing seeds for future restoration projects, and for the community to propagate in the broader area.

But Verbena Fields is more than an ecological project; it is also a site for the development of political strategies for strengthening Indigenous resource sovereignty and Tribal stewardship. Key to the Tribe's plans to expand this work has been a strategy to protect key plant resources by utilizing a recent California law, AB52, establishing protection for Tribal cultural resources, including plants, and expanding state agencies' obligations for consultation with Tribes over impacts to these resources in their traditional territories. Through their work, Ali and her team have transformed the former industrial site into a demonstration of what Mel says "a living cultural resource would look like." Buttressing this work in the field has been Ali's creation, as Master TEK Practitioner, of a growing list of key species to be designated by the Tribe as cultural resources. These legal protections not only obligate state agencies to engage in Tribal consultation on an expanded range of land management projects, but can also be used to protect key species from economic exploitation:

> *I said to the Tribe, if you label these as keystone species, and we protect them for cultural consultation, it kind of keeps people from like opening up a farmers market with all of our Tribal medicine as a non-Native and saying, 'Look, I'm gonna make money off the knowledge of the Mechoopda and how they use their plants.'*

The work at Verbena Fields is therefore tied into broader strategies for enhancing Tribal sovereignty and stewardship, and for opening up new avenues for economic development by increasing Tribal control over native plant–based products. One of these avenues involves use of the Forest Goods for Services program, whereby USDA provides material support to emerging businesses developing revenue streams from forest-based products. Traditional uses present a range of opportunities for non-timber forest products from protected Tribal resources, from medicinals and food to dyes, fibers, and building materials. USFS Stewardship Contracting also provides opportunities, in addition to direct employment, for Mechoopda practitioners to gain access and use rights to traditional territories under public control. As Ali describes, by pioneering this legal and economic strategy, "I wanted to build a model for the Tribes, all Tribes, so anyone can use it."

Ali and her team are also working to develop a workforce capable of implementing TEK-informed management on an expanded scale, including on private lands through a TEK worker certification program. The TEK Certification program is housed under the Mechoopda Tribe's Cultural Resources Preservation Enterprise, the operations arm of the Tribal Historic Preservation Office, and is thus fully under the authority of the Tribe. The program is tailored to contractors working with state, federal, and county management agencies to improve their understanding of the significance and practice of Indigenous land care techniques. The program's website states, "**Every Tribe should have a certification program that allows other contractors to get a TEK certification from their people.**"[63] Certification ensures greater integration of TEK into

61 This case was informed and reviewed by Ali Meders-Knight and Meleiza Figueroa.

62 We include common names for each species along with their Indigenous Mechoopda names in parentheses.

63 TEK Chico, "Traditional Ecological Knowledge, Get Certified!",

land management agendas and raises pay for TEK-certified practitioners. Referring to California's use of incarcerated workers in forest and fire management, Ali states that "they've created a situation where land management is undervalued so much that it's done as a punishment… The addition of TEK to this type of workforce seems to give it some merit, and some integrity." TEK-informed management may be more labor-intensive, and more costly—features that Ali ultimately views as key benefits, increasing both its employment and ecological impacts. Despite potentially higher costs, Ali and crew leads she works with claim that landholders recognize the increased benefits to soil and watershed health of their work, and return for ongoing maintenance.

At Verbena Fields, Ali's team is developing TEK-informed methods for the use of biomass removed during restoration efforts to enhance restoration, including through the construction of beaver dams and living willow fences. These skilled services could be another source of revenue for Tribally based crews, as well as an additional source of valuable non-timber forest products removed during restoration work. In addition to their work with native plants, Ali and her team are interested in the potential for products from the large volumes of invasives to be removed during restoration work—including eucalyptus, Himalayan blackberry, Scotch broom, and others. Mel says: "I'm Filipina, and so in our community, we're thinking about: how can we use bamboo?" Tribal jurisdiction also provides opportunities for, as Ali puts it, "proof of concept" for biomass facilities, housing utilizing traditional building techniques (under AB1010), and other innovative uses of forest products under Tribal sovereignty.

At the time of writing, the Mechoopda Tribe is in the process of approving a Tribal Self-Determination agreement with the Mendocino National Forest to establish a Tribal seed bank, which Mel says is the first of its kind in the nation. As Mel describes,

> *we have found that seeds for reforestation and revegetation in wildfire burn scars has presented a particular challenge for agencies, as they are understaffed and under resourced both in seeds (which are typically bought from private nurseries) and conifer cone collection to fulfill the dire needs of these devastated areas. Seeds—especially native seeds for re-conversion to fire-adapted, drought tolerant native mixed oak/hardwood forest mosaics—has become our number one point of leverage and priority to secure restoration contracts.*

With greater understanding of Tribal sovereignty and law on the part of collaborators in state and federal agencies, Ali sees the potential for partnerships that position Tribes as leaders in the development of non-timber forest products enterprises and locally based restoration economies that benefit Tribes and the state as a whole.

However, building Verbena Fields has required contending with resistance from some non-Indigenous governance bodies, and educating them on the importance and legitimacy of Indigenous knowledge and land-tending practices. Despite the new protections offered under AB52, **a persistent lack of recognition of Indigenous peoples as living inheritors of resources and traditions hinders consultation efforts**. Some local agencies are used to reaching out to Tribes regarding archaeological sites, but many continue to fail to engage in meaningful dialog. Ali and Mel have worked with allies in county agencies to rewrite the consultation process in light of the recognition of living cultural resources. **Moreover, Indigenous knowledge-holders are not typically paid to participate in consultation processes, unlike their counterparts in state and local government**. This presents a key procedural justice issue as well as a capacity issue, given the limited capacity of many Tribes for adequate coverage of necessary consultation processes. Another barrier, in addition to outright resistance from local non-Indigenous authorities, has been a lack of education on the part of local and federal government staff on Indigenous sovereignty and Tribal law. Lack of public awareness of traditional management practices and the importance of beneficial fire—including among county and local governments—also poses barriers, particularly to cultural burning.

By linking education, political strategy, and economic and workforce development initiatives, Mechoopda innovators and collaborators are building models for expanded Indigenous stewardship and governance of ancestral lands that can ensure that restoration initiatives contribute to both social and ecological integrity. These efforts stand to benefit all Californians and deserve greater attention and support from non-Indigenous governing bodies, landholders, and the broader public.

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tekchico.org.

SUMMARY RECOMMENDATIONS

USFS

- Pursue opportunities for partnerships and government-to-government relations with Tribes to pilot and develop alternative revenue streams from biomass and non-timber forest products, using Goods for Services, Good Neighbor Authority, and other relevant programs and legislation. **R4.3**[(a)]
- Develop co-funded positions in partnership with Tribes to expand USFS capacity for Tribal engagement, including well-compensated Tribal liaisons. **R3.2**
- Develop USFS employee training and education on Tribal law and sovereignty and the benefits of TEK-informed management, collaborating with Tribes to develop appropriate curricula, and ensure that all engagements with TEK respect Tribal authority over knowledge. Implement the recommendations for the forthcoming USFS Tribal Relations Strategic Plan for Region 5.[64] **R3.3**

State and county governments

- Increase and enforce penalties for failure to consult with Tribes on relevant sites and resources. Consider Tribally determined carve-outs, demonstration sites, and pilot programs as mitigation measures for CEQA/NEPA Mitigated Negative Declarations. Develop best practice guidance on consultation for state and federal employees (in collaboration with USFS), and work with Tribes to support costs of participation in the consultation process, including compensating Indigenous knowledge holders for their time and strengthening relationships to ensure Tribal input in planning and scoping of land management projects. **R4.1**
- Consider, in consultation with appropriate Tribal governance bodies, opportunities for land tax programs to support Native nations and/or organizations. **R4.2**
- Provide workforce development funding specific to Tribal enterprises, worker cooperatives, and other innovative models that prioritize high-quality jobs, living wages, and career pathways. **R2.7**

Training and educational recommendations

- Where possible, colleges and universities should work with Tribal authorities that have TEK education programs to include education on locally appropriate TEK concepts and approaches, ensuring that such programs are housed under Tribal authority. **R2.6**

(a) Notation at the end of each recommendation refers to corresponding detailed recommendations in Section VII of this report.

64 See United States Forest Service, "Tribal Relations - Our Commitment," https://www.fs.usda.gov/main/r5/workingtogether/tribalrelations.

Calaveras Healthy Impact Product Solutions (CHIPS)[65]

In the early 2000s, Calaveras County, like many other forest-dependent communities, was suffering in the wake of the long decline of the timber industry. With 22 mill closures and unemployment rates around 23 percent, "we had two exports from our area," said former Calaveras County Supervisor Steve Wilensky: "methamphetamine, and our kids." Also as in many similar communities, deep political divisions pitted segments of the population against one another, with conflicting narratives of who was to blame. Shortly following his election in 2003, Steve attended a Tribal gathering, where he spoke at length with Elders about the conditions in their community, the ongoing impacts of the California genocide, and their traditional forest management practices. These Elders challenged him to respond to the situation. In response, Steve called a meeting of three local Tribes, several environmental organizations, and local loggers and mill workers. As he described, "while there was still some dispute about whether to cut the 10 percent of remaining old growth, we could all agree that the other 90 percent needed restoration and stewardship, and that we could maybe rebuild an economy at least to some extent on those concepts. CHIPS was born out of that meeting."

This holistic approach to forestry work that combines social, economic, and environmental benefits has been central to CHIPS's mission since that time. CHIPS now runs several crews who do brush clearing, mastication, hand thinning, meadow restoration, and pile burning on public and private lands. Shortly after its founding, the organization helped to coordinate the Amador-Calaveras Consensus Group, with which it has worked closely. As a nonprofit that both receives grant money and also runs crews that bid on grant-funded projects administered by other organizations,[66] CHIPS has an unusual and hybrid model that has evolved through its use of diverse sources of support, including grants and federal appropriations through the Collaborative Forest Landscape Restoration Program. Starting off fully grant-funded, the organization has recently expanded the scale of its work and shifted to supporting itself primarily through its forestry contracts with USFS and partner organizations. As Steve describes, CHIPS's nonprofit status enables them to bring in grant resources not available directly to the USFS, while promoting a greater focus on community benefit and local workforce development: "We've really made a concerted effort to change the contracting patterns of our partners with some considerable success, especially since we've been better at bringing in money than the federal budget."

CHIPS now has 55 employees, over 90 percent of whom are Indigenous from seven Tribal groups, including Hung A Lel Ti Washoe, Maidu, Paiute, Mechoopda, and Miwok. CHIPS is not a Tribal enterprise, but has cooperative agreements with several Tribes. All crew leads, as well as the organization's operations manager, are Indigenous, and the organization focuses on developing leaders up through the ranks. For Craig Christiansen, a former CHIPS foreman and member of the Washoe Tribe, working with the organization provided a way out of a difficult situation as a youth in an environment with few economic opportunities. CHIPS's focus on quality jobs and career pathways is crucial, Craig argues, for attracting employees to an industry characterized by physically demanding, seasonal work in remote locations, when workers may earn equivalent starting wages in retail, warehouse work, or fast food: "**I think people naturally want to have some kind of sense that they're going somewhere, that they're not just remaining stagnant in one position**."

But this model also swims upstream of the status quo in the sector as a whole. As a small organization, CHIPS struggles to compete with large, established companies working on a low-wage and high-volume model, many of which are based out of state and employ H2B visa workers who enjoy few labor protections. Prevailing rates per acre are not always sufficient to support competitive wages for local workers, even given high local unemployment rates. Even though, as a nonprofit, CHIPS was able to cut overhead by operating with an all-volunteer administration in its early days, in the beginning its rates per acre were still two to three times higher than the rates of their large competitors, and still did not cover their costs.

Building skilled teams has taken years, and the organization has struggled to sustain living wages for its employees and make competitive bids in the process. In their almost 20-year development, they have benefited from the support and informal guidance of partners in the USFS, Bureau of Land Management, National Parks Service, and other agencies, and in 2020 won the Best in Basin award from the Tahoe Regional Planning Agency for excellence in environmental design. This progress has required the commitment of partners in USFS and elsewhere to work with the organization through their development phases, despite higher costs. For a time, the organization struggled to ensure essential training for its employees—such as S212 sawyer certifications—given increasingly demanding fire seasons that drew certified instructors to the frontlines for a large part of the year. However, its recent High Roads Partnership grant in partnership with the Sierra Institute

65 This case was informed by Steve Wilensky and Craig Christiansen, and reviewed by Steve Wilensky.

66 CHIPS also works as a private contractor; roughly one-third of CHIPS's work has been on privately-owned land.

and the Big Sandy Rancheria, and a grant from the Sierra Nevada Conservancy, have enabled CHIPS to contract skilled trainers, many of whom are Indigenous, and acquire essential equipment to conduct trainings at worksites and Tribal headquarters. Operating on state-funded grants also poses challenges to a small organization with limited resources, as CHIPS frequently is left waiting for grant reimbursement across multiple payroll periods.

CHIPS's goal is not to replicate the business model of their competitors, however, but to build a skilled workforce that can accomplish high-quality work informed by place-based knowledge of the region, including the multi-generational TEK and land management practices of diverse Indigenous groups. For Steve, who is non-Indigenous, this is a very different model—both socially and ecologically—than conventional fuels reduction, and different than some conservation approaches focusing solely on habitat preservation for a single charismatic species. CHIPS avoids using herbicides and other harmful chemicals, and is working to integrate TEK-informed management into their projects—including cultural burning practices whose extinguishment has historically been central to the colonial settlement of California.

These efforts, however, face barriers posed by a lack of awareness and recognition of TEK within settler institutions, as well as (specific to fire) stringent liability laws, constrained burn windows and grant timelines, and public fear of fire. Integrating TEK traditions into CHIPS work also involves ongoing conversation among multiple TEK traditions local to CHIPS's working area, and debate over the role of these traditions in supporting adaptation to a changing climate. Steve is hopeful that their ongoing projects will demonstrate the value of this approach on the ground, in accomplishing holistic restoration that also prioritizes the social and economic well-being of local and Indigenous people. Local benefit, he says,

> *is making a long-term investment in the place where you're doing the work and having the benefits accrue primarily to the people who live there. And that relationship may look expensive at its first iteration, but there is no question that in the long term, the Sierra is going to be dependent on people of the Sierra, and its historic residents and cultures, to get us back to where we need to be.*

CHIPS is built on the recognition that the social and ecological degradations faced by their local communities are linked, and that the solutions must be as well. But these socially restorative goals have proven the most difficult to achieve. **Ongoing legacies of Indigenous genocide and colonization have created complex intergenerational traumas with effects on all aspects of well-being for Indigenous peoples**. These traumas are perpetuated through inequities in criminal justice, health care, housing, and transportation. Employees thus face barriers posed by structural racism as well as, not infrequently, racist harassment and profiling in the course of their work. In the absence of a robust safety network to address these interlinked issues, CHIPS focuses on fundamental social issues like reducing re-incarceration among formerly incarcerated community members, and works through formal and informal channels to support their employees in accessing essential services. A key barrier is transportation and housing for crews in remote rural areas.

The vision of ecologically and socially restorative work that CHIPS promotes cannot be accomplished by a single organization, but relies on an enhanced social and physical infrastructure that can support community well-being as well as a sustainable forest products industry. The retreat of the timber industry across the region shuttered mills that might otherwise have been retooled for small-diameter material and biomass. The same barriers facing biomass development in general—including high processing and transportation costs, limited infrastructure, and low-value product, in competition with other (agricultural) sources—has limited the growth of additional revenue sources for CHIPS. **Realizing the potential of restoration to support robust, sustainable rural economies will require ambitious public investment in wood products processing, including high value-added products such as graphene**.

Additionally, investment in social support systems and anti-poverty measures targeted for rural communities are essential for ensuring community well-being that is integral to workforce development. "We've figured out sort of Rube Goldberg designs around a very fundamental set of issues," Steve says, "and that shouldn't be left to a small nonprofit that has a strained budget and minimal resources, especially for transportation." Looking forward, Steve sees potential for building some of these supports by utilizing the capacities and privileges of Tribes, including their priority access to surplus military equipment and vehicles. This requires additional capacity-building within Tribes to develop strategies and skilled personnel to navigate necessary bureaucratic channels. CHIPS is currently expanding with the help of the High Roads Partnership grant that it won with the Sierra Institute. But expansion has also increased strain on its crews, who are now stretched across multiple projects in several locations. Looking toward the future, the organization is focused on the development of Tribal enterprises that can expand its fundamental approach—socially and ecologically restorative forest management—across the region.

SUMMARY RECOMMENDATIONS

Federal

- Address the needs of rural communities and Tribes in federal funding for transportation modernization. **R4.5**
- Provide federal support for climate-adapted public housing solutions for rural areas, including through partnership with Tribal governments. State and federal agencies should collaborate to better utilize temporary worker housing. **R4.6**
- Extend federal recognition to unrecognized Tribes in California that allow them to access funding and capacity-building programs through the Bureau of Indian Affairs and other agencies. **R4.3**
- Recognize that decarceration and criminal justice reform are fundamental to building community resilience, and develop federal grant-making programs to build in-community, culturally appropriate alternatives to mass, punitive incarceration. **R4.11**

USFS

- Update guidelines on consideration of local economic benefit in contracting, considering local workforce development and fair labor practices. **R1.3, R2.5**
- Engage in government-to-government relations with Tribes to accomplish shared management goals. **R4.3**
- Develop co-funded positions in partnership with Tribes to expand USFS capacity for Tribal engagement, including Tribal liaisons. **R3.2**
- Develop USFS employee training and education on Tribal law and awareness of the benefits of TEK-informed management approaches, collaborating with Tribes to develop appropriate curricula and ensure that engagements with TEK respect Tribal authority over knowledge. **R3.3**

State and local government

- CalFire and USFS should collaborate to assess the multiple barriers to increased use of beneficial fire. **R1.6**
- Increase availability and subsidize the cost of key trainings, such as S212 sawyer training, red cards, and others, via CalFire workforce development funding or other grants, and ensure that these trainings are widely available to workers in their home communities. **R2.3**
- Support the expansion of TEK Certification under appropriate Tribal authorities that enhance recognition and value of TEK expertise. **R2.6**
- Provide workforce development funding specific to Tribal enterprises, worker cooperatives, and other innovative models that prioritize high-quality jobs, living wages, and career pathways. **R2.7**
- Reduce reimbursement timeline on state-funded grants. **R1.1**

The Forestry and Fire Recruitment Program (FFRP)[67]

After Brandon Smith served as an incarcerated firefighter in CalFire's fire camp program, he struggled to find a path toward regular employment. Turned away by multiple fire agencies, Brandon spent two years piecing together information from contacts in the industry to navigate necessary re-trainings, certifications, and seasonal application deadlines, while facing all the challenges posed by the conditions of his parole for a low-level offense. The difficulties of transferring his skills as a firefighter into post-incarceration employment inspired Brandon to co-found The Forestry and Fire Recruitment Program, an organization that builds career pathways for formerly incarcerated firefighters. "I found my own way through this obscure maze," Brandon says; "now FFRP is about expanding those pathways."

Although about one-third of California's wildland firefighters are incarcerated, these workers face multiple barriers to regular employment in the industry following release. The certifications they receive in prison fire camp are not directly transferable to post-incarceration employment, and state explicitly that they were gained while incarcerated, exacerbating stigmas already faced by survivors of the criminal justice system. Workers with some criminal convictions, including nonviolent offenses, are also prevented by state law from gaining necessary EMT trainings, and many firefighting departments and public agencies will not hire workers with any criminal record. Some of these barriers were the target of recent state law, AB2147, which enables fire camp participants to petition for expedited expungement of their records. But while this is a step forward, it is by no means an easy fix. Expungement is an expensive and long process, generally requiring the assistance of an attorney, and the law still gives wide discretion to judges tasked with granting the expungement. **Further, there is still no comprehensive state program for helping workers to navigate necessary re-trainings—many of which are redundant with those they received in fire camp—and application processes to build their qualifications and gain employment**.

FFRP fills this gap by providing coaching, career training, certifications, and interim employment for formerly incarcerated firefighters, recruiting from fire camps across the state and connecting participants with long-term employment opportunities.[68] It's a service that Brandon feels should be expanded into a state-run program. Incarcerated firefighters possess skills, training, and experience that is applicable not only to suppression, but also the application and management of beneficial fire. The 2022 California Strategic Plan for Prescribed Fire, Cultural Burning and Prescribed Natural Fire from the Wildfire and Forest Resilience Task Force outlines important interventions and training supports to build the state's fire workforce, emphasizing the need to increase training opportunities and diversity, and expand career pathways in the application and management of beneficial fire. However, the plan does not include specific language regarding the envisioned role of the state's large incarcerated suppression workforce in addressing these needs.

More comprehensive support for career pathways out of fire camp would help to address the shortfall of fire and forest health workers in the state, and address re-incarceration by offering living-wage employment. It would also increase diversity in the fire workforce, since the majority of women, Black and POC firefighters in the state are currently or formerly incarcerated. There are existing programs that can be expanded: the California Conservation Corps (CCC) has latitude to recruit formerly incarcerated firefighters, although wages are low while participating in the program. A pilot training camp was established in 2018 in Ventura County through collaboration among CCC, CalFire, and the California Department of Corrections and Rehabilitation. But a 2021 bill (SB804) that would have expanded this program into Northern California was vetoed by Governor Newsom in October of that year with the intention to consider new training facilities through the budget process.[69] With a widely acknowledged need to build the firefighting and prescribed fire workforce, easing job pathways for the thousands of firefighters in the state who already have years of on-the-ground experience presents an obvious solution.

But fixes to the situation must also address multiple barriers faced by survivors of the criminal justice system, and deeply entrenched stigmas. The head of the union representing CalFire firefighters has come out against AB2147, claiming that formerly incarcerated workers are not sufficiently trustworthy to perform the routine duties of a firefighter and EMT. Formerly incarcerated firefighters argue that they have already performed these duties while imprisoned, and that they still have to meet the same training requirements and standards of excellence as all

67 This case was informed and reviewed by Brandon Smith and Sara Sindija.

68 A summary of the organization's work can be found at "2022 Award Recipients: Brandon Smith and Royal Ramie," The James Irvine Foundation Leadership Awards, https://irvineawards.org/award-recipient/brandon-smith-royal-ramey/.

69 Helen Kirstein, "Options for a Forestry Management Training Center in Northern California," Legislative Analyst's Office (Sacramento, CA: 2022), 4, https://lao.ca.gov/Publications/Report/4487.

other firefighters.[70] Inmates convicted of arson or violent and sexual offenses are already barred from participation in the fire camp program. Nevertheless, stigmas like this persist in many departments and agencies, adding to the routine challenges to employment that people face as conditions of their release—including limitations on travel and other parole requirements.

More problematic, however, is the perverse policy incentive created by the state's heavy reliance on incarcerated labor. Incarcerated workers earn $2–$5/day, plus an extra $1/hour while on a fire line, while working alongside state firefighters who earn on average $42 an hour— saving the state millions in suppression costs.[71] News coverage highlighted the dilemma created during the 2020 wildfire season when California released many low-level offenders and locked down twelve prison fire camps because of the COVID-19 pandemic, depleting the state's emergency response force.[72] Continued reliance on incarcerated labor thereby works against broader imperatives to end mass incarceration and redress the harms of the criminal justice system. If the program is to persist, it needs to be reconceptualized as a career pathway on par with other apprenticeship and training programs that can both address reincarceration and help to build the state's regular fire workforce, through greater integration with specific post-incarceration career opportunities.

Right now, FFRP works hard to find job placements for its participants. Often this leads people to northern counties in the state, or in Oregon and Washington, because of the concentration of industry in that region. Because Los Angeles County incarcerates more people than any other county in the state, most incarcerated firefighters are from Southern California, making it especially difficult for these firefighters to find local employment following their release. And while FFRP has built supportive relationships with some National Forests, municipal and state agencies have declined to work with the organization because of stigma against formerly incarcerated workers. Informal barriers like these are especially consequential in an industry characterized by tight-knit networks of land managers and contractors, and complex contracting processes. This reticence not only hinders career pathways for experienced fire workers (including in suppression and beneficial burning), but also misses opportunities for greater coordination and partnership to prioritize work across the state. Brandon sees potential for FFRP to play a greater role in addressing critical land management needs via improved data availability and collaborative prioritization of fuels reduction and restoration work across the state. Such collaboration could enable them to more effectively direct their participants to available jobs, thereby addressing labor shortages statewide.

In an industry marked by limited labor availability, FFRP is an exception—with eight crews of 40 employees, the organization continually has a waitlist. In 2022, FFRP sponsored its first bill, AB1908, that would have enabled any inmate who successfully completed the fire camp program to receive a firefighter certificate from CalFire upon release. Unfortunately, with swift pushback from the firefighters' union, the bill made little headway. But this or similar legislation will be crucial to reforming the fire camp program into a solid career pathway, and will also improve overall societal well-being by increasing career opportunities and addressing industry-wide labor shortages. **Key to the success of future legislative efforts will be increasing recognition and respect for formerly incarcerated workers' skills and experience, addressing stigmas and informal barriers limiting post-incarceration employment, aligning certifications to turn fire camp into a legitimate career training program, and realigning policy incentives away from reliance on incarcerated workers as a low-cost solution to the state's labor problem—including by raising wages for incarcerated workers**.

70 Jay Will, "A New Law to Help Formerly Incarcerated Firefighters is Far More Limited Than It Seems," *The Appeal* (15 Sept 2020), https://theappeal.org/california-wildfires-formerly-incarcerated-firefighters/.

71 Nick Sibilla, "Federal Judge: Californians Who Fought Fires In Prison Can't Become Career Firefighters," *Forbes* (16 Feb 2021), https://www.forbes.com/sites/nicksibilla/2021/02/16/federal-judge-californians-who-fought-fires-in-prison-cant-become-career-firefighters/?sh=1c9058fd170f; US Bureau of Labor Statistics, Occupational Employment and Wages: 33-2011 Firefighters (May 2020), https://www.bls.gov/oes/current/oes332011.htm.

72 Thomas Fuller, "Coronavirus Limits California's Efforts to Fight Fires With Prison Labor," *New York Times* (22 August 2020), https://www.nytimes.com/2020/08/22/us/california-wildfires-prisoners.html; Kevin Stark, "Coronavirus Pandemic Sidelines California's Inmate Firefighters," *National Public Radio* (29 July 2020), https://www.npr.org/2020/07/29/896179424/coronavirus-pandemic-sidelines-californias-inmate-firefighters.

SUMMARY RECOMMENDATIONS

USFS

- Increase USFS outreach and collaboration with community colleges, Tribal and community organizations, and organizations working with formerly incarcerated firefighters to educate and support potential applicants on employment pathways into USFS, and to increase diversity in the workforce. **R3.5**

State and local government

- Facilitate career pathways and increase pay for formerly incarcerated firefighters. **R2.2**
- End perverse policy incentives that perpetuate state reliance on incarcerated firefighters, and address the social impacts of mass incarceration. **R4.11**

Finance and Investment for Forest Restoration Economies[73]

Alongside grassroots models for workforce equity, a novel financial instrument may seem an odd fit. But new financial tools will be essential for enabling the large-scale investment necessary to transform and scale up forest restoration. With this need in mind, the nonprofit organization Blue Forest Conservation created the Forest Resilience Bond (FRB) in order to address the challenges presented by the current system for funding and financing public lands restoration work. **The FRB has an impact not only as a single financial mechanism, but as a tool integrated into large-scale, multi-stakeholder collaborative planning efforts, linked up with efforts to secure investment in wood processing facilities necessary to sustain restoration work in the long term**.

Conceived by Blue Forest's founders while at Berkeley's Haas Business School, the FRB works by bringing downstream stakeholders who benefit from forest restoration in their areas, like water utilities, to jointly fund restoration projects with USFS. USFS and their partners plan the restoration work, and secure reimbursable state grant funds to support that work. A blend of concessional investors (philanthropic program–related investments) and market-rate investors (like impact investment funds, pension funds, or insurers) then provide low-interest loans that make funding available up front, enabling implementation to happen more quickly. Investors are paid off over a 5- to 10-year timeline, with an average 2.5 percent interest provided by the downstream funder. The role of these downstream funders is crucial, because the USFS, as a federal agency, is prevented from paying interest on loans, and state grant programs are also often prevented from paying interest. Thus, the financial mechanism does not increase costs for public budgets, and investors have no direct role in the planning or forest treatment prioritization process. The model is especially well suited to insurers, who may also benefit from forest management through reduced risk of catastrophic loss due to wildfire. Because the loans are backed by state grant funding, they offer secure returns.

The first FRB pilot on the Yuba Project, in the Tahoe National Forest, was launched in 2018, with the Yuba Water Agency, a utility, as the downstream funder. **Blue Forest estimates that its financing reduced the timeline of the Yuba Project to four years, in contrast to a projected 10–12 years**. The National Forest Foundation has been leading the implementation of the Yuba Project since its inception, and is completing restoration treatments in 2022. Though the project is relatively small—covering roughly 14,500 acres, and providing $4 million in private capital—the model has been scaling up, and Blue Forest has more than $200 million worth of projects in the pipeline, ranging in size up to 190,000 acres throughout the western United States.

As an intermediary, Blue Forest plays a role not just in the provision of capital, but in building networks of stakeholders and helping to catalyze larger-scale collaboration. This has borne fruit in the North Yuba Forest Partnership, a 275,000-acre landscape planning initiative involving nine organizations. Blue Forest was described by USFS leadership as a "key synergistic player" in this collaboration, helping to galvanize interest from diverse stakeholders and increase visibility by elected and appointed officials. The North Yuba River area, encompassing the North Yuba Forest Partnership, has recently been selected as one of 10 priority landscapes for the USFS 10-year Wildfire Crisis Strategy implementation and one of the 15 Collaborative Forest Restoration Program projects funded through the Bipartisan Infrastructure Law and annual appropriations.[74]

One of the major benefits of the FRB is in smoothing out the process of utilizing state grant funds to support federal lands work. Because state grant funds are only available to grantees through reimbursement, grantee organizations (often small nonprofits) or contractors must carry high overhead, often waiting three months or more for payment. During our surveys and interviews, slow payment timelines was the number one barrier cited by contractors for doing public lands work. The FRB addresses this gap in the funding system and enables work to be initiated faster than through traditional USFS ways of funding restoration via timber sales.

While some USFS staff without direct experience with the FRB were skeptical of its potential, the large majority of staff we spoke with described its success at increasing the speed of implementation and reducing financial burdens on grantee organizations and contractors. Perhaps most significantly, some interviewees also suggested its potential to change the dynamic between the USFS and timber buyers. **Conventionally, restoration work is funded in large part from timber sales supplemented by congressional appropriations, meaning that the projects most likely to get completed are those that can pay for themselves through timber sales**. Because timber buyers have the flexibility to purchase a contract and wait several years to cut until the trees are more mature, this can slow

73 This case was informed by Zach Knight, Phil Saksa, Andrew Salmon, Lindsay Nitta, CathyLeBlanc, and Allison Thomson, and reviewed by Zach Knight, Phil Saksa, and Allison Thomson.

74 USFS, *Confronting the Wildfire Crisis*.

the pace of implementation—especially in a market like California's, where public agencies are effectively tethered to the strategies of a single private timber buyer with a large amount of its own timber to process that usually takes precedence over wood sourced from public lands. The presence of investment capital has begun to alter that dynamic, according to our conversations, by providing funding up front. As noted by a USFS specialist on the Yuba Project, interviewed in 2021:

> *Anyone who questions the resilience bond and what that can do for us, I would point them to the Yuba Project; the only piece of ground that isn't treated in the Yuba Project is our traditional timber sale… that was the first thing out of the gate… and not a tree has been cut on that sale. And everything else is either done or going to be done by the end of this season.*

By providing an avenue to pay for the ecosystem service benefits of restoration, the FRB enables money to flow directly into high-value restoration work that was previously taking a back seat to timber values. The Yuba Project and many projects in Blue Forest's pipeline rely on the ability to demonstrate to local water utilities and other downstream beneficiaries that investing in upstream forest restoration has a clear economic return through additional hydropower generation and decreasing the risk of high-severity wildfires. By including these downstream payers, the FRB is better able to value all of the benefits of restoration projects beyond timber, improving conservation outcomes and speeding up implementation.

In the longer term, the FRB may also support other kinds of essential investment in wood processing facilities that would enable sustainable and diversified restoration economies, in many cases by monetizing the carbon benefits of certain wood products. Because forest restoration work involves thinning trees and brush, and thereby removing a large amount of sub-timber material from the landscape, there has been a great deal of attention to the problem of how to dispose of and utilize this material, and it is often piled and burned on the landscape so as not to increase fire hazards. Proponents have argued that, since this material is piled and burned in the forest or left to decompose, forest waste biomass used to produce electricity, fuels, biochar, or other wood products may offer carbon benefits, if it replaces more carbon-intensive electricity sources and other products. But there is also great emphasis on forest biomass utilization as a key part of galvanizing restoration work; without a market for currently low- or zero-value material coming off the landscape, funding challenges will continue. Biomass subsidy programs like Bioenergy Market Adjusting Tariff (BioMAT) and Bioenergy Renewable Auction Mechanism (BioRAM) have therefore been rolled out in an attempt to support restoration work, which provides preferential pricing for biopower facilities selling electricity to the grid.[75]

However, these existing price supports for energy generation have not been sufficient to meet the costs of transporting waste material off the landscape. Biomass is worth little to nothing on the open market, in part because there are plentiful, easily accessible sources of biomass derived from agriculture. The fuel and labor costs of chipping and hauling biomass from remote forest areas is generally between $50 and $120 per ton, far higher than current subsidies can support.[76] One community organization involved in the North Yuba Forest Partnership, the Camptonville Community Partnership, has been working for several years to access financing for a biomass business campus. The campus would sell 3 megawatts (MW) of power to the grid through the state's BioMAT program at preferential pricing, and utilize the other 0.5MW to power the facility. A co-located business campus would house related industries that could also utilize the waste heat from the generation process—for instance, for furniture manufacturing. But even with this subsidy, stable and affordable feedstocks for the facility are out of reach: Camptonville Community Partnership received quotes from contractors in the area of costs ranging from $70 to $110 per bone-dry ton of waste biomass, while their early models showed they could afford to pay roughly half of those prices. In order to cover that gap, Camptonville Community Partnership worked with Blue Forest in 2021 to subsidize the delivery costs for an interim period, while it can attract other businesses to the campus that would generate additional income and may increase the organization's ability to afford higher prices per ton.

Further challenges are presented by the difficulty of guaranteeing long-term feedstocks; the USFS cannot enter into contract beyond its annual appropriations, and a general lack of transparency around project pipelines that will be producing biomass makes it challenging to enter into long-term contracts for biomass sourcing. Increasing transparency around project planning and pipelines, and providing state-supported capital investment in biomass

75 The Bioenergy Feed-in Tariff Program or the Bioenergy Market Adjusting Tariff (BioMAT) is a feed-in tariff program for small bioenergy renewable generators less than 5 MW in size; The Bioenergy. Renewable Auction Mechanism (BioRAM) is intended to streamline the biomass procurement process.

76 Camille Swezy, John Bailey, and Woodam Chung, "Linking Federal Forest Restoration with Wood Utilization: Modeling Biomass Prices and Analyzing Forest Restoration Costs in the Northern Sierra Nevada" *Energies* 14, no. 9 (2021): 2696. https://doi.org/10.3390/en14092696.

business campuses and facilities for producing value-added products like biochar and dimensional lumber, would improve the prospects for biomass markets by increasing supply chain transparency and fostering high-value end uses. Additionally, there is the potential to explore biomass for transportation fuels, which are eligible for government incentive programs like the Low Carbon Fuel Standard and the Renewable Fuel Standard. Across the board, biomass policy supports must ensure compliance with National Environmental Protection Act and California Environmental Quality Act regulations, and only support utilization of material that is residual to the restoration process and otherwise not merchantable (for example, under 10 inches diameter).

By enabling larger-scale, longer-term planning and connecting stakeholders involved in various parts of the biomass supply chain, the FRB may help to resolve these feedstock issues. **However, a rural industrial policy approach including public investment in wood processing facilities could offer a dramatic boost to the pace and scale of forest restoration, supporting higher prices for waste biomass while providing new jobs and economic opportunities for under-resourced areas**.

The complex challenges involved in revitalizing and reinventing forest-based economies to meet current challenges require diverse financial tools. **Innovative financial solutions like the FRB, however, do not replace robust public funding—rather, they fundamentally rely on it to enable the USFS to participate as a strong partner able to effectively mobilize labor to accomplish work at an accelerated pace**. According to several of the USFS staff we spoke with, the challenge presented by the FRB is human capacity: interviewees expressed enthusiasm for the successes of the model and concern that, without parallel efforts to increase staffing in the agency, incoming money could outpace capacity. As one USFS interviewee in a leadership position said, "What I don't want to see happen is for people to have the perception that we can hand the whole thing off to investors and partnership; we still need somebody that's a responsible, accountable agency to make sure the work getting done on the ground is in accordance with the public's best interest.".

SUMMARY RECOMMENDATIONS

USFS

- Increase staff in planning, permitting, compliance, and monitoring, and create new staff positions in project management for large collaboratives, in order to effectively scale up implementation in line with new financial resources. **R3.1, R3.4**

State and local government

- The state legislature, in collaboration with federal and state agencies, should consider coordinated and non-competitive funding strategies for supporting infrastructure investment and land management based on collaborative prioritization across state, federal, and Tribal lands. **R1.2**
- Focus support for biomass utilization on capital investment for the production of high-value products, and explore potential for support via California's Low Carbon Fuel Standard. **R4.8**
- Encourage water utilities and other beneficiaries to invest in upstream forest and watershed health. **R4.7**

VII. RECOMMENDATIONS

Transforming forest management into a socially and environmentally restorative climate solution requires ambitious, coordinated action among multiple levels of government, reforms to the ways that government works with partners, and investments in a well-supported and well-trained workforce. This entails reversing austerity that has led to understaffing in the USFS, and linking forest management to broader social investment policies like the American Jobs Plan and the Green New Deal. Without improvements in wages and working conditions, the necessary expansion of the restoration workforce will not be achieved. Our recommendations encompass four broad themes that are key for achieving these goals.

1. Increasing the effectiveness of state funding for forest management and workforce development

1.1: **Increase flexibility in the use of state grant funds for forest restoration.**

The immense scale of need for forest management demands long-term planning and maintenance, and collaboration among numerous public agencies, Tribes, and NGOs. More flexible timelines in the use of grant funds would enable more effective coordination of work on the ground, and facilitate greater use of beneficial fire. **The state legislature should consider measures to enable rollover or extension of grant funds when work is inhibited by unavoidable restrictions on seasonal working days, permit delays, or other factors.**

1.2: **Explore non-competitive and/or coordinated funding options for using state funds to support restoration work, including multi-agency block grants.**

Locating, applying for, managing, and reporting on grant funds requires a significant amount of human resources in public agencies and nonprofit partners. Current project-based funding provides essential resources for supporting forest management, but does so on a piecemeal basis, putting entities in competition with one another across the same landscape. Nonprofits are continually fundraising to support staff salaries and projects, while also attempting to increase capacity to meet land management challenges. Additionally, the reimbursable nature of grant funds poses challenges for grantee organizations and contractors with small operating budgets, and the focus on project-based funding does not support investment in the infrastructure necessary to sustain restoration economies in the long term. The challenges of moving state money to federal lands work through this system has required innovative financial solutions, like the Forest Resilience Bond, to fill in the gaps. **The state legislature, in collaboration with federal and state agencies, should consider non-competitive and/or coordinated funding strategies for supporting land management based on collaborative prioritization across state, federal, and Tribal lands**.

Multi-agency block grants could provide a mechanism for coordinating funding to scale up impact, facilitate year-round work, and address multiple land management goals (including fuels reduction, forest health, infrastructure, carbon sequestration, and habitat and watershed enhancement). Block grants could consolidate existing and new funding from a range of agencies,[77] and could be administered by regional conservation agencies (in our study region, the Sierra Nevada Conservancy). In this funding mix, water agencies and utilities would be crucial allies, with the potential for nominal conservation fees focused on industrial/commercial water users for essential watershed management work. Block grants would support work at larger scales and longer timeframes than existing grants, based on statewide prioritization by a multi-agency advisory board. This consolidated approach to funding would provide a number of benefits:

- Longer-term funding would support more effective implementation, especially burning.
- Projects covering a larger land area could enable workers to more easily move among work in different locations/elevations to accommodate weather-related limitations on work days or smoke events.
- Focusing one-time funding on long-term investments in wood processing and other infrastructure would break the cycle of grant dependence and enable self-sustaining forest management.

1.3: **Develop best practices for grantees to prioritize workforce development, fair labor practices, and the social and economic benefits of forest restoration for local communities.**

While the Forest Service has guidelines for prioritizing local economic benefit in the contracting process, there are no available standards or best practices for nonprofits and other grant-administering organizations. However, existing research by the

77 Agencies currently funding restoration work, or who could provide new funding to a consolidated pool, include but are not limited to: the California Department of Water Resources; the Wildlife Conservation Board; CalFire; CalTrans; Association of California Water Agencies; California Office of Emergency Services; FEMA; national and state parks; regional FireSafe Councils; and the Natural Resource Conservation Service.

Sierra Institute, the Watershed Center,[78] and other entities provides valuable resources for integrating locally appropriate criteria for local workforce development and other socio-economic benefits into the contracting process. Such best practices should also include guidance for contracting organizations to ensure contractors' compliance with state and federal labor standards. **The California Wildfire and Forest Resilience Task Force could commission the development of best practices for prioritizing local economic benefit and workforce development for state grantees, or this work could be funded through CalFire's Workforce Development grant program**.

1.4: **Develop a single-point source of information on grant-funded projects available for bid.**

As more federal lands work is administered through nonprofit organizations, contractors have to seek out information from multiple sources to find work available for bid, and may be left out of word-of-mouth networks. A third-party database of fuels treatment projects in the planning stages is currently in development,[79] but **the USFS and CalFire should collaborate to support a single-point source of information for contractors to locate publicly funded projects on public lands**. Additional information on projects in the planning stages will also help contractors to better anticipate and be prepared for available work.

1.5: **Increase data transparency on spending of state grant funds to better track workforce development impacts.**

CalFire has recently initiated a new Workforce Development Grant program, funded by the GGRF. However, tracking funds dispersed on existing grants would enable further accountability and transparency regarding the economic and workforce impacts of existing spending, by tracking where these funds ultimately are spent, and therefore who benefits from that spending. **CalFire should use the data it already collects from grantee organizations to track the location of contractors working on grant-funded projects and which businesses ultimately benefit from state grant funds**.

1.6: **CalFire and USFS should collaborate to assess the multiple barriers to increased use of beneficial fire.**

The recently released Strategic Plan for Expanding the Use of Beneficial Fire addresses many of the challenges to increased use of beneficial burning.[80] In addition, **USFS should collaborate with CalFire to undertake a comprehensive assessment and streamlining of policy pertaining to wildfire liability and beneficial burning**, including liability for inadvertent ignitions, insurance costs, and the combined impact of USFS PAL restrictions, timelines on state grants, and state funding requirements and policy to limit possibilities for burning.

2. Increasing the effectiveness of state funding for forest management and workforce development

2.1: **Develop cross-agency approaches to wage standards, training requirements, and enforcement of labor law as part of ongoing collaborations for forest management.**

Although not the direct focus of this report, the lack of enforcement of wage standards and labor laws is a well-recognized problem in the forestry sector.[81] Challenges to enforcement include the remote and temporary nature of much forest work, the prevalence of subcontracting and small operators, and the lack of labor protections for H2B visa workers. The 2020 High Roads report from the Berkeley Labor Center recommended steps to increasing worker protections, including the need to verify compliance with labor and employment laws for all forestry contractors working on public lands.[82] This report shows, however, that existing wage standards, even if enforced, may not lift the wage floor sufficiently to ensure sustainable employment across the sector. **As part of ongoing cross-agency collaborations for forest management, state and federal agencies should work together to**:

- **Establish living-wage standards for forest work on public lands, above current "prevailing wage" standards, and increase enforcement of these standards in contracting with public agencies and with partners utilizing state grant funds**. Living wage standards should extend to H2B visa workers and out-of-state contractors.

78 Jolley et al. *USFS Acquisition Mechanisms and Potential for Increased Local Contracting*; Davis et al., *Investment Opportunities for Increasing Forest and Fire Management Capacity in California*.

79 See "ProjectsDB" at Wildfires.Org.

80 Key interventions include establishing a Prescribed Fire Claims fund for private burners and Tribes.

81 Collier, "Chapter 11: Natural and Working Lands"; "The Piñeros: Reviewing the Welfare of Workers on Federal Lands. Hearing before the House Committee on Natural Resources (16 Sept 2008); "Forest Service Workers," Pub. L. No. S. Hrg. 109-427, § Subcommittee on Public Lands and Forests of the Committee on Energy and Natural Resources (2006), https://www.gpo.gov/fdsys/pkg/CHRG-109shrg28144/html/CHRG-109shrg28144.htm

82 Collier, "Chapter 11: Natural and Working Lands."

- **Require out-of-state contractors to pay equivalent costs for workers compensation as in-state contractors, even on temporary contracts**. This will help to ease the downward pressure on rates for local contractors that contributes to forcing down wages.
- **Establish and enforce training requirements for forest restoration contractors**. Current agency practice requires that fire suppression contractors demonstrate adequate training for crew members at pre-award inspections, but these requirements are not extended to fuels reduction or other restoration contracts. Several forestry workers' advocacy groups have advocated for extending relevant training requirements to labor-intensive forest restoration contracts, including sawyer trainings through Level C, to improve conditions for forest workers.
- **Improve enforcement of labor laws on public lands contracts**. There must be adequate funding for the federal Department of Labor's Wages and Hour Division, whose staff investigator roster has shrunk precipitously over the last decade, while penalties imposed for labor violations remain insufficient to discourage bad behavior.[83]
- **Develop a recognizable standard of excellence for contractors utilizing best labor practices**. A standard of excellence could certify contractors who are providing living wages, taking adequate training and safety precautions, and following best labor practices. This certification could provide extra points in the bidding process on contracts utilizing public funds, including state grants.

2.2: **Facilitate career pathways for formerly incarcerated firefighters.**

Incarcerated firefighters make up an estimated 30 percent of the state's firefighting workforce,[84] but face significant formal and informal barriers to regular employment as returning citizens. Reducing these barriers is essential not only for increasing equity and diversity in forestry and fire work, but also for meeting the state's land management goals. In order to build career pathways into the regular workforce, **the state legislature and relevant agencies such as CalFire and the California Department of Corrections and Rehabilitation should consider the following reforms**:

- **Harmonize certifications** for incarcerated firefighters with regular-workforce certifications and training, for fire suppression, beneficial fire application, forestry, and other skills. **Remove stigmatizing language** specifying that certifications were gained while incarcerated.
- **Provide budgetary and legislative support for expansion of training programs**, as in proposed bill SB804, in collaboration with organizations already working with the target. These programs should provide holistic support and career counseling for workers contending with multiple barriers posed by addiction and other health issues, and conditions of release. Ensure that training programs prioritizing formerly incarcerated workers, including those on parole or probation, pay equivalent wages to those paid in equivalent training programs.
- **Assess impacts of AB2147** on easing pathways toward EMT certification, including tracking expungement timelines for applicants. Develop specific guidance to decision-makers to expedite expungements and increase transparency of decision making for appeals purposes.
- **Increase wages for incarcerated workers** in line with those in California Conservation Corps programs.
- **Develop trainings and outreach** for use in federal, state, county, and municipal fire agencies on the fire camp program, to combat stigma and promote understanding and recognition of formerly incarcerated workers' skills and experience.
- Work with organizations like FFRP and the California Conservation Corps to **align workforce development and recruitment with statewide prioritization of land management**, including increasing data availability.

2.3: **Provide state funding to increase financial and human resources for essential skills and safety trainings, including know-your-rights trainings for workers.**

To enable compliance with training requirements described above, **CalFire could increase its direct support for essential trainings to private sector contractors, including those for sawyers and burn personnel**. This would help to alleviate the effects of seasonal shortages of certified trainers that have prevented some contractors and organizations from adequately training their staff. **CalFire workforce development grants or direct funds could also support organizations to develop and disseminate know-your-rights trainings to workers**.

83 Daniel Costa, Phillip Martin, and Zachariah Routledge, *Federal labor standards enforcement in agriculture*. Economic Policy Institute (Washington, DC: 2020), https://www.epi.org/publication/federal-labor-standards-enforcement-in-agriculture-data-reveal-the-biggest-violators-and-raise-new-questions-about-how-to-improve-and-target-efforts-to-protect-farmworkers/#epi-toc

84 Jamie Lowe, "The Incarcerated Women Who Fight California's Wildfires," *New York Times* (31 August 2017), https://www.nytimes.com/2017/08/31/magazine/the-incarcerated-women-who-fight-californias-wildfires.html.

2.4: **Expand opportunities and certifications to recognize on-the-job training, and expand paid apprenticeship programs linked to specific career paths.**

The majority of contractors we spoke with expressed enthusiasm for more training opportunities for their workers through apprenticeship and internship programs in partnership with community colleges and other educational institutions. A number of community colleges and other educational institutions in the Tahoe–Central Sierra region are developing programs in various aspects of forest management. However, these programs are often classroom-based, and many workers who may benefit from these programs are not easily able to relocate from their communities. **Integrating apprenticeships and paid on-the-job training into these programs, especially for equipment operators, could provide direct career paths for students and advancement opportunities for current workers, increase skilled operators who are currently in short supply, and help support training costs for employers**. These programs could be especially valuable where they allow students to gain credentials while working and learning remotely.

2.5: **Integrate living wage costs into planning and budgeting for public lands restoration work, and update current practices for considering best value in USFS contracting processes.**

This study did not directly assess USFS consideration of best value or local benefit in the contracting process. However, our conversations with USFS staff and contractors demonstrated the perception that bidding processes tended to go low-bid. Many local contractors expressed a perception that low-bid work was of lower quality in terms of its overall contributions to forest health, that low-bid projects were frequently not completed on contract terms, and that competition with lower-priced competitors drove down wages in the sector overall. Confirming these perceptions was beyond the scope of our research. While there is need for more up-to-date and representative assessment of the consideration of local benefit in USFS contracting, a 2007 study in Forest Service Region 3 showed that 74 percent of contracts went to the lowest bid, while none of the assessed solicitations indicated a consideration of local benefit. **Current practices for considering local benefit and best value should be assessed and updated, building on existing studies and recommendations**.[85] Considerations of local benefit should take into account workforce development, living wages, and fair labor practices, as distinct from other economic benefits such as money spent on accommodations or food for temporary workers. Planning and budgeting for forest management should take into account higher costs of treatment necessary to support living wages in the industry.

2.6: **Integrate education on Tribal law and sovereignty, and locally appropriate TEK, into forestry and related educational programs.**

Tribes in many parts of California are pioneering innovative approaches to forest management, often integrated with community development and other goals. TEK experts in many areas hold valuable expertise for resilient and effective forest management. However, many forestry professionals not affiliated with Tribes lack key knowledge about Tribal sovereignty that would facilitate partnerships, and are unfamiliar with TEK systems. **Colleges and universities should partner with Tribes, including those denied federal recognition, in order to include education on Tribal law and sovereignty into forestry programs. Where possible, colleges and universities should work with Tribal authorities that have TEK education programs to include education on locally appropriate TEK concepts and approaches. Such collaborations should be designed to ensure that curricula are locally relevant, that university support benefits Indigenous experts and Tribal communities as a whole, and that collaborations support Tribal authority over TEK and self-determination**.

2.7: **Provide workforce development funding specific to Tribal enterprises, worker cooperatives, and other innovative models that prioritize high-quality jobs, living wages, and career pathways.**

Improving pay and working conditions and supporting workers' rights in forestry requires new organizational models that empower workers. **Workforce development funds, like those offered through CalFire's GGRF-funded Workforce Development Grants program, should support the piloting and expansion of workers' cooperatives and Tribal enterprises as an alternative to conventional business models**.

3. Rebuilding key capacities in the Forest Service

3.1: **Develop new permanent positions in project management, oversight, and coordination for large partnerships.**

Large collaboratives need project managers to identify external funding opportunities, coordinate grant applications, and manage multi-stakeholder partnerships. Dedicated staff in these positions would relieve USFS staff time spent managing large collaborative partnerships,

85 Jolley et al., *USFS Acquisition Mechanisms and Potential for Increased Local Contracting.*

would streamline collaborative work, and would enhance access to, and ability to use, external funding opportunities. Partnership managers could also ensure adequate oversight and quality control on work contracted through external partners. Partnership managers in each forest could facilitate regional coordination and prioritization.

3.2: **Develop Tribal liaison positions in partnership with local Tribal governments and other Indigenous leadership.**

Tribes are key partners with critical knowledge and capacities for restoration. **Tribal liaisons could facilitate collaboration and government-to-government relations, workforce development, and shared stewardship in ways that support and enhance Tribal sovereignty**. USFS should pursue joint positions with Tribes in order to bring in liaisons with appropriate expertise, prioritize hiring Indigenous personnel and Tribal members, and ensure that these positions enhance the capacity of Tribes and USFS and support substantive and long-term relationship-building. A current liaison position under the Intergovernmental Personnel Act with the Eastern Band of Cherokee in the Southeast Region may offer a model, with potential to make further use of that program.

3.3: **Provide USFS staff training in Indigenous law and sovereignty and increase awareness of the benefits of TEK-informed land management among USFS staff.**

In addition to dedicated Tribal liaisons, ensuring that USFS foresters and other key staff have education in Tribal law and sovereignty would facilitate collaboration with Tribes and efforts to pilot and develop alternative forest products. **USFS should develop employee training and education on Tribal law and sovereignty and increase awareness of the benefits of TEK-informed management**, collaborating with Tribes to develop appropriate curricula and direct resources to Indigenous experts, ensuring that engagements with TEK respect the authority of the Tribe's traditional knowledge. **In Region 5, this approach is currently being developed through a Tribal Relations Strategic Plan, which must be fully funded and implemented by USFS**.

3.4: **Increase staff in planning, permitting, monitoring, and compliance.**

More specialists, including archaeologists, botanists, biologists, hydrologists, and other specialists at GS levels 5–9, are needed to perform surveys required for compliance, monitoring, and adaptive management. **Additional legislative funds are necessary to create NEPA teams dedicated to vegetation management, while retaining existing specialists to work on other projects**.[86] Increased use of the Forest Service Enterprise Program could help to increase NEPA capacities and facilitate large-scale, long-term planning and prioritization across regions; this should be accompanied by increased local staffing to enhance planning capacities, maintain progress on management goals while responding to seasonal demands, combat staff burnout, facilitate partnerships, and enable adaptive management. Prioritizing permanent positions should be considered, as USFS staff report that significant money and time are spent repeatedly recruiting for temporary positions. With effective project management, joint positions could allow partners to have more autonomy to make decisions on condition-sensitive treatments.

3.5: **Increase USFS outreach and collaboration with community colleges, community organizations, and organizations working with formerly incarcerated firefighters to educate and support potential applicants on employment pathways into USFS, and to increase diversity in the workforce.**

USFS can partner, at forest and regional levels, with organizations like FFRP and state agencies like the California Conservation Corps to **develop employment pathways and training opportunities for employees from under-represented groups, including formerly incarcerated fire workers**.

3.6: **Explore options for increasing retention and reducing turnover of key leadership and public-facing positions, and increasing pathways into higher-level positions.**

High turnover in district and forest leadership erodes relations with the external workforce and partners, and can inhibit effective implementation. **Efforts to improve retention across the board should include**:

- Cost of living increases in areas with high housing costs, and/or offer subsidized housing
- Increased staffing to combat staff burnout
- Increased salary/wages in line with comparable agencies and organizations
- Consideration of reinstituting transfer of station benefits to fill higher-level leadership positions

There is also a need to improve pathways into higher-level positions, especially for under-represented groups. Applicant pools for highly skilled positions are very limited in some areas, and more work should be done to **provide training**

86 *Planning staff officers are the thinnest spread of any position on the forest. NEPA Planners and specialists that focus solely on veg management projects for the next 10 years would be a game changer! Retain existing specialists to continue to work on a wide variety of other projects. Archaeologists, it seems like they're often a pinch point… they have laws they have to abide by for their survey work and their documentation. But if you don't have enough people to do that it slows things down.*

opportunities and guidance for Forest Service employees to work their way into higher-level positions. This may also help to maintain continuity in leadership and other positions providing key interfaces with the public, like district ranger, by developing alternatives to details for leadership training.

3.7: **Assess full costs of contracting to determine essential government positions and those that can be jointly funded with partners.**

As more work that was once performed by in-house USFS staff is now performed by external contractors or partners, there is a need for better understanding of the full costs of contracting and outsourcing. In some instances, this increases speed and flexibility of hiring, and reduces costs; in other cases, it disrupts continuity and accumulation of expertise, and diverts already-limited staff time to contract management. **The USFS should conduct a region-wide assessment to determine the full cost of contracting for different positions, and those that can be most effectively performed through partners and contractors**.

4. Building inclusive restoration economies

4.1: **Increase state support for consultation with Tribes over living cultural resources.**

California's AB52 has expanded the responsibilities of state agencies to consult with Tribes over living cultural resources. State agencies should work with Tribes to fund the costs of participation in the consultation process, including compensating Indigenous knowledge holders for their time. State grants should support the development of best-practice guidance for state and local government employees to consult with Tribes on living cultural resources, building on models already being developed by Tribes such as the Mechoopda. **State legislators should also increase and support enforcement of penalties for failure to consult with Tribes on relevant sites and resources, and compensate Indigenous knowledge holders for their time in consultation processes.**

4.2: **State and county governments should consider, in consultation with appropriate Tribal governance bodies, opportunities for land tax programs to support Native nations and/or organizations.**

Better resourcing Tribal governments in general will increase capacities for land stewardship, and support the expansion of existing land management programs in many Tribes. **Identification of opportunities for land tax programs should be undertaken in consultation with Tribal governments** to be designed in appropriate ways that support Indigenous sovereignty and self-determination.[87] This should include support for living cultural resource protection, including but not limited to TEK Certification programs, capacity building for Tribal restoration enterprises, restoration contracts, workforce development, rights of nature, Indian water rights settlements, and land repatriation.

4.3: **Engage in government-to-government relations with Tribes to accomplish shared management goals.**

USFS can increase engagement in government-to-government collaboration with Tribes, as an alternative to contracting, to accomplish shared management goals. These relationships could also explore opportunities for piloting innovative approaches to biomass utilization, including for housing. **Extending and restoring federal recognition for Tribes denied that recognition would also increase support for Tribal land management**, by allowing them to access funding and capacity-building programs through the Bureau of Indian Affairs and other agencies.

4.4: **Include wildfire impacts in greenhouse gas accounting for federal and state emissions goals, and recognize the carbon benefits of proactive forest management.**

The costs of climate inaction should be accurately reflected in carbon accounting, including the public health, infrastructure, and other costs of forest degradation. Benefits accrued through forest restoration should also be included in Congressional Budget Office/California Legislative Analysis Office scores, and in those of comparable agencies throughout the country. Considerable scientific research on the carbon benefits of fuels reduction and other forest management treatments can guide these efforts.[88]

4.5: **Address the needs of rural communities and Tribes in federal funding for transportation modernization.**

Federal and state funding for transportation modernization must not overlook the needs of rural communities and Tribes. The Bipartisan Infrastructure Bill of 2021 will direct

87 More information on existing approaches can be found at "Voluntary Land Taxes," The Native Governance Center (9 March 2021), https://nativegov.org/news/voluntary-land-taxes/.

88 Matthew D. Hurteau and Malcolm North, "Carbon Recovery Rates Following Different Wildfire Risk Mitigation Treatments." *Forest Ecology and Management* 260, no. 5 (2010): 930–37. https://doi.org/10.1016/j.foreco.2010.06.015; Huang, Ching-Hsun, Alex Finkral, Christopher Sorensen, and Thomas Kolb. "Toward Full Economic Valuation of Forest Fuels-Reduction Treatments." *Journal of Environmental Management* 130 (2013): 221–31. https://doi.org/10.1016/j.jenvman.2013.08.052.

around $40 billion to California over the next five years.[89] **California Department of Transportation should work with Tribal partners to develop proposals for competitive infrastructure funding under the Federal Highway Administration Nationally Significant Federal Lands and Tribal Projects program**, which are earmarked for transit projects adjacent to federal and Tribal lands that improve transportation access and reliability.[90]

4.6: **Provide federal support for climate-adapted public housing solutions for rural areas, and increase use of existing temporary worker housing on public lands.**

Rural areas across the West face rising housing costs and housing scarcity that impact workforce development, requiring an increase in both permanent and seasonal housing. At the same time, rural communities in the wildland-urban interface and forested areas are at high risk of severe wildfire. **A Green New Deal for Public Housing should address the need for climate-adapted public housing in rural areas, including through partnership with Tribal governments**. Government-to-government relationships with Tribes could explore innovative housing solutions within and adjacent to Tribal jurisdictions (see R4.3).

Increasing the pace and scale of restoration, and supporting year-round employment, will also require more temporary housing for workers in remote areas. Such temporary housing stock exists, but is underutilized. **Public agencies including the Bureau of Land Management, USFS, FEMA, and state and national parks should collaborate to assess the state of existing temporary worker housing on public lands, and develop a system for allocating this housing to contractors and organizations doing public lands restoration work**.

4.7: **Encourage water utilities and other beneficiaries to invest in upstream forest and watershed health.**

California should build on AB2480 (2016), which designated source watershed as part of the state's water infrastructure, by offering benefits or incentives to water and hydropower utilities that contribute to forest restoration, either through joint funding or long-term dedicated staff positions that create cohesive partnerships between utilities and land managers. **Coordinated multi-agency funding strategies should also seek participation from water utilities and commercial water users in funding forest restoration (see R1.2).**

4.8: **Focus support for biomass utilization on capital investment for the production of high-value products, and explore potential for support via California's Low Carbon Fuel Standard.**

In general, technologies that utilize the whole tree, and not simply the biggest and often most ecologically important trees, can help add a much-needed revenue stream to forest management. Current state subsidies for utilizing forest biomass have focused on power generation, but even with these price supports, the cost of chipping and transporting biomass waste—especially from hard-to-access areas—is prohibitive. **The state should focus on supporting investment in local infrastructure and facilities to utilize woody biomass for value-added products, including biochar and dimensional lumber, and increasing transparency of biomass supply.** Coordinated, multi-agency funding approaches could facilitate this investment (see R1.2), which is currently not possible with existing grants or via the BioMAT program authorized by SB1122. Some of these products provide durable carbon storage benefits and are eligible for voluntary market carbon credits. Facilities for their production can also integrate small-scale biopower or cogeneration utilizing slash to generate electricity. Increasing transparency of project pipelines, and when and where biomass is being generated, will better support the existing BioMAT program and enable longer-term investment in processing facilities. **There is also potential to support biomass investment via access to California's Low Carbon Fuel standard**. Biopower plants which can generate electricity used by electric vehicles can get ~$220/ton of CO2 benefit (like a carbon offset) from the government. This could increase the infrastructure for electric vehicles by increasing charging stations in rural areas, and fundamentally change the financial equation.

4.9: **Create a study group within the Air Resources Board and CalFire to evaluate the potential of direct state interventions to remedy market failures in the timber industry.**

Mill capacity is limited across the state, and is widely understood as a significant barrier to the current system for funding forest management. A study group on this topic should explore scenarios for expanding wood processing infrastructure, especially for small-diameter material and value-added biomass products, as well as potential market reforms. **There are a number of approaches that could be evaluated, including direct state ownership of new or reopened mills, or joint partnerships between states and utilities, among other unconventional ownership structures**. The state contribution to this investment could come from

89 Joshua Bote, "Bipartisan infrastructure bill passes: Here's what California will get," SFGate (15 Nov 2021), https://www.sfgate.com/california-politics/article/Bipartisan-infrastructure-bill-what-California-get-16623346.php.

90 "The Bipartisan Infrastructure Bill will Deliver for California," U.S. Department of Transportation Office of Public Affairs, (Washington, DC: 2021), https://www.transportation.gov/sites/dot.gov/files/2021-11/BIL_California.pdf.

GGRF, from public pensions, or through debt investment from county public banks recently authorized by AB1177. These facilities could be given statutory dispensation to prioritize fair-value purchasing from restoration project residues and public lands. Other governments, including federal, Tribal, and county, might explore this approach as well, with different blends of financing and ownership structure.

4.10: **Integrate forest management goals with other high-level social investment policy.**

While the Inflation Reduction Act makes some investments in forest restoration, more systemic investment in rural communities is needed to maximize its potential. Between the Bipartisan Infrastructure Law and the Inflation Reduction Act (if passed), the Federal Government is making investments in water infrastructure, small-scale biomass, grid modernization, and mine remediation, and building new industries in distressed communities—all goals that can be served by a high road approach to forest management. **'California's federal legislators should renew their push for key provisions of the Build Back Better agenda that have been dropped from current legislation. T**he Protecting the Right to Organize Act and the Civilian Climate Corps would make significant contributions to creating a restoration economy in the rural West that will benefit the entire country now and in the future.

4.11: **End policy incentives that perpetuate state reliance on incarcerated firefighters, and address the social impacts of mass incarceration.**

Decarceration and criminal justice reform are fundamental to building resilient communities and a stable, capable workforce. Incarceration perpetuates, and does not resolve, poverty-related health and social problems affecting many communities—both urban and rural—and impacts the forestry workforce. State and federal grant-making programs can support in-community, culturally appropriate alternatives to mass, punitive incarceration as a crucial foundation of other workforce development efforts.

Conclusion

Droughts, fires, and extreme heat make it clear that the climate crisis has arrived in California. These worsening environmental conditions intersect with long histories of Indigenous genocide and dispossession, shifting land uses, fire suppression, rural deindustrialization, and public disinvestment in land management. One way or another, the United States and California will have to expand restorative forest management to protect ecosystems, communities, and economies threatened by this political ecological crisis. Increased resources and attention are beginning to drive more ambitious forest management initiatives, but without broad, far-reaching reforms and investments, the forest restoration industry as a whole will remain on a low road trajectory, with dire implications for Indigenous and rural communities. We have argued for an investment-forward, green industrial policy approach to public lands management through better funding distribution and more robust public agencies, an approach that also supports stewardship and self-determination by Indigenous communities while building workforce capacities and community resources. The high road to forest resilience is in sight; now it is up to policymakers to take it.

APPENDIX: METHODS

Analysis of USFS contracting data

We retrieved data from USASpending.gov on USFS contracting for work performed within the three National Forests intersecting the TCSI area (Tahoe, Plumas, and El Dorado), and the Lake Tahoe Basin Management Unit (LTBMU), from fiscal years 2008 through 2021. The borders of these forests encompass and exceed the total area of the TCSI. We included a diverse range of restoration and management work according to a list of product and service codes included at the end of this appendix. We used these data to assess the proportion of local capture of USFS contracts using federally appropriated funds (including both value and frequency of contracts).

Survey design and dissemination

Our survey was designed in collaboration with our steering committee and revised based on their feedback. We developed a list of local contractors based on the database on USFS contracting from USASpending.org, as well as other sources, in order to capture contractors not working directly with USFS. These other sources included business listings for relevant NAICS codes in Reference USA, the CalFire list of Licensed Timber Operators, practitioners registered as Technical Service Providers with the Natural Resource Conservation Service, and contractor lists provided by local FireSafe councils. We also received recommendations of contractors from members of our steering committee. We compiled these contacts into a database, which was then screened via web searches and phone calls for accuracy and relevance. From a list that started with 648 potential contractors in March 2021, after eliminating redundant, non-operational, and irrelevant entries, 187 remained. Contractors were invited to participate in the survey via phone and email, based on available contact information. We disseminated surveys to 180 contractors in our first-tier counties between April and July. We received a total of 55 completed surveys, of which 46 were within our study area (response rate = 25 percent). While we did not solicit surveys in our second-tier counties, we received a few through word of mouth or outdated location information, and we included these in the analysis. We eliminated survey responses that were farther out of area.

Interviews

Contractors self-selected to participate in follow-up interviews after completing the survey. We endeavored to interview all 22 of those who volunteered, and completed interviews with 20 from 19 organizations, in addition to two interviewees from one organization contacted after the survey (for a total of 22 interviewees across 20 organizations). All interviewees were private sector contractors, except for two from California Conservation Corps offices. Interviews were semi-structured, based on a list of questions developed with our steering committee and tailored to each interviewee's business focus and survey responses. We sought to speak with contractors working across the spectrum of forest management activities, from planning and permitting restoration projects to conifer cone collection to mechanical and hand thinning. All interviews were transcribed and coded by the research team to identify emergent themes.

Interviews with USFS staff were designed to highlight capacity issues and experiences of USFS staff at the forest and district levels, especially regarding partnerships and relationships with the local private sector workforce. We reached out to 18 staff across the three National Forests and the LTBMU, and were able to complete interviews with 11 staff. As a result of our existing contacts, the majority of these interviews were with staff on the Tahoe National Forest; we were not able to speak to any staff on the LTBMU. Interviews were semi-structured and tailored to interviewees' work focus and experience. Questions were designed with feedback from select members of the steering committee. Because of the small number of these interviews, they should not be interpreted as representative; however, experiences with capacity and funding issues were consistent across interviews, providing qualitative insight into staff capacity issues affecting the ability of the USFS to take full advantage of new partnerships and funding resources, and suggest the need for further internal research by the agency on staffing needs. Conversations with the USFS National Partnership Office broadly confirmed these findings and the agency's interest in addressing staffing issues.

Interviews with 14 nonprofit and state agency staff were conducted for background information and context, to develop case studies, and to discuss emerging findings and recommendations. As a result of our existing contacts, these discussions may overrepresent the views of organizational staff in the northern part of our study area. Because a 2020 study by the Watershed Center assessed the capacities and needs of organizations conducting forest restoration statewide,[91] we did not attempt a representative sample of these entities, but instead used select conversations to inform and contextualize our understandings of issues affecting private sector contractors, labor markets, and the effectiveness of non-appropriated funding and partnerships with USFS.

91 Davis et al., *Investment Opportunities for Increasing Forest and Fire Management Capacity in California.*

Questionnaire on USFS staffing needs

To augment these interviews and shed further light on USFS staffing needs in particular, we circulated a brief questionnaire to contacts in USFS and two regional forest management networks on key staffing needs for USFS positions that could be funded in the 2021 federal infrastructure bill. We received 18 responses, which inform our discussion and recommendations on USFS staffing needs.

Work categories

Table A.1 lists categories of work included in this study, including product or service codes (PSCs) used in USFS data, categories used in our contractor survey, and broader synthetic categories used in the analysis (left-hand column). We adapted the list of PSCs used in a guidance document from the Ecosystem Workforce Program at the University of Oregon, to include codes for work related to a variety of forest management practices.

Table A.1 (page 63) lists categories of work included in this study, including product or service codes (PSCs) used in USFS data, categories used in our contractor survey, and broader synthetic categories used in the analysis (left-hand column). We adapted the list of PSCs used in a guidance document from the Ecosystem Workforce Program at the University of Oregon, to include codes for work related to a variety of forest management practices.

Table A.1

Work categories	Product/Service Code (USFS data)	Survey categories
Studies/analysis	B502: special studies/analysis- air quality; B503: special studies/analysis- archeological/paleontological; B506 special studies/analysis- data (other than scientific); B507 special studies/analysis- economic studies; B509: special studies/analysis- endangered species: plant/animal; B510: special studies/analysis- environmental assessments; B516: special studies/analysis- animal/fisheries; B517: special studies/analysis- geological; B518: special studies/analysis- geophysical; B519: special studies/analysis- geotechnical; B520: special studies/analysis- grazing/range; B521: special studies/analysis- historical; B525: special studies/analysis- natural resource; B527: special studies/analysis- recreation; B529: special studies/analysis- scientific data; B532: special studies/analysis- soil; B533: special studies/analysis- water quality; B534 special studies/analysis- wildlife; B599 special studies/analysis- other	Environmental monitoring Historical/archaeological surveys Socio-economic monitoring Biological/environmental surveys NEPA/CEQA process Planning, mapping, or site assessment
Roads design, construction, and maintenance	Y222: construct/highways-rds-sts-brdgs-ra; Y1LB: construction of highways, roads, streets, bridges, and railways; Z222: maintenance, repair or alteration of highways, roads, streets, bridges, and railways; Z2LB: repair or alteration of highways/roads/streets/bridges/railways; C1LB: architect and engineering-construction: highways, roads, streets, bridges, and railways (new); C122: highway, roads, streets, bridges, a (removed)	Construction or road work
Other construction, maintenance, or restoration of real property	Y219 construction of other conservation and development facilities; Y1KZ: construction of other conservation and development facilities; Y1LB: construction of highways, roads, streets, bridges, and railways; Y293: construct/unimproved real prop; Y1PC: construction of unimproved real property; Y300: construct/restoration; Z219: maintenance, repair or alteration of other conservation and development facilities; Z2KZ: repair or alteration of other conservation and development facilities; Z293: maintenance, repair or alteration of unimproved real property (land); Z2PC: repair or alteration of unimproved real property (land); Z300: maint, rep-alt/restoration; Z2QA: repair or alteration of restoration of real property (public or private)	Construction or road work
Natural resources and conservation, including thinning, planting, site preparation and treatment	F001: natural resources/conservation- aerial fertilization/spraying; F002: natural resources/conservation- aerial seeding; F004: natural resources/conservation- forest/range fire rehabilitation (non-construction); F005: natural resources/conservation- forest tree planting; F006: natural resources/conservation- land treatment practices; F007: natural resources/conservation- range seeding (ground equipment); F008: natural resources/conservation- recreation site maintenance (non-construction); F009: natural resources/conservation- seed collection/production; F010: natural resources/conservation- seedling production/transplanting; F011: natural resources/conservation- surface mining reclamation (non-construction); F012: natural resources/conservation- survey line clearing; F013: natural resources/conservation- tree breeding; F018: natural resources/conservation- other forest/range improvements (non-construction); F019: natural resources/conservation- other wildlife management; F021: natural resources/conservation- site preparation; F099: natural resources/conservation- other	Defensible space Hand cut/hand pile Mechanical thinning Planting Mastication Seed saving or nursery services Commercial timber harvest Biomass removal Prescribed/Cultural burning Invasives removal
Fire suppression and pre-suppression	F003: natural resources/conservation- forest-range fire suppression/presuppression	Fire suppression
Environmental systems protection, including water quality support, hazard remediation, surface mine reclamation facilities	F103: environmental systems protection- water quality support; F105: environmental systems protection- pesticide support; F107: environmental systems protection- toxic and hazardous substance analysis; F108: environmental systems protection- environmental remediation/hazard removal; Y215 construction of surface mine reclamation facilities; Y1KE: construction of surface mine reclamation facilities; Z215: maintenance, repair or alteration of surface mine reclamation facilities; Z2KE: repair or alteration of surface mine reclamation facilities	Environmental remediation