A CHANGING CLIMATE VULNERABILITY IN CALIFORNIA'S EASTERN SIERRA

# **Executive Summary**



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## A CHANGING CLIMATE | VULNERABILITY IN CALIFORNIA'S EASTERN SIERRA

Eastern Sierra Sustainable Recreation and Tourism Initiative

Prepared for:

Prepared by:

Town of Mammoth Lakes on behalf of The Eastern Sierra Sustainable Recreation Partnership and for the delivery of The Sustainable Recreation and Tourism Initiative

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## ACKNOWLEDGEMENTS

## FUNDING

Funding for this project has been provided by the Sierra Nevada Conservancy, an agency of the State of California, under the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018



## **PROJECT TEAM**

**PlaceWorks** is one of the West's preeminent planning, design, and environmental consulting firms, serving both public- and private-sector clients in the fields of climate

action and resiliency, comprehensive planning, environmental review, urban design, landscape architecture, community outreach, and GIS. For more information about PlaceWorks, visit www.placeworks.com. PlaceWorks led the consultant team, preparation of the Climate Change Vulnerability Assessment, development of climate adaptation and resilience projects, and report preparation.

#### **Project Team Members**

Tammy L. Seale, Climate Action & Resiliency Principal Eli Krispi, Climate Action & Resiliency Senior Associate Jacqueline Protsman, Climate Action & Resiliency Associate Rob Mazur, GIS Manager Erin Guy, GIS Analyst & Project Planner Gina Froelich, Technical Editor Amanda Lukondi, Word Processor

ICF Incorporated, LLC, a global consulting services company, is internationally recognized for expertise and leadership in economic impact analysis, benefit-cost analysis, and climate resilience planning. For more information about ICF, visit www.icf.com. The ICF project team led the Natural Capital Assessment and the Ecosystem Service Impacts components of the report.

#### **Project Team Members**

Jonathan Hecht, PhD, Director of Economics David Ryder, Economics Consultant Clair Munaretto, Senior Economics Analyst Grady Renfrow, Economics Analyst



EASTERN SIERRA





**Atlas Planning Solutions** is a small, woman-owned, disabled veteran business enterprise that specializes in hazard mitigation, emergency management, and climate resilience for jurisdictions throughout California. For more information about Atlas Planning Solutions, visit <u>www.atlasplanning.org</u>. Atlas Planning Solutions supported the development of the Climate Change Vulnerability Assessment and development of climate adaptation and resilience projects.



#### **Project Team Members**

Aaron Pfannenstiel, Principal

The **Mammoth Lakes Trails and Public Access Foundation**, MLTPA, is a 501(c) 3 non-profit organization incorporated in 2007 as a public benefit corporation in the State of California. MLTPA has been engaged with local and regional issues of sustainable recreation and collaboration in California's Eastern Sierra since its inception and provides technical

support to a regional public/public recreation-based solution, the Eastern Sierra Sustainable Recreation Partnership.

For this effort, MLTPA provided a variety of services, including grant and project management, meeting content development, research, meeting convening, public and participant communications, and document production. Visit <u>mltpa.org</u> for more information on our work.

## THE EASTERN SIERRA SUSTAINABLE RECREATION PARTNERSHIP

The Eastern Sierra Sustainable Recreation Partnership (ESSRP) is a unique public/public partnership among local Eastern Sierra governments, state agencies, and federal agencies.

In July of 2018, a Non-Funded Challenge Cost-Share Agreement was signed between Mono County; the Town of Mammoth Lakes, California; and the U.S. Department of Agriculture Forest Service Pacific Southwest Region, Inyo National Forest and Intermountain Region, and Humboldt-Toiyabe National Forest memorializing the Eastern Sierra Sustainable Recreation Partnership (ESSRP).

Subsequently, Alpine County voted to join the ESSRP on August 20, 2019, the City of Bishop voted to join on September 9, 2019, and Inyo County voted to join on October 8, 2019. Additionally, the Bureau of Land Management, California Department of Transportation (Caltrans), and the National Park Service have all formally indicated their desire to join the ESSRP.

For more information, please visit: <u>https://mltpa.org/essrp/sustainable-recreation-and-tourism-project</u>.





## THE SUSTAINABLE RECREATION AND TOURISM INITIATIVE

In spring 2019, the Sierra Nevada Conservancy's Governing Board demonstrated a pioneering commitment to rural California's outdoor recreation economy and natural resources by authorizing Proposition 68 funding for the "Sustainable Recreation and Tourism Initiative," a project to benefit the conservancy's eastern subregion, including Inyo, Mono, and Alpine counties.

The initiative supports the ESSRP in its goals to "... design, plan, implement, and report out projects to improve and maintain recreational opportunities as well as restore ecosystems to their natural resiliency and functions." The initiative is composed of four tracks, or areas of focus, with specific deliverables: Regional Recreation Stakeholder Engagement; Climate Adaptation & Resilience Assessment; Connection to the Eastern Sierra Visitor Audience; and Project Development & Prioritization for Funding.

## LAND ACKNOWLEDGEMENT

Public lands in the United States hold the creation stories, burial grounds, and ceremonies of indigenous people who were killed or forcibly removed from their ancestral homes during territorial acquisition.

Many tribes, composed of different bands, continue to live in the Eastern Sierra region, caring for their native lands as they coexist with the ongoing impacts of colonization. Past or present tribes and bands associated with the region that this effort is aware of include, but are not limited to, the Miwok, Mono Lake Kutzadika'a, Mono/Monache, Nüümü (Paiute), Newe (Shoshone), Timbi-Sha, Utu Utu Gwaitu Paiute, and Washoe.

Two Nüümü terms describe the region and provide important context to ideas offered in this document. The first is Pamidu Toiyabe (Western Mountains), and the other, more widely known place name is Payahuunadü (The Place Where Water Flows).

This acknowledgement is an invitation to all organizations, residents, and visitors to recognize the way this history has shaped the present as all parties work together in anticipation of a better future.

## **EXECUTIVE SUMMARY**

#### Introduction

The Eastern Sierra is a high-desert landscape in California that shares a common border with the state of Nevada. Composed of three California counties (Alpine, Mono, and Inyo), the region is defined by the Sierra Nevada range, the western terminus of the Northern Basin and Range.

More than 90 percent of the region's 17,148 square miles is managed by federal government agencies, including the U.S. Forest Service, the National Park Service, and the Bureau of Land Management. The principal owner of the region's private property, the Los Angeles Department of Water and Power, acquired more than 450 square miles of farm and ranchland in the early years of the 20th century to secure water rights for the Los Angeles region. The remaining private property and gateway communities are dispersed across the region, home to a permanent population of about 35,000 residents.

Unparalleled opportunities for outdoor recreation have compelled visitation to the region for many generations. The Eastern Sierra hosts both the highest peak and lowest valley in the 48 contiguous United States, as well as the oldest living thing on Earth, the Great Basin bristlecone pine (*Pinus longaeva*). Annual visitor estimates range between 4 and 7 million, principally from Southern California, but from across the country and globe as well. Visitation drives the region's recreation-based tourism economy and represents the primary challenge as well as the essential opportunity for achieving regional economic, social, and environmental sustainability.

#### **Key Terms**

**Resiliency:** The ability of a community to withstand, recover from, and learn from past climate disasters to strengthen future response and recovery efforts.

**Adaptation:** The process of making changes in response to current or future environmental conditions, usually to reduce harm and take advantage of new opportunities.

**Vulnerability:** The degree to which natural, built, and human systems are susceptible to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt.

**Ecosystem Services:** The benefits that humans receive from ecosystems. These services are broadly disaggregated into provisioning, regulating, supporting, and cultural services.

**Benefit Transfer:** Estimating the value of ecosystem services from existing studies and applying them to a new context. It is broadly broken into benefit function transfer and benefit value transfer.

**Sustainable Recreation:** The set of recreation settings and opportunities in the National Forest System that is ecologically, economically, and socially sustainable for present and future generations.

Sources: California Governor's Office of Emergency Services, 2020, *California Adaptation Planning Guide*, <u>https://www.caloes.ca.gov/climate</u>; ICF, 2021, "Sustainable Recreation and Tourism Initiative: Baseline Natural Capital Assessment"; Forest Service Handbook (fsh) 1909.12

The Eastern Sierra region is largely dependent on natural ecosystems and essential resources to sustain the recreation and tourism economy. Climate change poses a threat by potentially increasing the frequency and intensity of natural hazards, which in turn may threaten or destroy critical ecosystem services needed for local communities and visitors. Natural hazards associated with climate change may also adversely affect or degrade the unique landscape in the Eastern Sierra that provides for the recreation-based economy that local communities depend on. To proactively manage for these potential risks posed by climate change, this report, Vulnerability in California's Eastern Sierra, summarizes the results of the Sustainable Recreation and Tourism Initiative's (SRTI's) "Climate Adaptation and Resilience Assessment," which includes an Adaptation & Resilience Assessment and a Natural Capital Assessment. Based on these efforts, the report provides Recommended Actions for the Eastern Sierra's adaptation to climate change. The purpose of this report is to provide an understanding of the economic value supplied by the ecosystem services in the SRTI Study Area (Study Area), shown in Figure ES-1, analyze how climate change may threaten the people, assets, and economic benefits of ecosystem services in the region, and specifically focus on how the effects of climate change may directly or indirectly affect outdoor recreation, tourism, and economic stability.



#### Figure ES-1. Sustainable Recreation and Tourism Initiative Study Area

Vulnerability in California's Eastern Sierra presents the results of two technical analyses: a Climate Change Vulnerability Assessment and a Natural Capital Assessment. The Climate Change Vulnerability Assessment looks at the severity and likelihood of how climatic changes to air quality, increased drought, flooding, wildfires, severe weather, etc. may affect specific populations and recreational activities that contribute to the Study Area's recreational economy. The Climate Change Vulnerability Assessment also analyzes the direct effects to infrastructure and other assets that support these activities. The resulting Vulnerability Assessment Matrix, shown in **Figure ES-2,** assigns a vulnerability score for each population and asset according to each climate change hazard analyzed. For example, outdoor workers in the Study Area have the highest vulnerability rating (or are most vulnerable) to climatic effects of increased smoke and ash from wildfires.

Populations and Assets	Air Quality, Smoke, Ash	Drought	Extreme Heat and Warm Nights	Flooding	Forestry Pests and Diseases
Populations					
Hospitality workers	V5	V4	V3	V3	-
Indoor tourism workers	<b>V</b> 4	V3	-	V3	-
Outdoor workers	V5	V3	V4	V3	V4
Persons in tribal communities	V5	V4	V4	V4	V4
Retail workers	V4	V3	V3	V3	-
Seasonal residents	V3	V2	V3	V2	V3
Seasonal residents who live on single access roads	٧3	-	-	V5	V4
Short-term visitors	V3	<b>V</b> 4	V2	V3	V2
Travel industry workers	V5	V3	V3	V2	-
Infrastructure					
Airports - charter/recreation/general aviation	-	-	-	V2	-
Airports - commercial service	-	-	-	-	-
Bicycle trails (California State Parks)	-	V2	-	V2	V2
Bicycle trails (City and County)	-	V2	-	V3	V3
Bicycle trails (Death Valley National Park)	-	-	-	V2	-

#### Figure ES-2. Example of the Vulnerability Assessment Matrix

The Natural Capital Assessment takes an economic approach by using benefit transfer methods<sup>\*</sup> to assign annual monetary values to various types of ecosystem services, as shown in **Figure ES-3**. This includes analyzing each ecosystem's climate regulation benefit through carbon sequestration and storage, erosion prevention, and increased water quality and flow regulation. Habitat enhancements and cultural value are also analyzed. This approach estimates the natural capital

<sup>\*</sup>Benefit transfer is an approach that involves using estimates of the value of ecosystem services from existing studies and applying them to a new context.

currently available to the region that may be jeopardized by the impacts of climate change.





## **Federal and State Policy Alignments**

The *Vulnerability in California's Eastern Sierra* report provides valuable social and economic analysis that will assist the region's evaluation of programs and projects for funding in alignment with the following federal and state policy goals for sustainable recreation and a resilient future.

#### Great American Outdoors Act

The Great American Outdoors Act<sup>\*</sup> was signed into law on August 4, 2020, with the goal to provide permanent funding of the Land and Water Conservation Fund at \$900 million per year and to provide up to \$1.9 billion per year for five years for needed maintenance for critical facilities in national parks, forests, wildlife refuges, recreation areas, and tribal lands across the United States. National forests and national parks in the Study Area host millions of visitors per year, creating significant infrastructure maintenance needs for roads, trails, restrooms, water treatment systems, and visitor facilities. Many of these buildings and infrastructure are aging and were built for fewer visitors; therefore, they do not currently meet the needs of the region.

The influx of funding to the Land and Water Conservation Fund through the Great American Outdoors Act will enable a backlog of maintenance and upgrade projects to be completed, ensuring sustainable recreation can be achieved in the Study Area. Several of the short-term and long-term projects proposed in the Climate Adaptation and Resilience Assessment can be funded through the Land and Water Conservation Fund.

#### Agreement for Shared Stewardship of California's Forests and Rangelands

Executed on August 12, 2020, the Agreement for Shared Stewardship of California's Forests and Rangelands<sup>+</sup> is a shared long-term strategy between the State of California and the U.S. Forest Service, Pacific Southwest Region, to reduce wildfire risks, restore watersheds, protect habitat and

<sup>\*</sup> https://www.congress.gov/bill/116th-congress/senate-bill/3422/text.

<sup>&</sup>lt;sup>†</sup> https://www.gov.ca.gov/wp-content/uploads/2020/08/8.12.20-CA-Shared-Stewardship-MOU.pdf.

biological diversity, and help meet California's climate objectives. This agreement includes a commitment by the U.S. Forest Service to match California's goal of reducing wildfire risks on 500,000 acres of forest land per year to protect public safety and ecology.

Many of the forest management activities included in this agreement will be funded by the Land and Water Conservation Fund that has been revitalized through the Great American Outdoors Act. The *Vulnerability in California's Eastern Sierra* report is consistent with this agreement and provides short- and long-term project-based solutions to sustainably manage forest land in the Eastern Sierra region to reduce the effect from wildfire and increase the resiliency for forest ecosystems.

#### Nature-Based Solutions

In October 2020, California Governor Newsom signed Executive Order N-82-20\*, enlisting the network of natural and working lands, including forests, rangelands, farms, wetlands, coasts, deserts, and urban green spaces to help reduce greenhouse gas emissions and contribute to achieving carbon neutrality and building climate resilience. This Executive Order established a State goal of conserving 30 percent of California's lands and coastal waters by 2030, launched the California Biodiversity Collaborative, and elevated the role of natural and working lands in the California climate change strategy. The Nature-Based Solutions strategy includes accelerating and expanding climate smart land management across California, increasing carbon removal and sequestration, better protecting communities and ecosystems from climate-driven threats, and catalyzing partnerships and leveraging resources.

The Vulnerability in California's Eastern Sierra report is focused on ecosystem services provided by natural lands that support sustainable outdoor recreation in the Eastern Sierra region. Recommendations in the report provide project-based solutions to protect ecosystem services and increase the resiliency of the regional outdoor recreation economy.

#### **Advancing California Policy Goals**

Recommended actions of this report are consistent with the objectives of CALREC Vision, which identifies using cross-jurisdictional collaboration to align California policy goals with federal land management practices, including:

- Assembly Bill 32 Climate Change Scoping Plan
- Access for All Initiative
- Agreement for Shared Stewardship of California's Forest and Rangelands
- California 2030: Natural and Working Lands Climate Change Implementation Plan
- Cutting Green Tape Initiative
- Destination Stewardship and Sustainable Travel Plan
- Health in All Policies
- Integrated Climate Adaptation and Resiliency Program
- Local Government General Plan Guidance
- Regions Rise Together
- Statewide Comprehensive Outdoor Recreation Plan Program

visit www.calrecvision.org

<sup>\*</sup> https://www.gov.ca.gov/wp-content/uploads/2020/10/10.07.2020-EO-N-82-20-.pdf.

## **Report Preparation**

The SRTI Project Team completed the Climate Adaptation and Resilience Assessment through a three-step process, including a **Baseline Natural Capital Assessment** (phase one of the Natural Capital Assessment), a **Climate Change Vulnerability Assessment**, and a **Climate Change Natural Capital Assessment** (phase two of the Natural Capital Assessment), with each step building from the results of the previous step.

- 1. **Baseline Natural Capital Assessment.** As a starting point, the Project Team identified the environmental baseline, characterizing the current provision of ecosystem services within the Study Area as part of the Baseline Natural Capital Assessment. The Baseline Natural Capital Assessment is designed to provide a detailed understanding of the economic benefits of ecosystem services. This economic value arises from the services that ecosystems provide, including such services as carbon sequestration and storage, water quality, and erosion prevention. To estimate the economic value of the natural capital within the Study Area, the Project Team conducted an analysis at the individual ecosystem service level, estimating the total annual economic value of ecosystem services provided by lands within the boundaries of the Study Area to range from approximately \$43.6 billion to \$190.9 billion, with an average annual value of \$95.4 billion.
- 2. **Climate Change Vulnerability Assessment.** The Project Team conducted a Climate Change Vulnerability Assessment using the recommended process in the *California Adaptation Planning Guide* and relying on key regional sources, such as the U.S. Forest Service's *Climate Change Vulnerability and Adaptation for Infrastructure and Recreation in the Sierra Nevada* and *Climate Change Vulnerability and Adaptation in the Intermountain Region* and EcoAdapt's *Southern California and Sierra Nevada Climate Adaptation Projects.* The Climate Change Vulnerability Assessment identifies populations and assets related to the recreation and tourism economy, identifies exposure of these populations and assets to climate change hazards, assesses impacts and adaptive capacity, and prioritizes vulnerability.
- 3. **Climate Change Natural Capital Assessment.** Following the Climate Change Vulnerability Assessment, the Project Team conducted a Climate Change Natural Capital Assessment to provide an understanding of the economic value of ecosystem services at risk from climate change. This analysis monetizes the impacts of climate change on ecosystem services where data and methods are available. The Project Team found that billions of dollars of ecosystem services are at risk from the impacts of climate change, particularly impacts from drought, heat waves, and wildfires.

## **Key Findings**

The Climate Change Vulnerability Assessment and Natural Capital Assessment resulted in several key findings for the Study Area. This includes findings that directly impact communities outside of the Study Area, such as the Southern California communities that receive water resources from the Study Area. These important findings include:

- Ecosystem services provide an average of \$95 billion per year in services to the Eastern Sierra region, with the highest valued service being carbon storage and water quality.
- Poor air quality, drought, extreme heat, and wildfire are projected to reduce the value ecosystem services by an average of \$270 million (per year). Other hazards are also projected to have significant impacts.
- Wildfire creates the most vulnerabilities for all populations, recreation activities, and other community assets compared to other hazards in the region.
- Energy and water systems are the most vulnerable infrastructure to climate change hazards.
- Tribal communities and other frontline groups\* face substantial health risk from climate change hazards.
- Homes, campgrounds, lodging, ranger stations, administrative centers, and other buildings are at risk of damage from climate change hazards.
- More precipitation is likely to fall as rain instead of snow, reducing the winter recreation season and associated economic activities.
- Water-based recreation activities are likely to decrease due in large part to increases in drought and extreme heat conditions.
- Summer recreation activities in all jurisdictions will likely be disrupted by climate change hazards.
- Changing temperature and precipitation patterns will likely cause widespread harm to forests, wetland, and aquatic habitats.
- Recreation and tourism industry workers are likely to face economic harm when recreation activities are disrupted.

<sup>\*</sup> Based on the *Defining Vulnerable Communities in the Context of Climate* Change report developed by the ICARP Technical Advisory Council, frontline communities experience heightened risk and increased sensitivity to climate change and have less capacity and fewer resources to cope with, adapt to, or recover from climate impacts.

## **Recommended Actions**

The Climate Change Vulnerability Assessment and Climate Change Natural Capital Assessment provide valuable information on which populations and infrastructure in the Eastern Sierra region are most at risk from climate change. The ecosystem services analysis provides information on which ecosystems provide the most natural capital as sources of protection from the effects of climate change on these vulnerable communities and infrastructure. This report provides a framework to make decisions on which programs and projects to invest in for the greatest resiliency of this unique region, specifically through the lens of a sustainable recreation economy, and through a list of recommended actions for implementation. These recommended actions are provided in an "umbrella" format, each including multiple smaller projects and tasks that incorporate other objectives from the SRTI.

#### • SRTI Climate: Funding Ready Projects

 Projects that have climate resiliency/sustainability co-benefits and that have been identified by the SRTI "Recreation Stakeholders;" hazard-reduction projects; or projects proposed by the U.S. Forest Service, National Park Service, and other regional partners that are ready to fund plan preparation, permitting, or construction.

#### • SRTI Climate: Regional Asset Inventory

 An Asset Inventory of all buildings and infrastructure and related assets for all jurisdictions located within the Study Area, including Global Positioning System (GPS)/geographic information system (GIS) spatial data and location information for mapping purposes along with key attribute information regarding the individual assets.

#### • SRTI Climate: Gap Assessment

• A Gap Assessment to follow the completion of the SRTI Asset Inventory to analyze what is currently on the ground for what is needed to meet the current and future demands of sustainable recreation activities and climate change in the region.

#### SRTI Climate: Sustainable Infrastructure Master Plan

 A Sustainable Infrastructure Master Plan building off of the SRTI Climate: Gap Assessment, which will provide a recommended set of projects and programs to help the region address the gaps identified. Detailed projects would be added from the SRTI Climate: Gap Assessment.

#### • SRTI Climate: Sustainable Recreation Outreach and Education

 Programs for incorporation into the SRTI "Visitor Connection Package" to educate residents, visitors, and workers about Sustainable Recreation and Stewardship, tribal culture, climate change hazards, and historical and interpretive opportunities within the Study Area.

These project recommendations seek to align the Eastern Sierra with California climate change policy, and in so doing, increase the region's eligibility for state and federal funding to plan for and implement solutions for climate change vulnerabilities and successful adaptation. This report and its recommendations establish the foundation for climate resiliency in California's Eastern Sierra.

Funding for this report and the "Sustainable Recreation and Tourism Initiative" has been provided by the Sierra Nevada Conservancy, an agency of the State of California, under the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access For All Act of 2018 (Proposition 68) and in support of the Sierra Nevada Watershed Improvement Program."







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