

# A climate adaptation-informed conservation strategy for southern California's montane forests

## Final Report for the USGS Climate Adaptation Science Center

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### **PUBLIC SUMMARY:**

In the Peninsular and Transverse Mountain Ranges of Southern California, montane forests (above 1200 m/4000 ft in elevation) are primarily restricted to “sky islands” of mixed conifer and hardwood species. Montane forests protect the upper watersheds of all the region’s major rivers, providing about 40% of the water used for human, agricultural, and industrial purposes in Southern California. However, these forests are facing numerous threats, including intensifying cycles of precipitation and drought, increasing temperatures, major bark beetle and goldspotted oak borer outbreaks, tree mortality events, severe wildfire, urban development, and invasive species. All of these have the ability to greatly impact the health and persistence of montane forests. Conservation of these forests is contingent upon updating and integrating our understanding of how to manage in ways that reduce forest vulnerability to severe disturbances such as fire.

In late 2020, we established the Southern California Montane Forests Project, a collaboration of the U.S. Forest Service, the USGS Southwest Climate Adaptation Science Center, San Diego State University, and the Climate Science Alliance. To advance the goal of conserving montane forests of the Southern California sky islands and sustaining the ecosystem services and benefits they provide, this collaboration has created a regional conservation strategy; developed large-scale treatment priority maps for reducing fire risk; summarized the best available management guidance in an interactive, online format; and supported postfire restoration planning for major fires in the region. Our efforts have supported decision makers in moving past barriers and created a strong scientific foundation for advancing projects with public and partner backing. The project has also developed regional co-stewardship and promoted the implementation of forest treatments at the right scale in the right places, while using all available tools to achieve better stewardship.

### **Southern Montane Forests Leader Group:**

Sarah Hennessy, PhD	USDA Forest Service
Carolyn Enquist, PhD	U.S. Geological Survey
Jeff Heys	USDA Forest Service
Megan Jennings, PhD	San Diego State University
Nicole Molinari, PhD	USDA Forest Service
Amber Pairs, PhD	Climate Science Alliance
Hugh Safford, PhD	University of California, Davis, Vibrant Planet, and US Forest Service (Retired)

### **Southern Montane Forests Project Group:**

Matthew Bokach	San Gabriel Mountains National Monument, Angeles National Forest
Kim Corella	California Department of Forestry and Fire Protection
Frank Davis, PhD	UCSB Bren School of Environmental Science and Management
Stacy Hishinuma, PhD	Region 5 State and Private Forestry, USDA Forest Service
Bethany Kyre, PhD	Region 5 State and Private Forestry, USDA Forest Service
John Lovio	California State Parks
Connor Magee	Citizen of Pala Band of Mission Indians (Payomkawichum/Cahuilla), and University of California, Davis
Randall Putz	City of Big Bear Lake
Kelly Sypolt	USDA - Natural Resources Conservation Service
Andrew Weinhart	Cleveland National Forest

### **PROJECT SUMMARY:**

Southern California’s montane forests are fundamental to the region from the standpoint of ecosystem services and biodiversity conservation. These forests are under existential threat from a suite of rapidly intensifying stressors and disturbances, including intensifying cycles of precipitation and drought, increasing temperatures, major bark beetle outbreaks, tree mortality events, severe wildfire, urban development, and invasive species. The overarching goal was to bring resources and focus to a critical but under-recognized region by creating a collaborative community of practice to both recognize the high level of risk to montane forests as well as bring strategic protection to the forest and significant ecosystem services they provide. Key objectives were to produce a conservation strategy focused on the sustainability of montane forests in Southern California; inform strategic implementation efforts; and utilize science outreach to support resource and fire managers. This project relied on extensive use of co-production with scientists, managers, Tribal, and non-Tribal groups to build support and consensus for the new conservation strategy. The major disturbances that are driving forest loss cross ownership boundaries, and successful management of forest resilience to these stressors requires partnership across boundary lines.

The conservation strategy was released in June 2024 in collaboration with San Diego State University Institute for Ecological Monitoring and Management (SDSU IEMM), U.S. Forest Service, USGS Southwest Climate Adaptation Science Center, and Climate Science Alliance. The conservation strategy applies to all higher elevation forested lands across the region, regardless of ownership, promoting an all-lands approach. The strategy includes conifer and hardwood forest types, and also highlights the ecological and social factors that distinguish Southern California and its unique needs. It provides recommendations for climate-adapted management with a focus on investment and management actions in key landscapes. It establishes a decision-support prioritization framework for landscape-scale planning, and includes an adaptation menu of project-level forest management strategies and tactics. This menu was developed specifically for use in Southern California montane forests, and relies on contributions and insights from regional managers and scientists. The strategy also provides guidance for planning in areas that have recently been impacted by fire.

This project produced several research outputs, including a **Practitioners Questionnaire**, the regional **Prioritization Framework**, and the **Adaptation Menu for Southern California Montane Forests**. Each of these products was developed using co-production with the community of practice.

- The **Practitioners Questionnaire** focused on challenges and barriers to both the planning and implementing of forest resilience projects and provided a starting place for the development of scientific products and tactics within the conservation strategy (Jennings et al. 2023). This product was conducted by collaborators at San Diego State University, and federal employees did not participate in the development or implementation of the questionnaire.
- The **Prioritization Framework** is an innovative customized decision framework that supports landscape-wide project prioritization based on key mappable factors, which are organized by exposure, vulnerability, and valued assets. The spatial product identifies priority areas for phased treatments and also provides a *monitor-resist-accommodate-transform* framework to aid in climate adapted conservation, restoration and landscape management (Jennings et al., *in press*).
- The **Adaptation Menu for Southern California Montane Forests** ([tinyurl.com/SoCalForestAdaptationMenu](https://tinyurl.com/SoCalForestAdaptationMenu)) is a regionally-focused extension of the California Climate Hub's Adaptation Strategies and Approaches for California Forest Ecosystems (California Climate Hub, 2020) and the Indigenous Climate Resilience Network's Tribal Climate Adaptation Menu (Tribal Adaptation Menu Team, 2019). The menu was developed through collaborative engagements with subject matter experts, Indigenous stewards, and project advisors, and guides managers through management options for a wide range of management situations. The adaptation menu is novel in the degree to which it focuses on the tactic-level operational details that are crucial for addressing many manager needs. Much of the text is designed and intended to be used verbatim by project managers in their required environmental planning documents.

In many respects, conditions in the forests of Southern California run ten to fifteen years ahead of the Sierra Nevada and the rest of California, and much of what is learned here will soon be relevant to the larger forests to the north. This project enabled the Southern California region to establish its place at the forefront of managers tackling the compounding threats of drought, disease, and fire.

## PROJECT REPORT

### ***Purpose and Objectives:***

Southern California's montane forests are fundamental to the region from the standpoint of ecosystem services and biodiversity conservation. These forests are under existential threat from a suite of rapidly intensifying stressors and disturbances, including many that have strong climate connections. Prior to this project, one major obstacle to the sustainability of montane forests in Southern California was the absence of a coordinated strategic conservation plan across agencies and stakeholders that incorporated consideration of trends in climate and other environmental and demographic factors. The purpose of this project was to produce a climate-informed conservation strategy for Southern California's montane forests, and to collaboratively bring resources and focus to a critical but underserved region.

### **The goals of this work were to:**

- ❖ Sensitize resource and fire managers, policy makers, the science community, and stakeholders to the high level of risk to montane forests as well as the significant ecosystem services they provide in Southern California and adjacent regions.
- ❖ Develop a collaborative community of practice to (1) produce a climate-informed conservation strategy for sustainability of montane forests in Southern California; (2) inform planning and management efforts that implement the strategy; and (3) utilize science outreach methodologies to support resource and fire managers.

### **The objectives under this agreement were to:**

- *Establish a stakeholder group to identify priorities and develop a strategy for creating a climate-informed Conservation Strategy for Southern California Montane Forests.* This project relied on extensive use of co-production with scientists, managers, Tribal, and non-Tribal groups to build support and consensus for the new conservation strategy. The major disturbances that are driving forest loss cross ownership boundaries, and successful management of forest resilience to these stressors requires partnership across boundary lines. We developed a community of practice including resource and fire managers, policy makers, scientists, Tribal partners, and other stakeholders across Southern California. We engaged with the community of practice through several types of activities. These included listening sessions with Tribal and Community groups, periodic convenings of regional thought leaders from across the community of practice, and focused technical workshops. Over the course of the agreement we estimate we had over 1600 interactions with individuals across the community in the last 4.5 years.
- *Complete a stakeholder driven climate-informed Conservation Strategy for Southern California Montane Forests.* The conservation strategy was released in June 2024 in collaboration with San Diego State University Institute for Ecological Monitoring and Management (SDSU IEMM), USGS, and Climate Science Alliance. The conservation strategy applies to all higher elevation forested lands across the region, regardless of ownership, promoting an all-lands approach. The strategy includes conifer and hardwood forest types, and also focuses on the ecological and social factors that distinguish Southern California. It provides recommendations for climate-adapted management with a focus on investment and management actions in key landscapes. It establishes a decision-support prioritization framework for landscape scale planning, and includes an adaptation menu of forest management strategies and tactics. This menu was developed specifically for use in Southern California montane forests, and relies on contributions and insights from regional managers and scientists. The strategy also provides guidance for planning in postfire situations.
- *Hold workshops and outreach activities to support adoption and implementation of the Conservation Strategy.* The conservation strategy release was coordinated with a public press release, a webinar, outreach to the Regional Forest and Fire Capacity Program, and the leadership teams of each of the National Forests in Southern California. Each of the major components of the conservation strategy was developed through pilot projects across the region, ultimately resulting in the development and delivery of 6 prioritization workshops, 2 adaptation workshops, and use of the postfire restoration framework for 4 major fire scars.

## **Organization and Approach:**

This section provides detail into how the project activities were conducted by task.

*Task 3.1. Establish a stakeholder group to identify priorities and develop a strategy for creating a climate-informed Conservation Strategy for Southern California montane forests.*

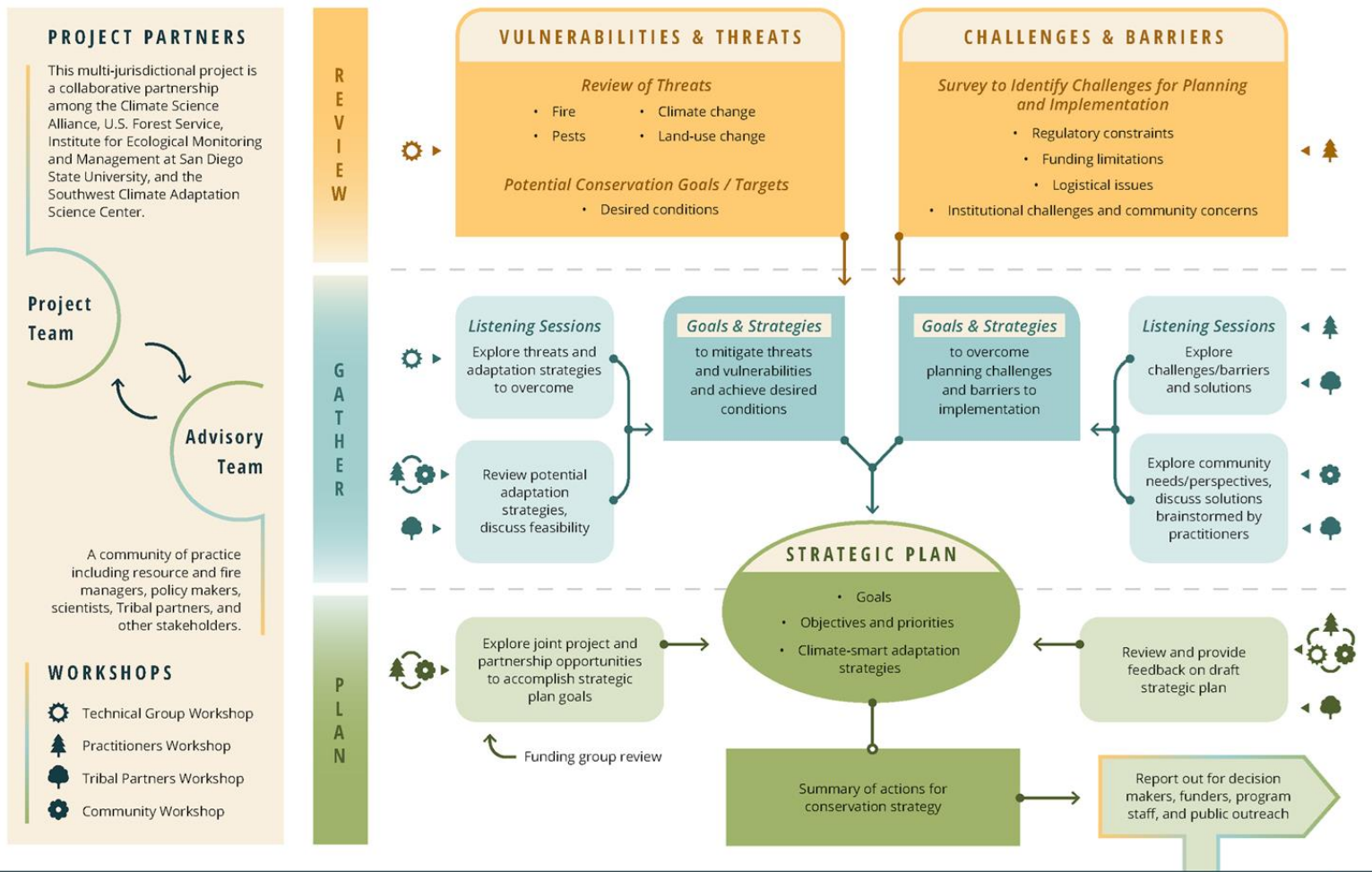
This project relied on the use of co-production to build support and consensus for the new conservation strategy. We developed a community of practice interested in forest management through outreach such as manager and community focused webinars, a project overview video, and a practitioner questionnaire that gave us critical input we could consider in the workshops. Each of these initial engagements offered opportunities to connect more closely with key partners who wanted to engage in and amplify our efforts. Throughout the project, the partners developed and maintained a contact list of stakeholders including academic researchers, advocacy groups, USFS staff, SW CASC-affiliated principal investigators, and Federal and State agency personnel for subsequent workshops and other engagements.

We identified and gathered a group made up of managers and decision makers across federal, Tribal, and state agencies, non-profit organizations, as well as community representatives, and several university scientists with expertise in forest and fire ecology. This project group was designed to be representative of different land management agencies, areas of expertise, and perspectives. Among others, the group included representatives from CalFire, UC Santa Barbara, Bureau of Land Management, CA State Parks, Natural Resources Conservation Service, San Diego State University, Santa Barbara Botanic Garden, and local government. We met with the group throughout the development of the conservation strategy, seeking input on our proposed process, individual components of the strategy, and the final products. We held meetings on May 11 and November 16, 2021; September 27 and November 30, 2022; April 18, 2023; and March 19, 2024.

The project relied on consistent engagement with Tribal groups throughout, primarily through Climate Science Alliance's Tribal Working Group. Initially, USFS and Climate Science Alliance coordinated to leverage the contact networks of both organizations for Tribal groups and developed a MOU to support this collaboration, signed June 7<sup>th</sup>, 2021. Communication was initiated with a project notice letter and a Tribal Listening Session was conducted during the Tribal Working Group monthly meeting in July 2021. We held several other Tribal engagement sessions, including a workshop at the Tribal EPA conference in Alpine, CA, a presentation for the board of the Kumeeyaay Diegueno Land Conservancy, and another dedicated workshop with the Tribal Working Group to gather input on our adaptation menu.

In addition, we conducted meetings with smaller groups of technical advisors as needed. Introductory contact was made with potential science advisors, and subsequently we convened a technical group on November 4, 2021 in order to gather focused guidance and technical expertise on refugia framework development. On January 17, 2023 we held a meeting of technical advisors to develop themes for a new adaptation menu guidance for Southern California, followed by a similar workshop held with Tribal contacts.

The infographic in Figure 1 describes our use of co-production throughout the development of the conservation strategy.



To learn more about the Southern California Montane Forests Project, please visit: [www.climate-science-alliance.org/southern-forests](http://www.climate-science-alliance.org/southern-forests)

Figure 1. Schematic highlighting partner engagement and work flow for co-production of the Southern California Montane Forest Conservation Strategy

*Task 3.2. Complete a stakeholder driven climate-informed Conservation Strategy for Southern California Montane Forests. Will include consideration of adjacent regions, including northern Baja California and the southern Sierra Nevada.*

The conservation strategy was released in June 2024 in collaboration with SDSU IEMM, USGS, and Climate Science Alliance with a [press release](#), [a community webinar](#), and targeted outreach. Summaries of the strategy were shared to the project advisory group, the Regional Forest and Fire Capacity Program’s Southern Convening, and Forest Leadership Teams. Activities that contributed to furthering the development of the stakeholder-driven conservation strategy are detailed under tasks 3.3 and 3.4.

*Task 3.3. Workshops and outreach activities, including presentations.*

Major work towards the Conservation Strategy occurred through workshop-based development of case studies. SDSU IEMM led the development of a quantitative prioritization framework to provide landscape-level recommendations for treatment prioritization, and also developed a workshop format for incorporating Forest and partner input. To pilot the process, we worked through two initial workshops, with follow-up discussions, to reach a final spatial product for the San Bernardino National Forest in November 2023. The workshops followed a structured format beginning with an overview of the project goals and objectives as well as the specific workshop objectives. Attendees then participated in a series of activities, identifying place-based priorities for active management, and highlighting the vulnerabilities or priority assets they were concerned about. Next, participants joined facilitated breakout groups to discuss and consider vulnerabilities and priority assets. Workshop facilitators gathered this detailed input and summarized the ideas into 10-14 themes or categories. These two lists (vulnerabilities and priority assets) were then posted for attendees to choose their top three concerns for each list through a dot poll voting exercise (Figure 2). Post-meeting summaries were distributed along with the results of the dot poll voting with an opportunity to provide additional feedback. After the workshops, draft products were developed through engagements regarding appropriate and relevant data sets to represent the priority vulnerabilities and assets identified in the workshops. Subsequently, we also conducted workshop engagements for San Diego County, the San Gabriel Mountains, and montane lands in and around Los Padres National Forest to support development of similar prioritization products for the rest of the region. Workshop attendees were diverse and included Forest Service, CalFIRE, County Fire, non-profit partners, Resource Conservation Districts, Fire Safe Councils and concerned citizens.



Figure 2. Dot poll voting during partner engagement at the San Bernardino National Forest. March 2023.

We conducted a case study for project-level application of the Northern Institute for Applied Climate Science's (NIACS) Adaptation Workshop framework to forest health and restoration treatments, through a 2-day workshop led by NIACS on the Cleveland National Forest. In addition to the Adaptation Workbook case study, we developed and drafted a new adaptation menu guidance for Southern California. To support this effort, we convened a technical advisory workshop to develop themes for the regional adaptation menu, and also conducted interviews with subject matter experts to ensure the utility, accuracy, and completeness of the new adaptation menu. We requested and received permission for the use and alteration of the [Adaptation Strategies and Approaches for California Forest Ecosystems](#) from California Climate Hub (California Climate Hub, 2020), and for the use and reproduction of the new [Quick Guide for Natural Resource Managers](#) from NIACS (Janowiak et al., 2022). We also drew ideas from the Indigenous Climate Resilience Network's Tribal Climate Adaptation Menu (Tribal Adaptation Menu Team, 2019).

We completed a case study of the Bobcat Fire (2020) on the Angeles National Forest as an application of the [Postfire Restoration Framework for National Forests in California](#) (USFS PSW-GTR-270) to Southern California vegetation communities including montane conifer, bigcone Douglas fir, and chaparral ecosystems. The Bobcat Fire case study was conducted through field meetings with Forest staff, analysis, and coordinated field data collection by the USFS Ecology field crew. Reporting for the finalized case study was submitted to Forest staff in November 2023. Additional support was provided during the development of project-level NEPA, the next subsequent step towards implementation. The postfire assessment was used to identify key areas for reforestation and served as the foundation for completing environmental compliance, which is an essential step toward implementation.

To further outreach, we developed our alignment with the California Regional Forest and Fire Capacity Program's leadership and funding pipeline through mutual coordination and contributions with the block-grantees (San Diego Regional Conservation District, Inland Empire Regional Conservation District

and others). This included providing input to the CA Department of Conservation during the development of the Southern California Regional Resource Kit and Regional Profile. Southern Montane Forest project leaders served as presenters and field trip leaders for the first SoCal Regional Task Force meeting, held in Calabasas, CA (February 2, 2023) and the second Regional Task Force meeting, held in Escondido, CA (April 2024). We also offered presentations throughout the project, detailed in the **Outreach** section below.

*Task 3.4. A Climate-Informed Conservation Strategy for Southern California's Montane Forests Meaningful Engagement Strategy.*

This task encompasses the Challenge Cost-Share Agreement established between USFS and SDSU IEMM under the same title. SDSU IEMM collaborated with Climate Science Alliance to lead the project's Engagement Strategy team. The funding under the initial agreement was spent out in 2022. The collaboration continued without disruption through a different agreement directly between the SW CASC and SDSU IEMM. This task supported a wide range of activities under Tasks 3.1-3.3, with an emphasis on outreach and engagement, including Tribal engagement. SDSU IEMM also contributed significantly to each of the scientific products described below.

**Project Results, Analysis and Findings:**

The IAA produced several research outputs, including a Practitioner Questionnaire and the Adaptation Menu for Southern California Montane Forests. CASC funding also supported the development of an innovative regional prioritization approach in the Prioritization Framework, which has now been published in an academic journal. Each of these products was developed using co-production with the community of practice.

**Practitioner Questionnaire**

The first major product for this project was a questionnaire about challenges and barriers to planning and implementing projects to improve forest resilience. The questionnaire was peer-reviewed by a university-based CASC PI prior to distribution and approved by the San Diego State University Institutional Review Board (IRB). Federal employees did not participate in the development or implementation of the questionnaire.

A total of 63 respondents completed the practitioner questionnaire in fall 2021. The geographic distribution of respondents was roughly proportional to the amount of forested land within each region of our study area and the representation of respondents from different organizational types was correlated with area of land ownership or management responsibilities. For example, over 54% of respondents were from federal agencies, which collectively manage the majority of the forested land in the project area. Respondents included those involved in project development, planning, and implementation with backgrounds in fire, forestry, biology, and planning or policy.

In the questionnaire, we asked respondents to share their perspectives on the challenges and barriers for both planning and implementing forest management projects including fuels reduction, forest health (e.g., thinning), prescribed burning, and reforestation or restoration. Prescribed fire and understory

thinning were the activities that practitioners prioritized as those most needed to conserve the region's forests, but several common challenges emerged that were shared across geographies, organizational type, and project stage (planning versus implementation). Specifically, staffing and funding capacity issues, competing priorities, environmental restrictions and the length of the environmental review process, as well as limited options for dealing with biomass or forest products were the most commonly cited challenges. These challenges were used as the basis for a solutions-focused brainstorming session during a practitioner workshop in January 2022. We used the practitioner questionnaire as well as workshop formats to inform the development of scientific products and tactics within the conservation strategy. Full results are provided in the conservation strategy and in the Conference Proceedings from the Volcan Mountain Symposium (Jennings et al. 2023).

### **Adaptation Menu**

The [Adaptation Menu for Southern California Montane Forests](#) is a regionally-focused extension of the California Climate Hub's Adaptation Strategies and Approaches for California Forest Ecosystems (California Climate Hub, 2020). The menu also draws conceptually from an existing [Tribal Climate Adaptation Menu](#) and seeks to center ideas and language significant to Indigenous stewards (Tribal Adaptation Menu Team, 2019). The menu was developed through collaborative engagements with subject matter experts, Indigenous stewards, and project advisors. It guides managers through options for a wide range of management situations and links them to adaptation strategies (Figure 3). The adaptation menu is novel in the degree to which it specifies on-the-ground tactics and operational details that are crucial for addressing manager needs. Much of the text is designed and intended to be used verbatim by project managers in their required environmental planning documents. IEMM developed and hosts an interactive online format for the Adaptation Menu (linked above) which enables managers to find needed information quickly and efficiently. The interactive viewer allows managers to search by strategy, as well as by management tactics (e.g. biodiversity, carbon storage, forest health, hydrology & soils, monitoring, partnership, pests & invasive species, wildfire risk) or by project activity (biomass utilization, community preparedness, forest thinning, grazing, outreach, prescribed fire, reforestation).



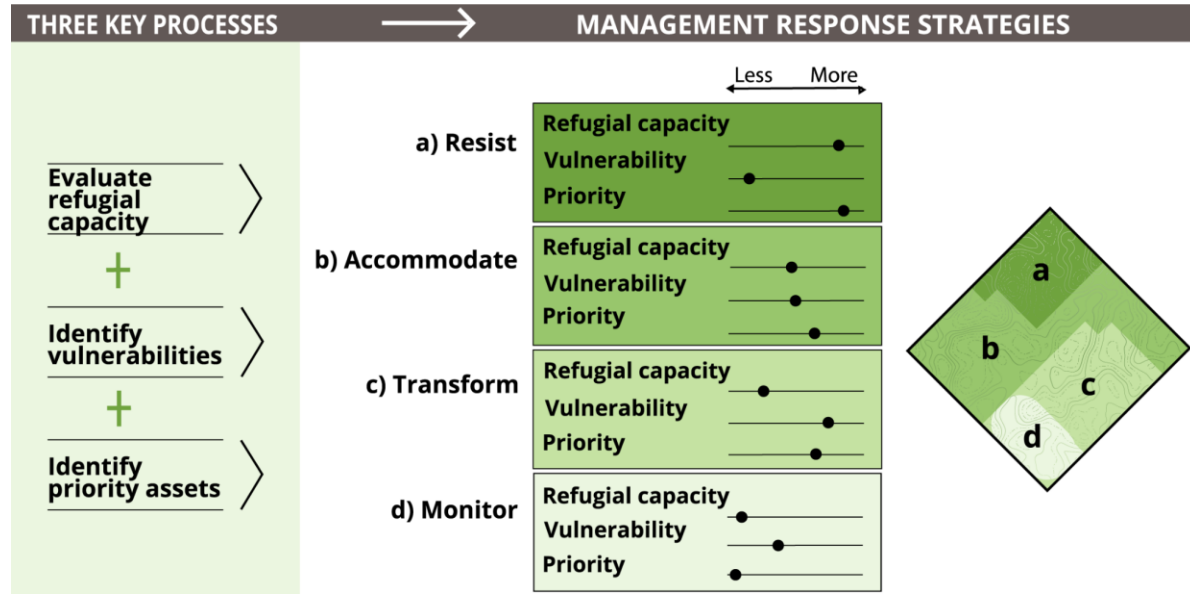
Figure 3. Response strategies from the Adaptation Menu. This schematic highlights the relationship between response and adaptation strategies.

### Prioritization Framework

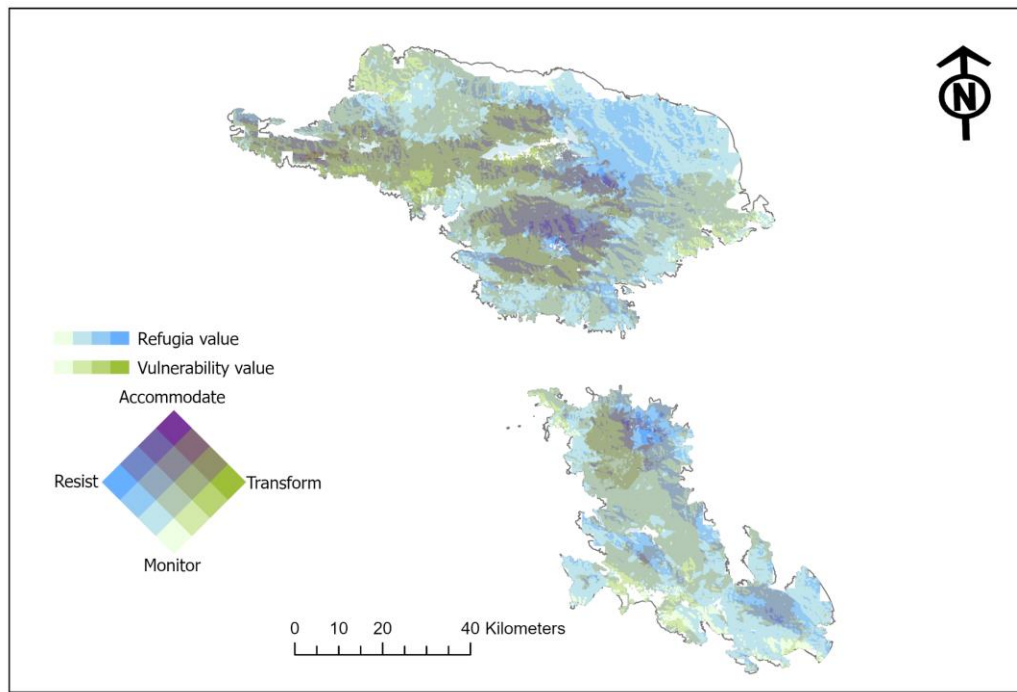
The Southern Montane Forests Prioritization Framework is an innovative customized decision framework that supports landscape-wide project prioritization based on key mappable factors. The framework has three layers of input, utilizing data layers that represent exposure to threats, priority assets, and vulnerabilities (Figure 4). The exposure layer is a newly-developed data product covering the full extent of montane forest across Southern California, representing intractable factors that managers do not have much ability to change. This layer represents refugia from climate, wildfire and human pressures and indicates areas on the landscape where forested habitats are most likely to be retained into the future. We developed the data product after conducting a technical advisory meeting with CASC-funded researchers using a similar approach in other ecosystems (Claudia Mengelt, Toni Lyn Morelli, and Tina Mozelewski). The data for priority assets (values specific to the focal area) and vulnerabilities (factors that can be managed) are identified by manager input via an interactive workshop format. Priority assets and vulnerabilities are evaluated at subregional scale, for example by county. Three key processes are quantified in the prioritization framework to produce a composite index-based score representing exposure, vulnerability, and priority across the entire landscape (Figure 4). The prioritization process is fully described in a soon to be released journal article in *Conservation Science and Practice* (Jennings et al., *in press*).

Figure 4. A. Three key processes (refugial capacity, vulnerabilities and priority assets) are mapped and linked to management response strategies to help managers with decision making and phasing of project implementation schedules. B. Example mapping output from the San Bernardino National Forest that shows the combined mapping of refugial capacity and vulnerability data. Figures from Jennings et al., *in press*.

A.



B.



## **Conclusions and Recommendations:**

The Southern Montane Forest Project was founded to address the complex issues related to forest management, changing fire regimes, and intensifying stressors in Southern California through sustained practice of co-production, partner engagement, and science communication. The forests of Southern California have been understudied and under-resourced, and this project enabled the region to establish its place at the forefront of managers tackling the compounding threats of drought, disease, and fire. In many respects, conditions in the forests of Southern California run ten to fifteen years ahead of the Sierra Nevada and the rest of California, and much of what is learned here will soon be relevant to the larger forests to the north.

In the course of the project, project leaders worked with a group of regional thought leaders to identify needs for both additional science development and overcoming barriers to partnership with critical audiences. The leader group continues to work toward addressing these issues through partnership and grant writing.

The following focal areas were identified for future science development:

- Improved raster datasets representing sensitive species
- Improved structural data for forests and fuels
- Introducing the Environmental Evaluation Modeling System (EEMS) into the existing workflow for the prioritization framework would greatly improve model communication with data hosting in Data Basin (Conservation Biology Institute)

To overcome existing barriers to partnership, the next steps for the Southern California Montane Project will include community convenings with professional facilitation to outreach the importance of the region's sky islands and overcome barriers to their management. We are also involved in the development of integrated and coordinated monitoring plans to evaluate progress according to the metrics identified in the Prioritization Framework.

## Products and Outreach:

The products for this effort included a website, a printable 1-page summary, an interactive Adaptation Menu, and an outreach video, in addition to the Conservation Strategy document. The project also produced a published journal article and the questionnaire results were included in a conference proceedings.

Outreach and engagement have been integral throughout this project, and were detailed in project annual reports. The outreach included 5 public meetings/listening sessions, 6 invited presentations, 8 workshops, project representation at 11 large events/conferences, 4 dedicated Tribal meetings/workshops and monthly updates to CSA's Tribal Working Group, and 6 project leader group meetings. A full list of workshops and outreach activities is compiled below, including project webinars, workshops, presentations, and other forms of outreach.

### Products:

**Website:** <https://www.climatesciencealliance.org/southern-forests>

**Project Summary:** <https://drive.google.com/file/d/1Ep8WexxJBkKJSSkXPVGXlzaNsJUzt40m/view>

**Video:** <https://www.youtube.com/watch?v=Abay0o5h-8c&t=2s>

**Conservation Strategy:** <https://doi.org/10.5281/zenodo.13129913>

**Adaptation Menu:** [tinyurl.com/SoCalForestAdaptationMenu](https://tinyurl.com/SoCalForestAdaptationMenu)

### Publications:

Hennessy, S., Jennings, M., Molinari, N., Magee, C., Pairis, A., & Safford, H. 2024. Climate-Adapted Conservation Strategy for Southern California Montane Forests. Zenodo.  
<https://doi.org/10.5281/zenodo.13129913>

Jennings, M.K., Hennessy, S., Enquist, C.A.F, and Molinari, N. In press. A climate-adapted refugia framework for enhancing ecosystem resilience: Actionable science for forest management in southern California. *Conservation Science and Practice*.

Jennings, M.K. Hennessy, S., Enquist, C., Molinari, N., Pairis, A., Safford, H., 2023. Building a collaborative, climate-informed strategy to conserve southern California's montane forests. In *Proceedings of the Volcan Mountain Symposium: Importance and Conservation Status of the Eastern Peninsular Ranges*. April 2023. Julian, California: Volcan Mountain Foundation.  
<https://www.volcanmt.org/2023VolcanSymposiumProceedings>

### Press articles:

- Will Southern California embrace logging of its 'sky island' forests?. *Union Tribune San Diego*. January 22, 2023.

- [San Diego group unveils conservation strategy for high-elevation forests.](#) *Times of San Diego.* July 30, 2024.
- [New conservation strategy aims to save SoCal’s vanishing forests.](#) *Fox 5/KUSI, San Diego.* August 1, 2024.
- [New conservation strategy released to protect montane forests in Southern California.](#) *Valley News.* August 11, 2024.

**Outreach:**

**Town Hall introductory sessions (hosted by USFS LA Urban Center):**

April 21 and 28, 2021

**Tribal Listening Session** July 27, 2021

**Project Leader Group meetings:**

May 11, 2021  
 November 16, 2021  
 September 27, 2022  
 November 30, 2022  
 April 18, 2023  
 March 19, 2024

**Community Webinars:**

March 7, 2022  
 March 10, 2022  
 March 16, 2022

**Technical Group meeting:** January 17, 2023

**Workshops:**

Practitioner Workshop (Virtual)	Jan 26, 2022
Prioritization Workshop for San Bernardino NF staff (San Bernardino)	March 24, 2023
Prioritization Workshop for Headwater Resiliency Partnership (Redlands)	April 27, 2023
Southern California Wildfire Crisis Strategy Data and Planning Workshop (Arcadia)	July 26, 2023
Adaptation Menu Workshop for Climate Science Alliance Tribal Working Group (Virtual)	Sept 6, 2023
Adaptation Menu Tribal Workshop at EPA (Viejas)	Oct 24, 2023
Prioritization Workshop for San Diego County (Santa Ysabel)	Nov 6, 2023
USFS Wildfire Crisis Strategy workshop (San Bernardino)	Feb 13, 2024
Angeles Prioritization Workshop (Arcadia)	Nov 19, 2024
Los Padres Prioritization Workshop (Goleta)	March 11, 2025

**Final project webinar:** January 9, 2025

**Presentations:**

Jennings, M. and S. Hennessy. 2025. The Southern California Montane Forest Strategy: Building resilience and adaptation into forest management. San Diego Monitoring and Management Program Monthly Coordination Meeting. San Diego, CA.

Molinari, N.A. 2025. Opportunities for southern California to reduce wildfire risk. Wildfire Resilience Funders Convening, Santa Barbara, CA.

Molinari, N.A. 2025. Cornerstones of the Wildfire Crisis Strategy in southern California. Santa Barbara Fire Safe Council. (Virtual).

Hennessy, S.M., Jennings, M., Molinari, N., Heys, J., and C. Enquist. 2024. The Southern Montane Forest Project: Focus on Reforestation. California Landscape Conservation and Adaptation Partnership. (Virtual).

Jennings, M.K., Hennessy, S.M., Enquist, C.A.F., and Molinari, N. 2024. A climate-informed strategy for enhancing forest resilience in southern California: From collaborative development to implementation. North American Congress for Conservation Biology. Vancouver, B.C., Canada.

Hennessy, S.M., Jennings, M., Molinari, N., Heys, J., and C. Enquist. 2024. The Southern Montane Forest Project: Building climate adaptation into the management of montane forests across Southern California. Santa Ana River Science and Conservation Symposium. Redlands, CA.

Jennings, M.K., Hennessy, S.M., Enquist, C.A.F., and Molinari, N. 2024. Southern California Climate-Adapted Montane Forest Strategy and Partnership: the foundation for an emergent Innovation Landscape. Southwest Innovation Landscape Network Kickoff Workshop.

Williams, J.W. and S.M. Hennessy. 2024. Natural Range of Variation (NRV) in the montane conifer forests of southern California – what historical conditions can tell us about managing forests in the era of fire suppression and climate change. CALFIRE Forest Health Research Program Grantee Webinar. (Virtual).

Jennings, M. 2024. Unique Landscapes and Challenges. California Task Force Regional Meeting. Escondido, CA.

Hennessy, S.M., Jennings, M., Molinari, N., Heys, J., and C. Enquist. 2024. The Southern Montane Forest Project: A Climate-Informed Conservation Strategy. Headwaters Resiliency Partnership Executive Meeting. (Virtual).

Hennessy, S.M., Jennings, M., Molinari, N., Heys, J., and C. Enquist. 2023. The Southern Montane Forest Project: A Climate-Informed Conservation Strategy. RFFC Southern Convening. Riverside, CA.

Jennings, M., Hennessy, S.M., Molinari, N., Heys, J., and C. Enquist. 25 October 2023. The Southern Montane Forest Project: A Climate-Informed Conservation Strategy. Kumeyaay Diegueño Land Conservancy.

Jennings, M.K. Hennessy, S., Enquist, C., Molinari, N., Pairis, A., Safford, H., 14 April 2023. Building a collaborative, climate-informed strategy to conserve southern California's montane forests. In Proceedings of the Volcan Mountain Symposium: Importance and Conservation Status of the Eastern Peninsular Ranges. April 2023. Julian, California: Volcan Mountain Foundation.

Jennings, M.K., Hennessy, S., Molinari, N. 2023. The Southern California Montane Forests Project: A Climate-Informed Conservation Strategy. Sierra to California All Lands Enhancement Project Annual Meeting, Sacramento, CA.

C. Enquist. 2023. The Southern Montane Forest Project: A Climate-Informed Conservation Strategy. Southern Convening. USFS R5 Climate Change Integration Team webinar (Virtual).

Molinari, N.A., Jennings, M.K., Hennessy, S., Enquist, C. and J. Heys. 2023. Southern California montane forest conservation strategy: Developing a prioritization framework for action. Association of Fire Ecology. Monterey, CA. (Poster)

Hennessy, S., and M.K. Jennings. 28 September 2022. The Southern California Montane Forests Project: A Climate-Informed Conservation Strategy. FFERAL Lecture Series with the California Fire Science Consortium. (Virtual).

Jennings, M. 2022. Applying a Multi-stressor Refugia Framework for Decision Support to Conserve Southern California's Montane Forests. North American Congress for Conservation Biology, Reno, NV.

Jennings, M., Hennessy, S.M., Molinari, N., Heys, J., and C. Enquist. 2022. The Southern Montane Forest Project: A Climate-Informed Conservation Strategy. Regional Forest and Fire Capacity Program, Southern Convening. (Virtual).

Jennings, M., Hennessy, S.M., Molinari, N., Heys, J., and C. Enquist. 2022. The Southern Montane Forest Project: A Climate-Informed Conservation Strategy. USGS Climate Adaptation Science Center (Virtual).

Safford, H., Hennessy, S., Enquist, C., Heys, J. Jennings, M. and A. Pairis. 2022. Interaction of wildfire and warming climate threatens the persistence of montane sky island forests across southern California. International Association of Wildland Fire, Pasadena, CA.

**Meeting Participation:**

Southwest Adaptation Forum, April 6-8, 2021

Southwest Adaptation Forum (with SW CASC, Albuquerque), October 10-13, 2022

Southern California Regional Forest and Fire Capacity Program Meeting (Irvine), 10/21/22

CA Wildfire and Forest Resilience Task Force Southern California Meeting (Calabasas), 2/2/2023

Participation in La Jolla Band of Luiseño Indians Forest Gathering (La Jolla Reservation), 9/17/23

International Fire Ecology and Management Congress (Monterey), December 4-7, 2023

CA Wildfire and Forest Resilience Task Force Southern California Meeting (Escondido), April 4-5, 2024

Southern CA Wildfire Resilience Convening (Redlands), 11/13/24

## References:

Bohlman, Gabrielle N.; Safford, Hugh D.; Skinner, Carl N. 2021. Natural range of variation for yellow pine and mixed-conifer forests in northwestern California and southwestern Oregon. Gen. Tech. Rep. PSW-GTR-273. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 146 p.

Janowiak, M.; Shannon, D.; Schmitt, K.; Baroli, M.; Brandt, L.; Handler, S.; Butler-Leopold, P.; Ontl, T.; Peterson, C.; Rutledge, A.; Swanston, C. 2022. A quick guide to adaptation planning for natural resources professionals. NRS-INF-41-22. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 14 p. <https://doi.org/10.2737/NRS-INF-41-22>

Meyer, M.D.; Long, J.W.; Safford, H.D., eds. 2021. Postfire restoration framework for national forests in California. Gen. Tech. Rep. PSW-GTR-270. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 204 p.

Safford, H., and J. T. Stevens. (2017). Natural range of variation for yellow pine and mixed-conifer forests in the Sierra Nevada, southern Cascades, and Modoc and Inyo National Forests, California, USA. Gen. Tech. Rep. PSW GTR-256, U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA.

Swanston, C.W.; Brandt, L.A.; Butler-Leopold, P.R.; Hall, K.R.; Handler, S.D.; Janowiak, M.K.; Merriam, K.; Meyer, M.; Molinari, N.; Schmitt, K.M.; Shannon, P.D.; Smith, J.B.; Wuenschel, A.; Ostoja, S.M. (2020). Adaptation Strategies and Approaches for California Forest Ecosystems. USDA California Climate Hub Technical Report CACH-2020-1. Davis, CA: U.S. Department of Agriculture, Climate Hubs. 65 p.

Tribal Adaptation Menu Team. 2019. Dibaginjigaadeg Anishinaabe Ezhitwaad: A Tribal Climate Adaptation Menu. Great Lakes Indian Fish and Wildlife Commission, Odanah, Wisconsin. 54 p.