WILDFIRE
NEEDS
ASSESSMENT

BRIEF   April 2024

CALIFORNIA
FIRE
FOUNDATION

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

Wildfire is an increasing problem throughout California and the rest of the nation. There are many techniques and tools available to wildfire practitioners, managers, and impacted communities. However, how to prioritize those techniques and tools with input from marginalized communities and attention to unique regional differences can be challenging.

The following report provides insights into historical wildfire events that impacted Santa Barbara and Ventura County, the current landscape of wildfire mitigation, evacuation, and recovery efforts and programs, as well as recommendations for future investments in wildfire mitigation, evacuation, and recovery efforts throughout the counties and the state.

Santa Barbara and Ventura County residents and ecosystems are familiar with fire as the counties' climates are a fire-prone, Mediterranean climate. Despite this familiarity, future climate projections anticipate more frequent and intense wildfires, perpetuating the need to further strengthen the region's resilience to wildfire. The report below outlines how to strengthen, streamline, and ensure that wildfire mitigation, evacuation, and recovery efforts are equitable and inclusive.

The California Fire Foundation (CFF) is a statewide 501 (c)(3) providing support to firefighters, families of fallen firefighters, and communities living with fire. Formed in 1987 by the California Professional Firefighters, the CFF's mandate includes an array of fallen firefighter survivor assistance projects and community initiatives. The Fire Foundation, with funding support from Edison International, engaged a team of faculty and student researchers from the Bren School of Environmental Science & Management and the 2035 Initiative

at the University of California, Santa Barbara, to develop this needs assessment. Ultimately, this effort compiles information about current and potential wildfire mitigation, preparedness, evacuation, and recovery strategies in Santa Barbara County and Ventura County to inform the CFF's future funding opportunities and strategies in the region.

The fire needs assessment identified the following strategies for bridging the gaps between identified needs and desired outcomes throughout the region.

CROSS-CUTTING STRATEGIES:

- Developing flexible bridge funding for nonprofits and fire agencies relying on grant funding to address grant and project delays and unrestricted basic funding mechanisms to support organizations that struggle with providing for employees (e.g., sick days, PTO).
- Developing metrics beyond acres-treated such as communities/people engaged, smoke/air quality exposure (e.g., smoke and toxic fumes), carbon sequestration/avoided carbon emissions from ignition in the WUI moving into the wildland, and carbon footprints related with home and structure loss and rebuilds.
- Developing micro-grants to support community wildfire planning efforts like CWPPs, RWMPs, and RPPs.

STRATEGIES FOR THE BUILT ENVIRONMENT:

- Fund a collection of road networks, housing, population, and temporary refuge areas.
- Fund the identification of water flow deficiencies during extreme conditions, localized storage capacity, and ingress/egress limitations for accessing water sources.
- Provide funding for personnel and planning that will contribute to county- and city-level climate adaptation strategies that address wildfire events.

STRATEGIES FOR THE LANDSCAPE:

- Collaborate and support agricultural stakeholders by developing financial incentives for maintaining and creating agricultural buffers throughout the region.
- Fund innovative wildfire mitigation techniques, such as developing agricultural and native plant buffers around communities.
- Conduct assessments to optimize burn windows, enhancing the pace of prescribed burning.
- Prepare for WUI breaches by assessing and funding greenspaces as fuel breaks/buffers.
- Address WUI breaches concerning Indigenous use through assessments and project-specific funding for Indigenous buffering activities.

STRATEGIES FOR THE COMMUNITY:

- Establish more Firewise USA communities by developing micro-grants for local communities, workshops to support communities, and other resource or funding support for Fire Safe Councils engaged in establishing Firewise USA communities.
- Fund trust-building events (e.g., focus groups, informal community meetings, and/or facilitated advisory councils) between vulnerable communities and fire organizations
  - » Fund communication materials that clearly convey (e.g., multiple languages, images, paper and digital) fire department and firefighter roles and responsibilities
  - » Focus engagement efforts on identifying and prioritizing the needs of vulnerable communities with ongoing relationship-building so as to enable engagement in planning not just response
- Develop grant/funding opportunities that support community education and organizing programs to bolster wildfire awareness (e.g., community workshops, staff training, liaisons, etc.)
- Break down the misconception that hardening is expensive, especially in Ventura County
  - » Develop home hardening and retrofit micro-grants, ensure that funding is available to renters too
  - » Funding opportunities for 7A requirements

INTRODUCTION

THE IMPORTANCE OF ADDRESSING WILDFIRE CHALLENGES IN SANTA BARBARA AND VENTURA COUNTY

Climate-related environmental change in California is increasing wildfire activity impacting lives and homes[1], threatening natural resources, and altering our uses of agricultural, commercial, and municipal landscapes[2,3]. Thirteen of the most destructive wildfires and twelve of the largest wildfires in California's history occurred between 2017 and 2021 alone, many of which occurred during the summer months.[4] The 2020 fire season was especially devastating, with over 8,500 wildfires, 4 million acres burned, over 11,000 structures destroyed, and 33 lives lost.[5] After the 2020 fire season, fire mitigation, response, and relief efforts scaled up throughout California and across the country. In the aftermath of 2020's record-setting fire season, California invested roughly $2.8 billion in wildfire resilience efforts. These investments are already paying off, protecting communities, and mitigating wildfire risks.[6-8] Thirteen of the most destructive wildfires and twelve of the largest wildfires in California's history occurred between 2017 and 2021 alone, many of which occurred during the summer months.[4]

Policy-makers and scientists alike are beginning to welcome and support investments in wildfire mitigation and resiliency practices that are both traditional and innovative.

> *Thirteen of the most destructive wildfires and twelve of the largest wildfires in California's history occurred between 2017 and 2021 alone, many of which occurred during the summer months.*

To highlight the scale of investment, communities across California were awarded nearly $96 million from the federal Community Wildfire Defense Grant (CWDG) program, which is primarily focused on capacity building to reduce wildfire risk in at-risk communities.[7] There is a diversity of

TABLE 1

TOP 10 MOST DEVASTATING FIRES IN CALIFORNIA

FIRE NAME	LOCATION	STRUCTURES DESTROYED	LIVES LOST	ACRES BURNED
Camp	Butte County	18,804	85	
Tubbs	Napa and Sonoma counties	5,636	22	
Tunnel-Oakland Hills	Alameda County	2,900	25	
Cedar	San Diego County	2,820	15	273,246
North Complex	Butte, Plumas, and Yuba counties	2,352	15	318,935
Valley	Lake, Napa, and Sonoma counties	1,958	—	
Witch	San Diego County	1,650	2	197,990
Woolsey	Ventura County	1,643	—	
Carr	Shasta and Trinity counties	1,614	7	229,651
Glass	Napa and Sonoma counties	1,520	—	
Thomas	Ventura and Santa Barbara counties	1,063	2	281,893

popular techniques employed to increase wildfire resilience throughout the country, state, and locally in Santa Barbara and Ventura counties. For example, prescribed burning and livestock grazing/prescribed herbivory is used to reduce fuel load and create fuel breaks. Preparing the built environment through retrofitting and increasing the resilience of homes, businesses, and critical infrastructure is becoming more common, too. Furthermore, investing in equitable community preparedness so that local residents and communities are prepared for wildfires is critical to ensuring resilience to wildfires.

Although mitigation is essential, investing in evacuation and recovery is necessary when considering the lasting impacts of fires like the Thomas and Woolsey Fires. Additionally, the climate models predict more frequent and intense wildfires throughout California, Santa Barbara County, and Ventura County. Fires occur throughout the summer months across California; however, Santa Barbara County and Ventura County have experienced large and destructive wildfires year-round. The Thomas Fire, for example, broke out in

December 2017, and the Woolsey Fire broke out in November 2018. These fires left their mark on the local communities and ecosystems, inspiring regional-scale efforts like the Regional Wildfire Mitigation Program (RWMP) and the Regional Priority Plan (RPP) in Santa Barbara County to prepare communities and ecosystems for wildfire. Organizations and fire community leaders are interested in pursuing an RWMP for Ventura County as well. These efforts along with several others in the counties also prioritize ecosystem health and restoration. Simultaneously, organizations like the local Fire Safe Councils aim to help community members prepare for wildfire. There are also an increasing number of Firewise USA communities, and several home hardening and defensible space programs available to residents.

The current cycle of California wildfire mitigation, evacuation, and recovery efforts suggests that an increase in effort is needed. In particular, wildfires in the region brought communities together, increasing wildfire preparedness and response efforts, while also revealing the depth of need for investment in mitigation, evacuation, and recovery.

REGIONAL FIRE HISTORY, ENVIRONMENT, AND CLIMATE PROJECTIONS

SANTA BARBARA AND VENTURA COUNTY

We lack a comprehensive understanding of extreme fire weather conditions, fire risk, and fire management in California foothills and coastal areas.
Fire regimes in these foothills and coastal ecosystems (specifically oak woodlands, coastal shrublands, and grasslands) have received less attention in both the scientific literature and in the development of models used to understand and predict how fire regimes may change with climate and management decisions. However, these same regions encompass much of the wildland-urban interface where humans are at risk from wildfire. The 2017 Thomas Fire in Ventura and Santa Barbara Counties is a tragic example of the impacts these catastrophic fires can have on our communities and environment.

Santa Barbara and Ventura Counties' Mediterranean climate supports a chaparral landscape that is well-adapted to wildfire. The hot, dry summers and cool, wet winters in the counties foster a unique chaparral biome and the timing of rain affects wildfire risk via Live Fuel Moisture (LFM),. In this region, the Chaparral biome is home to hundreds of species and is a critical component of the water cycle through drought periods and the traditionally hot, dry summers.[13] From mapped fire histories in the region, fire frequency in the chaparral is estimated to be 30 to 50 years; however, stands can appear to be recovered after about 15 years.[11] If repeat burning occurs in young stands of chaparrals, the result can be type conversion to invasive and very flammable grasses.[14] Specific to Ventura County and the Thomas Fire, some observations indicate that chaparral in the burned area could take decades to return to its previous condition.[15]

> *We lack a comprehensive understanding of extreme fire weather conditions, fire risk, and fire management in California foothills and coastal areas.*

In addition to the chaparral biome, the counties have a unique ecosystem and climatic conditions due to proximity to the Pacific Ocean, the presence of mountain-range topography, and the relationship with atmospheric wind conditions like "sundowners." The combination of these factors contribute to the frequency, severity, and risk of wildfires in the counties. Sundowner winds are considered the most important fire-weather condition affecting Santa Barbara County.[16,17] Like Sundowner Winds, fog is an important weather phenomenon for assessing fire risk. Fog commonly brings moisture to Santa Barbara County ecosystems during dry summer months, changing temperature, humidity, soil moisture, and live fuel moisture.[18] Ongoing research through UCSB is working to calibrate the impacts of fog into fire prediction models like the Weather Research & Forecasting model (WRF) to improve fire weather forecasting throughout Santa Barbara and Ventura County.

Climate-related environmental change in California is increasing wildfire activity at the cost of lives and homes and with significant impacts on natural resources and the agricultural, commercial, and municipal uses of our landscapes.

The region has a long and rich history of wildfire. It is widely recognized that fire is part of this ecosystem, which is evident in many native species' adaptation and resilience to fire. Furthermore, the Chumash people, the traditional custodians of this land, practiced consistent cultural burning in this area, contributing to the ecosystem's relationship with fire. However, human development and adversity to wildfire risk in the counties have disrupted natural fire regimes.[19]

To develop a clearer picture of how fire-prone ecosystems overlap with human development, there are many map-based tools that present this information. For example, CAL FIRE's Fire Hazard Severity Zone (FHSZ) maps classify State Responsibility Areas as moderate, high, and very high risk of wildfire.[20,21] According to CAL FIRE's FHSZ maps, 502,952 acres and 210,652 acres of Santa Barbara County fall within the very high and high fire severity zones in state responsibility areas (SRA) respectively. Similarly, in Ventura County, 341,173 acres fall within the very high category, while 12,257 acres fall in the high fire severity zones in SRAs.[22] These are likely under-estimates of the acreage with high fire risk because they do not include Local Responsibility Areas. While the State Fire Marshal identifies the FHSZs, most of the areas across both counties are broadly referred to as the wildland-urban interface. While the definitions of the WUI vary,[23] it typically refers to areas where housing and vegetation intermingle and/or where housing is near contiguous wildland vegetation.[24] While Santa Barbara and Ventura County are relatively developed and populated areas, they are in close proximity to the Los Padres National Forest, Angeles National Forest, other federal lands (e.g., Bureau of Reclamation (USBR), Bureau of Land Management (BLM), and the National Park System (NPS), State-managed land like Sedgewick Reserve, and county open spaces.[25]
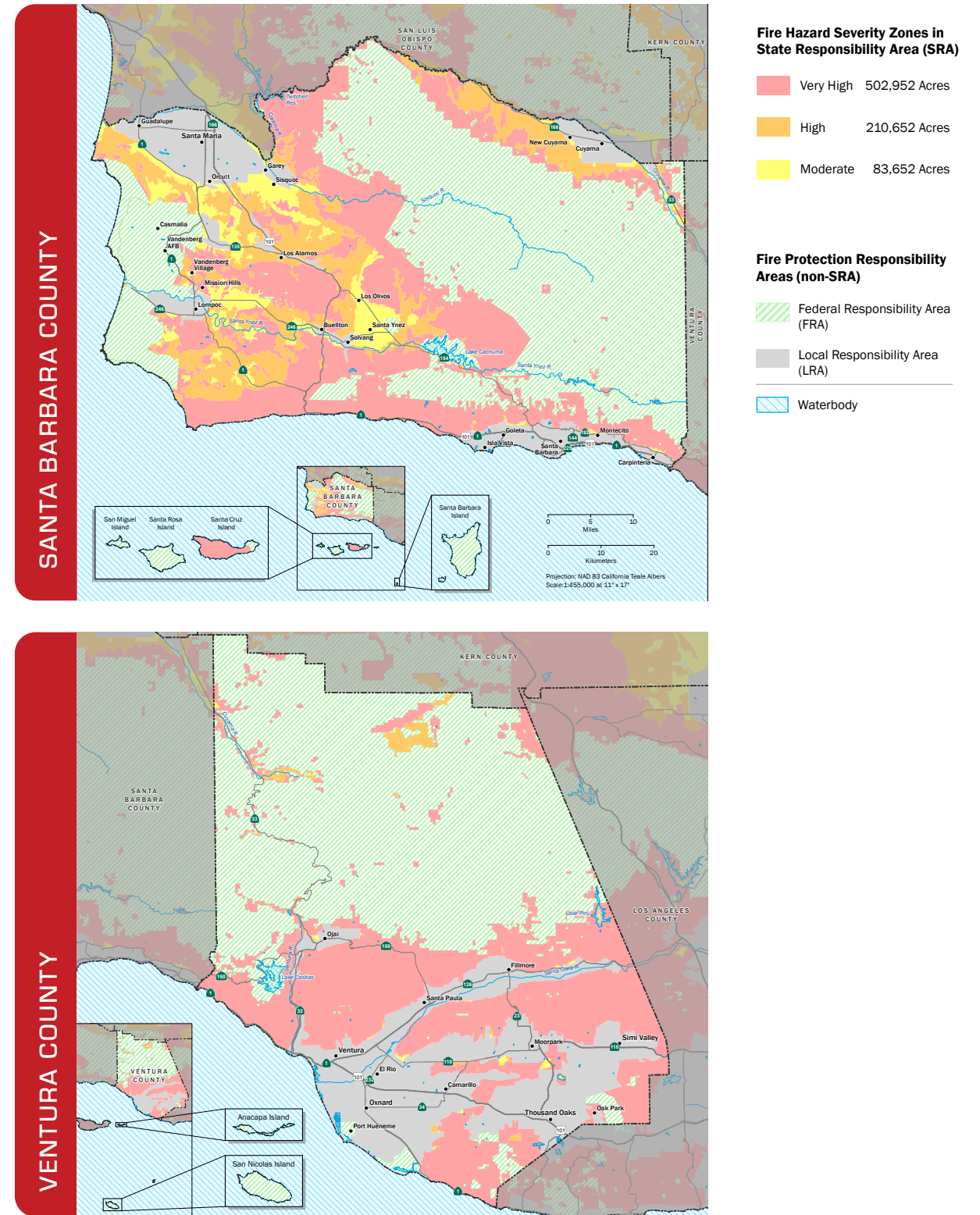
Climate-related environmental change in California is increasing wildfire activity at the cost of lives and homes and with significant impacts on natural resources and the agricultural, commercial, and municipal uses of our landscapes.[2,3]

FIRE HAZARD SEVERITY ZONES

SANTA BARBARA COUNTY

VENTURA COUNTY

Fire Hazard Severity Zones in State Responsibility Area (SRA)

- Very High   502,952 Acres
- High   210,652 Acres
- Moderate   83,652 Acres

Fire Protection Responsibility Areas (non-SRA)

- Federal Responsibility Area (FRA)
- Local Responsibility Area (LRA)
- Waterbody

MAJOR WILDFIRES IN SANTA BARBARA COUNTY

FIRE NAME	DATE	STRUCTURES DAMAGED OR DESTROYED	ACRES BURNED	LIVES LOST	CAUSE
Thomas	December 2017 –March 2018	1,063	281,893	2; 21 indirectly (mud/debris flows)	Powerlines
Paint	June 1990	673	4,270	1	Arson
Sycamore	July 1997	234	806	0	Kite info powerlines
Tea	November – 2009	210	1,940	0	Campfire
Coyote	September 1964	94	65,338	1	Undetermined
Jesusita	May 2009	80	8,733	0	Equipment use
Whittier	July 2017	53	18,430	0	Vehicle
Holiday	July 2018	28	113	0	Powerlines
Wheeler	July 1985	26	119,361	0	Miscellaneous
Refugio	September 1955	20	79,428	0	Structure fire
Alamo	July 2017	15	28,687	0	Under investigation
Alisal	October 2021	12	16,953	0	Under investigation
Romero	October 1971	4	14,538	4	Arson
Gap	July 2008	4	9,443	0	Miscellaneous
Zaca	July 2007	1	240,207	0	Equipment use
Canyon	August 2016	1	12,518	1	Under investigation
Sherpa	June 2016	1	7,474	0	Miscellaneous
Gaviota	July 2004	1	7,440	0	Lightning
Marre	September 1993	0	43,822	0	Smoking
Rey	September 2016	0	33,606	0	Powerlines
Perkins	July 2006	0	14,988	0	Lightning
Honda	December 1977	0	10,000	4	Powerlines
Cave	November 2019	0	3,126	0	Arson
White	May 2013	0	1,984	0	Miscellaneous

TABLE 2. This table came from the Santa Barbara County Fire Department.[26]

MAJOR WILDFIRES IN VENTURA COUNTY

FIRE NAME	DATE	STRUCTURES DESTROYED	ACRES BURNED	LIVES LOST	CAUSE
Matilija	September 7–20, 1932	--	219,254	--	Unknown, possibly escaped campfire
Thomas	December 4, 2017–March 22, 2018	1,063	281,893	2; 21 indirectly (mud/debris flows)	Downed power lines
Day	September 4, 2006 – October 13, 2006	11	162,702	0	Arson
Wheeler	July 1-14, 1985	56	122,724	--	Arson
Simi	October 25, 2003 –November 5, 2003	315	108,204	0	Unknown
Woolsey	November 8–21, 2018	1,643	96,949	3	Powerlines
Ferndale	October 14, 1985	20	46,809	--	--
Thatcher	June 6, 1917	60	44,003	--	--
Green Meadows	October 26, 1993	45	38,477	--	--
Wheeler Springs	September 12, 1948	17	22,503	1	Butane leak in a shed
Wolf	June 1, 2002	--	21,638	--	--
Sence Ranch	October 15, 1967	76	18,354	--	--
Calumet	October 21, 1958	5	17,212	--	--
Shekell	December 4, 2006	7	13,600	12	Power lines
Piru	July 1, 1988		12,068	--	Gas-powered saw
Potrero	September 26, 1973	3	12,297	--	--
Grand	April 28, 1996	0	10,925	--	--
Timber Canyon	October 16, 1967	8	10,841	--	--

TABLE 3. This information was gathered from a variety of sources.

The included tables summarize documented major wildfires including information about the size of each wildfire (acres burned), structures damaged or destroyed, and any lives lost in each county.

In addition to the climate change-induced frequency of wildfire activity, the California Climate Adaptation Strategy outlines other climate-driven environmental changes in the counties. The California Climate Adaptation Strategy (CCAS) is a state-led climate adaptation strategy that is updated every three years.[27] This strategy places Santa Barbara County in the Central Coast Region and Ventura County in the Los Angeles Region, although throughout this report we refer to the counties as "the region."[27] CCAS outlines the following predictions for the Santa Barbara and Ventura counties:

SANTA BARBARA COUNTY:
Future projections for the environment, ecosystems, and natural resources in the county include 4 - 5 °F increases in temperature maximums by mid-century (2050), increasingly variable annual precipitation, with higher maximum precipitation amounts and longer droughts.[28] Precipitation conditions will likely impact wildfire recovery time.[28]

VENTURA COUNTY:
Experiencing similar climatic changes to Santa Barbara County, future projections for the environment, ecosystems, and natural resources in the area include 4 - 5 °F increases in temperatures by mid-century and 5 - 8 °F increases by the late-century.[29] Reduced precipitation in the area is also expected to yield higher wildfire risk with an increased burned area of 60-75%.[29]

REGIONAL POPULATION, ECONOMICS, AND EQUITY

According to the 2020 Census data, over 1.2 million people (July 2022 Census estimates) call Santa Barbara and Ventura County home.[30,31] The California Department of Finance estimates slight population increases in Santa Barbara County and slight population decreases in Ventura County over the coming decades (see Table 4).[32] A majority of community members are white (higher than 80% for both counties) and almost half of each community identifies as Hispanic/Latinx (47.5% in Santa Barbara County and 44.5% in Ventura County, respectively).[30,31] A majority of community members are well-educated (81.9% in Santa Barbara County and 85.6% in Ventura County have a high school education or higher, and 35.1% in Santa Barbara County and 34% have a Bachelor's degree or higher).[30,31] Compared to California's percent of persons living in poverty in 2021, which is 12.3%, Santa Barbara County is home to more persons living in poverty, while Ventura County has less than the state average.[30,31] In Santa Barbara County 15.2% of persons are living at or below the poverty line, while 8.9% of persons in Ventura County are living at or below the poverty line.[30,31]

SANTA BARBARA AND VENTURA COUNTY POPULATION AND PROJECTIONS 2020 - 2060

COUNTY	2022	2030	2040	2050	2060
Santa Barbara County	443,210	459,727	475,401	486,994	498,417
Ventura County	829,764	805,456	789,877	758,161	718,345
Total:	**1,272,974**	**1,265,183**	**1,265,278**	**1,245,155**	**1,216,762**

TABLE 4: SANTA BARBARA AND VENTURA COUNTY POPULATION PROJECTIONS. The values in the table to the left come from the California Department of Finance's population values and projections for Santa Barbara and Ventura County from 2022 - 2060.[32]

Furthermore, marginalized communities lack resources and face more inequities due to poverty and other systemic injustices. These realities make these communities more vulnerable to wildfire than the broader community.

The region fosters a thriving agricultural economy, hosts several universities, and boasts a healthy tourism economy. In Santa Barbara County, the following industries comprise 40% of the County's employment and 66% of new jobs: **1)** agriculture, tourism, and wine, **2)** business support services, **3)** healthcare**, 4)** building and design, **5)** technology and innovation, and **6)** energy and the environment. In Ventura County, more than 30% of jobs are in **1)** government, **2)** health care and social assistance, **3)** retail trade, and **4)** accommodation and food services.[33] In Santa Barbara County, the agricultural sector generated $1.9 billion in 2022 [34] and the wine industry generated $1.7 billion.[35] In Ventura County, the tenth-highest producer of agricultural products in California and nationwide, the agricultural sector generated $2.1 billion.[36] Wine and agriculture are at greater risk than other economic sectors due to smoke taint, loss of crops during wildfire events, and insurability challenges caused by wildfires and wildfire risk.[37]

Housing growth since the 1990s has occurred more frequently in the WUI, increasing further the risk of ignition and risks to firefighters working to put out such ignitions.[19] In California, over 40,000 buildings were destroyed by wildfires from 2013 to 2018.[38] A majority of the counties' land area is already developed and falls within high-risk areas, driving the need to harden existing homes and other structures. In spite of the fact that both counties are highly developed, California's Housing Element Law requires additional development in the regions. In Santa Barbara County, it can be challenging to find a location for housing units, which occasionally means that development is forced to occur in a high-risk fire area.[21,39]

Furthermore, marginalized communities lack resources and face more inequities due to poverty and other systemic injustices.[40] These realities make these communities more vulnerable to wildfire than the broader community.[40] However, there is little research that examines social vulnerability associated with wildfire.[41–43] Considering conditions that promote or inhibit vulnerable communities from having agency, participating in decision-making, and accessing wildfire mitigation resources often due to economic, social, or financial reasons are all critical components that lead to higher rates of vulnerability.[41–43] Vulnerable communities in Santa Barbara and Ventura County include non-English speakers, women, people of color, new residents, undocumented individuals, elderly individuals, disabled individuals, low-income individuals, rural residents, homeless individuals, renters, and individuals between the age of 18 and 24 years old.[40] Because these communities are particularly vulnerable, they require attentive consideration in wildfire planning and management.[40,43]

REGIONAL ORGANIZATIONAL STRUCTURE

Santa Barbara and Ventura Counties are referred to as contract counties, where county fire departments are responsible for State Responsibility Areas (rather than CAL FIRE). In each county, there is an active group of stakeholders who collaborate with the fire departments and land managers on public lands. In southern Santa Barbara County, the Santa Barbara Fire Safe Council through the Regional Wildfire Mitigation Plan (RWMP) takes the lead on much of the coordination of wildfire preparedness activities. The RWMP has outlined needed mitigation activities under three domains: Landscape Resilience, Built Environment Resilience, and Community Resilience. In addition to the RWMP, there is a Regional Priority Plan (RPP), which is a stakeholder-driven list of current and anticipated wildfire resiliency projects in Santa Barbara County. Lastly, the Ventura County Wildfire Collaborative provides organizations, agencies, and residents in Ventura County with a space to communicate and collaborate on wildfire resiliency work through events like the recent Wildfire Preparedness Town Hall on March 7, 2024. There are many stakeholders involved in wildfire mitigation, including environmental groups, like the Community Environmental Council and local conservation districts, preparedness organizations, like the American Red Cross and LISTOS, community organizations, like the Santa Barbara Botanic Garden, and local government agencies and sponsored programs dedicated to wildfire preparedness, evacuation, and recovery like ReadySetGo

This combination of methodologies was selected to robustly assess current efforts and recommendations for the future and to curate novel mitigation techniques suited for the unique region.

and Ready Ventura County. The Santa Barbara Fire Safe Council has, to date, been more active in southern Santa Barbara County than northern and the RWMP is currently being expanded to northern Santa Barbara County. While there is only one Fire Safe Council in Santa Barbara County, there are several in Ventura County, including the Ventura Regional Fire Safe Council and more local Fire Safe Councils, like the Ojai Valley Fire Safe Council.

RESEARCH METHODOLOGY

Over several months, the research team conducted semi-structured stakeholder interviews with a qualitative analysis that identified emerging themes. These emerging themes were combined with a comprehensive scientific literature review to confirm and prioritize needs identified throughout the assessment. This combination of methodologies was selected to robustly assess current efforts and recommendations for the future and to curate novel mitigation techniques suited for the unique region.

The semi-structured interviews were with Santa Barbara County and Ventura County wildfire experts and were designed to develop an understanding of the ongoing efforts and needs within wildfire preparedness, mitigation, evacuation, and recovery. Each interview included questions about successful efforts and programs in both counties, gaps and needs that could be addressed with additional capacity and funding resources. Additionally, each interview touched on equity considerations and challenges from the perspective of the stakeholders. The research team thoroughly documented each interview to develop an understanding of the current landscape and identify cross-cutting themes. The interviews were also invaluable to developing near-term and long-term gaps as well as strategies that will address those gaps in the future.

In addition to the stakeholder interviews conducted by the research team, the researchers compiled scientific literature and reports about wildfire mitigation, evacuation, and recovery efforts in California, chaparral ecosystems, and throughout the Western U.S. The research team's expertise in fire science and local environmental politics was applied throughout the process as was the expertise gleaned from scientific literature and wildfire-specific research reports.

For the stakeholder interview portion of this research, we spoke with representatives of the City of Santa Barbara, LISTOS, Santa Barbara County Fire Department Vegetation Management Section, Santa Barbara County Fire Safe Council, Santa Barbara County Planning Department, Ventura County Fire Department, Ventura County Professional Firefighters, and Ventura County Regional Fire Safe Council, among others. There were several community groups and local governmental entities that we reached out to but were not able to speak to.

NEEDS ASSESSMENT TABLE

NAVIGATING THE TABLE

The following table presents gaps, strategies, ecological considerations, social considerations, and additional information organized by category (mitigation, evacuation, recovery, or all) identified through this process. Beyond the table columns, the table is organized by four headers: Cross-cutting Themes, Built Environment Domain, Community Domain, and the Landscape Domain. The three domains follow the framework of the Regional Wildfire Mitigation Program (RWMP), a holistic approach to wildfire mitigation that bolsters wildfire resiliency in the Wildland-Urban Interface (WUI) throughout the built environment, landscape, and community, while the Cross-cutting Themes apply across each domain.[44,45]

Cross-cutting Themes:
This section generates impact across all the RWMP domains. This section focuses on wildfire planning, regional collaboration, innovative funding mechanisms, and the development of new metrics for wildfire mitigation treatments. Gaps and strategies in this section go beyond traditional approaches to increase regional resiliency to wildfire, support local workers, conserve the environment, and promote regional communications and collaborative planning efforts.

Built Environment Domain:
This domain builds capacity to retrofit and increase the resiliency of critical infrastructure. Organizations and entities working within this domain generally include local fire departments, fire districts, planning and public works departments, and community leaders.[44]

Community Domain:
This domain focuses on educating, engaging, and training community members to increase wildfire resilience.[44] This domain pays special attention to vulnerable and underserved communities through equitable efforts and programs.[44] Organizations and entities working in this domain generally include local Fire Safe Councils and other community-driven organizations.[44]

The table is designed to be read left to right, highlighting the gap, presenting the need, and outlining the associated ecological and social considerations for each strategy, and providing additional supporting information. For additional guidance, here is the breakdown of each column.

NEEDS ASSESSMENT NARRATIVE

CURRENT EFFORTS AND IDENTIFIED GAPS

Throughout our research, we identified several gaps and strategies that were not specific to the Built Environment, Landscape, or Community Domains but were cross-cutting themes that emerged through the stakeholder interviews we conducted. Organizations and entities working in wildfire mitigation, evacuation, and recovery need flexible funding mechanisms, incentives for novel and creative mitigation and preparedness practices that go beyond acres treated, and resources to continue investments in wildfire-preparedness plans like Community Wildfire Protection Plans (CWPPs), RWMPs, and RPPs.

RECOMMENDATIONS FOR THE FUTURE

To address the multi-faceted nature of wildfire risk throughout the counties, our approach with the identified cross-cutting themes is centered around the following needs and strategies:

Developing flexible bridge funding for nonprofits and fire agencies relying on grant funding to address grant and project delays and unrestricted basic funding mechanisms to support organizations that struggle with providing for employees (e.g., sick days, PTO).

Developing metrics beyond acres-treated such as communities/people engaged, smoke/air quality exposure (e.g., smoke and toxic fumes), carbon sequestration/avoided carbon emissions from ignition in the WUI moving into the wildland, and carbon footprints related with home and structure loss and rebuilds.

Developing micro-grants to support community wildfire planning efforts like CWPPs, RWMPs, and RPPs.

Strategy 1: Develop Flexible Funding Mechanisms
Most of the organizations and entities working in wildfire mitigation, evacuation, and recovery space experience financial challenges. Notably, there are challenges with cash flow. Often, organizations must wait up to nine months for the arrival of grant reimbursements after the start date of a project. Many non-profits focused on wildfires and natural disasters are reliant on fundraising, which can distract from the mission at hand. Similarly, projects are put on pause due to financial constraints, and sometimes organizations

struggle to provide their staff with sick time, paid time off, jury duty, office space, and mileage reimbursements.

Ultimately, nonprofits need unrestricted, reliable funding mechanisms that allow them to allocate resources where they are needed most – to support their mission and their staff. In addition to the unrestricted funding, bridge funding that allows organizations to put funding towards grant and project delays will go a long way for these organizations.

Most projects and funding in wildfire resilience use a simple metric to evaluate effectiveness: acres treated. While fuels management is an important contributor to wildfire resilience, its use as a singular metric makes it difficult to evaluate projects that contribute in other ways.

Strategy 2: Develop Metrics Beyond Acres Treated
Most projects and funding in wildfire resilience use a simple metric to evaluate effectiveness: acres treated. While fuels management is an important contributor to wildfire resilience, its use as a singular metric makes it difficult to evaluate projects that contribute in other ways. Interviewees from many organizations emphasized that development of metrics beyond acres treated would enable them to better serve and evaluate community outreach, broader impacts of landscape-scale mitigation, and other projects that advance wildfire resilience. Several additional metrics came to light in this research.

First, carbon sequestration is critical for climate mitigation and is often affected by fuels management. Thus, encouraging projects to consider their carbon sequestration impacts would enable a better understanding of how wildfire mitigation and climate mitigation might work hand- in-hand or trade off. For example, the RHESSys model, which can be coupled with a fire spread model,[46] which is currently used by the California Air Resources Board (CARB) to evaluate carbon sequestration on natural and working lands.

Second, another possible metric is the amount of avoided smoke exposure from wildfires and burning synthetic materials commonly found in structures. A study conducted by the EPA in 2022 after the Marshall Fire in Colorado found that fires burning in the WUI release higher rates of particulate matter and other chemical components.[47] These air pollutants are released from burning plastics and other commonly found synthetic materials, increasing the

risks of negative health impacts associated with wildfire.[47] Quantifying avoided smoke exposure could be a useful metric in the future.

Finally, community outreach programs can be difficult to evaluate, as the implementation of the recommended mitigation and preparedness activities can be difficult to observe. Metrics including the number of people reached or volunteer hours can be helpful, and there is room to think beyond these too. With the increase in available data, especially from remote sensing and other technologies, funders should begin to consider how evaluation of projects can quantify mitigation and preparedness. This could include remote sensing of defensible space or the use of publicly available data to observe decreased vulnerability in the form of roof retrofitting or home hardening.

Strategy 3: Invest in Collaboration and Intentional Stakeholder Engagement
Several cities, towns, and neighborhoods throughout the counties have adopted wildfire planning frameworks to reduce wildfire ignition, increase community preparedness for wildfire events, and bolster wildfire resiliency throughout the county. There are nine CWPPs in Santa Barbara County as well as RWMP and an RPP. In Ventura County, there is one county-wide CWPP, seven local CWPPs, and the Ventura County Wildfire Collective, a county-wide collaborative that fosters relationships and communication between various fire-engaged entities. While such planning efforts reduce wildfire ignition and increase community awareness, a major benefit of these types of efforts is in the regional, inter-agency collaboration that occurs when

communities and various stakeholders come together to protect their homes, communities, and ecosystems.

Greater collaboration can prevent isolated planning and redundant work, reducing the need to compete for funding and staff amongst organizations and entities in similar fields. Collaborative planning efforts can also build community capacity, strengthen social networks, and increase access to wildfire resources, especially in vulnerable communities – noted barriers to feeling prepared for wildfire expressed by Ventura County residents in a recent study.[40,42] The adoption of wildfire

planning frameworks that coordinate efforts across jurisdictional boundaries underscores the invaluable role of regional collaboration while also reducing wildfire risk and strengthening community preparedness. By streamlining efforts and fostering collaboration, these frameworks illustrate the strength of collective action in protecting homes, communities, and ecosystems from unwanted fire on the landscape.

BUILT ENVIRONMENT DOMAIN

CURRENT EFFORTS

Wildfire resilience is shaped by the built environment. In particular, the infrastructure for water, evacuation, and utilities is critical to wildfire mitigation, response, and recovery. There are several ongoing efforts to identify vulnerabilities within the built environment and bolster wildfire resiliency in both Ventura and Santa Barbara counties. Various entities, including Fire Safe Councils, fire departments, fire districts, and planning and public works departments are involved with activities pertaining to the Built Environment Domain.

In Santa Barbara County, the SBCFSC adopted the RWMP. The current first phase of the RWMP includes an analysis of businesses and critical water, evacuation, and utility infrastructure. The Community Wildfire Planning Center (CWPC) is leading efforts in this domain, eventually prioritizing retrofitting programs and mitigation activities that will provide the highest benefit to the community at large. In addition to RWMP-related work in the county, the Long-Range Planning Division is working on several updates and assessments. Currently, the department is updating the Seismic Safety & Safety Element, which establishes protection protocols against natural and climate-related hazards. This update includes revisions to wildfire policies and actions, an evacuation modeling and planning project, and preparation for the county's Climate Adaptation Plan.[48] Additionally, in 2023, the County produced the Hazard Mitigation Plan Update, which included wildfire-related information and addressed water supply challenges in the county.[49]

> *Wildfire resilience is shaped by the built environment. In particular, the infrastructure for water, evacuation, and utilities is critical to wildfire mitigation, response, and recovery.*

In Ventura County, the Ventura County General Plan was recently updated and includes an analysis of wildfire hazards. Elements like the assembly of interagency teams to develop and coordinate resource management following a wildfire are incorporated in the plan's wildfire hazards section.[50] In 2023, the Ventura County Grand Jury served the City of Ventura a report triggered by water availability for firefighting during the Thomas and Woolsey Fires. The report cites that most of the 15 water purveyors in the county lack written protocols during fire weather days, sufficient on-site emergency power, and up-to-date communication protocols for communication during wildfire events.[51] Ventura Water and the City of Ventura are actively responding to this report. Lastly, the VCRFSC is interested in adopting a RWMP, which would follow a similar approach to the Santa Barbara RWMP, beginning with a scoping phase to identify where vulnerabilities and opportunities for resiliency exist across the built environment.

Southern California Edison (SCE) developed an extensive Wildfire Mitigation Plan for 2023 - 2025 as well as several supporting documents to address wildfire mitigation throughout California.[52] The plan includes information about SCE's efforts to reduce ignition risks through system design, vegetation management and inspections, situational awareness and forecasting, emergency preparedness, community education, and public safety power shutoffs.[52]

IDENTIFIED GAPS

Many wildfire mitigation efforts focus on reducing hazards, firefighting response, and vegetation management; however, protecting critical infrastructure before a wildfire can save lives and protect the built environment during a wildfire.[45,53] A great deal of critical infrastructure is at risk from wildfires directly.[54] For example, adequate water supply and distribution are critical during a wildfire event, but are often left vulnerable after a wildfire.[55,56] An assessment of water supply and distribution infrastructure is a priority as infrastructure improvements only occur as a condition of development reviews45. Addressing evacuation routes is also critical to protect communities from wildfires[57,58], and especially for rural and vulnerable communities across both counties.[40,59]

SUCCESS STORY

As part of an effort to update Santa Barbara County's safety requirements, Santa Barbara County's Long Range Planning Division is currently assessing evacuation route safety, viability, and capacity during an emergency. This assessment will identify communities and developments with only one ingress/egress route and safe evacuation locations for residents to access during a wildfire or other natural disaster. A consultant is further assessing "bottleneck" areas and potential solutions in unincorporated areas of the county, and there is a working group composed of representatives from the Office of Emergency Management (OEM), Public Works Department, local fire departments, and other external stakeholders involved in the assessment. In addition to the county's work and the working group, part of this effort included a survey to reach residents and community members and gather their input. One of the final products of the assessment will be a public-facing application that will provide residents with information about their evacuation area and accessible evacuation routes. This effort will be complete by June 2024. At that time, the Long Range Planning Department will present the findings and recommendations to the Board of Supervisors, ultimately leading to an update to the County's safety element.

Many wildfire mitigation efforts focus on reducing hazards, firefighting response, and vegetation management; however, protecting critical infrastructure before a wildfire can save lives and protect the built environment during a wildfire.

RECOMMENDATIONS FOR THE FUTURE

To mitigate wildfire risk throughout the counties, our approach within the Built Environment Domain is centered around the following needs and strategies:

Fund a collection of road networks, housing, population, and temporary refuge areas.

Fund the identification of water flow deficiencies during extreme conditions, localized storage capacity, and ingress/egress limitations for accessing water sources.

Provide funding for personnel and planning that will contribute to county- and city-level climate adaptation strategies that address wildfire events.

Strategy 1: Fund and Consolidate Infrastructure Data
Funding the collection of comprehensive road networks, housing, population, and temporary refuge areas is the first step in understanding where additional resources should be allocated for improving evacuation routes and resources. Obtaining and organizing this information in a single accessible clearinghouse to inform infrastructure investments can protect communities during wildfire events. Doing this before a wildfire can protect community health and safety, promote economic stability, and bolster evacuation preparedness.[45] By identifying vulnerabilities, regional organizations, and entities can work collaboratively to invest in resiliency efforts that protect communities during wildfire events. The CWPC is expected to collect much of this data for southern Santa Barbara County, but it remains an important first step in addressing build environment challenges for northern Santa Barbara County and Ventura County.

Strategy 2: Consolidate Information to Optimize Water Supply and Distribution
Water supply and distribution are critical during a wildfire event. As the Ventura County Grand Jury report cited, firefighters experienced challenges with water supply and distribution during the Thomas and Woolsey Fires.[51] Assessing local water flow deficiencies, storage capacity, and accessibility limitations will help both counties identify system vulnerabilities. These assessments are not commonly addressed through other wildfire planning efforts like CWPPs.[45] Improving water supply and distribution can increase firefighter's ability to respond to wildfire and help mitigate human health impacts associated

Improving water supply and distribution can increase firefighter's ability to respond to wildfire and help mitigate human health impacts associated with wildfire events.

with wildfire events. Like other infrastructure data, there is a need for the collection and identification of weaknesses in Ventura County and northern Santa Barbara County.

Strategy 3: Fund Local Planning and Response Efforts
Funding for personnel and planning for county- and city-level climate adaptation strategies will help address wildfire events, increase regional wildfire mitigation, and improve recovery efforts. Local government entities are limited by their capacity and funding to respond to climate-related incidents that are increasing in frequency. Funding to support additional staff with designated climate-incident roles would increase local government's capacity to mitigate and respond to climate-related incidents like wildfires. In turn, additional funding can lead to improvements in county- and city-level infrastructure and recovery efforts that benefit residents across both counties.

CURRENT EFFORTS

Landscape resilience requires strategic development of priorities for fuel management that go beyond traditional fuel reduction to encompass buffers, greenbelts, and working lands. Whether such buffers exist around communities in Santa Barbara and Ventura Counties is highly variable. Some areas have maintained an agricultural buffer along the WUI boundary, while other areas have housing intermingled with the wildlands.

Vegetation Management units within fire departments play a major role in landscape-scale planning and implementation of projects to mitigate fire. Both the Santa Barbara County Fire Department and Ventura County Fire Department dedicate resources to reducing risks posed by vegetation in the region. Specifically, SBCFD's Vegetation Management section (VMP) manages vegetation via thinning, chipping, mastication, and prescribed herbivory. The Ventura County Fire Department's (VCFD) Fire Hazard Reduction Program (FHRP), a foundational element of VCFD's Wildland Fire Action Plan, also focuses on vegetation management throughout the county. VCFD's work emphasizes the importance of the homeowner's role in brush clearing and defensible space through requirements and annual evaluations. VCFD will conduct brush clearing and defensible space if a home is not up-to-date by the annual evaluation.

Private landowners and entities such as city Parks and Recreation Departments play key roles in vegetation

Vegetation Management units within fire departments play a major role in landscape-scale planning and implementation of projects to mitigate fire.

management, as these portions of the landscape can help to produce a patchwork of spaces that can reduce losses during wildfires. The Santa Barbara Mountain Communities Defensible Space Plan[62], the Ojai Valley Fire Safe Council CWPP[63], and the Carpinteria Summerland Fire Hazard Fuels Reduction Treatment Project[64] are a few examples of landscape approaches to wildfire mitigation on private lands in the region.

In addition to fuel management work, the Environmental Defense Center (EDC) conducts annual water sampling in the Goleta Valley to understand the relationship between wildfire impacts and water quality in the region.[65] Published in 2021, the report includes sampling from 2013 - 2020, finding that replacing non-native, flammable plants with native plants minimizes wildfire, flooding, and debris flow threats while also protecting the hydrology of local watersheds, creeks, landscapes, and groundwater basins can improve stream, riparian, oak forest, fish, and wildfire conditions.[65]

IDENTIFIED GAPS

While there has been a heavy reliance on fuels management via mechanical and hand thinning, there is a need for a broader approach when thinking about the landscape that draws on diverse scientific literature.[11,12,45,66] Incorporating agricultural buffers, prescribed herbivory, prescribed burning, municipal green spaces, and Indigenous knowledge of wildfire into landscape-level wildfire resiliency techniques will lead to holistic solutions in the unique coastal shrub and oak woodland environment of Santa Barbara and Ventura counties.[11,12,45,66] Communicating the value in developing awareness for landscape-related wildfire resiliency strategies is critical to the execution and effectiveness of the aforementioned techniques.[45,67,68] Similarly, effectively communicating the relationship between reduced wildfire risk and healthy ecosystems is also critical.[45,67,68]

SUCCESS STORY

There is a significant amount of research and information about prescribed burning in high-elevation conifer forests throughout the Western U.S.; however, researchers know far less about prescribed burning in the coastal foothills of California, where Santa Barbara and Ventura County are located. The Building Resilience to Wildfires project is a multi-year collaborative effort led by the UC Santa Barbara Natural Reserve System at Sedgwick Reserve involving researchers at the University of California Santa Barbara and the University of California Santa Cruz to address the gap in prescribed burning knowledge.[69] This project investigates the effects of prescribed burning on coastal shrublands, oak woodlands, grasslands, and ecosystem recovery time, water, and flammability of plants, as well as how fire weather contributes to these dynamics.[69] Another component of this research is inputting the measured values into a model - the Regional Hydro-Ecologic Simulation System (RHESSys-Fire) - that will predict how vegetation and fuel moisture patterns will recover following fires and how recovery might change under various climate change scenarios.[69] As part of this research, several TREX burns, in partnership with TNC and other organizations, have been undertaken at the Sedgwick Reserve, with pre-, during, and post-measurement of ecosystem characteristics. These burns have served training functions, research functions, and fuels reduction functions.[69] The findings of this research will be published and available to the public, decision- makers, and fire practitioners within the year.[69] The findings will not only provide insights into prescribed burning but also into fire behavior in a changing climate within the coastal foothills of California.[69]

RECOMMENDATIONS FOR THE FUTURE

Our approach within the Landscape Domain is centered around the following needs and strategies:

Collaborate and support agricultural stakeholders by developing financial incentives for maintaining and creating agricultural buffers throughout the region.

Fund innovative wildfire mitigation techniques, such as developing agricultural and native plant buffers around communities.

Conduct assessments to optimize burn windows, enhancing the pace of prescribed burning.

Prepare for WUI breaches by assessing and funding greenspaces as fuel breaks/buffers.

Address WUI breaches concerning Indigenous use through assessments and project-specific funding for Indigenous buffering activities.

Strategy 1: Develop Financial Incentives for Agricultural Stakeholders

The combination of Sundowner winds in Santa Barbara County and Santa Ana winds in Ventura County typically mean that wildfires sweep into the WUI from adjacent wildlands. Orchards and other agricultural or open space landscapes traditionally buffered many of these communities.[45] Depending on the species,[70] there is evidence that agricultural buffers like certain irrigated orchards (or even golf courses[71] can decrease fire intensity and slow the spread of wildfire.[72] Despite the benefits that orchards can provide, agricultural landowners do not internalize the value they provide to homeowners and homeowners do not pay for the value they receive from the wildfire mitigation value of the buffers. There is an opportunity to work to develop creative financial instruments (akin to wetlands mitigation banks) that can help maintain agricultural buffers in Santa Barbara and Ventura Counties.[73] One interim step to jump-start such initiatives would be to bring together insurance companies, real estate interests, homeowners (perhaps via associations), and agricultural producers to examine possible means of maintaining agricultural buffers.

Strategy 2: Fund Innovative Mitigation Techniques

Beyond landscape-scale agricultural buffers like orchards, there is a need to promote information and funding opportunities that bolster wildfire resiliency at the landscape scale. Fire regimes and fire regeneration strategies influence the flammability of plants (e.g., oaks[74] and chaparral shrubs[75]). However, there is little research on the flammability of plants beyond agricultural crops,[70] so homeowner and community planting decisions are not well-informed by the flammability characteristics of plantings. Practical research on the flammability of landscape plants should be conducted. Once those characteristics are well-established, grant funding for community landscaping that reduces the flammability of the landscape, especially in buffer areas, could productively reduce wildfire vulnerability. Strategically placed fire-resistant landscape showcases could increase fire-resistant landscaping adoption by other local homeowners, homeowner's associations, and businesses.

Additionally, funding research to investigate how existing agricultural buffers, agricultural/crop production, water use, and water efficiency provide co-benefits for the region in terms of reduced wildfire risk, increased economic productivity, and increased food availability to generate a return on investment (ROI)-style assessment could further inform how regional agriculture production, water use, and

Prescribed burning has been shown to be a highly effective way to manage wildland fuels, making ecosystems and landscapes more resilient to catastrophic wildfires.

plants bolster wildfire resiliency. Previous research has shown that high foliar moisture provides an effective wildfire buffer around WUI areas.[45]

Furthermore, there are several innovative approaches to bolstering wildfire resiliency that practitioners and researchers are exploring throughout the U.S. For example, The Coldfire Project in Colorado is utilizing mycelium to decompose slash piles into compost, reducing the additional risk that leftovers from fuels reduction work poses in high wildfire risk and WUI areas.[76] Also, continuing to invest in localized prescribed herbivory efforts will reduce fuel loads and engage agricultural community members throughout the counties. Lastly, prescribed herbivory provides additional benefits like the ability to direct goats around sensitive habitat areas and reduces additional greenhouse gas emissions associated with mechanical thinning equipment.[77]

Strategy 3: Expand Prescribed Burning Windows and Acreage

Prescribed burning has been shown to be a highly effective way to manage wildland fuels, making ecosystems and landscapes more resilient to catastrophic wildfires.[78] Prescribed burning also mimics the more frequent fires with which California's ecosystems evolved before the history of western wildfire suppression. However, there are several challenges that prevent the widespread adoption of prescribed burns in wildland management. First, prescribed burns are currently expensive, requiring the mobilization of extensive resources, often more than once to accommodate safe weather conditions. Second, understanding the optimal frequency and intensity of prescribed burns in the context of a specific landscape's hydrology, vegetation communities, live fuel moisture, and weather, is key to

There are several challenges that prevent the widespread adoption of prescribed burns in wildland management.

predicting the intensity of prescribed burns, choosing optimal return intervals for prescribed burns, and hence building an effective ecosystem management strategy. The multi-year prescribed burning research effort between several of the UCs investigated ecological conditions pre- and post-prescribed burning on the Sedgwick Reserve that may inform future discussions around optimizing prescribed burning.

Third, the winemaking community's concerns about how grape exposure to smoke can negatively affect the taste of the wine – producing a "smoke-tainted" taste – is another barrier.[79] Researchers like Anita Oberholster at UC Davis are investigating the impacts of smoke on winemaking and taste, especially from the 2017 Glass Fire in Napa.[80,81] Similarly, Air Pollution Control Districts, which are responsible for issuing prescribed burning permits, work to mitigate smoke-related impacts on human and environmental health. Engaging regional vintners and grape growers in the development of prescribed burning protocols with regional vintners and grape growers is paramount. Field trips for stakeholders to visit prescribed burn events hosted by the Prescribed Fire

> There is a long history of Indigenous burning in Santa Barbara and Ventura Counties.

Strategy 5: Create Awareness of Cultural Resources
There is a long history of Indigenous burning in Santa Barbara and Ventura Counties.[82] The chaparral was burned to create grasslands and stands of chaparral shrubs of various age classes[83] for use as food, in basket making, and other needs. Recovering Indigenous knowledge of and experience with fire helps increase culturally important species and offer insights for management. For example, The Nature Conservancy's (TNC) prescribed burn training exchange (TREX) program[84] has been undertaking cultural burns (e.g., with the Yoruk Cultural Fire Management Council[85]). In deep collaboration with Indigenous partners in the region, redeveloping knowledge about how the management of wildfire, including prescribed burning, can shape the availability of culturally important plants is a critical objective. Where cultural resources are located, the effect of fire on their regeneration, and the effect of fire on

seed germination for plant species of use are all important to better understand in the region.

Strategy 6: Develop Knowledge of Locally-Specific Fire Behavior Indicators
There is a need to support research on locally-specific fire behavior indicators, especially localized winds, under predicted climate scenarios. Since wildfires are driven by Sundowner and Santa Ana winds in Santa Barbara and Ventura Counties, respectively, it is important to better understand extreme fire weather in California and how climate change has exacerbated these conditions.[86,87] These strong downslope winds in mountain regions result in particularly fast-moving and dangerous wildfires. In particular, research that contributes to advanced warning for dangerous fire weather induced by winds can help with preparedness, evacuation, and resilience.

Training Exchanges (TREX) can be an effective mechanism for engaging stakeholders with concerns about the smoke produced via prescribed burns, as can sharing smoke modeling work.

Strategy 4: Assess Public Green Spaces as Fuel Breaks and Buffers
Understanding water cycling in our environment helps us understand the impacts on plant-available water, which is particularly important for predicting fire risk.[11] The flammability of live vegetation is governed by live fuel moisture (LFM).[11] In seasonally dry environments, like Santa Barbara and Ventura counties, LFM is key to understanding a plant's flammability and ability to survive drought. Studies in California, Spain, Australia, Argentina, and southwestern China have established the relationship between LFM, wildfire, and fire behavior.[12] Specific to chaparral fuel beds found in this region and plants

found within the WUI, understanding LFM patterns in public green spaces like parks, greenbelts, community gardens, and other green spaces throughout the region could help wildfire managers and planners predict fire behavior.[11]

Gathering information about the size and location of such green spaces is equally important in identifying priority areas that could serve as fuel breaks and buffers in the region. Identifying locations with fuel break and buffer potential among already existing green spaces could help connect other wildfire-resilient areas throughout the counties, developing a diverse network of fuel breaks and buffers created through strategies beyond traditional vegetation management techniques. Currently, there is not a central clearing house for this information, but gathering, identifying, and organizing the information in one space would be helpful for wildfire planners and managers.

CURRENT EFFORTS

Community involvement in wildfire resiliency is essential not only for their ownership of a significant portion of land throughout each county but also because when the needs and perspectives of community members are integrated into wildfire mitigation and planning strategies they become more effective. Even though the counties are situated in areas with naturally occurring fires, many residents do not feel prepared for wildfire and harbor concerns about the risks posed by wildfire.[40] There needs to be greater awareness and access to information and resources for safely living with wildfire.[45]

Many organizations and agencies work tirelessly to conduct outreach, engage with, and educate residents and communities. The local Fire Safe Councils, of which there are six in Ventura County and one in Santa Barbara County, generally include representatives from local fire departments and districts, government agencies, businesses, environmental organizations, and the community(ies). The Ventura County Regional Fire Safe Council, for example, hosts monthly webinars for residents to learn about the benefits of Firewise USA and the process of earning recognition as a Firewise site. These workshops are popular among residents and help the Fire Safe Council support communities through becoming a Firewise site.

Other organizations like LISTOS, the Community Environmental Center, the Santa Barbara Bucket Brigade, the Community Emergency Response Team (CERT), local conservation districts, local community councils, Promotoras

> *Many organizations and agencies work tirelessly to conduct outreach, engage with, and educate residents and communities.*

Y Promotores, and religious spaces (e.g., churches and other places of worship) are also deeply engaged in community engagement, outreach, and education. Many of these organizations double as community hubs and safe spaces in addition to providing wildfire mitigation, evacuation, and recovery resources for residents and communities.

In addition to the many active organizations working to promote wildfire preparedness and bolster wildfire resilience amongst county residents, there are unique, creative projects like The Burn Cycle Project that are dedicated to improving wildfire awareness. The Burn Cycle Project, a locally-based wildfire education experience designed by Ethan Turpin and collaborators from the fire service, scientists, artists, journalists, and educators, immerses its audience via interactive media experiences to foster improved understandings of wildfire risk amongst practitioners and community members.[88]

IDENTIFIED GAPS

Community-focused organizations offer invaluable wildfire mitigation, evacuation, and recovery programs and services to the region. Their on-the-ground work with communities fosters trust, promotes resource distribution, and serves as a line of communication between communities and decision-making agencies and entities.[40,42,89] However, many of these organizations are non-profits or local government entities that struggle with funding and capacity. These organizations are forced to dedicate valuable staff time to fundraising and grant applications that are not guaranteed in place of work that aligns directly with their missions. The lack of funding available to these organizations creates recruitment and retention problems, placing additional stress on staff and volunteers. Ultimately, more robust funding and capacity are needed to support the engagement efforts and educational materials these organizations provide. Streamlining permitting processes and improving planning requirements pertaining to wildfire resiliency efforts at the local and State government levels are

identified needs. However, there is not an identified strategy that can definitively address the gaps created by permitting and planning requirements. However, when possible supporting local governments with funding and capacity building can go a long way in bolstering wildfire resilience.

Tangentially connected are the challenges associated with trust and communication. A critical component of working with communities is the time spent building relationships with residents and community leaders.[40,42] While these relationships can yield effective, need-based programming and resources, it also means that a significant gap forms when someone retires or leaves a role. Additional funding to support capacity development could help organizations avoid relying on relationships between residents and individuals representing community organizations. Novel engagement, outreach, communication, and educational initiatives can effectively address the existing gaps, enhancing wildfire resilience across the communities of both counties.

More broadly, LISTOS California in the Governor's Office of Emergency Services (Cal OES) "engages a statewide network of community-based organizations, Tribal Governments, and Community Emergency Response Teams across the state to boost resiliency, provide accessible in-language information and advance a new culture of disaster preparedness." This includes outreach in Indigenous languages and preparedness and safety resources in many languages spoken in California.

SUCCESS STORY

Immigrant Hope Santa Barbara, a locally-based organization, connected to Shoreline Community Church, provides resources and support to immigrants and immigrant families in the community. In addition to offering support services like English classes for all ages and support for adults looking to naturalize, Immigrant Hope connects Spanish-speaking community members to CERT training events. CERT is a FEMA program that educates volunteers about disaster preparedness specific to their locality.[90] The Santa Barbara City Fire Department hosted the CERT training in partnership with Immigrant Hope Community Center and LISTOS and graduated [20] Spanish-speaking community members.[91] These community members can disseminate preparedness information across their communities in ways that organizations and individuals who are not deeply embedded in the community cannot.

In Ventura County, the National Network of Promotores and Community Health Workers has collaborated with the Ventura Regional Fire Safe Council and researchers to provide outreach on wildfire preparedness and to facilitate community engagement.[40] The focus of the organization on promoting the health and well-being of Latinos/as and their families works especially well to gather information about community needs. Given that wildfire smoke can lead to damaging health effects, especially in vulnerable communities that already have higher rates of asthma and other health challenges,[92] the linkage between community health and wildfire preparedness (especially evacuation preparedness) can facilitate protection of health and safety.

More broadly, LISTOS California in the Governor's Office of Emergency Services (Cal OES) "engages a statewide network of community-based organizations, Tribal Governments, and Community Emergency Response Teams across the state to boost resiliency, provide accessible in-language information and advance a new culture of disaster preparedness."[93] This includes outreach in Indigenous languages and preparedness and safety resources in many languages spoken in California.

RECOMMENDATIONS FOR THE FUTURE

To address the multi-faceted nature of wildfire risk throughout the counties, our approach within the Community Domain is centered around the following needs and strategies:

Establish more Firewise USA communities by developing: micro-grants for local communities, workshops to support communities, and other resource or funding support for Fire Safe Councils engaged in establishing Firewise USA communities

Fund trust-building events (e.g., focus groups, informal community meetings, and/or facilitated advisory councils) between vulnerable communities and fire organizations

- Fund communication materials that clearly convey (e.g., multiple languages, images, paper and digital) fire department and firefighter roles and responsibilities

- Focus engagement efforts on identifying and prioritizing the needs of vulnerable communities with ongoing relationship-building to enable engagement in planning, not only response

Develop grant/funding opportunities that support community education and organizing programs to bolster wildfire awareness (e.g., community workshops, staff training, liaisons, etc.)

Break down the misconception that hardening is expensive, especially in Ventura County

- Develop home hardening and retrofit micro-grants, ensure that funding is available to renters too

- Funding opportunities for 7A requirements

Strategy 1: Establish More Firewise USA Communities
Administered by the National Fire Protection Association (NFPA), Firewise USA® is a program that facilitates local communities' efforts to develop wildfire resilience.[94] It is co-sponsored by the US Forest Service and the National Association of State Foresters. Once a neighborhood has established a board or committee and defined the boundaries of the community (from 8 to 2500 single-family dwellings), the community assesses its wildfire risk, especially emphasizing homes and yards. Based on that risk assessment, the board creates a three-year action plan aimed at reducing ignition risk to homes.[94] This can include neighborhood chipping projects to encourage brush clearance, home hardening activities, and training. Firewise USA® communities can receive reduced insurance rates.

Homes near Firewise communities have lower rates of loss in wildfires[95] and participants report increased knowledge about wildfire resilience[96], evidence that community wildfire resilience efforts can be effective. As of September 2023, there were 11 Firewise communities in Santa Barbara County[3] and in Ventura County.[97]

Since there is evidence that voluntary activities like Firewise USA® can help to reduce ignitions and mobilize Firewise behaviors, participation in the Firewise USA® could be expanded. Southern California has relatively few sites, even in places that have experienced larger fires.[98] Generally, areas with higher proportions of old and white residents and areas in High or Very High FHSZs are more likely to have Firewise communities,[98] suggesting that any to-seed

Firewise communities should emphasize communities with more non-white residents and younger populations. Notably, none of the Ventura County Firewise communities are in socially vulnerable communities. Importantly, these efforts are more successful when the leadership team is actively engaged.[99] This implies that efforts to seed Firewise communities should be willing to invest time and effort in building the leadership team.

The strategies that could facilitate more Firewise communities include micro-grants for local communities, workshops to support communities, workshops to disseminate Firewise USA ® information, and other resource or funding support for local organizations engaged in promoting the establishment of Firewise USA communities. Since these efforts are largely community-driven, small investments to facilitate a strong leadership team with seed funding could magnify the ignition reduction potential that Firewise has been shown to produce.
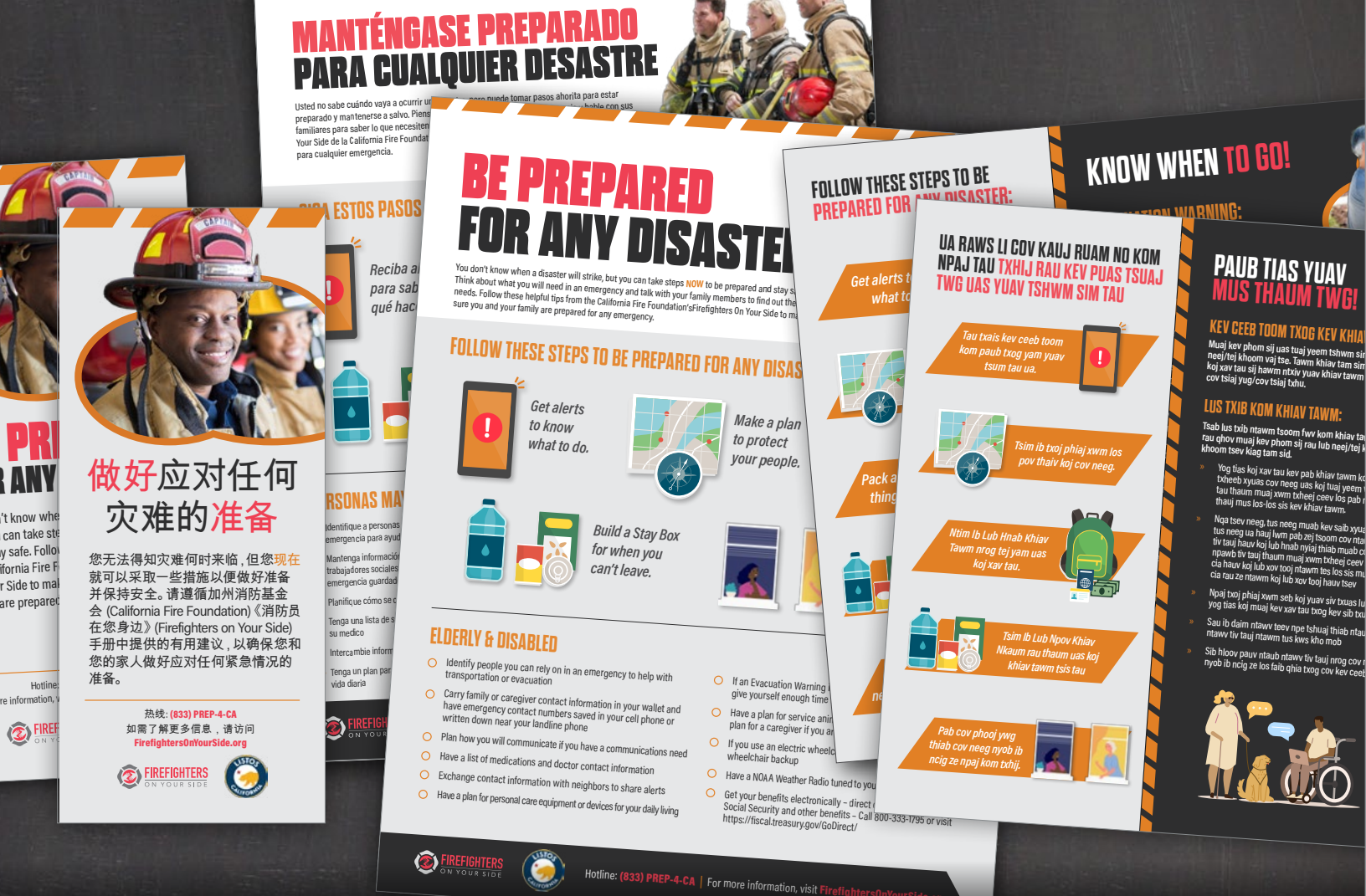
Strategy 2: Develop Relationships and Trust between Vulnerable Communities and Wildfire Managers and Planners
Marginalized communities, which lack resources and face more inequities due to poverty and other systemic injustices are at a much greater risk to wildfires. Unfortunately, these inequities show up in wildfire planning, too. Many communities and individuals are considered vulnerable throughout both counties (e.g., in Ventura County, roughly 45% of the county is considered vulnerable).[40] The

Marginalized communities, which lack resources and face more inequities due to poverty and other systemic injustices are at a much greater risk to wildfires. Unfortunately, these inequities show up in wildfire planning, too.

Thomas and Woolsey Fires highlighted the disproportionate impacts on vulnerable communities, underscoring the need for wildfire managers and planning efforts to support vulnerable communities.

Baker et. al, 2024, identified and recommended focus groups, informal community meetings, and/or facilitated advisory councils between vulnerable communities and fire organizations as effective strategies for trust-building and resonating with vulnerable communities. Ideally, building

to note that educational materials are text-heavy, making them inaccessible to community members with low literacy rates.[40] More targeted and linguistically accessible materials could increase residents' wildfire preparedness.

Lastly, wildfire managers and planners should consider other communities with specific needs such as members of rural, ranching, and agricultural communities. It is critical to engage these stakeholders in wildfire mitigation, evacuation, and recovery efforts. Beyond engagement, it is important to acknowledge that they may have different needs than the broader community and that different communication strategies may reach and resonate with them better than traditional methods.

Strategy 3: Support Community Education, Engagement, and Outreach

Community engagement and outreach efforts often focus on increasing wildfire awareness; however, there are several untapped communication channels that wildfire managers, planners, and practitioners could leverage to bolster wildfire resiliency across the counties. Expanding engagement and outreach to educational spaces could be an effective way to bolster wildfire resiliency across the counties. A few examples of targeted educational initiatives include incorporating wildfire into elementary and secondary fire education programs, advanced science courses, and fire and wildfire career development resources into local curriculums. Additionally, educational opportunities for working professionals in landscaping, development, architecture, and real estate focused on integrating wildfire mitigation strategies (e.g., defensible space and home hardening) into current practices could address wildfire awareness and resiliency from new angles. Similarly, educational efforts for landlords and renters are critical–nearly 60% of residents in Santa Barbara County are renters[100] and about 36% of residents in Ventura County are renters.[101] Grants for educational opportunities (e.g., workshops, trainings, and certifications) at local schools from the elementary to community college levels are also needed.

Strategy 4: Promote Affordable Home Hardening Mechanisms

Construct and retrofit wildfire-resilient structures and homes can play an important role in reducing wildfire ignition and spread.[102] A growing body of research indicates that individual, home-level changes to the built environment, home hardening, can reduce wildfire risk in the built environment or WUI areas.[103] Ignition sources for homes include wind-blown embers, radiant heat, and direct flame contact.[102] While home hardening is critical, there is a

Expanding engagement and outreach to educational spaces could be an effective way to bolster wildfire resiliency across the counties

common misconception that this strategy comes with higher costs, placing the financial burdens of wildfire mitigation work on homeowners and renters. However, a recent Headwaters Economics report about home hardening in California found that home hardening investments are not much more expensive than costs associated with baseline home building and retrofitting costs and that in the long-term the return on investment is worthwhile.[102]

Specifically, it costs about $2,800 to retrofit decks and create a 0 - 5 foot defensible space buffer around a home and approximately $18,000 - $27,000 more to construct the most optimal wildfire- resilient home using premium materials.[102] Micro-grants for homeowners, landlords, and renters who are interested in retrofitting roofs, under-eave areas, exterior walls, attached decks, and near- home landscaping could encourage more wildfire-resilient home investments and demonstrate to others that these improvements can be affordable. Lastly, improvements to home hardening could improve insurability for many homeowners, a known challenge throughout California.

trust and improving communication between vulnerable communities and fire organizations will result in increased representation of vulnerable communities' needs in wildfire management and planning. Additionally, these events and increased communications will help further clarify the roles and responsibilities of fire organizations in regard to wildfire mitigation, evacuation, and recovery while also providing community members with greater access to wildfire resiliency resources and tactics.

Clearly conveyed communication materials are critical. Specifically, materials should be provided in several languages (e.g., Spanish, Mextico, and Barbareño Chumash) and formats (e.g., image-based materials, paper materials, and digital materials).[40] Engagement efforts must be intentional about identifying and prioritizing the needs of vulnerable communities, which are different from the needs of the broader community. Particularly, non-English speakers, women, people of color, and newer residents are less prepared for wildfire.[40] Additionally, it is important

Clearly conveyed communication materials are critical. Specifically, materials should be provided in several languages (e.g., Spanish, Mextico, and Barbareño Chumash) and formats (e.g., image-based materials, paper materials, and digital materials)

REFERENCES

1. Goss, M. et al. Climate change is increasing the likelihood of extreme autumn wildfire conditions across California. Environ. Res. Lett. 15, 094016 (2020).

2. Abatzoglou, J. T. & Williams, A. P. Impact of anthropogenic climate change on wildfire across western US forests. Proc. Natl. Acad. Sci. 113, 11770–11775 (2016).

3. Safford, H. D., Paulson, A. K., Steel, Z. L., Young, D. J. N. & Wayman, R. B. The 2020 California fire season: A year like no other, a return to the past or a harbinger of the future? Glob. Ecol. Biogeogr. 31, 2005–2025 (2022).

4. wfca_teila. History of California Wildfires. WFCA https://wfca.com/wildfire- articles/history-of-california-wildfires/ (2022).

5. 2020 Fire Season Incident Archive | CAL FIRE. https://www.fire.ca.gov/incidents/2020.

6. Morse, J. California's Fire Safe Future. (2023).

7. Pohl, K. Analysis of the first round of Community Wildfire Defense Grants. Headwaters Economics https://headwaterseconomics.org/natural-hazards/cwdg- first-round/ (2023).

8. Expenditure Plan. California Wildfire & Forest Resilience. https://wildfiretaskforce.org/about/expenditure-plan/.

9. Crist, M. R. Rethinking the focus on forest fires in federal wildland fire management: Landscape patterns and trends of non-forest and forest burned area. J. Environ. Manage. 327, 116718 (2023).

10. Nitrogen cycling and export in California chaparral: the role of climate in shaping ecosystem responses to fire - Hanan - 2017 - Ecological Monographs - Wiley Online Library. https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/ecm.1234.

11. Dennison, P. E. & Moritz, M. A. Critical live fuel moisture in chaparral ecosystems: a threshold for fire activity and its relationship to antecedent precipitation. Int. J. Wildland Fire 18, 1021–1027 (2009).

12. Park, I., Fauss, K. & Moritz, M. A. Forecasting Live Fuel Moisture of Adenostema fasciculatum and Its Relationship to Regional Wildfire Dynamics across Southern California Shrublands. Fire 5, 110 (2022).

13. Secret Treasures of Our Threatened Chaparral Forest » Environmental Defense Center. https://www.environmentaldefensecenter.org/secret-treasures-of-our- threatened-chaparral-forest/ (2015).

14. Batllori, E. et al. Compound fire-drought regimes promote ecosystem transitions in Mediterranean ecosystems. J. Ecol. 107, 1187–1198 (2019).

15. Ventura-Fire-Strategic-Plan_English.pdf.

16. Zigner, K. et al. Effects of Extreme Wind Variability on Modeled Wildfire Spread. 2019, A23J-2952 (2019).

17. LaDochy, S. & Witiw, M. California Winds and Fire Weather. in Fire and Rain: California's Changing Weather and Climate (eds. LaDochy, S. & Witiw, M.) 107–126 (Springer Nature Switzerland, Cham, 2023). doi:10.1007/978-3-031-32273-0_8.

18. Emery, N. C., D'Antonio, C. M. & Still, C. J. Fog and live fuel moisture in coastal California shrublands. Ecosphere 9, e02167 (2018).

19. Radeloff, V. C. et al. Rapid growth of the US wildland-urban interface raises wildfire risk. Proc. Natl. Acad. Sci. 115, 3314–3319 (2018).

20. Fire Hazard Severity Zones | OSFM. https://osfm.fire.ca.gov/what-we-do/community- wildfire-preparedness-and-mitigation/fire-hazard-severity-zones.

21. Zigner, K. et al. Wildfire Risk in the Complex Terrain of the Santa Barbara Wildland– Urban Interface during Extreme Winds. Fire 5, 138 (2022).

22. fhsz_county_sra_11x17_2022_santabarbara_2.pdf.

23. wildland-urban-interface-2019.pdf.

24. Wildland-Urban Interface (WUI) Change 1990-2020 – SILVIS LAB – UW–Madison. https://silvis.forest.wisc.edu/data/wui-change/.

25. BLM National Data. https://blm- egis.maps.arcgis.com/apps/webappviewer/index.html?id=6f0da4c7931440a8a80bfe 20eddd7550%20 &extent=-125,%2031.0,%20-114,%2043.0.

26. McKibben, D. Unit Strategic Fire Plan 2010. (2023).

27. California, S. of. California Climate Adaptation Strategy. https://climateresilience.ca.gov/.

28. California, S. of. Central Coast Region - California Climate Adaptation Strategy. https://climateresilience.ca.gov/regions/central-coast.html.

29. California, S. of. Los Angeles Region - California Climate Adaptation Strategy. https://climateresilience.ca.gov/regions/los-angeles.html.

30. U.S. Census Bureau QuickFacts: Santa Barbara County, California. https://www.census.gov/quickfacts/fact/table/santabarbaracountycalifornia/PST045 222.

31. U.S. Census Bureau QuickFacts: Ventura County, California. https://www.census.gov/quickfacts/fact/table/venturacountycalifornia/PST045222.

32. Projections | Department of Finance.https://dof.ca.gov/forecasting/demographics/projections/.

33. Economic Information | Santa Barbara County, CA - Official Website. https://www.countyofsb.org/1845/Economic-Information.

34. 2022 Agricultural Crop Production Report | Santa Barbara County, CA - Official Website. https://www.countyofsb.org/3967/2022-Agricultural-Crop-Production- Report.

35. SBV_Economic-Impact-of-SB-County_2-16-22-Final.pdf.

36. Ventura-County-2022-Crop-and-Livestock-Report.pdf.

37. The Impact of Wildfires on California Agriculture Informational Hearing Report.pdf.

38. Fire | Free Full-Text | Factors Associated with Structure Loss in the 2013–2018 California Wildfires. https://www.mdpi.com/2571-6255/2/3/49.

39. Yamamura, J. Granny Flats in Fire Zones Required by State. The Santa Barbara Independent https://www.independent.com/2020/09/29/granny-flats-in-fire-zones- required-by-state/ (2020).

40. Baker, B. et al. Social Inequity and Wildfire Response: Identifying Gaps and Interventions in Ventura County, California. https://www.mdpi.com/2571-6255/7/2/41 (2024).

41. Davies, I. P., Haugo, R. D., Robertson, J. C. & Levin, P. S. The unequal vulnerability of communities of color to wildfire. PLOS ONE 13, e0205825 (2018).

42. Lambrou, N., Kolden, C., Loukaitou-Sideris, A., Anjum, E. & Acey, C. Social drivers of vulnerability to wildfire disasters: A review of the literature. Landsc. Urban Plan. 237, 104797 (2023).

43. Méndez, M., Flores-Haro, G. & Zucker, L. The (in)visible victims of disaster: Understanding the vulnerability of undocumented Latino/a and indigenous immigrants. Geoforum 116, 50–62 (2020).

44. Regional Wildfire Mitigation Program. Regional Wildfire Mitigation Programhttps://rwmpsantabarbara.org/.

45. Moritz, M. A. et al. Beyond a Focus on Fuel Reduction in the WUI: The Need for Regional Wildfire Mitigation to Address Multiple Risks. Front. For. Glob. Change 5, (2022).

46. Bart, R. R., Kennedy, M. C., Tague, C. L. & McKenzie, D. Integrating fire effects on vegetation carbon cycling within an ecohydrologic model. Ecol. Model. 416, 108880 (2020).

47. US EPA, O. Study Shows Some Household Materials Burned in Wildfires Can be More Toxic Than Others. https://www.epa.gov/sciencematters/study-shows-some- household-materials-burned-wildfires-can-be-more-toxic-others (2022).

48. Safety Element Update | Santa Barbara County, CA - Official Website. https://www.countyofsb.org/762/Safety-Element-Update.

49. Santa Barbara CountyMulti-Jurisditctional Hazard Mitigation Plan.

50. Wildfire Hazards. https://egeneralplan.vcrma.org/chapter/wildfire-hazards/.

51. Ventura Water Staff Report.

52. Wildfire Mitigation Plan & Related Documents. https://www.sce.com/safety/wild-fire-mitigation.

53. Murray, A. T. et al. Developing effective wildfire risk mitigation plans for the wildland urban interface. Int. J. Appl. Earth Obs. Geoinformation 124, 103531 (2023).

54. Modaresi Rad, A. et al. Human and infrastructure exposure to large wildfires in the United States. Nat. Sustain. 6, 1343–1351 (2023).

55. Water treatment implications after the High Park Wildfire, Colorado - Writer - 2014 - Journal AWWA - Wiley Online Library. https://awwa.onlinelibrary. wiley.com/doi/abs/10.5942/jawwa.2014.106.0055.

56. Schulze, S. S. & Fischer, E. C. Prediction of Water Distribution System Contamination Based on Wildfire Burn Severity in Wildland Urban Interface Communities. ACS EST Water 1, 291–299 (2021).

57. Murray, A. T. et al. Fire and Flood Vulnerability, and Implications for Evacuation. in Geospatial Technology and Smart Cities: ICT, Geoscience Modeling, GIS and Remote Sensing (ed. Sharma, P.) 299–314 (Springer International Publishing, Cham, 2021). doi:10.1007/978-3-030-71945-6_17.

58. Cova, T. J., Theobald, D. M., Norman, J. B. & Siebeneck, L. K. Mapping wildfire evacuation vulnerability in the western US: the limits of infrastructure. GeoJournal 78, 273–285 (2013).

59. Grajdura, S. & Niemeier, D. Inequities & Injustices in Large-Scale California Wildfire Evacuations & Post-Evacuations. SSRN Scholarly Paper at https://doi.org/10.2139/ssrn.4022006 (2022).

60. Fuel_Treatment_Projects_MainMap_EDIT. https://sbc- gis.maps.arcgis.com/apps/mapviewer/index.html?webmap=38987de258434cf3a19e 3634d4288d68.

61. State of California - Department of Fish and Wildlife.

62. Santa Barbara Mountain Communities Defensible Space Plan. SBC Wildfire Resilience Priorities https://www.sbcwildfireresilience.org/projects/mountain- communities-defensible-space-plan.

63. About the Ojai CWPP | Ojai Valley Fire Safe Council. https://firesafeojai.org/about- the-ojai-cwpp/.

64. Carpinteria Summerland Fire Hazard Fuels Reduction Treatment Project — SBC Wildfire Resilience Priorities. https://www.sbcwildfireresilience.org/projects/summerland-fuel-treatment.

65. Kalber, M. & Trautwein, B. ENVIRONMENTAL DEFENSE CENTER.

66. Cui, X. et al. Green firebreaks as a management tool for wildfires: Lessons from China. J. Environ. Manage. 233, 329–336 (2019).

67. Herbert, C. & Butsic, V. Assessing the Effectiveness of Green Landscape Buffers to Reduce Fire Severity and Limit Fire Spread in California: Case Study of Golf Courses. Fire 5, 44 (2022).

68. Learning To Burn: Using Prescribed Fire To Keep California's Foothills Safe From Wildfire - Natural Reserve System. https://ucnrs.org/learning-to-burn-using- prescribed-fire-to-keep-californias-foothills-safe-from-wildfire/ (2023).

69. Wong, K. Learning To Burn: Using Prescribed Fire To Keep California's Foothills Safe From Wildfire - Natural Reserve System. https://ucnrs.org/learning-to-burn-using- prescribed-fire-to-keep-californias-foothills-safe-from-wildfire/ (2023).

70. Pagadala, T., Alam, M. A., Maxwell, T. M. R. & Curran, T. J. Measuring flammability of crops, pastures, fruit trees, and weeds: A novel tool to fight wildfires in agricultural landscapes. Sci. Total Environ. 906, 167489 (2024).

71. Herbert, C. & Butsic, V. Assessing the Effectiveness of Green Landscape Buffers to Reduce Fire Severity and Limit Fire Spread in California: Case Study of Golf Courses. Fire 5, 44 (2022).

72. Fu, X., Lidar, A., Kantar, M. & Raghavan, B. Edible fire buffers: Mitigation of wildfire with multifunctional landscapes. PNAS Nexus 2, pgad315 (2023).

73. Chirouze, M., Clark, J., Hayes, J., Roberts, K. & Chamberlin, S. WILDFIRE RISK REDUCTION BUFFERS.

74. Engber, E. A. & Varner, J. M. Patterns of flammability of the California oaks: the role of leaf traits. Can. J. For. Res. 42, 1965–1975 (2012).

75. Cowan, P. D. & Ackerly, D. D. Post-fire regeneration strategies and flammability traits of California chaparral shrubs. Int. J. Wildland Fire 19, 984–989 (2010).

76. Miller, S. R. Can mushrooms help prevent wildfires? - The Washington Post. https://www.washingtonpost.com/climate-solutions/2023/07/10/wildfire-prevention- mushroom-composting/ (2023).

77. Prescribed Grazing FAQs. Community Environmental Council. https://cecsb.org/prescribed-grazing-faqs.

78. Hunter, M. E. & Robles, M. D. Tamm review: The effects of prescribed fire on wildfire regimes and impacts: A framework for comparison. For. Ecol. Manag. 475, 118435 (2020).

79. Caffrey, A. et al. Changes in Smoke-Taint Volatile-Phenol Glycosides in Wildfire Smoke-Exposed Cabernet Sauvignon Grapes throughout Winemaking. Am. J. Enol. Vitic. 70, 373–381 (2019).

80. Wallace, B. How Wildfires Are Threatening California's Prized Napa Cab. https://nymag.com/intelligencer/article/california-wildfires-wine-napa-cab. html.

81. Anita Oberholster | Viticulture and Enology. https://wineserver.ucdavis.edu/people/anita-oberholster#/.

82. Keeley, J. E. Native American impacts on fire regimes of the California coastal ranges. J. Biogeogr. 29, 303–320 (2002).

83. Anderson, M. K. & Keeley, J. E. Native Peoples' Relationship to the California Chaparral. in Valuing Chaparral: Ecological, Socio-Economic, and Management Perspectives (eds. Underwood, E. C., Safford, H. D., Molinari, N. A. & Keeley, J. E.) 79 – 121 (Springer International Publishing, Cham, 2018). doi:10.1007/978 -3-319-68303-4_4.

84. Training Exchanges Support Fire Practitioners, Expand Controlled Burns. The Nature Conservancy https://www.nature.org/en-us/what-we-do/our-priorities/protect-water- and-land/land-and-water-stories/fire-training-exchanges-expand-controlled-burns/.

85. Projects. culturalfire.org https://www.culturalfire.org/projects.

86. Carvalho, L. et al. The Sundowner Winds Experiment (SWEX) Pilot Study: Understanding Downslope Windstorms in the Santa Ynez Mountains, Santa Barbara, California in: Monthly Weather Review Volume 148 Issue 4 (2020). https://journals.ametsoc.org/configurable/content/journals$002fmwre$002f148$002 f4$002fmwr-d-19- 0207.1.xml?t:ac=journals%2002fmwre%2002f148%2002f4%2002fmwr-d-19- 0207.1.xml.

87. Zigner, K. et al. Evaluating the Ability of FARSITE to Simulate Wildfires Influenced by Extreme, Downslope Winds in Santa Barbara, California. https://www.mdpi.com/2571-6255/3/3/29 (2020).

88. Burn Cycle Project. https://burncycleproject.com/.

89. Kolden, C. A. & Henson, C. A Socio-Ecological Approach to Mitigating Wildfire Vulnerability in the Wildland Urban Interface: A Case Study from the 2017 Thomas Fire. Fire 2, 9 (2019).

90. Community Emergency Response Team (CERT) | FEMA.gov. https://www.fema.gov/emergency-managers/individuals- communities/preparedness-activities-webinars/community-emergency-response- team.

91. Office, C. A. Two Classes Graduate Community Emergency Response Team Training This Year | City of Santa Barbara. https://santabarbaraca.gov/news/two-classes- graduate-community-emergency-response-team-training-year (2022).

92. Gold, D. R. & Wright, R. POPULATION DISPARITIES IN ASTHMA. Annu. Rev. Public Health 26, 89–113 (2005).

93. gall_admin. About. Listos California https://www.listoscalifornia.org/about/.

94. How to become a Firewise USA® site. https://www.nfpa.org/education-and- research/wildfire/firewise-usa/become-a-firewise-usa-site.

95. Kramer, H. A., Mockrin, M. H., Alexandre, P. M., Stewart, S. I. & Radeloff, V. C. Where wildfires destroy buildings in the US relative to the wildland–urban interface and national fire outreach programs. Int. J. Wildland Fire 27, 329–341 (2018).

96. McGee, T. K. Public engagement in neighbourhood level wildfire mitigation and preparedness: Case studies from Canada, the US and Australia. J. Environ. Manage. 92, 2524–2532 (2011).

97. Firewise USA® - Firewise USA® sites. https://www.nfpa.org/education-and- research/wildfire/firewise-usa/firewise-usa-sites.

98. Kampfschulte, A. R. & Miller, R. K. Regional participation trends for community wildfire preparedness program Firewise USA. Environ. Res. Clim. 2, 035013 (2023).

99. Evans, A. et al. Evaluating the Effectiveness of Mitigation Activities in the Wildland-Urban Interface.

100. Average rent in Santa Barbara | Rental Housing Market 2024 — Point2. https://www.point2homes.com/US/Average-Rent/CA/Santa-Barbara.html.

101. Ventura County, CA Household Income, Population & Demographics | Point2. https://www.point2homes.com/US/Neighborhood/CA/Ventura-County-Demographics.html.

102. Barrett, K., Quarles, S. L. & Gorham, D. J. Construction costs for a wildfire-resistant home: California edition. Headwaters Economics https://headwaterseconomics.org/natural-hazards/wildfire-resistant-costs- california/ (2022).

103. Building a Wildfire-Resistant Home: Codes and Costs.

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