

SIERRA NEVADA

Climate Vulnerability Assessment



SIERRA
BUSINESS COUNCIL

September 2022

ACKNOWLEDGEMENTS

SIERRA NEVADA Climate Vulnerability Assessment

Prepared for and funded by
Sierra Nevada Conservancy

Prepared by
Sierra Business Council

with assistance from
The Sierra Institute for Community and Environment



CONTACT

Sierra Business Council
10183 Truckee Airport Rd.
Truckee, CA 96161
sierracamp@sierrabusiness.org
530.582.4800

FUNDING

In 2020, Sierra Business Council's Sierra Climate Adaptation and Mitigation Partnership (CAMP) was awarded \$191,655 from the Sierra Nevada Conservancy as part of their Resilient Sierra Nevada Communities Program funded by Prop 68. Proceeds from the grant were used to complete a triple-bottom-line climate vulnerability assessment across all 22 counties of the Sierra Nevada.

The Sierra CAMP is a cross-sector partnership that promotes and facilitates regional climate adaptation and mitigation strategies; serves as a climate action capacity-building hub for Sierra/Cascade communities; and fosters urban-rural connections to build statewide investment in our region's communities and natural resources. Sierra CAMP is a collaborative effort managed by Sierra Business Council.

PROJECT TEAM

Sierra Business Council

Primary Authors:

Erika Harvey
Kaeleigh Reynolds

Design:

Jill Sanford

Copyeditor:

Tara May Flanagan

Executive Review:

Kristin York
Steve Frisch

Supporting Team:

Justine Quealy
James Sedlak
Emily Blackmer
Claire Kasinadhuni
Nikki Caravelli
Simone Cordery-Cotter

Technical Assistance Group (TAG)

Michael Dettinger
Holly Alpert
Jose Sanchez
Marion Vernon
Whitney Brennan
Courtney Henderson
John Wentworth
Christine Albana
Clarke Stevenson
Jeff Lauder
Chelsea Taylor
Nathan Bengtsson
Erika Seward
Christiana Darlington

Sierra Institute for Community and Environment

Jonathan Kusel
Corrinne Scieszka

Climate data provided by:

California-Nevada Climate Applications Program at Scripps Institution of Oceanography



EXECUTIVE SUMMARY

Introduction

The Sierra Nevada Climate Vulnerability Assessment identifies climate vulnerabilities specific to the Sierra Nevada Conservancy (SNC) region. The assessment is designed to provide communities with localized climate risks and hazards, projection data, and technical support to undertake climate planning and priority-project identification. This climate assessment was guided by a triple bottom line approach that considers the economy, environment, and community simultaneously and holds that these sectors thrive when positioned in balance with each other.

The primary intent of this report is to provide an understanding of climate risks within the SNC region, and to technically assist with implementation of Senate Bill 379 (SB 379). Many SNC communities do not have a hazard mitigation plan or updated safety element as required by SB 379. This assessment is intended to provide more specific indicators and hazards at the jurisdictional level, and explain how Sierra ecosystems, economies, and communities will be impacted by those hazards. This assessment can be used to inform hazard mitigation plans and safety elements for counties within the SNC region.

Assessment Boundary

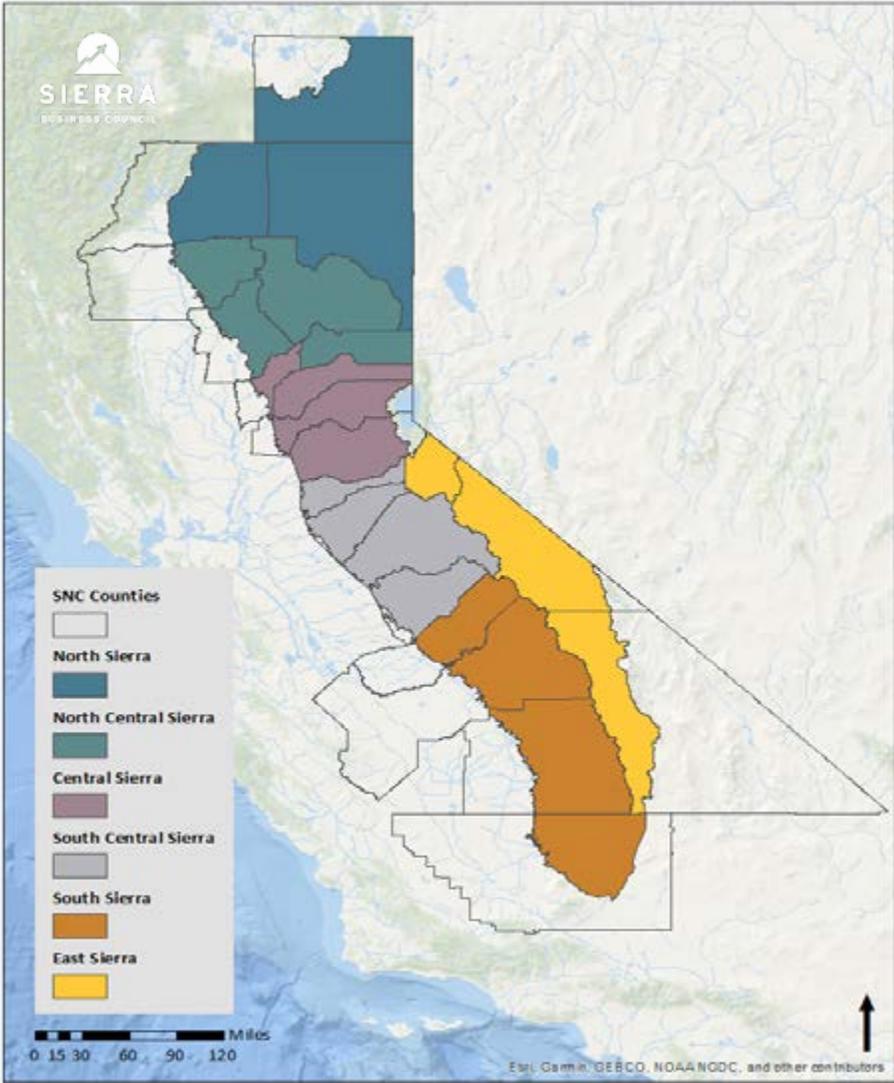
The Sierra Nevada Climate Vulnerability Assessment is confined by the SNC boundary, which encompasses 22 counties and includes the Modoc Plateau, Southern Cascades, Basin and Range, and Sierra Nevada mountain range. This region is a quarter of California's landmass, covering nearly 25 million acres and ranging from 200 to 14,505 feet in elevation.

The SNC region is an ecologically diverse rural area characterized by mountainous peaks, rolling foothills, small towns, and pine forests. Due to the SNC region's extremely diverse topography and geography, SBC used the SNC-defined subregions to break up the larger region when discussing and analyzing the region's climate data projection.¹



SNC-Defined Subregion Boundary

The landscape is one of the most important assets to the SNC region. The Sierra Nevada sources 60% of the state’s developed water supply and embodies endless wilderness that provides natural resources and services critical to ecosystems and California economies.²

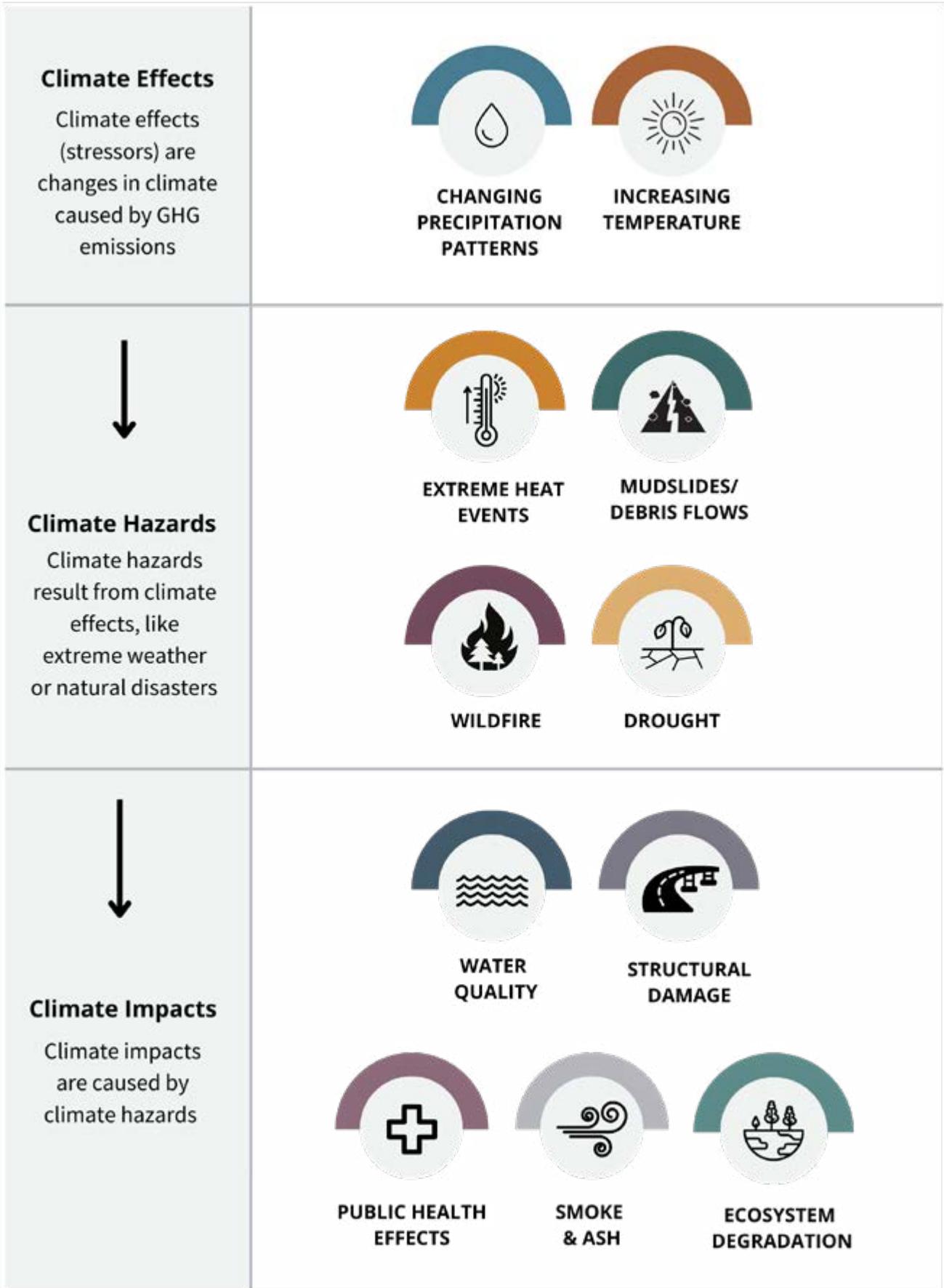


Land Cover Types:

Land Cover Types	Acreage	Percent of Total Land
Wilderness	20,359,813	87.89%
Agriculture	2,712,490	11.71%
Development	92,646	0.40%
Total Acreage	23,164,949	

Key Terms

Climate Change - the change in the state of the climate that can be measured by a change in the average, or variability of properties that exist for long periods of time (decades or longer)



Vulnerability - the overall degree to which people, ecosystems, or infrastructure are susceptible to climate change; vulnerability is a function of climate impacts and the adaptive capacity of a system

Adaptation - the process of adjusting to projected or actual changes in climate and its impacts in order to reduce harm to humans, ecosystems, and infrastructure

Community Capacity - the ability of local residents to respond to climate effects, hazards, and impacts while meeting the needs of all residents

SB 379

As noted, this report is designed to technically assist with implementation of SB 379. SB 379 is a land use/general plan/safety element act to amend Section 65302 of the Government Code approved by the governor in 2015. This assessment coupled with the Adaptation Planning Guide (APG) provides a starting point for counties and cities within the region to jumpstart their incorporation of SB 379. SB 379 requires that all cities and counties within California integrate climate adaptation into their general plans by 2022 (depending on whether or not jurisdictions already have a Local Hazard Mitigation Plan).

Report Preparation

In order to adequately present vulnerability and capacity in regards to climate change impacts within the SNC region, a comprehensive understanding of the historical climate data and projected climate data was necessary.

Observed data was collected from the state and federal sources described in the methods section of this report.

This report utilized climate projection data for mid-century and late-century time frames under RCP 8.5. Projection datasets for this assessment came from the California-Nevada Climate Applications Program at Scripps Institution of Oceanography.

A group of expert climate scientists in the Sierra Nevada region were consulted to better inform the climate science presented in this report.

Along with climate data, data on current socioeconomic well-being and demographic trends in the region was collected. Much of the data used in this report was pulled from the 2020 US Census.

This report defines the economic drivers of the region as tourism, recreation, natural resources, and agriculture. Analysis was conducted to determine the climate hazards and impacts that will most affect the economic development of the region.

In order to access community capacity, SBC partnered with the Sierra Institute for Community and Environment (SI) to conduct community workshops. These workshops asked participants to rate capacity in communities they are familiar with based on the five capitals that define capacity: physical, human, social, cultural, and financial. While these workshops did produce final capacity scores for all communities within the region, they were not highly attended and, in general, lacked diverse attendees that may have deeper insight into their communities' adaptive capacity.

Using climate and population data at the county level, risk profiles were developed for each of the 22 counties within the SNC region. These profiles use a scoring method to quantitatively present the likelihood of climate hazards occurring in each county, the risk faced by vulnerable populations in the county, and the combined impact of climate hazards on vulnerable populations. Local planners and policymakers may want to begin utilizing this report with the risk profile for their jurisdiction. These profiles will help planners and policymakers prioritize climate hazards and vulnerable groups in need of the most planning and resources to build adaptive capacity. We recommend planners and policymakers start utilizing this report by reading their jurisdiction's risk profile in chapter 6.

PIVOTAL FINDINGS

Climate Science

Increased Temperature

The mean temperature has increased 3°F in the last 60 years (from 46°F in 1960 to 49°F in 2020). In the next 20 years, the mean is anticipated to increase up to 1°F–2°F, and in the next 40 years is anticipated to increase an additional 2°F– 3°F.

Snow Water Equivalent (SWE)

Between 1950 and 1990, the Central Sierra subregion averaged ~4–11 inches (~7 inches average) of measured Snow Water Equivalent (SWE) on April 1. However, in the last 20 years, measured SWE has decreased to 2–4 inches on April 1. In the future, averages are projected to drop down to almost 0 inches of SWE by the 2090s.

Declining Snowpack

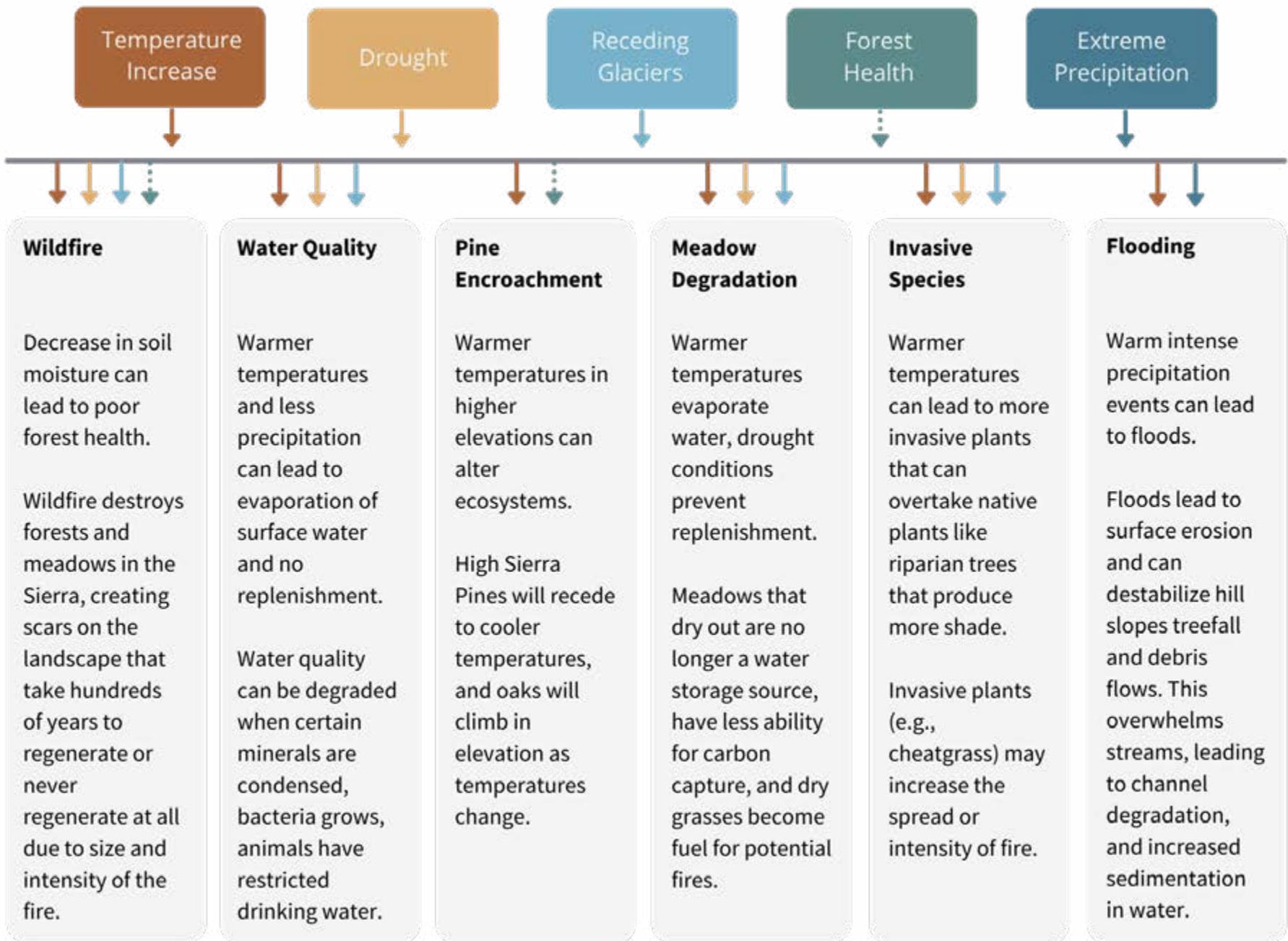
Snowpack is estimated to be minimal to nonexistent around the 6,000 ft elevation mark by 2099.

Glaciers in the Sierra have shrunk 70% on average since the beginning of the 20th century.³

Lengthening Wildfire Season

The California Department of Forestry and Fire Protection has estimated that the length of the fire season has increased by 75 days across the Sierra Nevada. Data from Cal-Adapt estimates this trend will continue to grow in the region by 48% on average during the mid-century (2035–2064) time frame.

Climate Data Summary



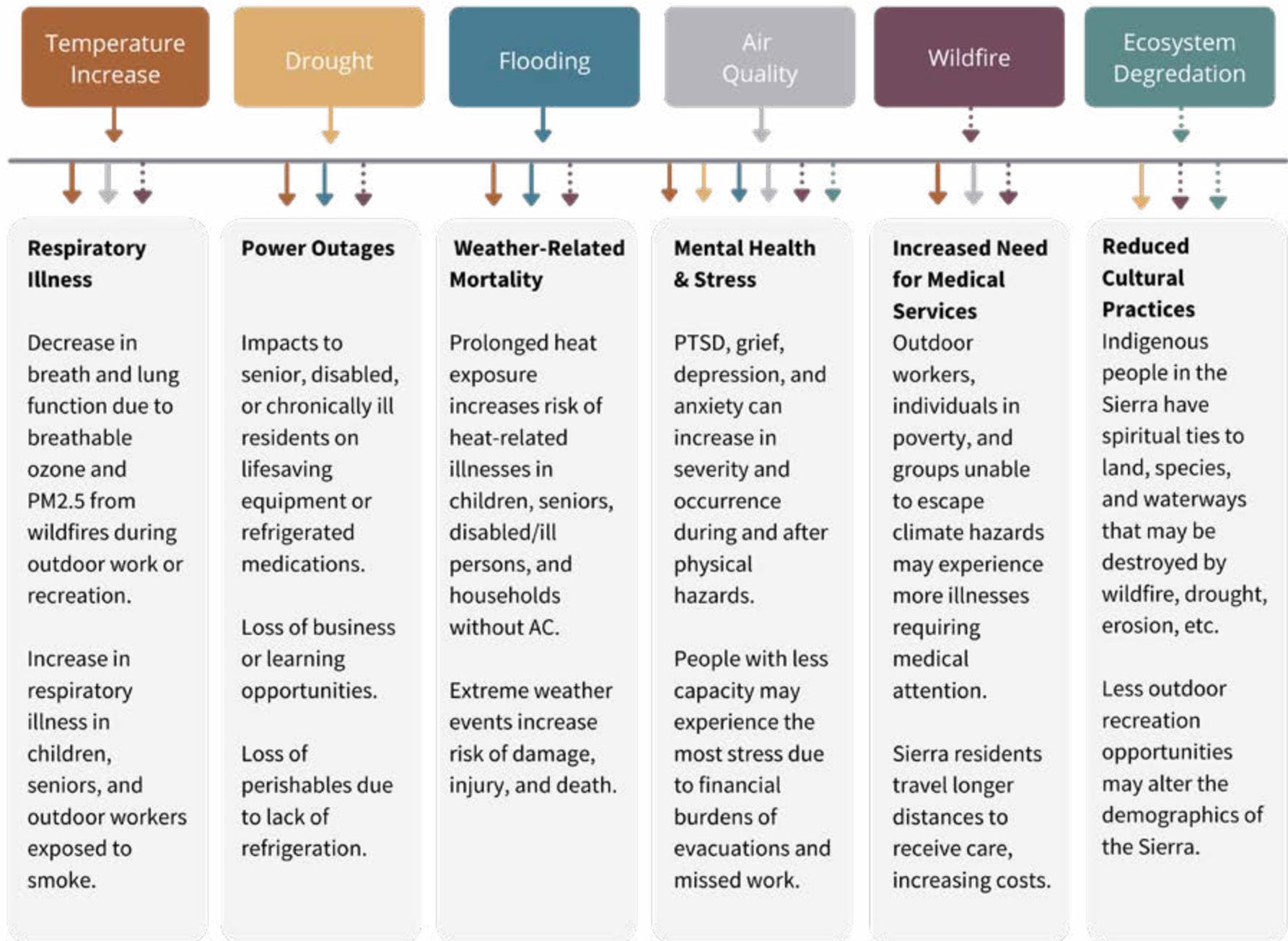
PIVOTAL FINDINGS

Underserved Populations

- Over half of the 880,000 people living in the SNC region belong to systemically underserved populations, including People of Color, the disabled community, Indigenous people, and people living in poverty.
- Over 40% of SNC regional households are housing burdened, and the majority of people in this group are renters.
- Populations with the highest risk to climate hazards are senior citizens, children, outdoor workers, and single-access road residents.



Population Data Summary



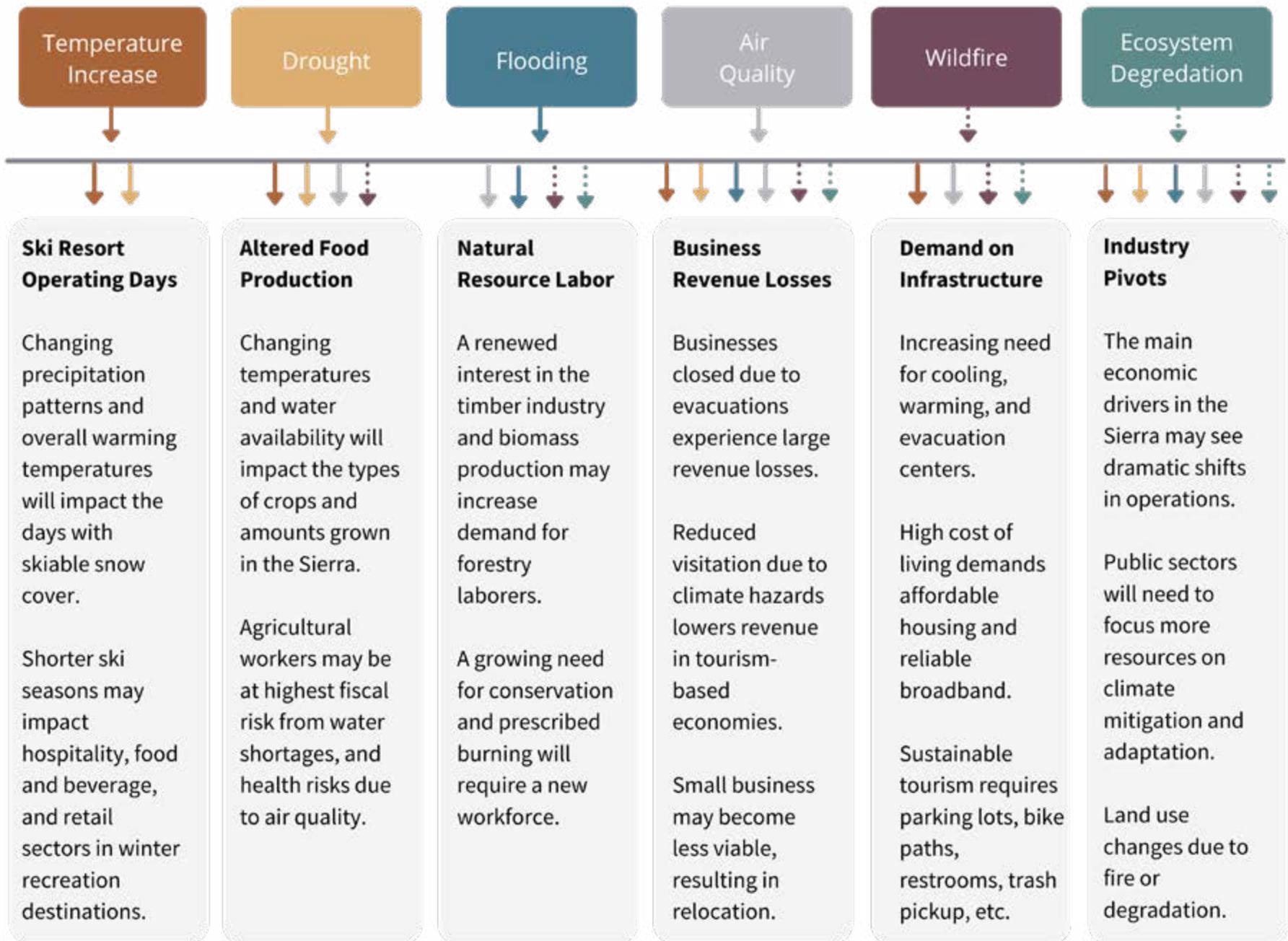
PIVOTAL FINDINGS

Economics

- Sectors that employ the majority of the population are Local Government and Social Services like health care, education, and utilities.
- While the average cost of living for a couple with one child is over \$75,000. Low wages are common in rural areas of the state, but the cost of living in the Sierra typically exceeds income levels.
- The most vulnerable industry to climate hazards in the Sierra may be tourism and recreation.
- Workers in these industries will be heavily impacted by reduced visitation. These careers offer the lowest pay in the SNC region, indicating this group of workers will have less capacity to adapt to climate hazards, as well as reduced work opportunities. This may lead to a mass out-migration of the working class.
- Visitation numbers may be reduced due to wildfire, either directly or indirectly by smoke. United States Forest Service data shows that when recreation opportunities are disrupted due to climate change, visitors choose a different destination entirely, rather than postponing their trip to the Sierra – this behavior may be heightened with snow drought and shorter ski seasons predicted to come by mid-century.



Economic Data Summary



PIVOTAL FINDINGS

Community Capacity

- Community members ranked the average capacity score for the SNC region at 2.9 (out of 5). A community capacity score of 3 indicates medium capacity to deal with climate change hazards and community stressors, like passing local development measures, building cross-cultural relationships, and implementing adaptation and mitigation strategies at the local level.
- Communities in the SNC region that scored themselves as having lower levels of capacity to deal with climate hazards typically have lower physical and cultural capital compared to other SNC region communities.
- High-capacity communities tend to have higher populations of younger residents with higher education levels who frequently organize in order to further community projects.



NEXT STEPS

This report is a regional document that can be used as a starting point for future projects and project prioritization. Next steps have been identified at the regional or state level, and at the local level.

Next Steps at the Regional Level

This assessment identified knowledge gaps in the SNC region. Some gaps in regional knowledge worth highlighting for research prioritization are:

- Specific climate/environmental indicator data gaps (eg., air quality)
- Socioeconomic data at the community level
- Statistics for specific vulnerable populations with known presence in the region
- Impacts historically underserved communities in rural regions will face due to climate change (outside general knowledge)

These four essential data gaps must be addressed if decision-making at the regional and state level is to encompass all people living within the SNC region.

Next Steps at the Local Level

Using the risk profiles in chapter 6, local planners and community members can begin prioritizing adaptation measures and mitigation strategies to lessen the impact of climate hazards. Research for this report exposed large gaps in capacity within local governments and public organizations. These gaps were typically due to a shortage of government staff, limited or unusable resources for small businesses, and assorted priorities within government operations. Some of these issues will take systemic change to overcome. Actionable next steps to begin building local capacity and knowledge include:

- Assessing local capacity by holding workshops with large groups of diverse community members representing each community
- Utilizing free technical assistance programs like the Sierra Nevada Energy Watch for energy efficiency projects
- Increasing starting wages for government employees to reduce turnover and attract new talent
- Developing hazard mitigation plans that consider how the most vulnerable populations will be affected by the most likely climate hazards

Ancestral Land Acknowledgement

SBC and the Sierra Nevada Climate Vulnerability Assessment recognizes that the region referenced in this report is the unceded, ancestral lands of numerous tribes, the original stewards of the Sierra Nevada region.

Executive Summary References

- 1 <https://sierranevada.ca.gov/>
- 2 https://sierranevada.ca.gov/wp-content/uploads/sites/326/2019/12/StateOfSierraForestsRpt_a11y.pdf
- 3 California 4th Assessment, Regional Report



SIERRA NEVADA Climate Vulnerability Assessment

to read the full report, visit:
sierrabusiness.org/vulnerability-assessment

INTRODUCTION

About This Assessment and How This Document Should Be Used

The Sierra Nevada Climate Vulnerability Assessment identifies climate vulnerabilities specific to the Modoc Plateau, Southern Cascades, Basin and Range, and the Sierra Nevada within the Sierra Nevada Conservancy (SNC) boundary.

The SNC defines their boundary as the Sierra Nevada region, but this report will refer to the boundary as the Sierra Nevada region, the SNC region, or the region.

The assessment is designed to provide communities with climate projection data and technical support needed to undertake climate planning and priority-project identification. This climate assessment was guided by a triple bottom line approach that considers the economy, environment, and community simultaneously and holds that these sectors thrive when positioned in balance with each other.



Assessment Boundary (SNC Region as of 2021)



Vulnerability assessments analyze climate hazards and their impacts. Due to their sparse populations, rural areas tend to be overlooked; thus, limited research has been conducted on demographics, economies, and hardships in the Sierra to inform policymakers of climate change impacts in these rural communities. This has limited the ability of jurisdictions within the SNC region to secure funding and prioritize climate resilience projects.

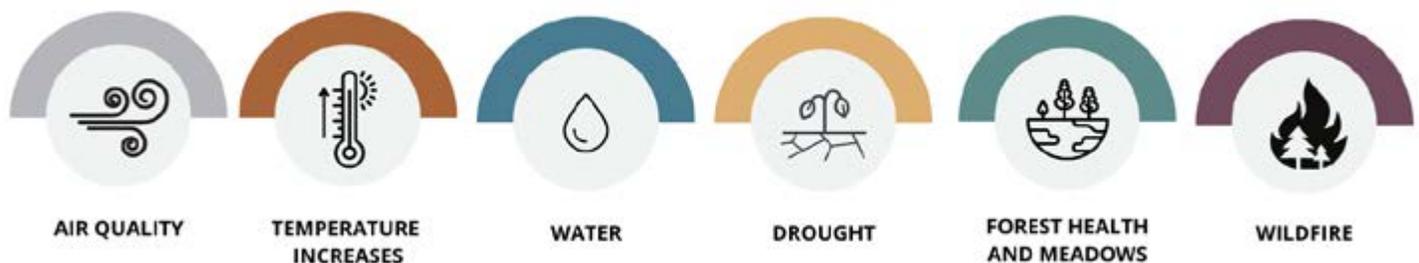
The primary intent of this assessment is to assist with climate action in a region where many rural communities are faced with capacity challenges. This report is also intended to build an understanding of climate risk within the SNC region and to technically assist with implementation of Senate Bill 379 (SB 379), especially in communities that do not have a hazard mitigation plan. Sierra Business Council (SBC) designed this document to be an informative tool that helps educate stakeholders and policy makers about the Sierra Nevada region, and guide them to make better-informed decisions regarding the region. The primary audience for this assessment is city and county planners and regional policy makers. However, SBC hopes that community members and climate-curious individuals will find this document informative. Policy starts at the ground level, and one of the goals of this document is to strengthen the voice of communities within the SNC region.

HOW THIS REPORT IS ORGANIZED

Chapter 1: Introduction

Chapter 2: Climate and Environmental Research Specific to the Sierra Nevada Region

- The natural environment in the Sierra Nevada region will be impacted by a warming climate.
- The top three climate crises currently facing the region are drought, wildfire, and snowpack decline.
- These climate crises, along with 20 other Sierra-specific climate indicators, will have far-reaching impacts on the environment, local economies, and public health.



Chapter 3: Understanding Underserved Populations Within the Region

- Over 880,000 people live within the SNC region, of which more than half are underserved or disadvantaged.
- The groups most vulnerable to climate impacts include the marginalized, the underserved, and the underrepresented. These groups include People of Color, California Native American tribes, individuals in poverty, and the disabled community. Across the SNC region, the greatest climate impact to vulnerable populations is wildfire.

Chapter 4: Economic and Built Systems Vulnerabilities

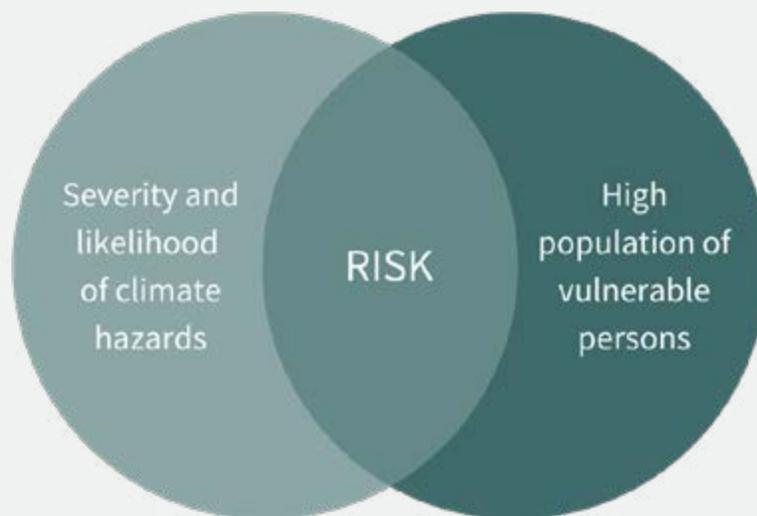
- The regional economic drivers are tourism, recreation, natural resources, and agriculture. However, local government and social services (i.e., health care, education, and transportation) are the largest employers in the Sierra Nevada region.
- Even though tourism is a primary economic driver in the SNC region (visitor spending exceeded \$9 billion in 2019), the tourism and recreation industry pays some of the lowest wages and is one of the drivers most vulnerable to climate impacts. New opportunities in natural resources may increase economic development in the region due to a growing biomass industry and increased forest management needs.
- Across the SNC region, the median household income does not meet the cost of living, and lack of affordable housing and access to quality infrastructure (e.g., broadband) may limit a community's capacity to endure and recover financially from climate impacts.

Chapter 5: **Community Capacity Assessments**

- These assessments were informed by community-held workshops, and scores were assigned by community member participants in the workshops.
- Scores are relative to other communities within the SNC region.
- The goal of these workshops was to gain insight into community capacity and to determine the ability of these communities to prepare and respond to climate impacts

Chapter 6: **Risk Profiles of Counties Within the Region**

- These profiles highlight county-level climate vulnerabilities and risks that could impact the Sierra Nevada region's populations, economies, and communities.
- Summaries can be used to assist with developing climate resiliency. Scores are presented for each of the 22 counties within the SNC region. Higher scores indicate increased severity of climate change impacts.
- Most counties within the region will see the greatest increases in extreme heat days and acreage burned by wildfires, while the vulnerable groups with the highest county populations are the housing burdened, residents without high-speed internet, People of Color, and senior citizens



Chapter 7: **Suggested Adaptation Framework and Strategies**

- How to utilize California's Adaptation Planning Guide (APG) as well as other resources using best practices
- Aggregated tools and resources for new users
- Examples of adaptation case studies

As noted, this report is designed to technically assist with implementation of SB 379. SB 379 is a land use/general plan/safety element act to amend Section 65302 of the Government Code approved by the governor in 2015. This assessment coupled with the Adaptation Planning Guide (APG) provides a starting point for counties and cities within the region to jumpstart their incorporation of SB 379. SB 379 requires that all cities and counties within California integrate climate adaptation into their general plans by 2022 (depending on whether or not jurisdictions already have a Local Hazard Mitigation Plan). There are three parts involved in responding to the SB 379 mandate:

1. Conduct a vulnerability assessment to identify risks
2. Set resilience goals, policies, and objections
3. Produce feasible implementation measures

SB 379 states, “A vulnerability assessment that identifies the risks that climate change poses to the local jurisdiction and the geographic areas at risk from climate change impacts, including but not limited to, an assessment of how climate change may affect the risks addressed pursuant to fire and flood risk.”¹ In relation to hazards and disasters, vulnerability is a concept that defines the relationship between humans and their environment. A vulnerability assessment is defined as a process that identifies vulnerabilities in a system. **For the purposes of this assessment, vulnerability is defined as the inability of a system to withstand the effects of a hostile environment.**

How Climate Data Helps Us Understand What Is Going On

Data is a valuable tool when used appropriately. In this report SBC uses raw climate and environmental data to generate maps for spatial analysis of vulnerability and risk in the SNC region, based on specific foothill and mountain boundaries (rather than using data averaged over county boundaries).

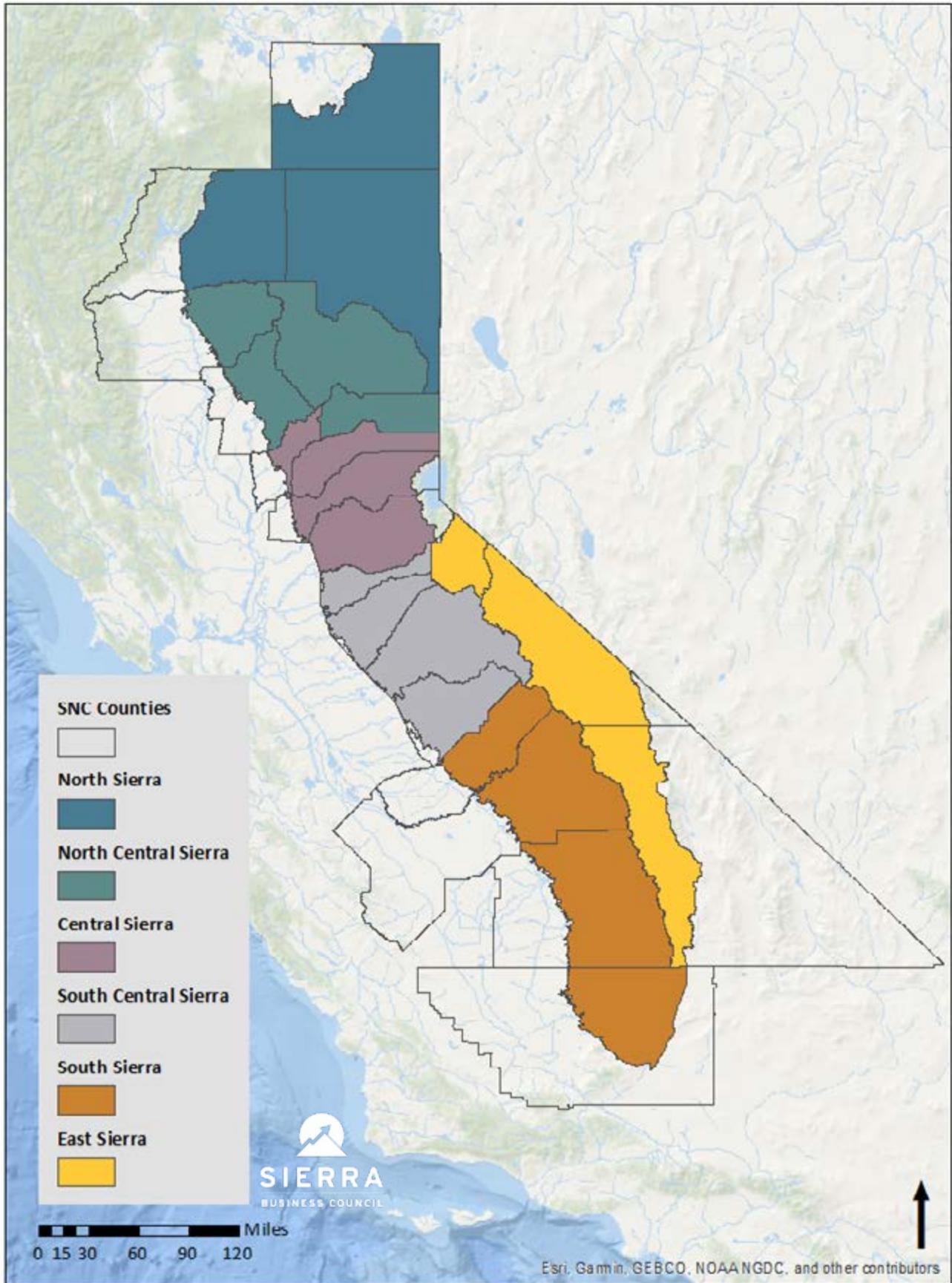
Observed climate data (i.e., raw data, baseline data, or historical data) shows trends and thresholds that are considered the norm. Best practice when using climate data is to use a 30-year baseline to compare current observations and future projections. The 1960–1990 baseline was established from the first IPCC report in the early 1990s and is still used today. It is the earliest consistent window before the most recent population and emission spike. Observed data also informs climate modeling; if the historic model matches the observed historical data, then the projection data for future climate scenarios is assumed to be more accurate. Every year, scientists collect observed data, resulting in more accurate models and parameters.

Observed data was collected from the state and federal sources described in the methods section of this report. Refer to the methods section for data disclosures and challenges. However, this report primarily presents and discusses climate projection data (but uses observed data) to illustrate change from baseline percentages. Projection datasets for this assessment came from the California-Nevada Climate Applications Program at Scripps Institution of Oceanography.

Projection data used for this assessment utilizes a 10 model average under the RCP 8.5 parameters. This report presents the mid-century (2036–2065) and the late-century (2070–2099) predicted scenario for varying climate indicators for the SNC designated subregions within the boundary (i.e., North Sierra, North Central Sierra, Central Sierra, East Sierra, South Central Sierra, and South Sierra—see the following map).

ABOUT THE SNC REGION

Subregions of the SNC



The Sierra Nevada Climate Vulnerability Assessment is confined by the SNC boundary, which encompasses 22 counties and includes the Modoc Plateau, Southern Cascades, Basin and Range, and Sierra Nevada mountain range. This region is a quarter of California’s landmass, covering nearly 25 million acres and ranging from 200 to 14,505 feet in elevation. The SNC region is an ecologically diverse rural area characterized by mountainous peaks, rolling foothills, small towns, and pine forests. Due to the SNC region’s extremely diverse topography and geography, SBC used the SNC defined subregions to break up the larger region when discussing and analyzing the region’s climate data projection. ²

Landscape and Land Cover Types

The landscape is one of the most important assets to the SNC region. The Sierra Nevada alone sources 60% of the state’s developed water supply and embodies endless wilderness, providing natural resources and services that are critical to ecosystems and California economies. ³

Land Cover Types	Acreage	Percent of Total Land
Natural	20,359,813	87.89%
Agriculture	2,712,490	11.71%
Development	92,646	0.40%
Total Acreage	23,164,949	

Socioeconomics in the SNC Region

Communities in the SNC region depend on natural and working lands to support the region’s four economic drivers: tourism, outdoor recreation, agriculture, and natural resources. Tourism provides the foundation for many local economies, accruing the SNC region \$8 billion to \$9 billion annually from 2015–2019. ⁴ While bolstering the economy, tourism industries pay the region’s lowest wages, and they may be heavily impacted by climate change by mid century. This may lead to a sizable percentage of the population with less financial ability to cope with climate hazards amidst job insecurity. This report analyzes the economic impact to the SNC region by identifying industry-specific risks, the financial burden of climate change impacts, and how household economics and individual financial hardship will affect the region’s ability to adapt.

The population residing within the SNC region is uniquely vulnerable to climate change due to their geographical location and environment, a lack of resources and essential services, and reduced representation of at-risk populations. Many at-risk populations have been systemically underserved and will require more support and resources to deal with climate change. These historically underserved groups include People of Color, the disabled community, California Native American tribes, and people living in poverty. Over 880,000 people live within the SNC region, of which more than 50% may be considered underserved or disadvantaged.

Underserved populations may have less capacity to endure and adapt to climate change hazards.

A community’s capacity is defined as the ability of local residents to respond to climate hazards

and meet the needs of all residents. This includes the ability of communities to respond to internal and external stresses, as well as take advantage of opportunities. The level of capacity a community has can be determined by the culmination of the five types of capital that make up capacity: financial, human, social, cultural, and physical. This report includes an assessment of community capacity within the SNC region performed by the Sierra Institute for Community and Environment (SI). In general, capacity levels vary significantly across the region, with high-capacity communities neighboring low-capacity communities.

Due to the rural nature of the SNC region, one of the greatest challenges to climate resilience is the limited capacity of local governments and small businesses to deal with climate hazards. Many smaller communities have less representation at the state—even county—level. This, along with state metrics that rank the SNC region as having a lower climate hazard risk, have caused the region to be left behind in terms of planning and funding resources. This report should be used as a guide to begin laying the groundwork for a more sustainable future in which strong communities, regenerative economies, and a resilient environment are the foundation of the SNC region.

Ancestral Land Acknowledgement

SBC and the Sierra Nevada Climate Vulnerability Assessment recognizes that the region referenced in this report is the unceded, ancestral lands of numerous tribes, the original stewards of the Sierra Nevada region.

Chapter 1 References:

- 1 SB 379: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB379
- 2 <https://sierranevada.ca.gov/>
- 3 https://sierranevada.ca.gov/wp-content/uploads/sites/326/2019/12/StateOfSierraForestsRpt_a11y.pdf
- 4 Visit California, Economic Impact of Travel in California 2011–2020, Authored by Dean Runyan Associates, Inc. and <https://hsr.ca.gov/high-speed-rail-in-california/california-traditional-tribal-territories-map/>

CLIMATE AND ENVIRONMENTAL RESEARCH

SPECIFIC TO THE SNC REGION

Chapter 2 Summary:

- The natural environment in the Sierra Nevada region will be impacted by a warming climate.
- The top three climate crises currently facing the region are drought, wildfire, and snowpack decline.
- These climate crises, along with 20 other Sierra-specific climate indicators, will have far-reaching impacts on the environment, local economies, and public health.
- Due to extreme increase in temperature, the Sierra Nevada region is predicted to continue to experience scenarios ranging from extreme precipitation to extreme drought. These conditions will continue to impact regional snowpack and wildfires.

INTRODUCTION

How This Chapter Should be Used

Please read this section prior to reviewing indicator subsections and datasets.

The Sierra Nevada Climate Vulnerability Assessment identifies climate vulnerabilities specific to the Sierra Nevada region. The assessment is designed to provide communities with the data and technical support needed to undertake climate planning and priority-project identification. Understanding these impacts enables a more comprehensive understanding of the potential each hazard has to cause fatalities, injuries, disruptions to the community, and other impacts.

The Sierra Nevada region is large, ecologically diverse, and predominantly rural. It is characterized by the granite peaks, rolling foothills, small towns, and pine forests that comprise the Sierra Nevada mountain range, which extends roughly 300 miles along the eastern edge of California and encompasses about one-fourth of the state. The Sierra Nevada region includes diverse topography ranging from 14,505 to 200 feet in elevation and is home to dynamic communities with varying interests and cultures.

In this report, SBC uses raw climate and environmental data (from various sources) to generate maps for spatial analysis of vulnerability and risk in the Sierra Nevada region. One of the advantages of mapping and clipping data to specific foothill and mountain boundaries (rather than using data averaged over county boundaries) is not having to manage the valley elevation discrepancy. Values are specific to 6x6 km grid cell location, but are averaged over 30 year (mid or late-century) time period. Elevation differences substantially affect mean values and create a wider range for the standard deviation. The projection maps in this report illustrate this challenge because the raw values are assigned to locations. Therefore, subregion tables illustrate how a large geographic area can have a range of projections based on location and elevation, and need to be used side-by-side with the maps. Each county table represents all grid cells averaged over the designated county.

The list of climate and environmental hazards and exposures (impacts) in the region can be extensive; accordingly, SBC reviewed Local Hazard Mitigation Plans and consulted specialists well versed in the region's environmental science to reach a consensus on impacts that best illustrate the level of risk and vulnerability in the SNC region due to climate change. These climate impacts were handpicked based on data availability, complexity, and regional relevance. There are many other (equally important) impacts that were not included in this report because they extend outside the scope of this assessment due to complexity and lack of data availability.

It is important to acknowledge that these climate impacts will have cascading effects; one impact is likely to influence another/others. For example, wildfires can set the stage for dangerous landslides from heavy rains unlikely to trigger such an event otherwise. These secondary impacts are not reviewed individually in this chapter but are addressed where relevant. Vulnerabilities of populations, economic assets, and ecosystems are addressed in later chapters.

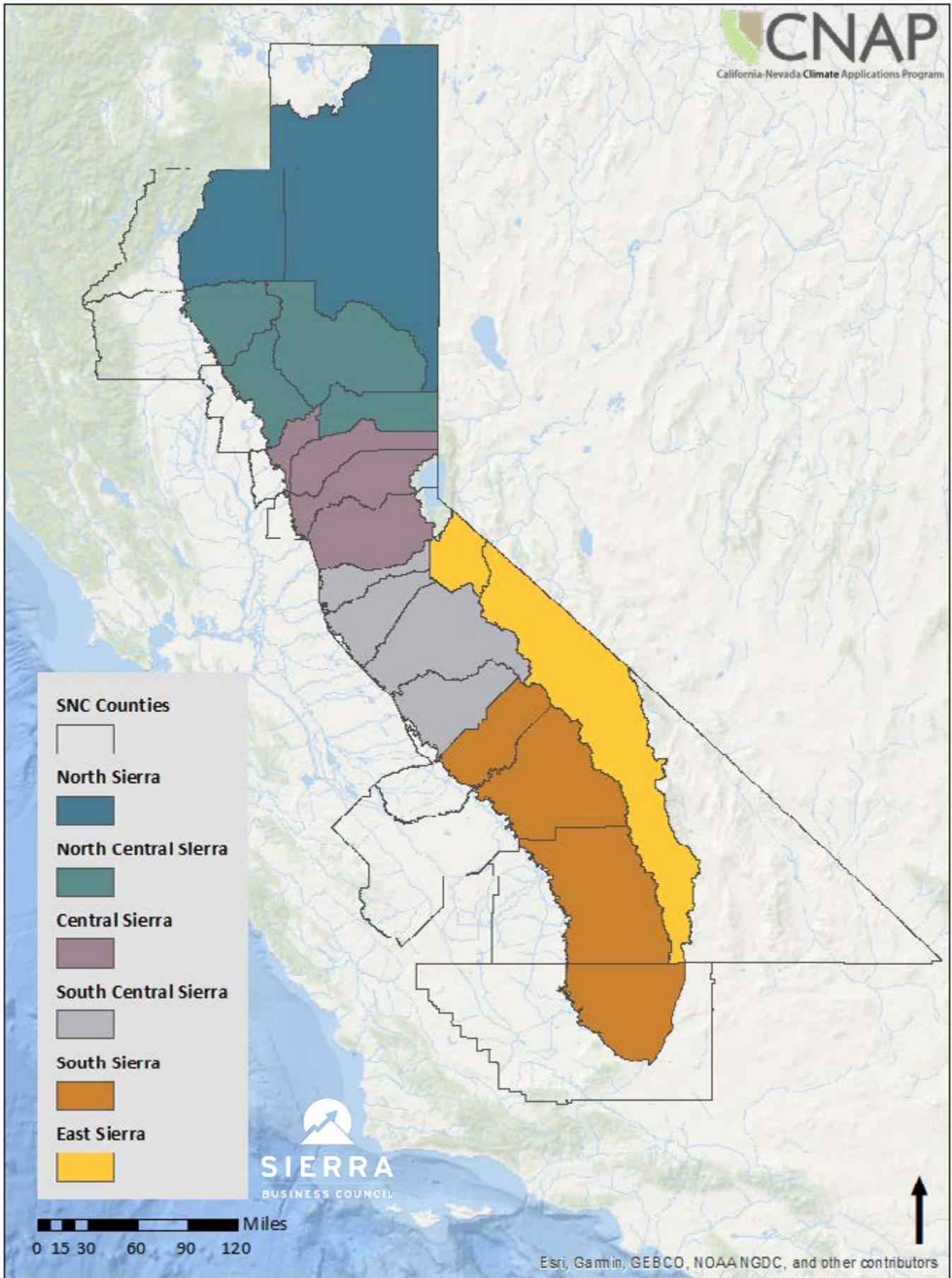
Climate scenario projections provide the best known representations of uncertainties in scientific understanding of the climate system, but they don't always capture uncertainties in how humans will influence the climate system as they respond or adapt through social or technological change. Representative Concentration Pathway (RCP) scenarios, which help to characterize how alternative trajectories in greenhouse gas emissions and other factors influence changes in climate, help to capture this secondary uncertainty. For the purposes of this assessment, we primarily show and discuss the climate projection data as analyzed against observed data or, when observed data is not present, modeled historical data.

RESEARCH DATA & LIMITATIONS

- Due to limited historical data collection by state agencies, some climate impacts indicators (ie. air quality) could not be accurately assessed.
- Some data sources were only available at county level resolution, and not all of the 22 counties fall within the SNC boundary entirely.
- County resolution data only provides averages across a county, and counties that have diverse elevations and geography can downplay vulnerabilities and risks.

Climate projection datasets used for this assessment were downscaled using the localized constructed analogs (LOCA) method and came from the *California-Nevada Climate Applications Program at Scripps Institution of Oceanography* and *Cal-Adapt [dataset](#)*. The dataset included the 10 climate model projections that were determined to best represent California climate under the RCP 8.5 scenario, which represents continued high emissions of greenhouse gasses. Each dataset summary shows the average of the 10 projections for each climate variable at mid century (2036–2065) and late century (2070–2099) within each designated subregion within the SNC boundary (i.e., North Sierra, North Central Sierra, Central Sierra, East Sierra, South Central Sierra, and South Sierra—see map below). All datasets illustrate predicted change from baseline (1961–1990). These are predicted values based on modeled projected datasets that are subject to change/improve as climate science acquires more data in the future.

SUBREGIONS OF THE SNC



CRISES IMPACTING THE REGION

In order to understand how to prepare for potential climate impacts cited in this report, an understanding of climate science and its impact in the SNC region is necessary.

The Sierra Nevada region is uniquely susceptible to the effects of climate change because of the region's snowpack and glaciers. Rising temperatures have been impacting ecosystems that are typically covered by snow and ice a majority of the year (or year-round). The southern half of the Cascade-Sierra Province is a unique geography in California that influences microclimates, water systems, the local rural communities and economies, and a large portion of the West Coast outdoor industry. Significant temperature increases that have already occurred—and are predicted to continue—illustrate hazards and detrimental impacts to environmental sensitivities that the rest of the state's metropolitan areas may experience only indirectly.

We are already feeling the impact of climate change. According to the Intergovernmental Panel on Climate Change (IPCC), much of the damage to our natural systems is irreversible, and continued atmospheric warming impacts will worsen over time if drastic measures are not taken. The Sierra Nevada region is predicted to continue to experience scenarios ranging from extreme precipitation to extreme drought. These conditions will continue to impact regional snowpack and wildfires. As a region, we can build resilience by understanding and preparing for these impacts to our communities through general planning, adaptation strategies, and policy implementation.

This assessment promotes climate education, adaptation, and mitigation efforts to address the effects of climate change that are already occurring and are among the greatest threats to the region. Increased extended drought, wildfire risk, and shrinking snowpack are a few of the climate impacts already affecting the area.

DROUGHT



DROUGHT

Oscillating drought conditions have influenced water supply in California. On average, glaciers in the Sierra have shrunk 70% since the beginning of the 20th century.¹ California has always relied on snowpack runoff from the Southern Cascades and Sierra Nevada to recharge its water systems. Water from melting snow provides 60% of the state's water supply for agriculture and urban needs. That includes city municipal water that is transported from the Sierra to many California metropolitan areas. Compared to the first half of the last century, the Sacramento River now experiences peak runoff almost one month earlier.² In

some areas, residents in the Sierra Nevada and the Central Valley have already experienced water shortage issues (such as dry wells) and some communities have had to deliver water to residents door-to-door during dry seasons.

“Hydroelectric power generated from Sierra Nevada rivers amounts to half of all hydroelectric production in the State, about 15% of all in-state power generation, and 9% of all electrical power used in the State.”³

WILDFIRE



WILDFIRE

The California Department of Forestry and Fire Protection has estimated the length of the fire season has increased by 75 days across the Sierra Nevada region, and data from Cal-Adapt estimates this figure will continue to grow in the region by 48% on average during the mid-century (2035–2064) time frame. Over the past 10 years, fires in California have grown in size and intensity to the point where forests can not regenerate and ecosystems are destroyed. The engraved burn scars have initiated risks into the landscape, leaving it vulnerable to extreme precipitation events.

In 2021, California experienced 373 fires. The five-year historical average is 190 fires, which means that California experienced a more than 96% increase in the number of fires in 2021. Out of the ~3.1 million acres that burned in California in 2021, at least ~1.5 million (~48%) of those acres burned within the SNC region. Three of the region's major fires in 2021 were considered megafires, resulting in over 200 days of burning, with severe air quality impacts across the region and the state. At least 2,332 people lost their homes and businesses due to fires within the SNC region. Fires in this region make up at least a quarter of California's historical "Top 20" lists on Cal Fire. The Dixie Fire is currently the largest single fire and second-largest fire in California's known history. It burned just under one million acres and stretched across five counties. The Caldor Fire, which burned across three counties, is listed as the 15th-largest fire in California's known history. The Dixie Fire and the Caldor fire both occurred in 2021 and were listed as #14 and #16 on Cal Fire's Top 20 Most Destructive California Wildfires, respectively.

SNOWPACK DECLINE



SNOW PACK

Warmer temperatures have already begun to influence the precipitation patterns in California, but the more noticeable changes occur within the mountainous region. Snow levels have risen in elevation, powdery snow has turned to dense, wetter snow, and overall snow levels have decreased in the last 20 years from the historical average of the 20th century. These issues pose economic and environmental risks to the region; more specifically, rising snow levels present economic risks to lower elevation ski resorts. Snow with a higher level of snow water equivalent (wetter snow) has revealed vulnerabilities in

infrastructure, and is said by scientists to evaporate faster than historical cold snow. However, the biggest fear within the climate science community is that overall snowpack has been decreasing and is predicted to continue decreasing throughout the 21st century. Snowpack is estimated to be minimal to nonexistent around the 6,000 ft. elevation mark by 2099.

HOW CLIMATE CHANGE IMPACTS
the following indicators:





OZONE

Ground level ozone is not directly emitted into the air, but is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC). These are important components of smog, which occurs when pollutants emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sources chemically react in the presence of sunlight.⁶

Ozone is most likely to reach unhealthy levels on hot sunny days, but can still reach dangerously high levels during colder months. Ozone can also be transported over long distances by wind, so even rural areas can experience high ozone levels. The Sierra Nevada in particular experiences high volumes of tourism traffic (due to limited public transportation) during peak winter and summer recreation months, which increases smog in populated areas. Also, the SNC region is not significantly far in distance from the greater metropolitan areas that regularly experience poor ozone, which can be transported via wind events to the SNC region.⁷

Ozone Concerns

Public Health	Economic	Environmental
<p>Respiratory irritation and lung disease</p> <p>Kills living cells (e.g., germs or human skin cells) upon contact</p> <p>Increases risk toward outdoor activities and exercising for sensitive populations</p> <p>Can trigger a variety of responses, such as chest pain, coughing, throat irritation, and airway inflammation</p>	<p>Poor air quality could cause six to nine million premature deaths by 2060, and cost up to 1% of global GDP (about \$2.6 trillion annually).⁴</p> <p>Reduces crop and timber yields, resulting in millions of dollars in economic losses</p> <p>Reduces the production of roots, seeds, fruit, and other plant constituents for agriculture, reducing the harvest</p> <p>Forms in greater quantities on hot, sunny, calm days. Ozone concentrations frequently exceed existing health standards during summer tourist seasons</p>	<p>Disturbs the stability of ecosystems, leading to the extinction of sensitive species⁵</p> <p>Reduces the overall productivity of plants, damaging cells and causing destruction of leaf tissue</p> <p>Reduces the ability of plants to photosynthesize and produce their own food</p> <p>Weakens plants, making them susceptible to disease, pests, cold, and drought</p>



SMOKE & ASH

Smoke

California’s fire season has escalated in recent years, increasing the number of smoky days and health impacts to communities. There are no physical projections for smoke. However, wildfire projections could be a proxy for air quality in the future since climate models project that there will be more frequent and severe wildfires in the region.¹¹ Climate models are projecting there will be more frequent and severe wildfires in the SNC region in the future.¹²

PM 2.5 Concerns

Public Health	Economic	Environment
<p>PM contains microscopic solids or liquid droplets that are so small that they can be inhaled and cause serious health problems, including heart and lung disease.</p> <p>Smoke affects both the lungs and the heart, leading to premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, increased respiratory symptoms such as irritation of the airways, and coughing or difficulty breathing.</p> <p>Mental health is greatly impacted by smoky days and/or weeks. For most people, it restricts exercise routines to indoor activities (COVID-19 also played a big role in 2020 and 2021, as many gyms were closed) .</p>	<p>People don’t go outside due to health concerns, and recreation sites are closed due to reduced visitation. These impacts play a significant role in rural economies and local businesses that rely on foot traffic.</p> <p>The Sierra Nevada region is the backbone of California’s growing \$92 billion outdoor recreation economy. Outdoor recreation in the Sierra encompasses many activities, some of which bring more direct and indirect revenue than others.</p> <p>Added costs include installing and maintaining air filtration systems inside homes and businesses, and medical costs for sensitive populations.</p>	<p>When the AQI exceeds 101 and begins to block the sun, temperatures can drop, and plants and trees can be impacted by dramatic climate swings.</p>



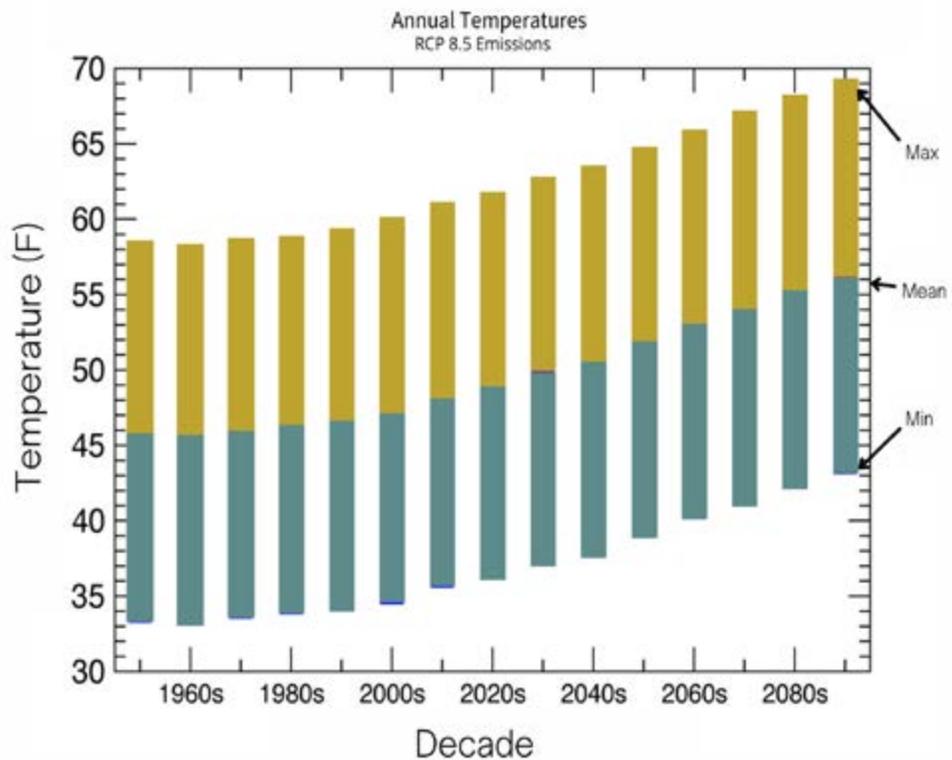
DAYTIME HEAT

The average annual temperatures for the SNC region fluctuated from 1960 to 1990. However, the annual averages have increased since the established historical baseline (1960–1990). As shown in the figure below, the biggest increase in the average max temperature at the level of Lake Tahoe (~6,000 ft. elevation) occurred from 1980 to 2020, which is almost a 7% average increase.

The below maps representing daytime heat illustrate the projected number of days that will exceed the threshold temperature. Threshold temperatures are defined as an extreme heat day or warm night when the daily temperature exceeds the historical 98th percentile of daily

maximum/minimum temperatures based on observed historical data from 1961–1990 between April and October. Whereas an extreme heat event is defined as four days where the min/max temperatures exceed the 98th percentile threshold. Each four-day-and-night period is counted as one event, so that if extreme temperatures persist for 10 consecutive days/nights, it counts as two heat waves. Extreme heat events are also increasing every year, as well as extreme heat days and warm nights.

Lake Tahoe



The maps below represent the average number of extreme heat days among

10 climate model projections for the 2036–2065 and 2070–2099 time periods. Since 1950, at least one out of 146 long-term weather stations statewide have recorded an on average an increase in extreme heat days of one day per year. More notably, extreme heat nights have increased faster, at a rate of 11 extreme heat nights per year. The rate of change in both extreme heat days and nights has been even faster over the past 30 years (1990–2020), with a rate of 7 and 21 days and nights per year. As heat events are projected to become more frequent and last longer, it is critical to prepare for the public health challenges they pose. The natural geographical features (eg. snow pack, glaciers, alpine lakes, meadows, forests, etc.) within the SNC region are not accustomed to warmer temperatures and will experience more noticeable change than the California Central Valley as a result. The risk of heat-related illnesses and deaths is influenced by the characteristics of an extreme heat event. When temperatures do not cool down at night, or when humidity is high, the body's ability to cool down is hampered.¹³

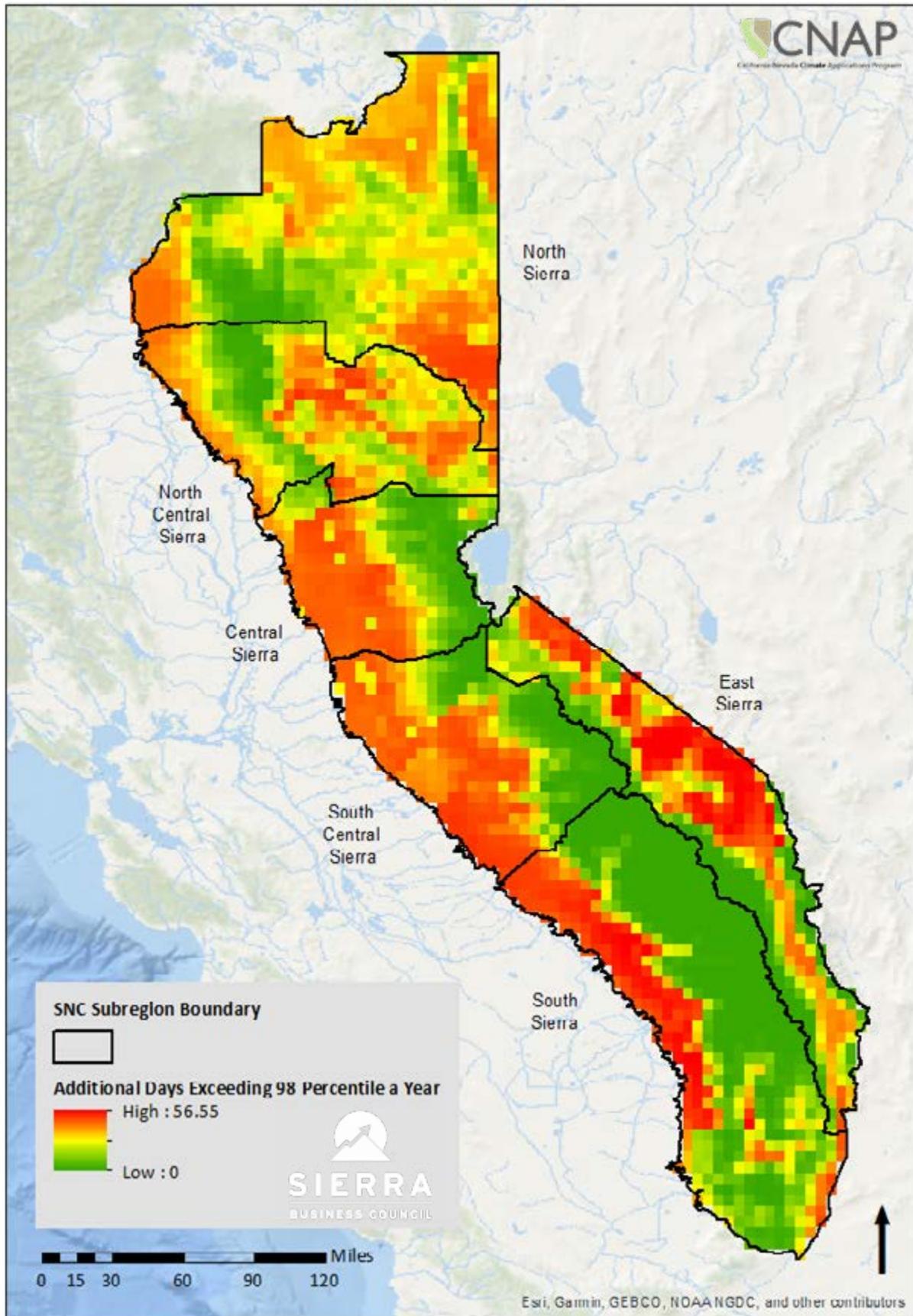
The authors of this report acknowledge that the Lake Tahoe is not within the boundaries of the SNC Region. However, it is a recognizable location at 6,000 that was chosen as an example to illustrate this data.

Daytime Heat Concerns

Public Health	Economic	Environmental
<p>Extreme heat causes the most weather-related deaths in the United States. Following a record-breaking heat wave in 2006, over 16,000 emergency room visits, more than 1,100 hospitalizations, and at least 140 deaths were reported.</p> <p>Within the SNC region, most communities are not accustomed to heat. Although temperatures may not reach the high levels seen in the Central Valley, many households in the SNC region don't have air conditioning and are not prepared for extreme heat events</p>	<p>Increasing temperatures impact the length of the winter season, and reduced winter conditions impact winter-related tourism (e.g., skiing). Ski resorts will see cost increases due to relying on snowmaking and fewer visitors.</p> <p>Warmer summers in the SNC region will result in a higher risk of wildfire, driving summer tourism to other places in fear of smoke and evacuation.</p> <p>Blackouts and power outages may result from power companies preparing for potential wildfire risk. Multi day power outages in the summer force homes and businesses to run generators to stay cool. Generators are very expensive and not a long-term solution. What's more, gasoline generators are fire hazards themselves (if used improperly).</p> <p>Raise demand in water supply, resulting in agricultural impacts like crop loss, reduced milk and egg production, and livestock illnesses and death.</p>	<p>Projected warming temperatures will influence sensitivities such as snowpack, runoff, evaporation, evapotranspiration, drought, surface water, forest health, types of greenery, and wildfire.</p> <p>Even during the winter months, warmer temperatures will influence snowpack. For example, elevations below 3300 ft. will no longer experience below-freezing temperatures in the winter as they did prior to 1950. At higher elevations, spring snowpack will melt at a faster rate; less spring snowpack combined with warmer temperatures will mean shorter winters overall.</p> <p>Other impacts include longer growing seasons, a transition from needle-leaved to broadleaved trees, conifer encroachment in riparian meadows, and invasive species.</p> <p>Wildfire risk increases as vegetation dries out.</p>

CHANGE IN NUMBER OF HEAT DAYS A YEAR 2036-2065

under RCP 8.5 Emissions



CHANGE IN NUMBER OF HEAT DAYS A YEAR 2036-2065

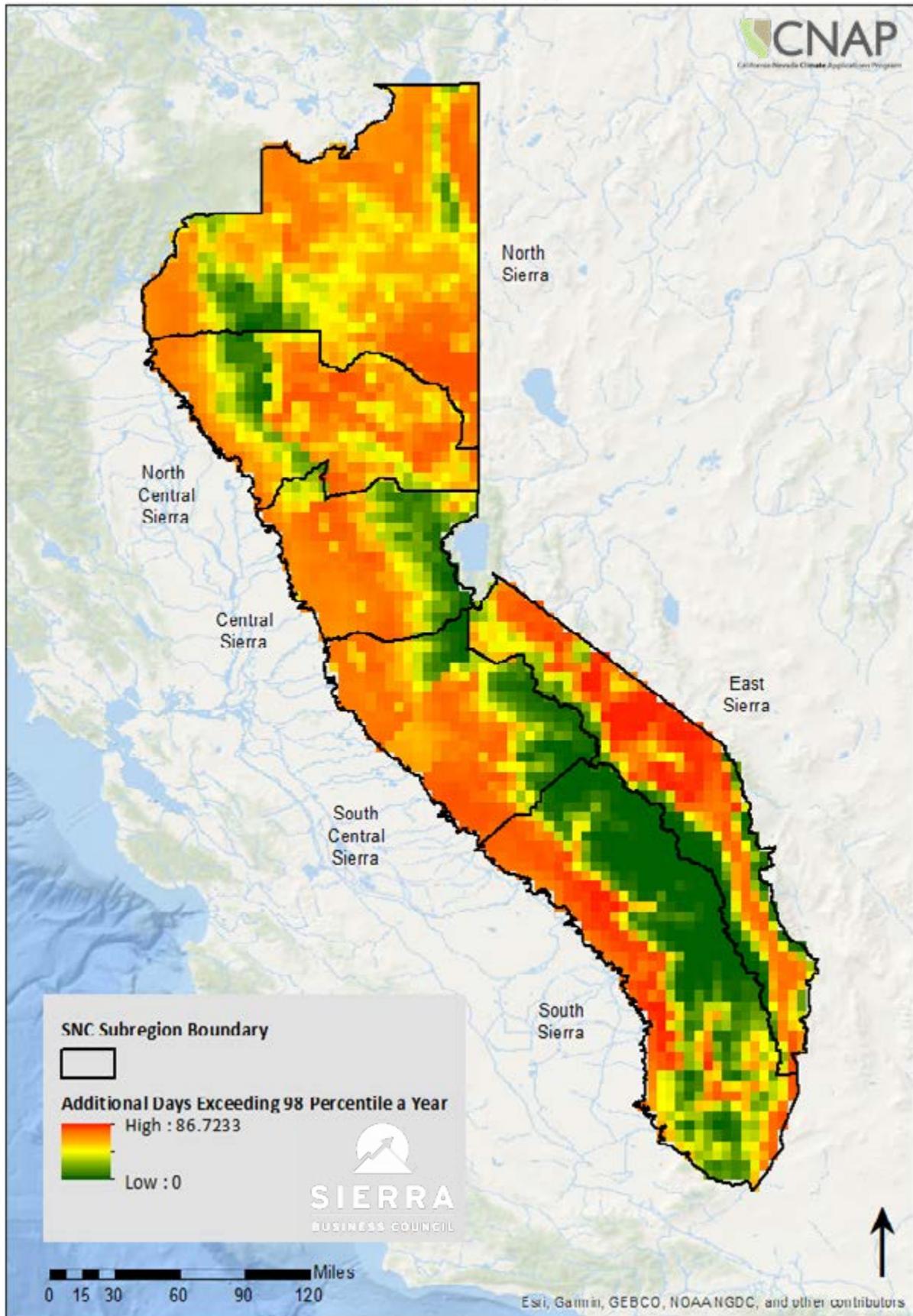
Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will increase 1–48 days a year	On average will increase 27 days a year
North Central Sierra	Will increase 1–50 days a year	On average will increase 27 days a year
Central Sierra	Will increase 1–48 days a year	On average will increase 26 days a year
East Sierra	Will increase 0–56 days a year	On average will increase 28 days a year
South Central Sierra	Will increase 0–49 days a year	On average will increase 27 days a year
South Sierra	Will increase 0–55 days a year	On average will increase 17 days a year

County	Average Increase in Days <i>Average Includes Diverse Topographic Changes</i>
Alpine	27.5
Amador	28.1
Butte	20.2
Calaveras	30.6
El Dorado	30.0
Fresno	13.7
Inyo	17.6
Kern	17.1
Lassen	28.2
Madera	21.8
Mariposa	31.3
Modoc	31.7
Mono	36.7
Nevada	28.3
Placer	22.4
Plumas	32.4
Shasta	20.9
Sierra	27.9
Tehama	22.9
Tulare	19.1
Tuolumne	24.5
Yuba	22.7

Tables coincide with the map on the previous page (data points are represented by grid colors). For example: as seen in the subregion table, higher elevations in the North Sierra Region will experience a minimal increase in the number of heat days per year, whereas the lower elevations will experience a much higher increase in heat days per year over the mid-century time period. On average Alpine county will experience a 27-day increase.

CHANGE IN NUMBER OF HEAT DAYS A YEAR 2070-2099

under RCP 8.5 Emissions



CHANGE IN NUMBER OF HEAT DAYS A YEAR 2070-2099

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will increase 1-77 days a year	On average will increase 56 days a year
North Central Sierra	Will increase 1-78 days a year	On average will increase 54 days a year
Central Sierra	Will increase 1-76 days a year	On average will increase 48 days a year
East Sierra	Will increase 0-86 days a year	On average will increase 52 days a year
South Central Sierra	Will increase 1-77 days a year	On average will increase 59 days a year
South Sierra	Will increase 1-86 days a year	On average will increase 33 days a year

County	Average Increase in Days <i>Average Includes Diverse Topographic Changes</i>
Alpine	54.0
Amador	49.4
Butte	42.3
Calaveras	53.4
El Dorado	51.4
Fresno	24.2
Inyo	36.2
Kern	37.8
Lassen	57.6
Madera	37.8
Mariposa	53.7
Modoc	61.8
Mono	64.8
Nevada	51.5
Placer	42.9
Plumas	62.1
Shasta	44.8
Sierra	56.4
Tehama	45.9
Tulare	35.7
Tuolumne	43.7
Yuba	48.1

Tables coincide with the map on the previous page (data points are represented by grid colors). For example: as seen in the subregion table, higher elevations in the North Sierra Region will experience a minimal increase in the number of heat days per year, whereas the lower elevations will experience a much higher increase in heat days per year over the late-century time period. On average Alpine county will experience a 54-day increase.

WARM NIGHTS



WARM NIGHTS

Nighttime temperatures are inherently more sensitive to the heat-trapping effects of greenhouse gases, which could be amplified by other factors, such as increased humidity and cloud cover.

As the climate continues to warm, increased demand for cooling will disproportionately impact certain California populations. Utility planning and construction decisions are guided by trends in degree days, as well as by the availability of energy-efficient cooling technologies, consumer behavior,

and population shifts. Climate change will likely influence the ability to meet the increased demand in electricity for cooling.

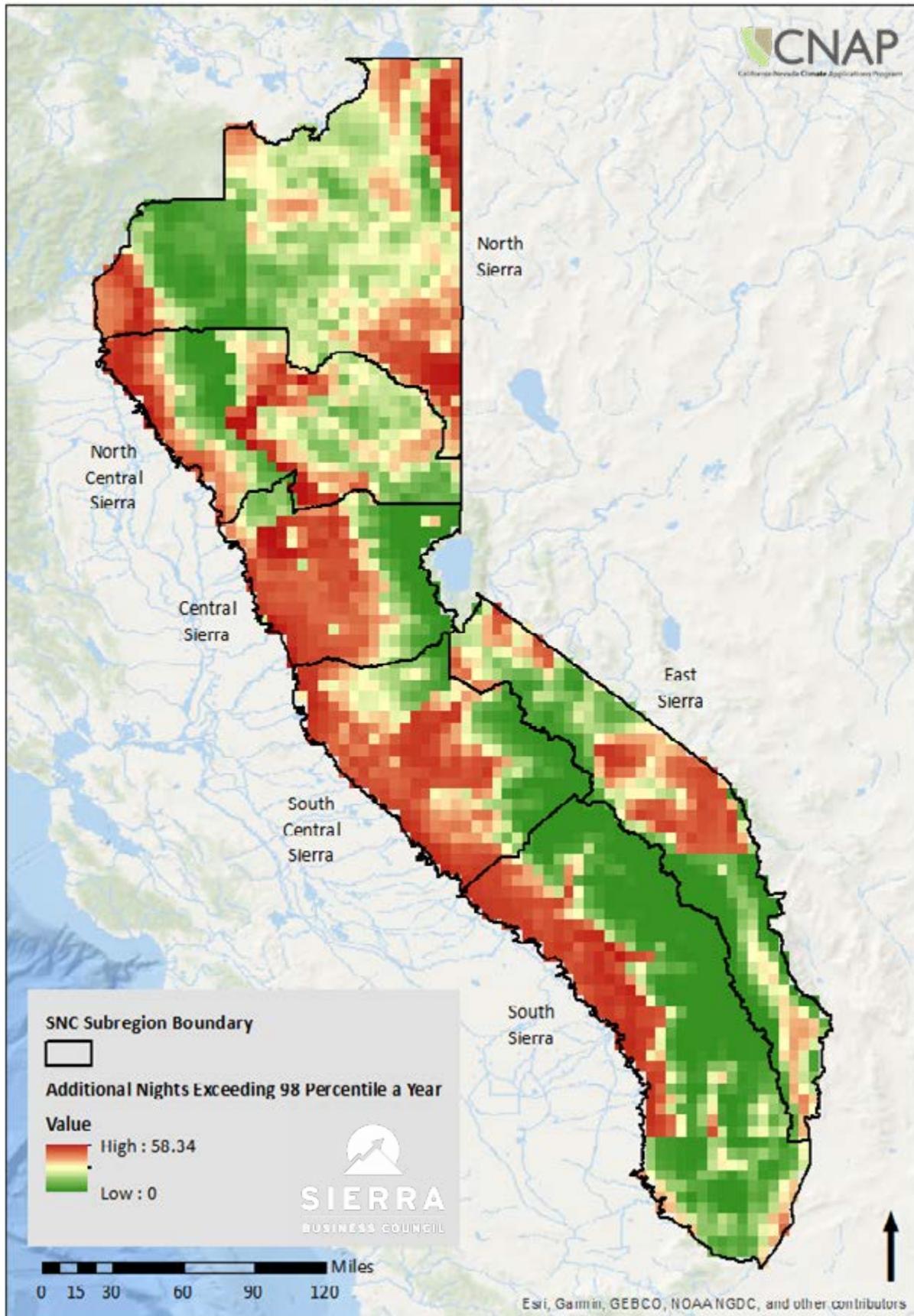
Warm nights are illustrated by nighttime temperatures that exceed 98 percentile “threshold temperatures”, and the maps below illustrate the number of warm nights per year.

Warm Nights Concerns

Public Health	Economic	Environmental
<p>Increasing nighttime temperatures could be more impactful than daytime temperatures. Households in areas with historically low threshold temperatures are less likely to own air conditioners. Households with lower incomes are also less likely to own air conditioners, making them even more vulnerable to the health effects of summer heat extremes.</p>		<p><i>See “Daytime Heat” above for information on how warmer temperatures impact rain/snowfall, SWE (snowpack), soil moisture/evapotranspiration, forest health, and fire.</i></p>
<p>Can influence dehydration and heat-related illnesses</p>	<p>Warming temperatures and more frequent wildfires can impact the operation or the efficiency of power plants, transmission networks, and natural gas facilities.</p> <p>Impact to energy cost associated with cooling</p>	

CHANGE IN NUMBER OF WARM NIGHTS A YEAR 2036-2065

under RCP 8.5 Emissions



CHANGE IN NUMBER OF WARM NIGHTS A YEAR 2036-2065

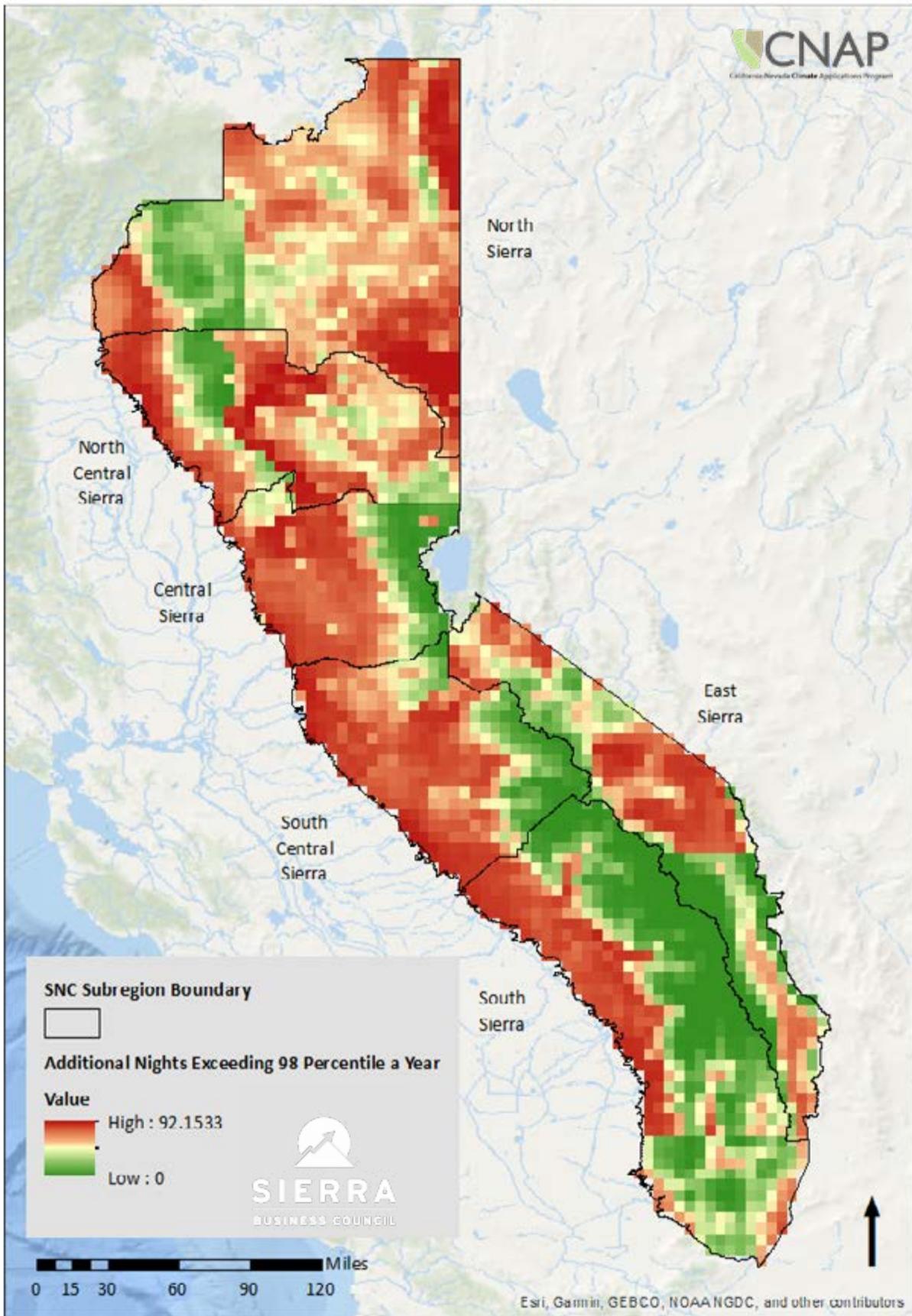
Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will increase 1–56 nights a year	On average will increase 25 nights a year
North Central Sierra	Will increase 1–58 nights a year	On average will increase 28 nights a year
Central Sierra	Will increase 1–57 nights a year	On average will increase 31 nights a year
East Sierra	Will increase 0–52 nights a year	On average will increase 22 nights a year
South Central Sierra	Will increase 0–53 nights a year	On average will increase 39 nights a year
South Sierra	Will increase 0–55 days a year	On average will increase 17 days a year

County	Average Increase in Days <i>Average Includes Diverse Topographic Changes</i>
Alpine	27.5
Amador	29.8
Butte	24.1
Calaveras	33.9
El Dorado	32.8
Fresno	17.5
Inyo	12.1
Kern	12.9
Lassen	27.8
Madera	24.6
Mariposa	30.4
Modoc	29.4
Mono	29.4
Nevada	33.3
Placer	29.5
Plumas	29.9
Shasta	16.7
Sierra	25.7
Tehama	29.1
Tulare	18.5
Tuolumne	30.7
Yuba	22.2

Tables coincide with the map on the previous page (data points are represented by grid colors). For example: as seen in the subregion table, higher elevations in the North Sierra Region will experience a minimal increase in the number of warm nights per year, whereas the lower elevations will experience a much higher increase in warm nights per year over the mid-century time period. On average Alpine County will experience a 27-night increase. 42

CHANGE IN NUMBER OF WARM NIGHTS A YEAR 2070-2099

under RCP 8.5 Emissions



CHANGE IN NUMBER OF WARM NIGHTS A YEAR 2070-2099

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will increase 3–92 days a year	On average will increase 57 days a year
North Central Sierra	Will increase 1–92 days a year	On average will increase 58 days a year
Central Sierra	Will increase 1–91 days a year	On average will increase 56 days a year
East Sierra	Will increase 0–86 days a year	On average will increase 28 days a year
South Central Sierra	Will increase 1–89 days a year	On average will increase 58 days a year
South Sierra	Will increase 0–86 days a year	On average will increase 34 days a year

County	Average Increase in Days <i>Average Includes Diverse Topographic Changes</i>
Alpine	56.9
Amador	59.2
Butte	51.6
Calaveras	66.1
El Dorado	58.2
Fresno	31.7
Inyo	28.3
Kern	31.3
Lassen	62.8
Madera	44.5
Mariposa	56.3
Modoc	64.7
Mono	58.4
Nevada	58.5
Placer	51.8
Plumas	64.5
Shasta	36.3
Sierra	55.7
Tehama	54.5
Tulare	36.0
Tuolumne	55.3
Yuba	54.1

Tables coincide with the map on the previous page (data points are represented by grid colors). For example: as seen in the subregion table, higher elevations in the North Sierra Region will experience a minimal increase in the number of warm nights per year, whereas the lower elevations will experience a much higher increase in warm nights per year over the late-century time period. On average Alpine County will experience a 56.9-night increase.

WATER

“Changing climate is likely to increase the need for water but reduce the supply.

Rising temperatures increase the rate at which water evaporates into the air from soils and surface waters. Rising temperatures also increase the rate at which plants transpire water into the air to keep cool, so irrigated farmland would need more water. However, less water is likely to be available because precip is unlikely to increase as much as evaporation. Soils are likely to be drier, and periods without rain are likely to become longer, making droughts more severe.” —EPA¹⁴

PRECIPITATION



PRECIPITATION

Precipitation can have wide-ranging effects on human well-being and ecosystems. Rainfall, snowfall, and the timing of snowmelt can all affect the amount of surface water and groundwater available for drinking, irrigation, and industry. These factors also influence river flooding and can determine what types of animals and plants (including crops) can survive in a particular place. Changes in precipitation can disrupt a wide range of natural processes, particularly if these changes occur more quickly than plant and animal species can adapt.

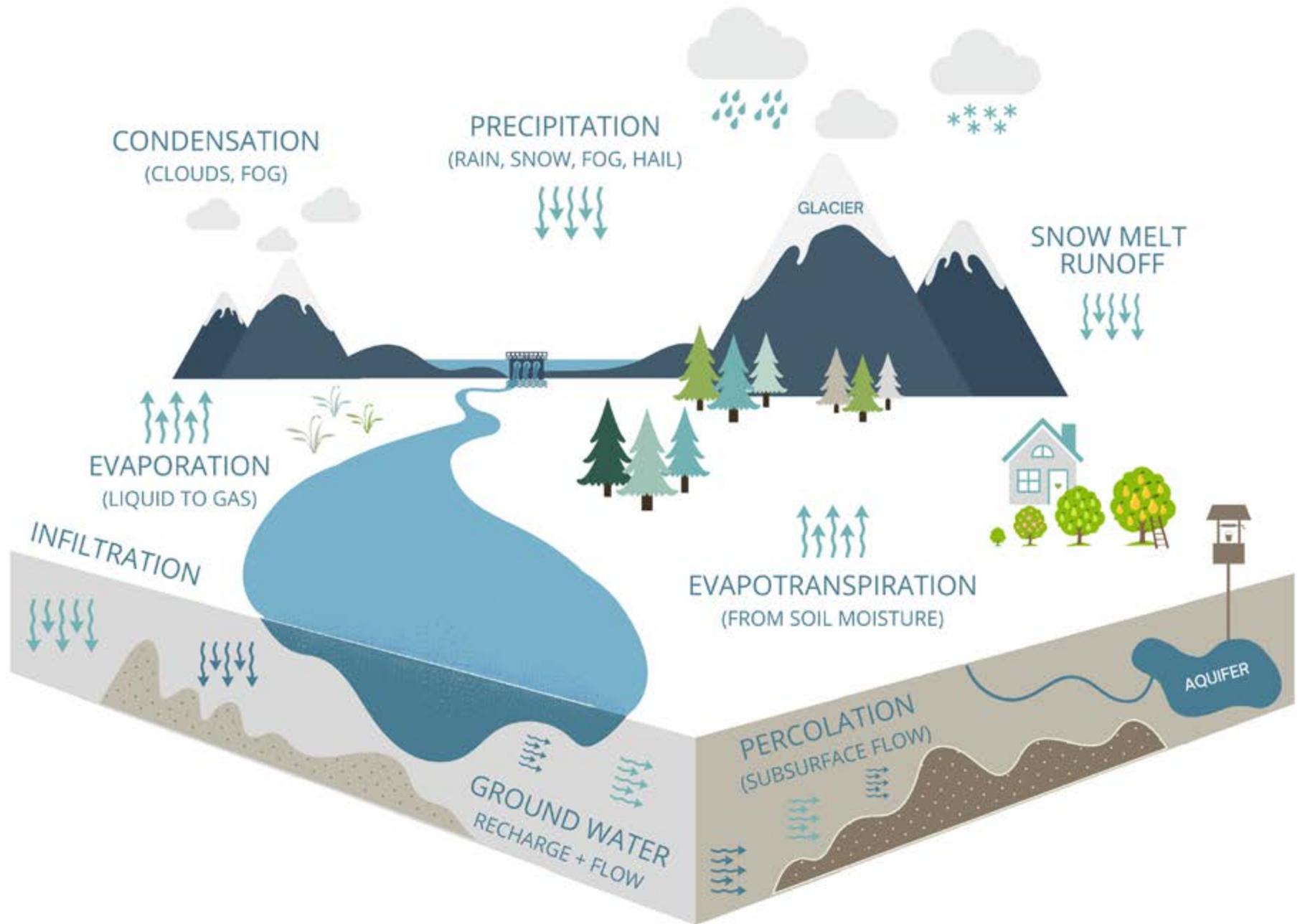
Extremely dry and extremely wet years have become more common in California. On average, the state receives 75% of its annual precipitation from November through March, with 50% occurring from December through February. However, as the winter months have become warmer in recent years, more precipitation has been falling as rain instead of snow over the watersheds that provide most of the state’s water supply.

Snowfall is an important aspect of winter in much of the United States. Many people depend on snowmelt for water in the spring, including millions of people in the western United States, where snowmelt provides 75% of the water supply.

Precipitation Concerns

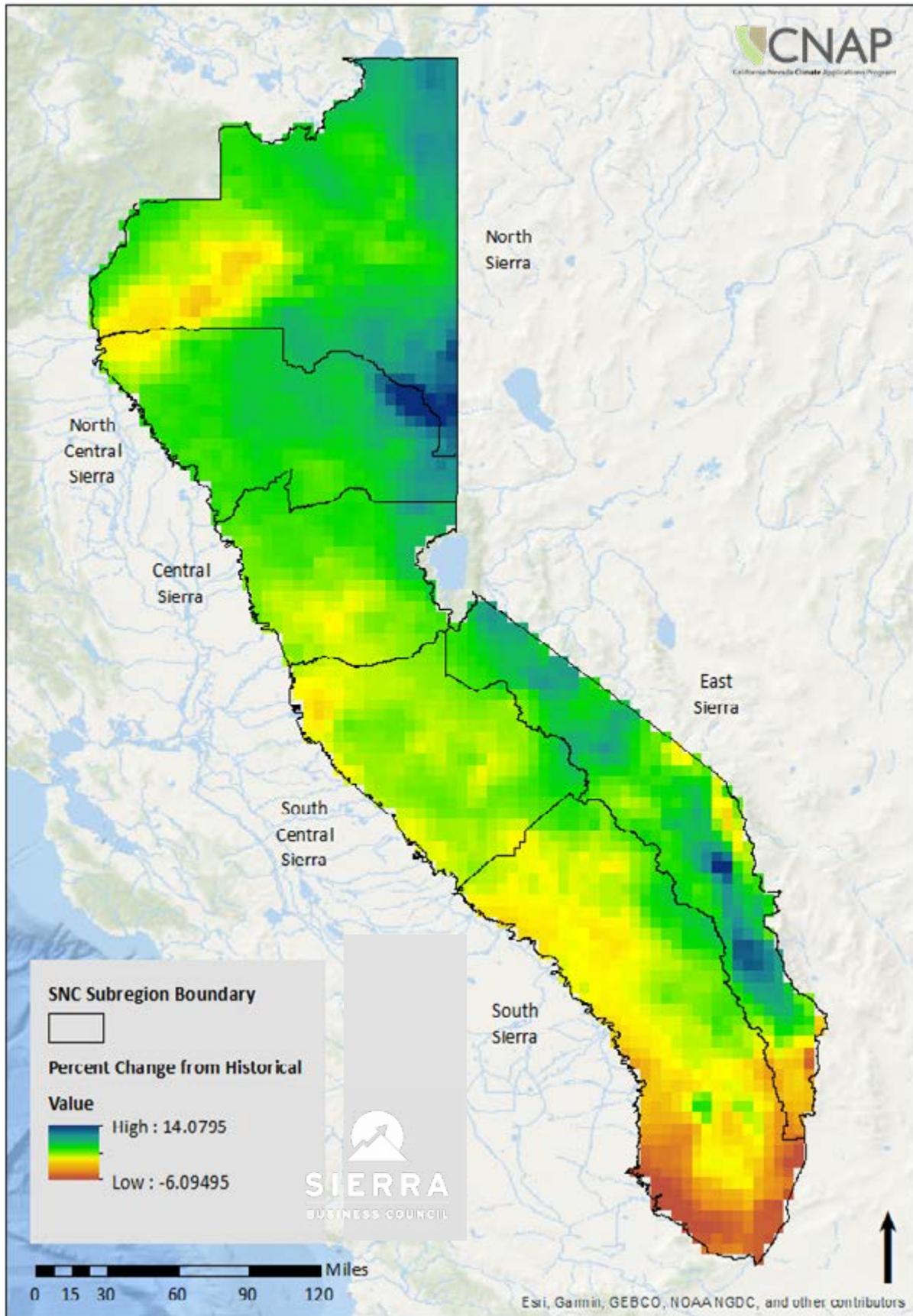
Public Health	Economic	Environmental
Higher temperatures lead to more evaporation, so areas with increased precipitation will not necessarily experience an increase in the amount of water available for drinking, irrigation, and industry.	Many communities rely on snow for winter recreation as well as warm-weather recreation activities, such as kayaking, fishing, etc. This will impact local economies through fewer visitors to the area.	Some plants and animals also depend on snow and snowmelt for survival.

THE WATER CYCLE



CHANGE IN MEAN ANNUAL PRECIPITATION 2036-2065

under RCP 8.5 Emissions



CHANGE IN MEAN ANNUAL PRECIPITATION 2036-2065

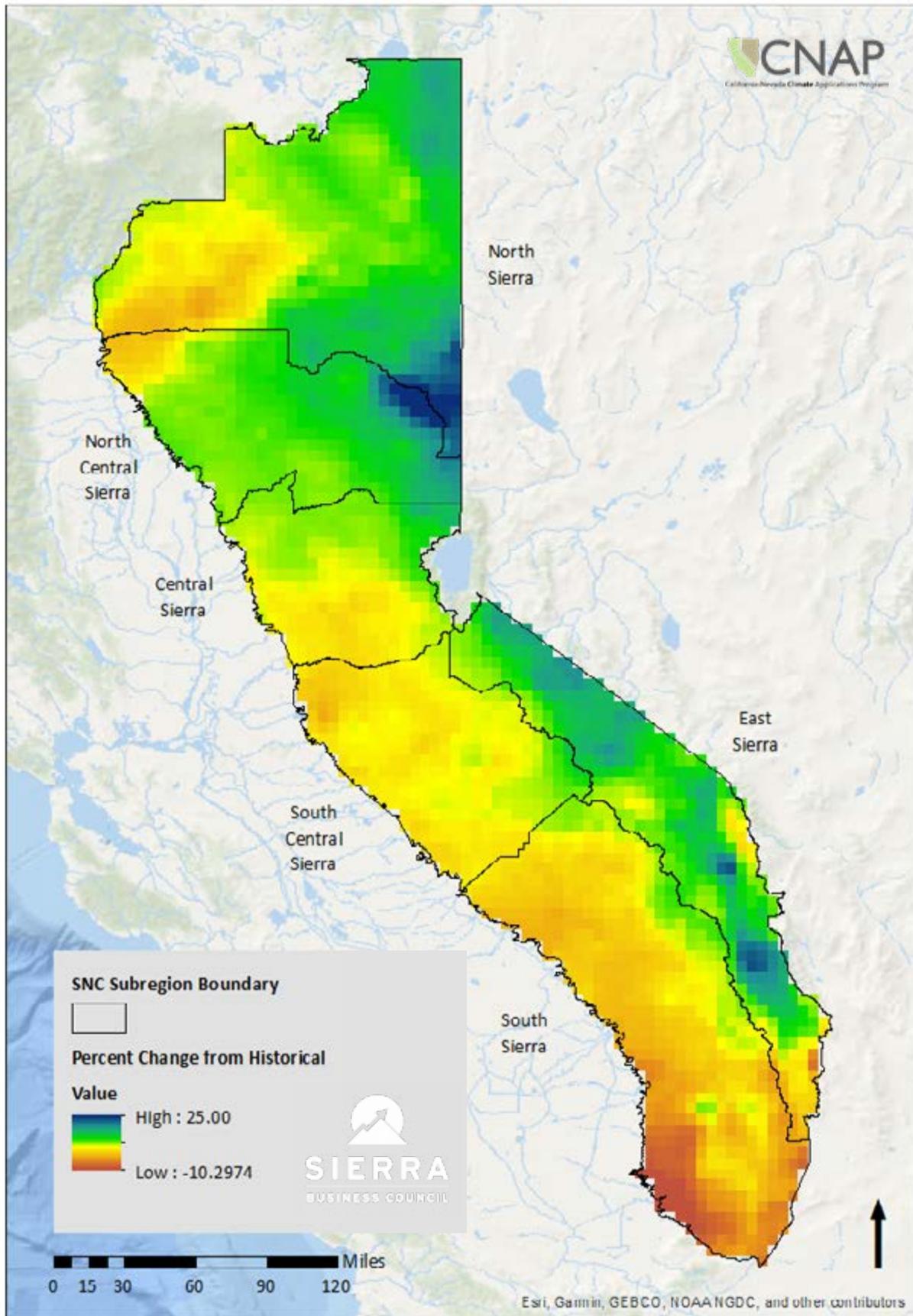
Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will increase 0.2%–12.2%	On average will increase 5.3%
North Central Sierra	Will increase 1.4%–14.1%	On average will increase 5.5%
Central Sierra	Will increase 1.9%–8.4%	On average will increase 4.1%
East Sierra	Could decrease 3.2%, but could increase up to 11.2%	On average will increase 5.2%
South Central Sierra	Will increase 0.8%–7.1%	On average will increase 3.2%
South Sierra	Could decrease 6.1%, but could increase up to 6.4%	On average will increase 1.6%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	5.8
Amador	2.7
Butte	4.7
Calaveras	2.9
El Dorado	3.2
Fresno	2.9
Inyo	5.1
Kern	-1.6
Lassen	5.8
Madera	2.8
Mariposa	3.3
Modoc	6.3
Mono	5.3
Nevada	4.9
Placer	4.4
Plumas	6.5
Shasta	2.9
Sierra	5.9
Tehama	3.6
Tulare	2.0
Tuolumne	3.5
Yuba	4.4

Tables coincide with the map on the previous page (data points are represented by grid colors). For example: as seen in the subregion table, on average the North Sierra Region will experience a 5.3% increase in mean annual precipitation during the mid-century time period. On average Alpine county will experience a 5.8% increase.

CHANGE IN MEAN ANNUAL PRECIPITATION 2070-2099

under RCP 8.5 Emissions



CHANGE IN MEAN ANNUAL PRECIPITATION 2070-2099

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Could decrease 0.6%, but could increase up to 22.8%	On average will increase 8.3%
North Central Sierra	Will increase 0.8%–24.8%	On average will increase 9%
Central Sierra	Will increase 2.4%–13.5%	On average will increase 5.8%
East Sierra	Could decrease 2.9%, but could increase up to 18.8%	On average will increase 9.7%
South Central Sierra	Will increase 0.1%–11.7%	On average will increase 4.3%
South Sierra	Could decrease 10.3%, but could increase up to 9%	On average will increase 1.8%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	9.5
Amador	3.2
Butte	7.4
Calaveras	3.7
El Dorado	4.1
Fresno	3.4
Inyo	8.9
Kern	-1.7
Lassen	9.9
Madera	3.5
Mariposa	4.4
Modoc	9.4
Mono	10.3
Nevada	7.7
Placer	6.3
Plumas	11.0
Shasta	3.5
Sierra	10.2
Tehama	4.8
Tulare	2.1
Tuolumne	4.8
Yuba	6.5

Tables coincide with the map on the previous page (data points are represented by grid colors). For example: as seen in the subregion table, on average the North Sierra Region will experience an 8.3% increase in mean annual precipitation during the late-century time period. On average Alpine County will experience a 9.5% increase.

EXTREME PRECIPITATION



(Heavy Precipitation)

Heavy precipitation has intensified and become more frequent across most of the United States. Extreme precipitation is defined as the amount of rain or snow experienced in a location that substantially exceeds the norm. A representation of a heavy period of precipitation varies depending on time and place. However, the threshold used to define an extreme-precipitation event is the top 1% of all days with precipitation during the reference period. Extreme precipitation does not necessarily mean the total amount of

precipitation at a location has increased, but that precipitation is occurring with more intensity. Changes in the intensity of precipitation, when combined with changes in the interval between precipitation events, can also lead to changes in overall precipitation totals. Climate change has been and will most likely continue to influence an increase in extreme precipitation events.

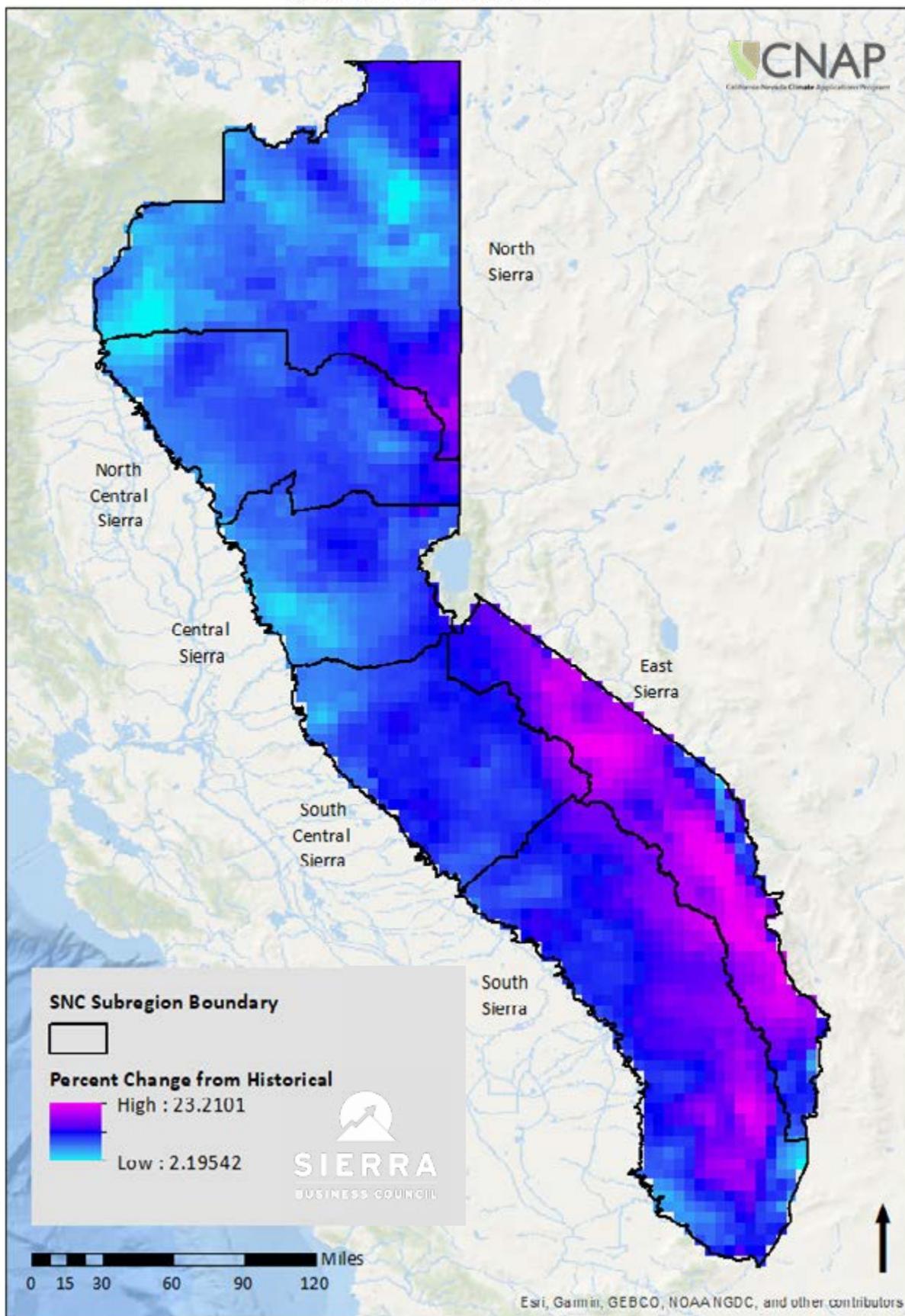
In this assessment, extreme precipitation is represented by a three-day maximum precipitation variable. This variable is represented by maximum precipitation that falls over a three-day period in a year. Three-day maximum precipitation illustrates how these events could increase, but they could occur anytime of year.¹⁵

Extreme Precipitation Concerns

Public Health	Economic	Environmental
<p>Can result in hazards such as flooding, mudslides, and debris flows. Injuries can include, drownings, and other flood-related effects on health and well-being.</p> <p>Large amounts of heavy snow can cause downed trees and landscape changes through avalanches. Impacts can include power outages.</p>	<p>Can result in damage to power infrastructure, resulting in power outages. Without proper heat alternatives, people can suffer from hypothermia.</p> <p>Runoff and flooding from heavy precipitation can damage roads and bridges, costing taxpayers millions.</p> <p>Without flood insurance, housing damage can be costly.</p>	<p>Landslides and debris flows can be a result of extreme precipitation events on wildfire burn scars.</p> <p>Runoff from landwash can impair water quality from polluted surface water.</p> <p>Runoff from extreme precipitation events shapes the landscape; floods and flash floods carve out valleys and arroyos and deposit sediment on floodplains.</p> <p>Increase in extreme precipitation events combined with the overall drier conditions expected may lead to the extreme degradation of meadows and forests from flooding, debris slides, and avalanches.</p>

CHANGE IN ANNUAL 3-DAY MAXIMUM PRECIPITATION 2036-2065

under RCP 8.5 Emissions



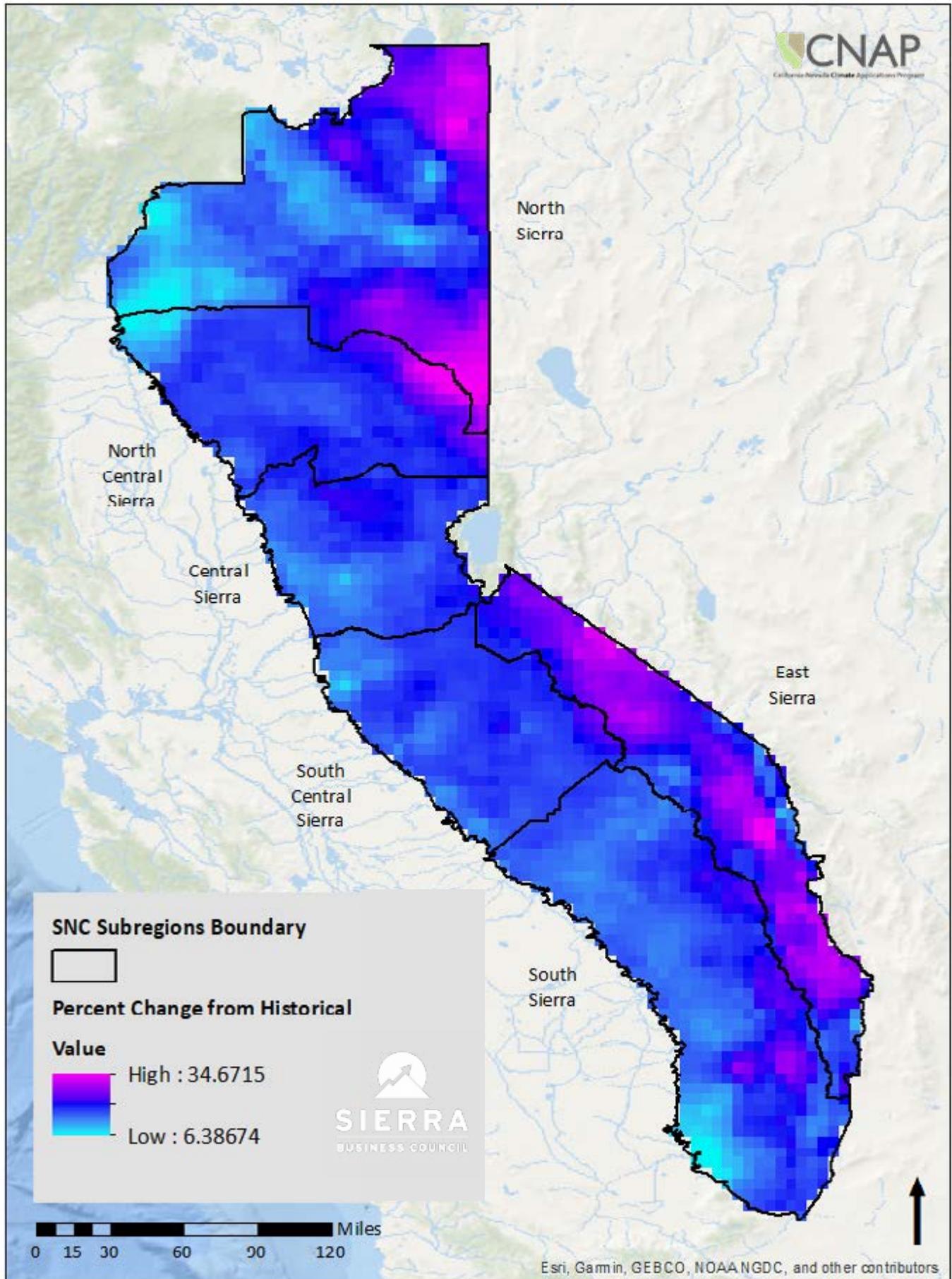
CHANGE IN ANNUAL 3-DAY MAXIMUM PRECIPITATION 2036-2065

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will increase 2.2%–17.6%	On average will increase 8.8%
North Central Sierra	Will increase 4%–18.2%	On average will increase 9.6%
Central Sierra	Will increase 4.7%–14.2%	On average will increase 9%
East Sierra	Will increase 5.6%–23.2%	On average will increase 15.8%
South Central Sierra	Will increase 5.3%–12.5%	On average will increase 10.5%
South Sierra	Will increase 3.8%–19.9%	On average will increase 12.8%

County	Average Increase in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	13.3
Amador	8.9
Butte	8.4
Calaveras	9.9
El Dorado	8.4
Fresno	13.4
Inyo	16.3
Kern	11.2
Lassen	9.5
Madera	11.6
Mariposa	11.0
Modoc	9.3
Mono	16.0
Nevada	9.7
Placer	9.5
Plumas	10.2
Shasta	6.8
Sierra	11.0
Tehama	8.2
Tulare	13.9
Tuolumne	11.9
Yuba	8.4

Tables coincide with the map on the previous page (data points are represented by grid colors). The 3-day maximum precipitation dataset is being used as a proxy for "extreme precipitation events." For example: as seen in the subregion table, on average the North Sierra Region will experience a 8.8% increase in 3-day maximum precipitation during the mid-century time period. On average Alpine county will experience a 13.3% increase.

CHANGE IN ANNUAL 3-DAY MAXIMUM PRECIPITATION 2070-2099 under RCP 8.5 Emissions



CHANGE IN ANNUAL 3-DAY MAXIMUM PRECIPITATION 2070-2099

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Could decrease 0.6%, but could increase up to 22.8%	On average will increase 8.3%
North Central Sierra	Will increase 0.8%–24.8%	On average will increase 9%
Central Sierra	Will increase 2.4%–13.5%	On average will increase 5.8%
East Sierra	Could decrease 2.9%, but could increase up to 18.8%	On average will increase 9.7%
South Central Sierra	Will increase 0.1%–11.7%	On average will increase 4.3%
South Sierra	Could decrease 10.3%, but could increase up to 9%	On average will increase 1.8%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	9.5
Amador	3.2
Butte	7.4
Calaveras	3.7
El Dorado	4.1
Fresno	3.4
Inyo	8.9
Kern	-1.7
Lassen	9.9
Madera	3.5
Mariposa	4.4
Modoc	9.4
Mono	10.3
Nevada	7.7
Placer	6.3
Plumas	11.0
Shasta	3.5
Sierra	10.2
Tehama	4.8
Tulare	2.1
Tuolumne	4.8
Yuba	6.5

Tables coincide with the map on the previous page (data points are represented by grid colors). For example: as seen in the subregion table, on average the North Sierra Region will experience an 8.3% increase in mean annual precipitation during the late-century time period. On average Alpine County will experience a 9.5% increase.



As extreme rains increase, there is more evaporation and more water available for rain, which contributes to changing weather patterns and flood risks. Extreme rain events are increasing in duration, intensity, and frequency, leading to more flash floods and more flooding from overflowing rivers and streams. Increases and decreases in frequency and magnitude of river flood events generally coincide with increases and decreases in the frequency of heavy rainfall events.

Climate change could affect trends in river flooding: communities may see larger and more frequent river floods in some places and smaller and less frequent floods in other places. As warmer temperatures cause more water to evaporate from the land and oceans, changes in the size and frequency of heavy precipitation events will affect the size and frequency of river flooding (see the Heavy Precipitation indicator). Changes in streamflow, the timing of snowmelt (see the Streamflow indicator), and the amount of snowpack that accumulates in the winter (see the Snowpack indicator) can also affect flood patterns.

For the purposes of this report, we have utilized the results from Flood Factor. The model uses 1980–2010 as a baseline period to analyze multiple environmental possibilities under the RCP 4.5 carbon emissions scenario with high and low uncertainty bounds.¹⁶

The resulting high, median, and low environmental scenarios are then used as inputs when calculating current and future flood risks to show how flood risks will change in 15 and 30 years.

The model calculates a location's probability of flooding from the four major flood types: rain, riverine, tidal events, and storm surge.

Rain-on-Snow (Flood Event)

A ROS event is an event that is influenced by variations in temperature and precipitation patterns. Flooding events that result from sub-zero snowpacks will freeze rain on top of or within the snowpack, creating a layer of ice with higher density. Warmer rain then falls on the ice, creating a rapid runoff effect in areas with steep topography and resulting in a flooding event.

How ROS events occur—and their flood risks—is still a subject of research. The severity of an event is determined by several factors: the magnitude of precipitation, elevation of the freezing level, water equivalent, and areal extent of the antecedent snowpack. Climate scientists have started to determine that ROS events are more frequent from October through May. However, the trend varies for the western United States, where ROS events occur frequently in early summer and early fall.¹⁷

Flooding Concerns

Public Health	Economic	Environmental
<p>As water quickly moves downslope, it can overwhelm streams, leading to channel degradation and increased sedimentation in water, making surface water undrinkable.</p> <p>Can harm and/or displace people</p>	<p>Large flood events can wipe out crops and damage infrastructure like homes, roads, and bridges.</p> <p>Tourisms will be impacted as people may not be able to get to desired locations due to roads and bridges being out.</p> <p>Flooding and sedimentation can directly affect the water supplies that communities depend on.</p>	<p>Larger and/or more frequent floods can disrupt ecosystems by displacing aquatic life, impairing water quality, increasing soil erosion, fallen trees, and debris flows.</p>

LANDSLIDES

(Mudslides & Debris Flow)



MUDSLIDES & DEBRIS FLOWS

One of the most dangerous postfire hazards are fast-moving, highly destructive debris flows. These events are typically triggered by intense rainfall, but even modest rainstorms can produce dangerous flash floods and debris flows when the hydrologic response of a watershed becomes vulnerable due to vegetation loss and soil exposure.

The dataset below is provided by the USGS, which conducts postfire debris-flow hazard assessments for select fires in the western US. The use of geospatial data related to basin morphometry, burn severity, soil properties, and rainfall characteristics is aggregated to estimate the probability and volume of debris flows that could occur in response to a design storm. The maps provided by the USGS depict the likelihood of debris-flow generation as well as estimates of flow magnitude in locations where debris flows initiate. The models do not predict downstream impacts, potential debris-flow runout paths, or the areal extent of debris-flow or flood inundation.

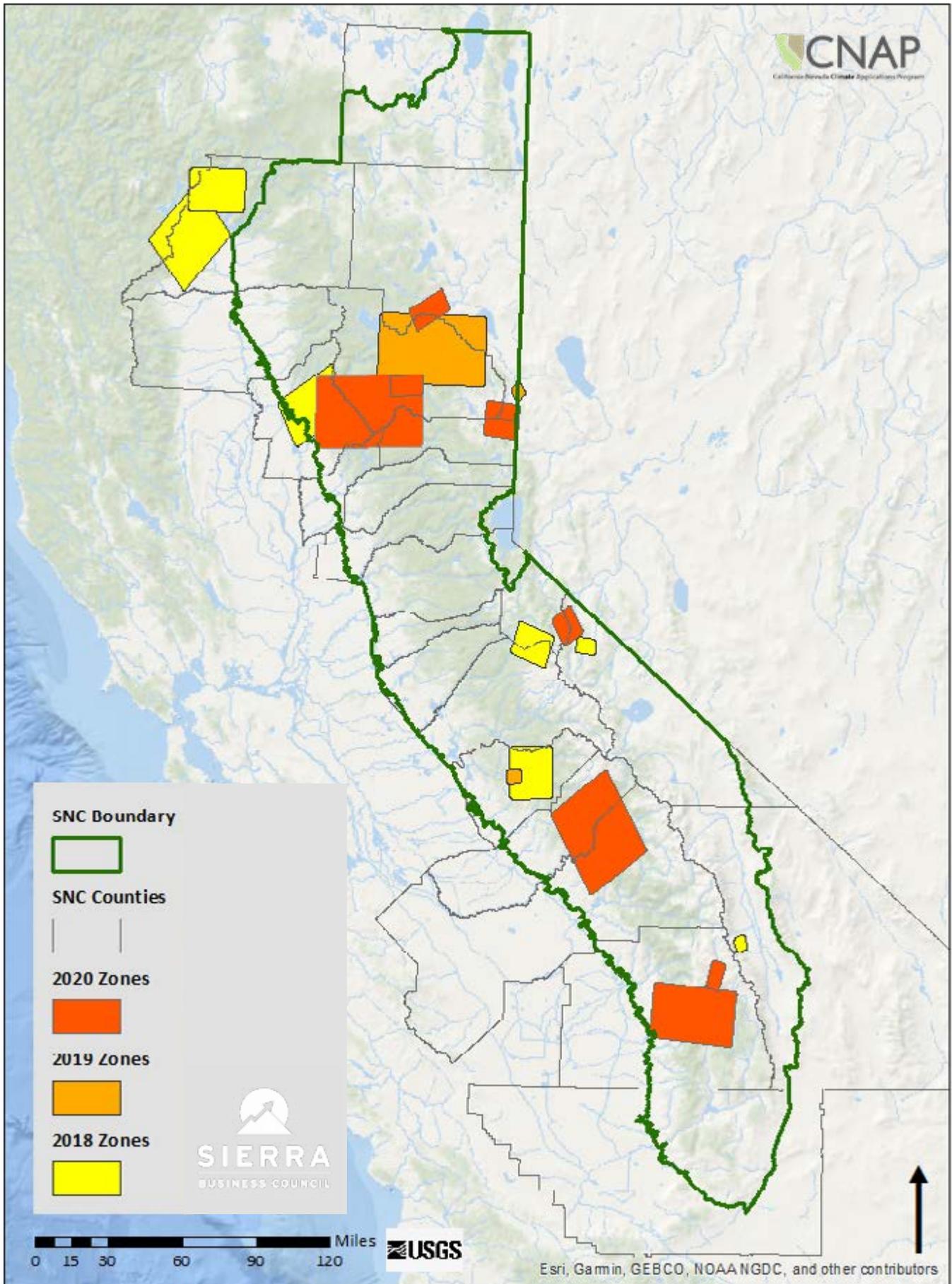
According to the USGS, there is no definitive timeline for risk in a particular area (postfire). Risk of debris flows can last anywhere from three to five years on average, depending on extreme precipitation events. The map below only represents wildfire scars from 2018 to 2020.

For more information regarding the data and limitations refer to: https://www.usgs.gov/natural-hazards/landslide-hazards/science/scientific-background?qt-science_center_objects=0#qt-science_center_objects

Landslide Concerns

Public Health	Economic	Environmental
Risk to people’s lives and well-being	Risk to property Can block drainage ways and damage infrastructure ¹⁹	High risk to permanently stripping vegetation, damaging water systems, and altering landscapes

HIGH PROBABILITY POST FIRE DEBRIS FLOW ZONES



HIGH PROBABILITY POST FIRE DEBRIS FLOW ZONES

By Subregion

	Number of Probability Events
North Sierra	Two events in Lassen county (one from 2019 and one from 2020 fires)
North Central Sierra	Six events in Butte, Plumas, and Sierra counties (one from 2018, one from 2019, and four from 2020 fires)
Central Sierra	One event in N. Yuba county (2020 fire)
East Sierra	Four events in Alpine, Mono, and Inyo counties (three from 2018 and one from 2020 fires)
South Central Sierra	Three events in Tuolumne and Mariposa counties (two from 2018, and one from 2019 fires)
South Sierra	Three events in Madera, Fresno, and Tulare counties (2020 fires)

AVALANCHES



There are three main climate variables that contribute to avalanches: extreme temperature swings, long winter dry spells, and warmer temperatures.

Extreme temperature swings in the early season makes the snowpack less cohesive and can lead to a less stable base in the snowpack. A less stable snowpack base can lead to large slab avalanches that can be life threatening, destructive to natural environments, and cause structural damage to utility infrastructure.

Longer dry spells between intense storms have become more common in the Sierra. A snow storm followed by a dry spell creates a weak layer in the snowpack. When a new storm comes it produces a strong snow layer and the weak layer cannot support it, hence a slide ensues.

With expected increases in warm temperatures throughout the year, rain-on-snow (ROS) will become more common. When rain falls on snow, slick ice layers develop in the snowpack. These, along with solar radiation, allow water to percolate the snowpack, which weakens the snowpack and leads to wet avalanches. Historically, wet avalanches are more frequent in the spring with warming temperatures and melting snow, but they could occur at any time with warmer temperatures now expected throughout the winter. When the snow water content increases, avalanches tend to increase.

Extreme precipitation events can influence extreme avalanches. If extreme precipitation events occur after long dry spells or while temperatures hover near freezing, more avalanches can be expected.

Avalanche Concerns

Public Health	Economic	Environmental
Can bury neighborhoods and communities		Avalanches can result in entire hillsides of downed trees, creating fuel for wildfires.
Risk to people’s lives and well-being	Block, damage, or destroy infrastructure including roads, bridges, power lines, buildings, cell towers, pump stations Can impact winter outdoor recreation businesses	Damage to mature trees will result in reduced habitat and food for wildlife and can decrease the amount of snowfall intercepted and retained by tree canopies. Can scour slopes, accumulate debris in the runout, and dam streams (which eventually will fail), and produce flooding by displacing water from lakes and streams ²⁰

“The decline in snowpack could further limit the supply of water for some purposes. Mountain snowpacks are natural reservoirs. They collect the snow that falls during winter and release water when the snow melts during spring and summer. Over the past 50 years, snowpack has been melting earlier in the year. Dams capture most meltwater and retain it for use later in the year. But upstream of these reservoirs, less water is available during droughts for ecosystems, fish, water-based recreation, and landowners who draw water directly from a flowing river.” —EPA²¹

SNOWPACK AND SNOW COVER

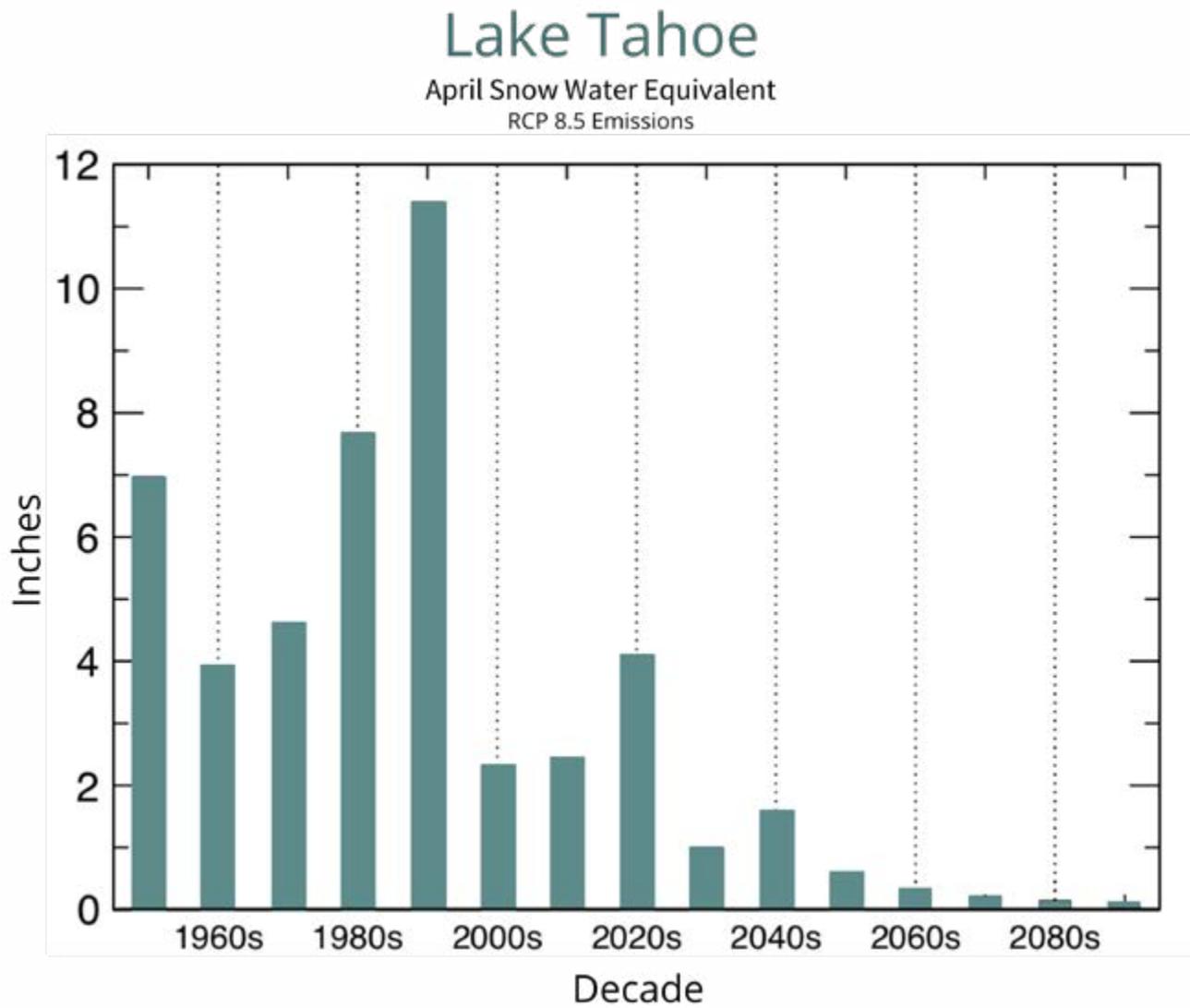


A measurement called Snow Water Equivalent (SWE) is used to determine trends in snowpack. SWE is the amount of water contained within the snowpack at a particular location. It can be thought of as the depth of water that would result if the entire snowpack were to melt. The amount of water stored in the state’s snowpack has been highly variable from year to year, ranging from a high of about 240% of average in 1952 to a record low of 5% in 2015. Across the US, water supplied by snow is expected to decline ~25% by 2050.²²

Snow cover refers to the area of land that is covered by snow at any given time. Between 1972 and 2015, the average portion of North America covered by snow decreased at a rate of about 3,300 square miles per year (based on weekly measurements taken throughout the year). There has been year-to-year variability, however, the length of time when snow covers the ground is nearly two weeks shorter now than it was in 1972.

Such changing climate conditions can have worldwide implications because snow and ice influence air temperatures, sea level, ocean currents, and storm patterns. More than 90% of measurement sites in the western United States reported decreased early spring snowpack between 1955 and 2016. Across all sites, snowpack depth declined by an average of 23% during the same time period.

Temperature and precipitation are key factors affecting snowpack and snow cover. Snowpack stores water from wintertime precipitation, releasing it as gradual runoff in the warmer months (snowmelt runoff). Snow cover is not just affected by climate change; it also affects the climate. Snow cover influences the climate by reflecting heat. Since snow is white, it only absorbs a small portion of sunlight (10%–20% in the case of fresh snow) and reflects the remaining sunlight back to space. Bare ground and open water are darker-colored surfaces that absorb the majority of the sun’s energy and heat up more quickly. This can result in the warming phenomenon known as “snow albedo feedback.”²³



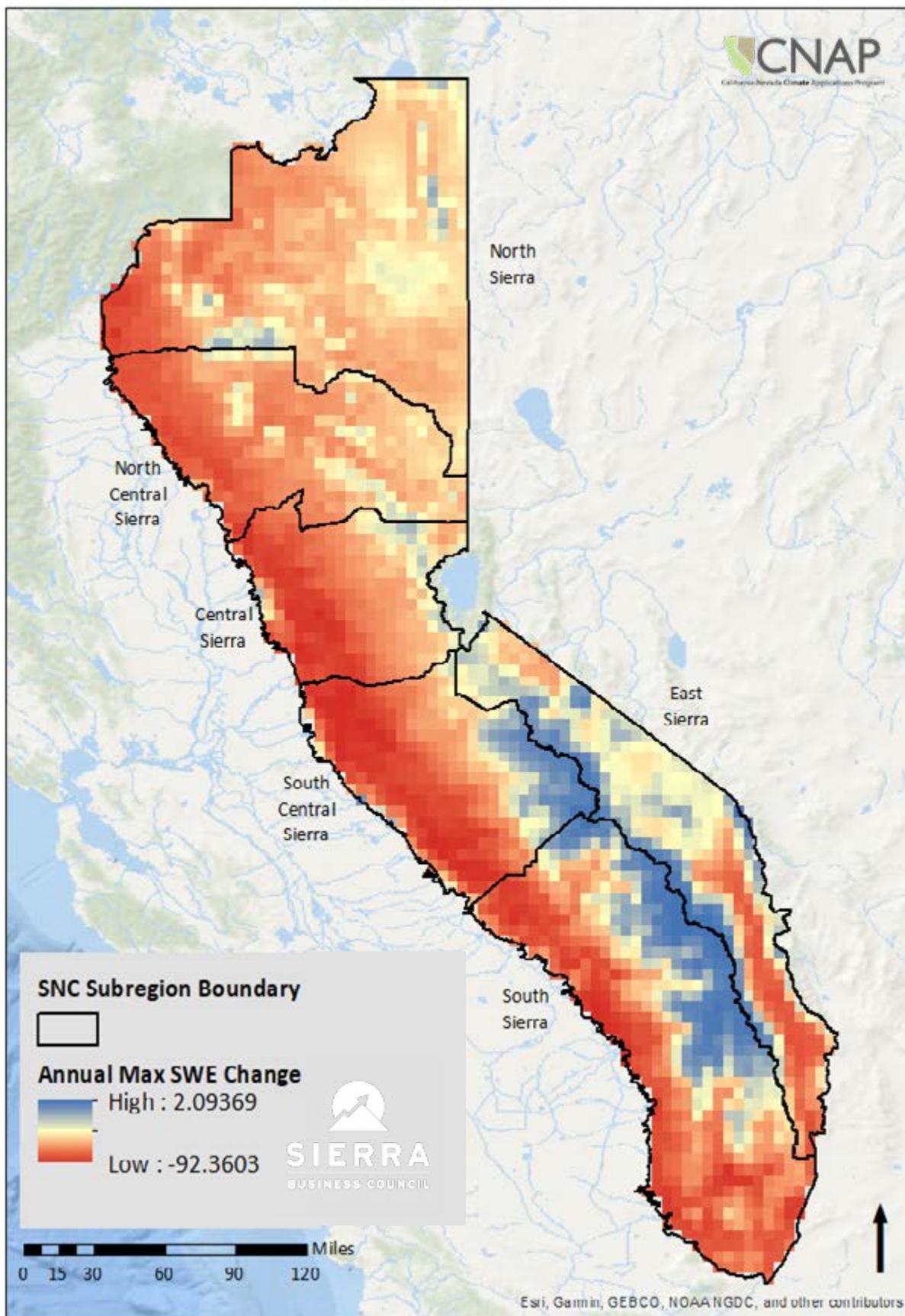
The authors of this report acknowledge that the Lake Tahoe is not within the boundaries of the SNC Region. However, it is a recognizable location at 6,000 that was chosen as an example to illustrate this data.

Snowpack and Snow Cover Concerns

Public Health	Economic	Environmental
	<p>Continual snow drought can lead to summer drought conditions and dry wells in areas that depend on private water systems, impacting the cost of drilling new or deeper wells.</p>	<p>Snow droughts reduce the amount of available water for spring and summer snowmelt.</p> <p>Less snow cover could diminish the beneficial insulating effects of snow for vegetation and wildlife.</p>
<p>California relies on water from melting snow in the Sierra Nevada to provide 60% of its water supply for agriculture and urban needs.</p>	<p>Directly impacts outdoor recreation industry and activities for millions of people</p> <p>Extreme snow storms can damage infrastructure and travel in rural mountainous regions</p>	<p>Impacts groundwater replenishing and soil moisture</p> <p>Lack of snow cover can impact sunlight reflection and influence surface temperature increases.</p>

CHANGE IN ANNUAL MAXIMUM SWE 2036-2065

under RCP 8.5 Emissions



CHANGE IN ANNUAL MAX SWE 2036-2065

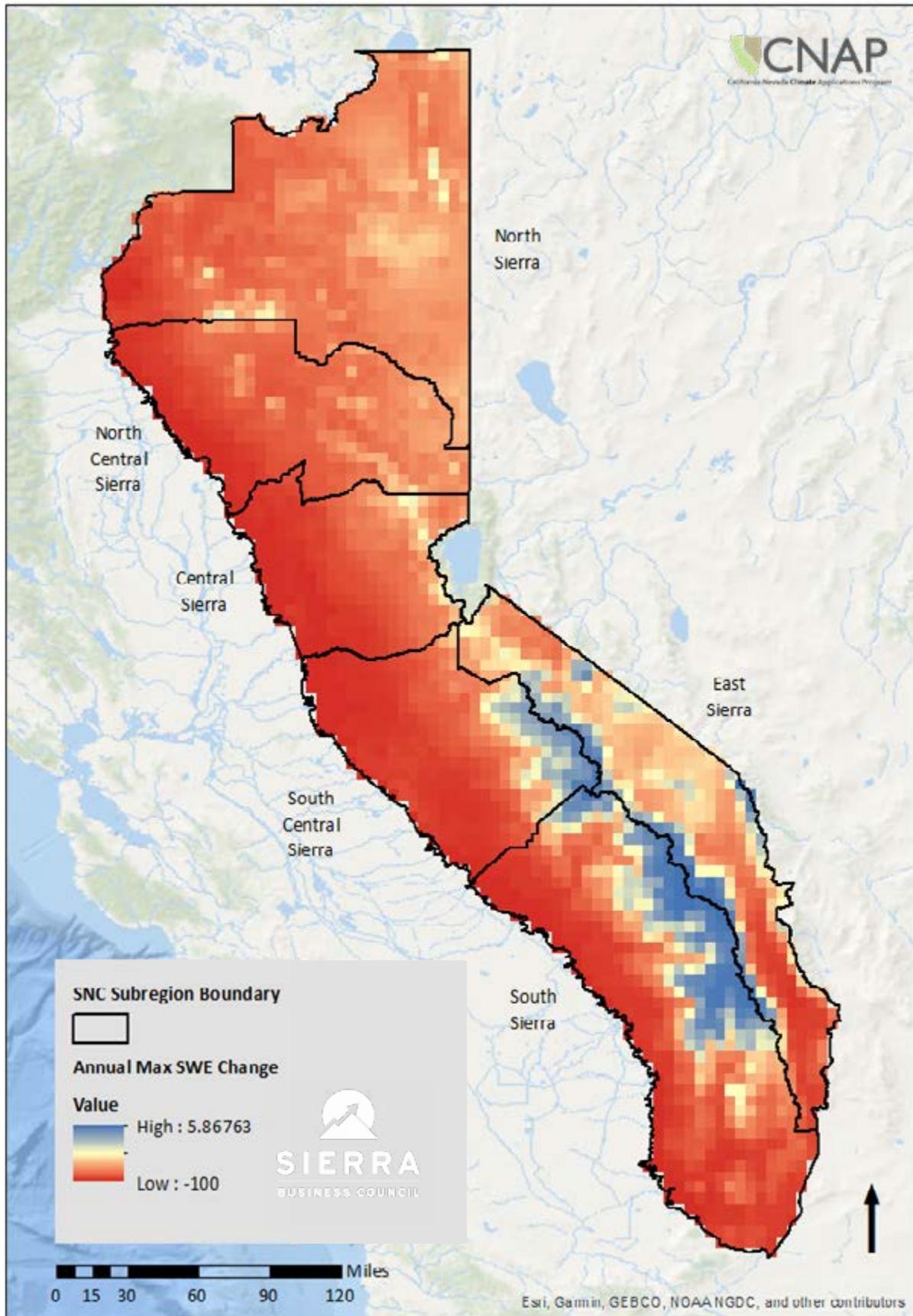
Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will decrease 18.9%–89.3%	On average will decrease 58.58%
North Central Sierra	Will decrease 31.6%–88.6%	On average will decrease 65.3%
Central Sierra	Will decrease 23.25%–90.9%	On average will decrease 69.7%
East Sierra	Will decrease 2.05%–83.5%	On average will decrease 43.2%
South Central Sierra	Could decrease 92.4%, but could increase 0.4%	On average will decrease 63.7%
South Sierra	Could decrease 92.2% but could increase 2.1%	On average will decrease 54.5%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	-40.4
Amador	-77.1
Butte	-76.4
Calaveras	-78.0
El Dorado	-72.5
Fresno	-41.2
Inyo	-53.4
Kern	-77.1
Lassen	-55.5
Madera	-58.2
Mariposa	-68.0
Modoc	-56.2
Mono	-35.9
Nevada	-67.0
Placer	-64.8
Plumas	-60.2
Shasta	-68.1
Sierra	-56.2
Tehama	-74.8
Tulare	-48.7
Tuolumne	-50.9
Yuba	-79.7

Tables coincide with the map on the previous page (data points are represented by grid colors). Snow levels are predicted to continue to recede in elevation. For example: as seen in the subregion table, higher elevations in the North Sierra Region will experience a minimum decrease of 18.9% in Annual Max SWE, whereas lower elevations will experience up to an 89.3% decrease in Annual Max SWE over the mid-century time period. On average Alpine county will experience a 40.4% decrease.

CHANGE IN ANNUAL MAXIMUM SWE 2070-2099

under RCP 8.5 Emissions



CHANGE IN ANNUAL MAXIMUM SWE 2070-2099

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will decrease 42.9%–99.8%	On average will decrease 78.4%
North Central Sierra	Will decrease 57%–100%	On average will decrease 85.5%
Central Sierra	Will decrease 45.7%–100%	On average will decrease 88.4%
East Sierra	Could decrease 98.6%, but could increase 5.9%	On average will decrease 60.5%
South Central Sierra	Will decrease 1.5%–100%	On average will decrease 81.4%
South Sierra	Could decrease 100%, but could increase 2.6%	On average will decrease 70.6%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	-63.9
Amador	-93.1
Butte	-95.2
Calaveras	-95.3
El Dorado	-89.9
Fresno	-56.2
Inyo	-68.6
Kern	-93.5
Lassen	-75.0
Madera	-75.9
Mariposa	-84.7
Modoc	-77.2
Mono	-53.3
Nevada	-85.6
Placer	-85.8
Plumas	-81.3
Shasta	-87.2
Sierra	-78.5
Tehama	-92.6
Tulare	-64.9
Tuolumne	-70.0
Yuba	-96.9

Tables coincide with the map on the previous page (data points are represented by grid colors). Snow levels are predicted to continue to recede in elevation. For example: as seen in the subregion table, higher elevations in the North Sierra Region will experience a minimum decrease of 42.9% in Annual Max SWE, whereas lower elevations will experience up to a 99.8% decrease in Annual Max SWE over the late-century time period. On average Alpine county will experience a 63.9% decrease.

SNOW COVER ON JANUARY 1

(Change in Fraction of Years with >50 mmSWE on January 1)



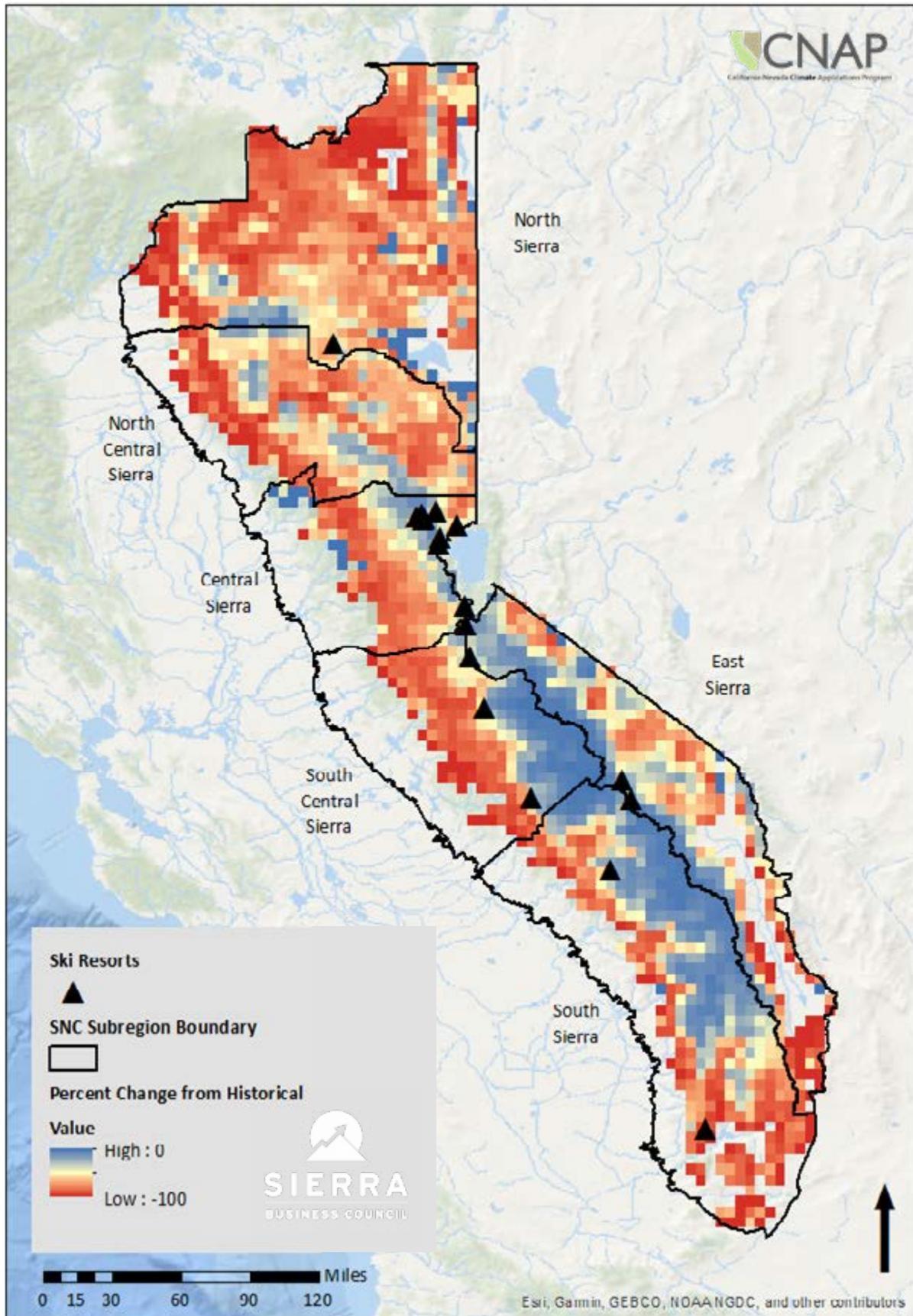
This variable was selected as an indicator for determining snow cover on January 1. In collaboration with our TAG members, and thinking about average ski resort openings based on conditions, January 1 was designated as an average benchmark for when ski resorts have the minimum 20 inches needed to open. Elevation plays a major role in interpreting this indicator, but its primary function is to illustrate how often there is snow on the ground on a particular day (January 1).

The January 1 metric is used to determine potential economic impacts on communities reliant on ski resorts and snow-sport tourism. In general, ski resorts generate a high percentage of seasonal revenue during the December and January holiday season. While many ski resorts rely on artificial snowmaking to open before the holiday season, a lack of natural snow cover will increase operating costs and reduce the ability of smaller resorts to open. Diminished snow cover on January 1st will result in economic hardship for some Sierra communities.

This dataset illustrates dramatic decrease throughout the mid and late-century in snow pack on January 1. As snow levels recede in elevation, ski resorts will be forced to open later, or commit to huge costs of making snow (temperatures permitting).

CHANGE IN SNOW COVER ON JANUARY 1 2036-2065

under RCP 8.5 Emissions



CHANGE IN SNOW COVER ON JANUARY 1 2036-2065

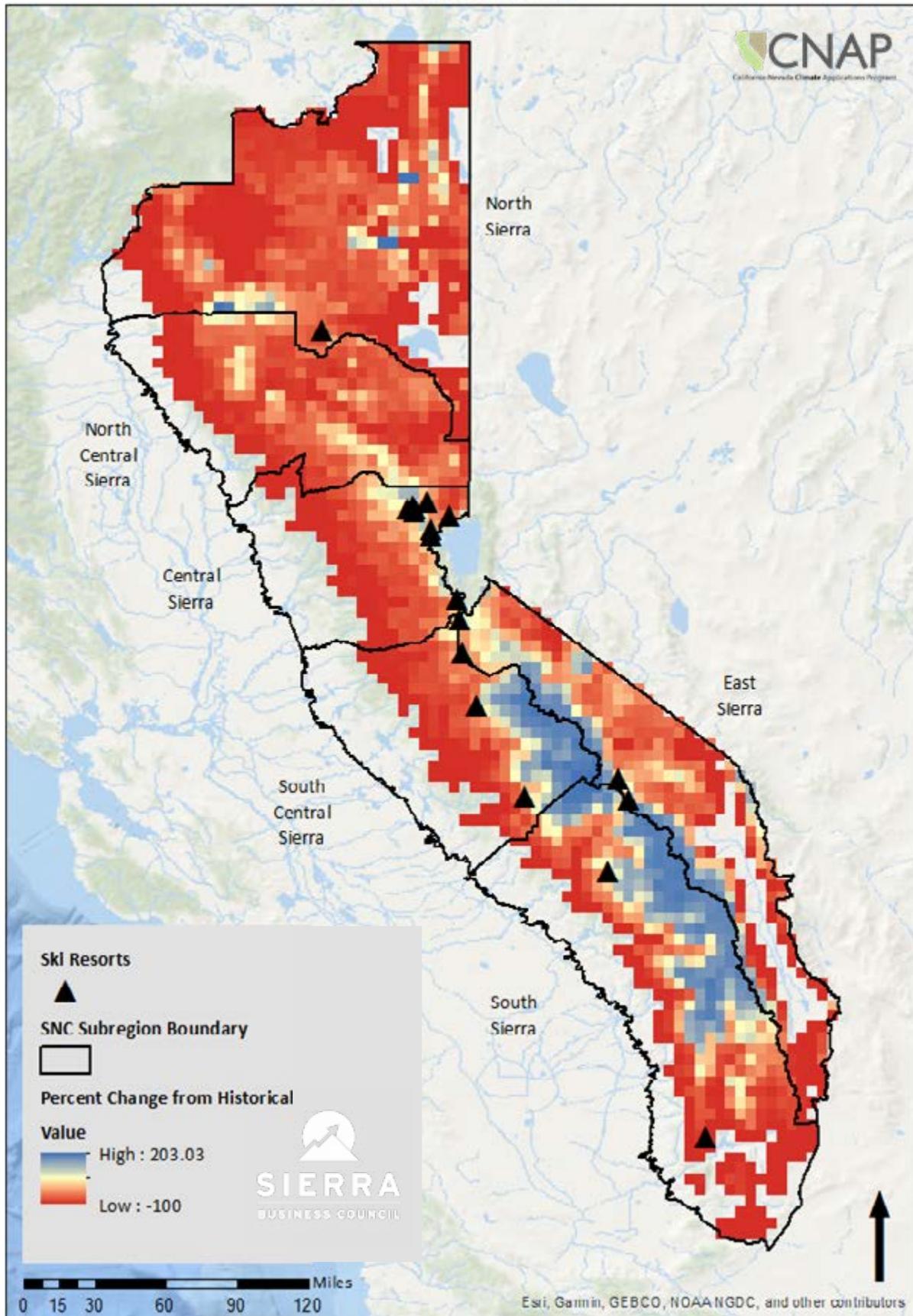
Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will decrease 0%–100%	On average will decrease 68.3%
North Central Sierra	Will decrease 11.5%–100%	On average will decrease 62.6%
Central Sierra	Will decrease 0%–100%	On average will decrease 57%
East Sierra	Will decrease 0%–100%	On average will decrease 46.1%
South Central Sierra	Will decrease 1%–100%	On average will decrease 52.2%
South Sierra	Will decrease 0%–100%	On average will decrease 47%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	-31.9
Amador	-65.3
Butte	-77.2
Calaveras	-75.6
El Dorado	-65.1
Fresno	-29.1
Inyo	-60.2
Kern	-84.6
Lassen	-62.7
Madera	-44.6
Mariposa	-53.7
Modoc	-76.0
Mono	-42.2
Nevada	-55.0
Placer	-53.0
Plumas	-60.5
Shasta	-68.9
Sierra	-53.7
Tehama	-71.1
Tulare	-45.2
Tuolumne	-44.9
Yuba	-31.2

Tables coincide with the map on the previous page (data points are represented by grid colors). For example: as seen in the subregion table, higher elevations in the North Sierra Region will experience a minimal decrease in snow cover on Jan 1, whereas lower elevations will experience a much higher decrease in snow cover on Jan 1 (up to a 100% decrease) over the mid-century time period. On average Alpine county will experience a 31.9 % decrease.

CHANGE IN SNOW COVER ON JANUARY 1 2070-2099

under RCP 8.5 Emissions



CHANGE IN SNOW COVER ON JANUARY 1 2070-2099

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will decrease 0%–100%	On average will decrease 89.5%
North Central Sierra	Will decrease 47%–100%	On average will decrease 86%
Central Sierra	Will decrease 28.8%–100%	On average will decrease 86%
East Sierra	Will decrease 4.9%–100%	On average will decrease 71%
South Central Sierra	Will decrease 5%–100%	On average will decrease 69.2%
South Sierra	Will decrease 4.9%–100%	On average will decrease 64.9%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	-63.5
Amador	-86.9
Butte	-94.4
Calaveras	-93.9
El Dorado	-89.3
Fresno	-46.8
Inyo	-76.6
Kern	-99.1
Lassen	-87.6
Madera	-61.4
Mariposa	-68.6
Modoc	-91.9
Mono	-69.9
Nevada	-81.6
Placer	-82.9
Plumas	-86.2
Shasta	-90.2
Sierra	-80.2
Tehama	-91.5
Tulare	-65.3
Tuolumne	-62.0
Yuba	-99.5

Tables coincide with the map on the previous page (data points are represented by grid colors). For example: as seen in the subregion table, higher elevations in the North Sierra Region will experience a minimal decrease in snow cover on Jan 1, whereas lower elevations will experience a much higher decrease in snow cover on Jan 1 (up to a 100% decrease) over the late-century time period. On average Alpine county will experience a 63.5 % decrease.



RUNOFF

When air temperature begins to warm in the spring, snow that has accumulated over the winter in California's mountains begins to melt, releasing water as runoff. Over the past century, a greater proportion of runoff from the Sierra Nevada has been flowing into the Sacramento River earlier in the spring.

The volume and timing of snowmelt runoff are affected by air temperature. During the winter, warmer temperatures result in more precipitation falling as rain instead of snow, resulting in less snowpack. The earlier arrival of warmer temperatures in the spring causes snow to melt earlier in the year. Since 1906, the fraction of annual snowmelt runoff that flows into the Sacramento River between April and July (springtime) has decreased by about 9%. (The total volume of runoff each year has not changed, just its timing.)



STREAMFLOW

Streamflow specifically refers to the amount of water flowing in a river and is measured by the rate at which water is carried. Rivers represent a critical resource not only for people but for all plants and animals. Oceans and groundwater rely on rivers to replenish and refresh their sources through streambeds and gravity.

Streamflow is influenced by the following natural and human factors: runoff, evaporation, transpiration, groundwater recharge/discharge, sedimentation, surface water withdrawals, flow regulation, stream channelization, drainage, changes to land use, and irrigation.

As temperatures increase and snowpack diminishes, streamflows are also projected to shift in their timing. A particular concern in California is the spring snowmelt, which feeds streamflow for irrigation and energy purposes when it is needed most.

California's major watersheds have been altered by large-scale projects such as dams and diversions that enable the management of water to meet human needs related to agriculture, urban uses, energy, and ecology. For this reason, it would be misleading to do a straight comparison of observed streamflows at a given point. This obstacle is overcome through the calculation of natural or unimpaired flows, which are what would occur if flows were not subjected to storage in reservoirs or to diversions (e.g., irrigation, power generation, and water supply).

Cal-Adapt's data illustrates where the most significant impacts to streamflow in the Sierra region: the Yuba River at Smartville will see the biggest decrease from 8%–9% from the mid-century to late-century RCP 8.5 projection, whereas the San Joaquin River at Millerton Reservoir will see the biggest increase ranging from 11% to 8% from the mid century to late century RCP 8.5 scenario.



RESERVOIRS

Reservoirs are natural or unnatural lakes designed to store fresh water by damming the source and controlling its output. Reservoirs can be used for drinking water, hydroelectric power, recreation, irrigation, downstream water supply, flood control, canals, and flow balancing. Reservoir water levels can be affected primarily by precipitation, streamflow, runoff, extreme temperatures, evaporation, and the rate at which water is being released.

As of July 2021, reservoirs within the SNC are holding less than 37% capacity of what is considered full. Reservoirs currently most at risk include the following:

Reservoirs within the SNC Subregions

SNC Subregion	Reservoirs
South Sierra	Buchanan Dam
South Sierra	Isabella Dam
South Sierra	Hidden Dam (Hensley)
South Sierra	Terminus Dam
South Sierra	Pine Flat Dam
North Central Sierra	Oroville Dam
South Central Sierra	New Exchequer-Lk McClure
South Central Sierra	New Hogan Lake

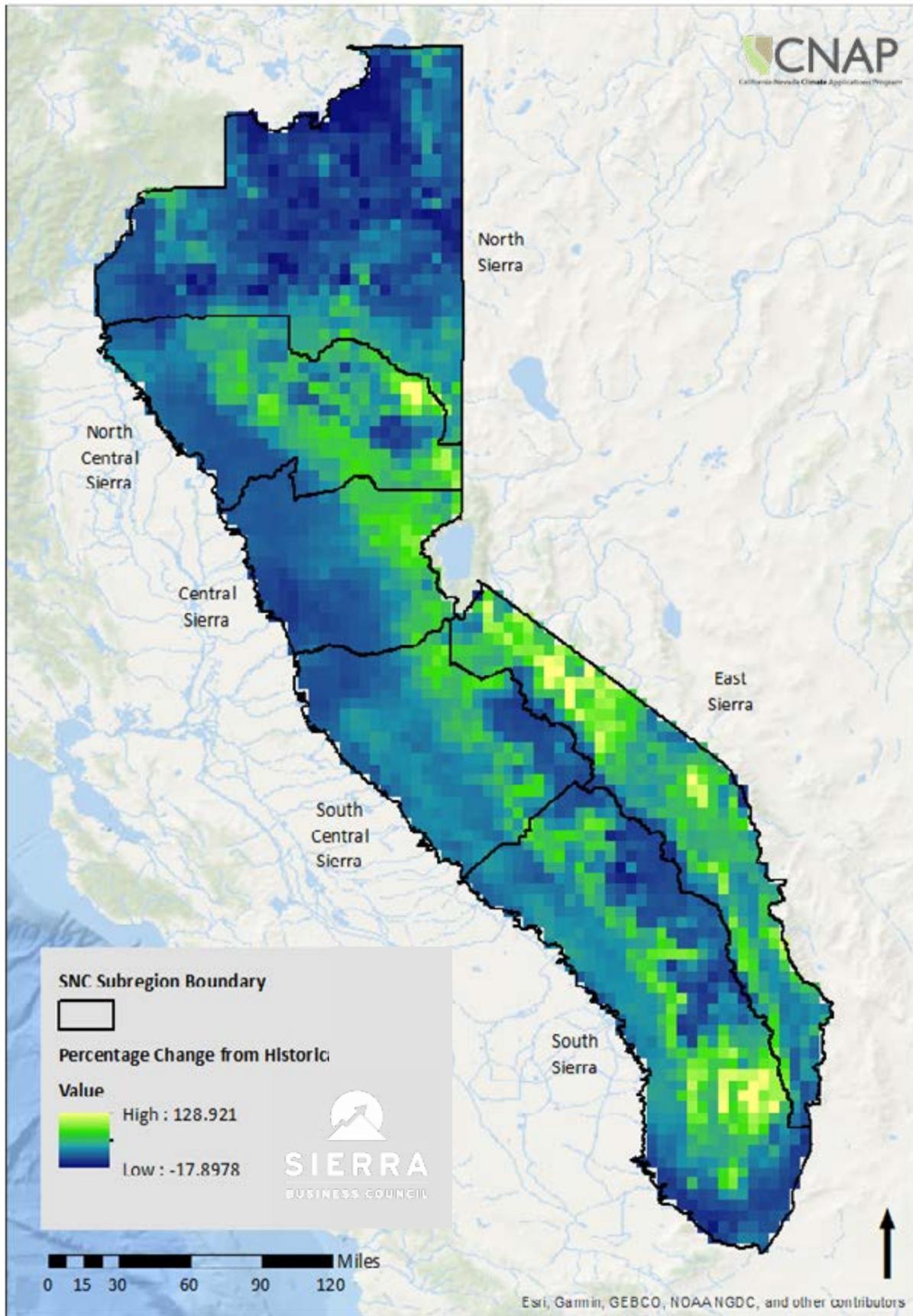
Reservoirs based in the foothills of the southern Sierra have recently seen the biggest impact from climate change. Capacity at these reservoirs range 7% at Buchanan Dam to 18% at Pine Flat Dam. Oroville Dam in the North Central Sierra foothills was measured at 22.7% capacity. South Central McClure Dam and New Hogan Dam measured at 27% and 31.8% capacity, respectively.

Averages vary depending on the reservoir. For example, the average at Pine Flats Dam is about 52% capacity, whereas Oroville Dam usually operates at about 34% capacity on average. At 17% capacity, Buchanan Dam has one of the lowest average capacities, but it still dropped 10% below that average in July. In 2022, we are seeing some of the lowest capacities in California reservoirs to date.²⁶

Surface Water Concerns

Public Health	Economic	Environmental
<p>Lack of surface water can impact changes to the water table, resulting in decreased groundwater elevations further impacting domestic and agricultural uses, hydroelectric power generation,²⁷ and recreation.</p>		<p>Reduced snowpack and flows from watersheds affects ecosystems, causing stress on vegetation and habitats for certain fish, and increased tree deaths and wildfires.²⁸</p>
<p>The state's water infrastructure was built based on historical patterns of precipitation and runoff. As the climate continues to change, these patterns are no longer the norm, calling for changes to existing water storage and flood management practices.</p>		

CHANGE IN MEAN ANNUAL PEAK DAILY RUNOFF 2036-2065 under RCP 8.5 Emissions



By observing change in days from historical, the change in mean day of peak runoff illustrates when the main floods could show up. Peak runoff is dependent upon large storms, and could happen anytime.

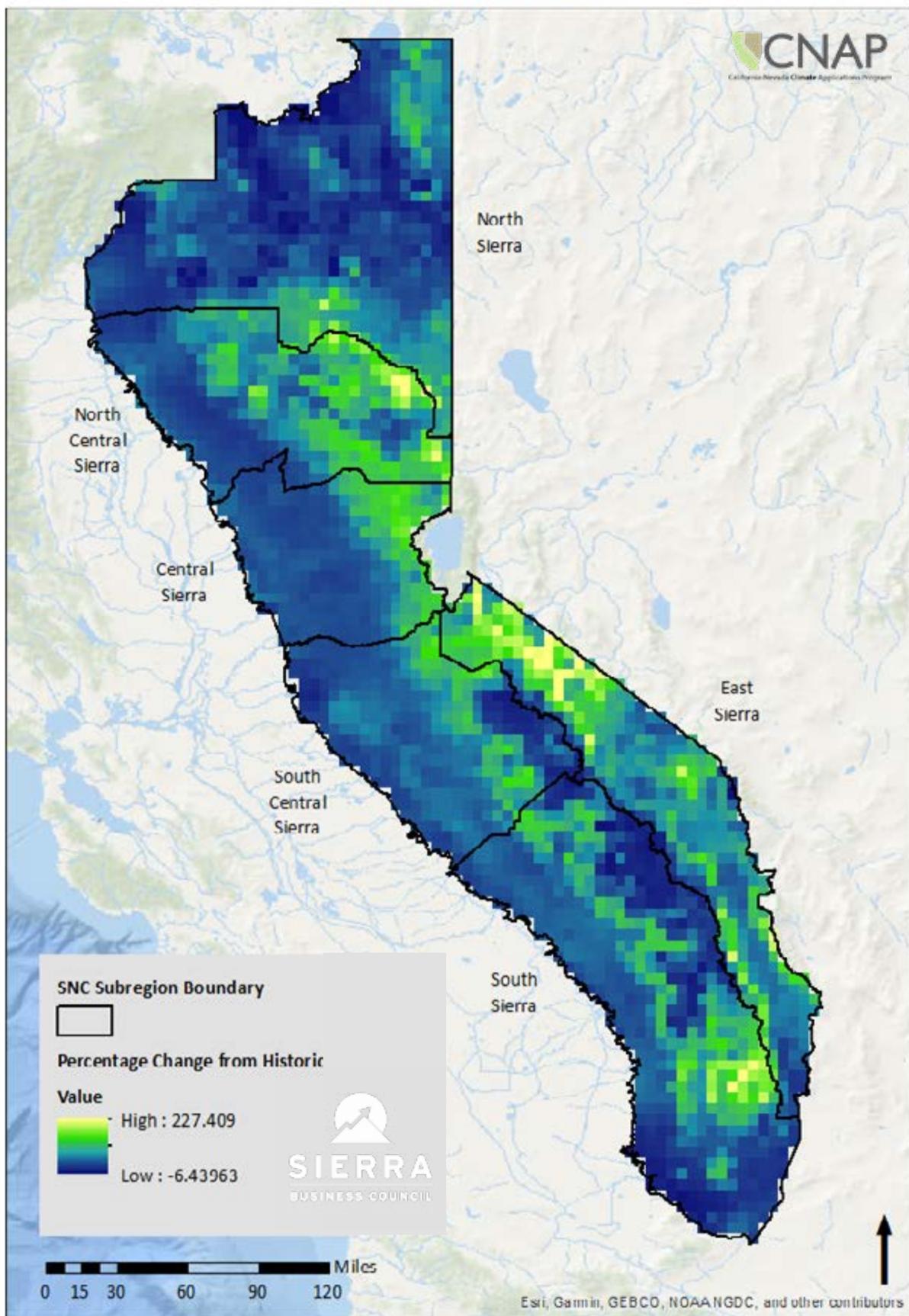
CHANGE IN MEAN ANNUAL PEAK DAILY RUNOFF 2036-2065

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Could decrease 18 days, but could increase 94 days	On average will increase 13 days
North Central Sierra	Will increase 3–108 days	On average will increase 33 days
Central Sierra	Will increase 1–74 days	On average will increase 26 days
East Sierra	Could decrease 1 day, but could increase 116 days	On average will increase 44 days
South Central Sierra	Will increase 3–71 days	On average will increase 26 days
South Sierra	Could decrease 7 days, but could increase 128 days	On average will increase 30 days

County	Average Increase in Days <i>Average Includes Diverse Topographic Changes</i>
Alpine	49.2
Amador	21.0
Butte	15.6
Calaveras	24.5
El Dorado	22.3
Fresno	24.6
Inyo	36.2
Kern	21.4
Lassen	16.4
Madera	27.9
Mariposa	26.9
Modoc	7.4
Mono	48.9
Nevada	29.0
Placer	34.2
Plumas	38.9
Shasta	15.7
Sierra	47.1
Tehama	23.3
Tulare	41.5
Tuolumne	27.2
Yuba	13.2

Tables coincide with the map on the previous page (data points are represented by grid colors). The annual peak daily runoff is one dataset being used as a proxy for assessing change in peak surface water. For example: as seen in the subregion table, on average the North Sierra Region will experience a 13 day increase in annual peak daily runoff during the mid-century time period. On average Alpine county will experience a 49.2-day increase. 80

CHANGE IN MEAN ANNUAL PEAK DAILY RUNOFF 2070-2099 under RCP 8.5 Emissions



CHANGE IN MEAN ANNUAL PEAK DAILY RUNOFF 2070-2099

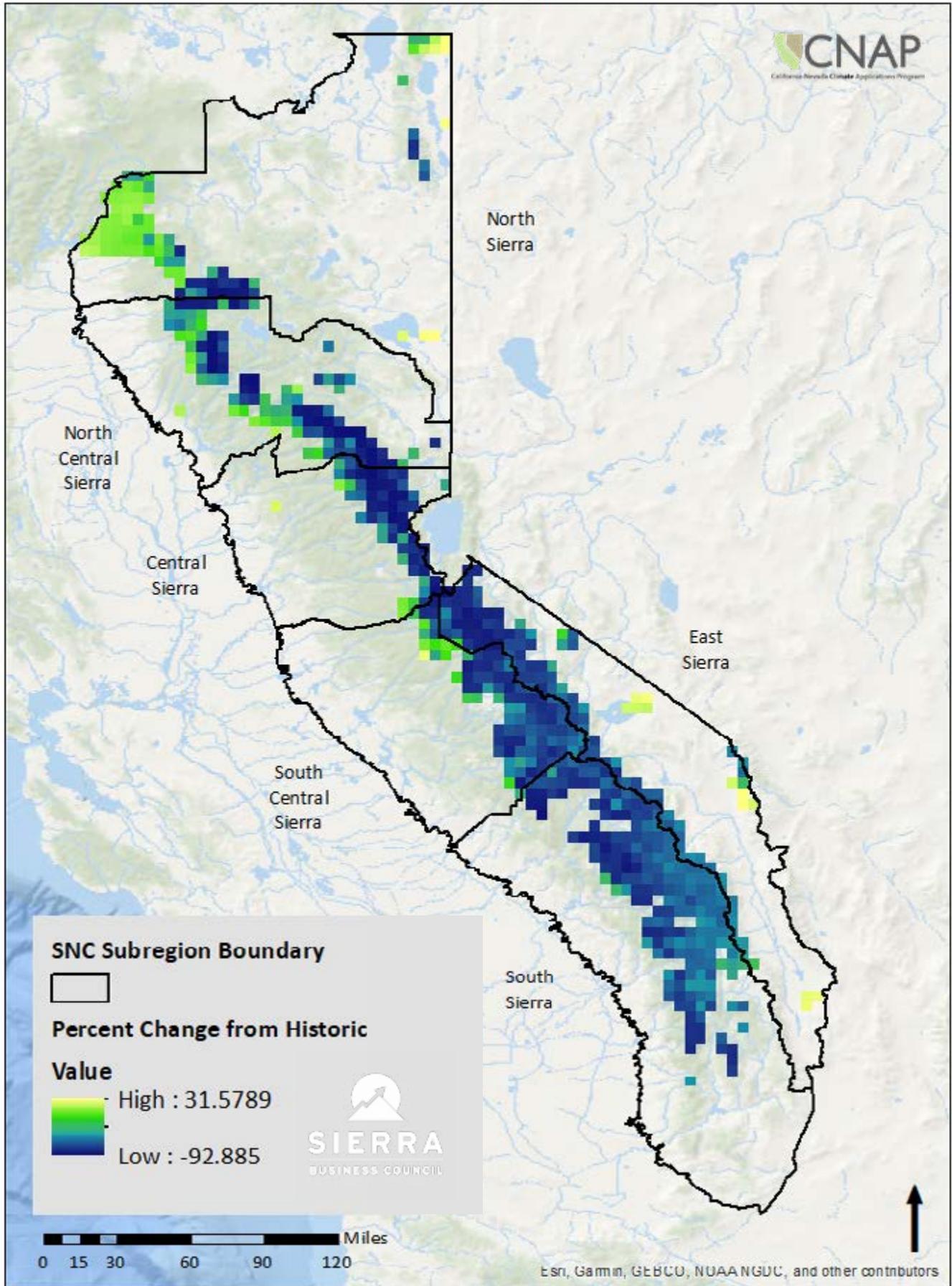
Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Could decrease 6 days, but could increase 174 days	On average will increase 38 days
North Central Sierra	Will increase 16–227 days	On average will increase 65 days
Central Sierra	Will increase 23–136 days	On average will increase 52 days
East Sierra	Will increase 1–216 days	On average will increase 79 days
South Central Sierra	Will increase 7–134 days	On average will increase 49 days
South Sierra	Will increase 4–203 days	On average will increase 49 days

County	Average Increase in Days <i>Average Includes Diverse Topographic Changes</i>
Alpine	110.0
Amador	44.4
Butte	33.5
Calaveras	45.7
El Dorado	47.9
Fresno	43.1
Inyo	65.8
Kern	30.1
Lassen	43.0
Madera	50.1
Mariposa	49.8
Modoc	35.2
Mono	82.3
Nevada	57.6
Placer	61.1
Plumas	80.2
Shasta	32.5
Sierra	87.2
Tehama	40.8
Tulare	66.8
Tuolumne	50.9
Yuba	33.6

Tables coincide with the map on the previous page (data points are represented by grid colors). The annual peak daily runoff is one dataset being used as a proxy for assessing change in peak surface water. For example: as seen in the subregion table, on average the North Sierra Region will experience a 38-day increase in annual peak daily runoff during the mid-century time period. On average Alpine county will experience a 110-day increase.

CHANGE IN MEAN SUMMER RUNOFF 2036-2065

under RCP 8.5 Emissions



Summer runoff (July–September) assesses drought potential and soil moisture. For example, summer runoff in the region is projected to decrease on average, which means drought conditions could continue.

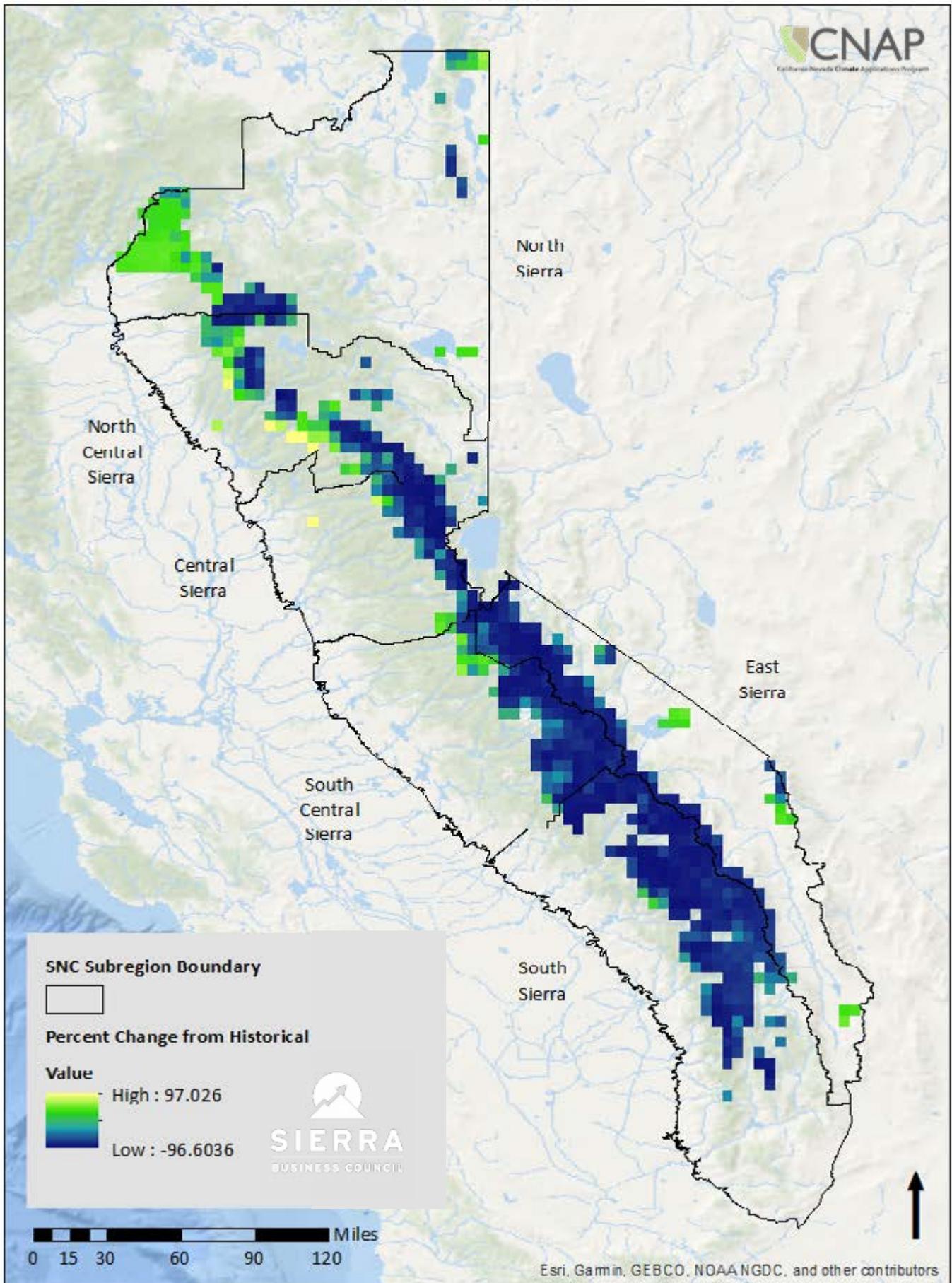
CHANGE IN MEAN SUMMER RUNOFF 2036-2065

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Could decrease 90.1%, but could increase 31.6%	On average will decrease 33.4%
North Central Sierra	Will decrease 4.8%–92.9%	On average will decrease 62.7%
Central Sierra	Could decrease 91.1%, but could increase 0.8%	On average will decrease 71%
East Sierra	Could decrease 90.4%, but could increase 9.2%	On average will decrease 63.7%
South Central Sierra	Could decrease 88.6%, but could increase 5.5%	On average will decrease 67.4%
South Sierra	Will decrease 40.5%–90.9%	On average will decrease 72%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	-78.9
Amador	-63.3
Butte	-48.1
Calaveras	-39.6
El Dorado	-65.8
Fresno	-73.1
Inyo	-51.6
Kern	-
Lassen	-52.3
Madera	-77.8
Mariposa	-70.5
Modoc	-27.4
Mono	-55.7
Nevada	-66.7
Placer	-77.7
Plumas	-61.9
Shasta	-31.7
Sierra	-73.1
Tehama	-53.7
Tulare	-68.2
Tuolumne	-69.4
Yuba	-5.7

Tables coincide with the map on the previous page (data points are represented by grid colors). The mean summer runoff is one dataset being used as a proxy for summer/soil moisture levels. For example: as seen in the subregion table, on average, the North Sierra Region will experience a 33.4% decrease in mean summer runoff during the mid-century time period. On average Alpine county will experience a 78.9% decrease.

CHANGE IN MEAN SUMMER RUNOFF 2070-2099 under RCP 8.5 Emissions



CHANGE IN MEAN SUMMER RUNOFF 2070-2099

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Could decrease 94.6%, but could increase 40.5%	On average will decrease 18.1%
North Central Sierra	Could decrease 96.2%, but could increase 97%	On average will decrease 39.4%
Central Sierra	Could decrease 95.6%, but could increase 65.8%	On average will decrease 64.7%
East Sierra	Could decrease 96%, but could increase 24.3%	On average will decrease 70.3%
South Central Sierra	Could decrease 95.5%, but could increase 35.5%	On average will decrease 68.8%
South Sierra	Could decrease 96.6%, but could increase 2.5%	On average will decrease 81.8%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	-82.5
Amador	-48.7
Butte	-8.6
Calaveras	-16.4
El Dorado	-59.0
Fresno	-84.2
Inyo	-63.5
Kern	-
Lassen	-48.6
Madera	-89.6
Mariposa	-74.9
Modoc	-27.0
Mono	-61.9
Nevada	-55.4
Placer	-75.3
Plumas	-37.0
Shasta	-11.1
Sierra	-60.4
Tehama	-24.5
Tulare	-75.2
Tuolumne	-73.5
Yuba	-

Tables coincide with the map on the previous page (data points are represented by grid colors). The mean summer runoff is one dataset being used as a proxy for summer/soil moisture levels. For example: as seen in the subregion table, on average the North Sierra Region will experience an 18.1% decrease in mean summer runoff during the late-century time period. On average Alpine county will experience a 82.5% decrease.



GROUNDWATER

Groundwater is generally defined as water that moves through soil and settles in pores between soil particles and fractures in underground rocks located in the saturation zone. In California, groundwater is legally defined as percolating water. It does not include the underflow of a surface stream or underground streams that flow in known and definite channels, which is defined as surface water.

Groundwater is replenished by surface water, and the replenish rate can be impacted by the following factors:

- Periods of drought
- Changes in precipitation patterns and timing
- Decline in snowpack
- Increase in extreme temperature
- Increased rates of evapotranspiration
- Extreme changes in runoff

When groundwater collects in porous rock or sediment) and becomes usable as a source of water, it is considered an aquifer. Aquifers exist in two types of physical systems: alluvial and fractured rock. Groundwater supplies 40% of California's drinking water. Fractured rock aquifers are the most common source of groundwater in the SNC region, but they do pose some challenges. Because water is stored along planar breaks in the bedrock, fractured rock aquifers offer limited storage capacity, and inconsistencies in water location and quantity makes them the most difficult type of aquifers to assess and drill.

Groundwater is a critical water supply source because it compensates for reduced surface water supplies during periods of drought. The need for proactive adaptation strategies to address extreme droughts projected under climate change are frequently discussed, yet there are limited examples of groundwater management strategies. A snow drought, where higher temperatures under climate change reduce snowmelt and change the timing of runoff, will affect imported surface water supplies that many groundwater basins rely on for consumptive use and for groundwater replenishment. Drought planning and groundwater management plans rarely intersect. Drought plans give limited attention to sustaining groundwater over the long term, while groundwater plans provide limited attention to drought, including the extreme droughts predicted under climate change.³⁰

Groundwater quantity can be extremely difficult to assess due to the complexity of factors it depends upon. However, there are a series of datasets available to use as a proxy including soil moisture and runoff.

Groundwater Concerns

Public Health	Economic	Environmental
<p>Impact agriculture irrigation and crop harvests. As water tables drop, private wells will be at risk of drying up and burning out pumps.</p>		<p>Poor forest health can result in bark beetles and other tree diseases.</p> <p>Water tables dropping can also impact ecosystems including meadows and forests, and the biodiversity that depends on them.</p>
<p>Groundwater directly impacts forest health and tree mortality, and therefore influencing wildfire risk.</p>		

WATER QUALITY



WATER QUALITY

Water quality describes the condition of the water, usually by a drinking and swimming standard. Quality is assessed by a variety of factors, including: the concentration of dissolved oxygen, level of bacteria, and level of salinity (saltiness). Contaminants such as pesticides, herbicides, heavy metals, and a high concentration of algae contribute to poor water quality.

The EPA completed its most recent assessment of rivers and streams (surface water) in 2004. In California, there are over 54,000 miles of rivers and streams that contribute to drinking water. However, prior to treatment, only 43% of those 54,000 miles is considered good quality. The EPA identifies heavy metals as the top contributor to the impairment of California rivers and streams, but nitrogen and phosphorus are major contributors as well. Water is a great solvent, which means it can contain dissolved chemicals. Groundwater settles through rocks and soil, providing opportunities for materials to dissolve as it moves. Groundwater usually has more dissolved substances than surface water. Contaminants can be natural or derived from human activity.

Increased air temperature, more precipitation falling as rain instead of snow, and the subsequent earlier runoff will contribute to warmer surface water temperatures. Poor water quality can pose health risks to people and ecosystems. Climate change impacts water quality in numerous ways. For example, communities in the Sierra often use rock salt to deice roads. As the range of daytime and nighttime temperatures becomes more extreme, thick sheets of ice are more likely to form on the road, requiring more salt to ensure safe driving. Because salt is soluble in water, excess sodium and chloride can be transported from surface to subsurface groundwater.

Water Quality Concerns

Public Health	Economic	Environmental
Algal blooms		
Stormwater runoff and erosion/sedimentation		
Polluted water can have adverse effects for human consumption	Treatment of water can be costly for human consumption; and Water related recreation may be impacted by contaminated water	Potential to greatly reduce riparian meadow biodiversity and impact downstream habitat, Salmonids are especially vulnerable to increased water temperatures due to their critical reliance on cold water for spawning and juvenile survival



DROUGHT

There are many definitions of drought. Meteorologists generally define drought as a prolonged period of dry weather caused by a lack of precipitation that results in a serious water shortage for some activity, population, or ecological system. Drought can also be defined as an extended imbalance between precipitation and evaporation. As average temperatures have risen due to climate change, Earth's water cycle has sped up through an increase in the rate of evaporation. An increase in evaporation

makes more water available in the air for precipitation but also contributes to dry land in some areas, leaving less moisture in the soil.

During the 20th century, many indices were created to measure drought severity by looking at precipitation, soil moisture, stream flow, vegetation health, and other variables. The most widely used index is the Palmer Drought Severity Index, which is calculated from precipitation and temperature measurements at weather stations. An index value of zero represents the average moisture conditions observed between 1931 and 1990 at a given location. A positive value means conditions are wetter than average, while a negative value is drier than average. Because this indicator focuses on national trends, it does not show how drought conditions vary by region.

Based on the long-term Palmer Index, drought conditions in the Southwest US have varied since 1895. The early 1900s and the 1950s experienced considerable drought, the 1980s were relatively wet, and the last decade has seen the most persistent droughts on record. Every part of the Southwest experienced higher average temperatures between 2000 and 2015 than the long-term average (1895–2015). Some areas were nearly 2°F warmer than average.

Indigenous populations are particularly threatened by prolonged droughts because of their economic and cultural dependence on land and water supplies. Furthermore, warming and drought can threaten medicinal and culturally important plants and animals and can reduce water quality and availability, making tribal populations particularly vulnerable to waterborne illnesses.³⁴

For more information regarding California's water conditions, check out Drought.CA.GOV.³⁵

Drought Concerns

Public Health	Economic	Environmental
<p>Consumption and water use can be impacted</p> <p>Rise of usage costs and limits on household water use</p> <p>Increased wildfire risk due to drier vegetation</p>	<p>Well drilling costs</p> <p>Agriculture impacts include irrigation costs, slow crop growth, and severe crop loss.</p> <p>Lowered reservoir levels on power generation and outdoor recreation</p>	<p>Rivers and streams become less suitable for fish and other aquatic organisms.</p> <p>Trees and other vegetation dry up, becoming more vulnerable to pests.</p> <p>Wildfire risk and magnification risk increase due to drier vegetation.</p>

SUMMER SOIL MOISTURE



Summer soil moisture refers to the average water content in the soil measured from June through September. This indicator is dependent on temperature, precipitation, rate of evapotranspiration, runoff, and elevation. Since drought is a difficult variable to measure and is dependent on many factors, this assessment utilizes soil moisture as a proxy for general landscape dryness, taking into account wildfire and forest health.

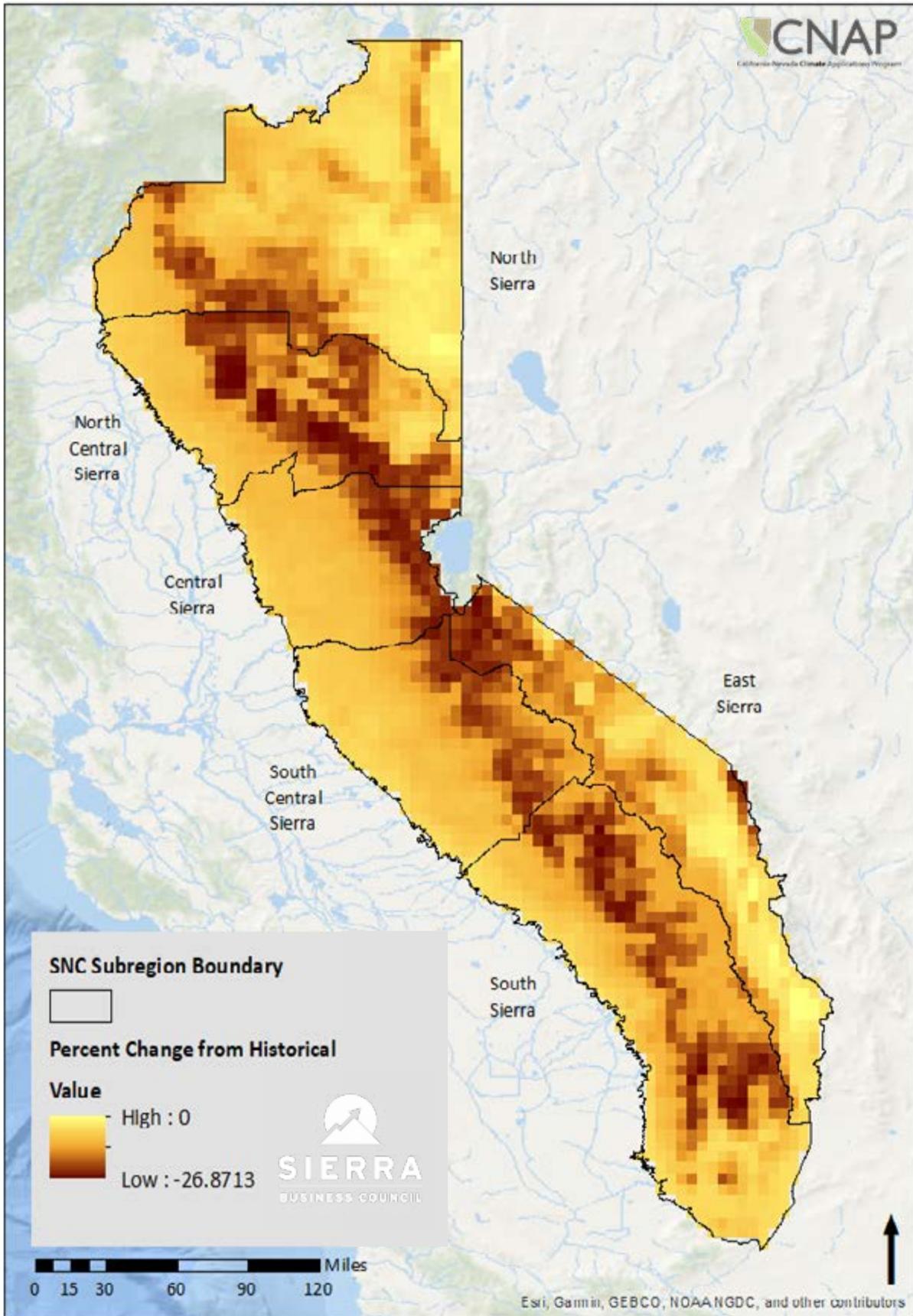
However, there are still gaps in research preventing existing measurements in soil moisture from being used to assess and mitigate drought impacts like wildfire outbreaks, lost agricultural production, and degraded wildlife habitat. Soil moisture is a critical variable for understanding the impact of drought on ecological, hydrological, and agricultural systems.³⁶ While there are some wetter climate models showing some minor increases in soil moisture in pockets of the region, on average, soil moisture is expected to significantly decrease across the Sierra. Areas with no percent change from historical are already very dry during the summer months.

Summer Soil Moisture Concerns

Public Health	Economic	Environmental
<p>Increasing the risk of high-hazard fire zones</p> <p>(See Drought above for more information.)</p>	<p>Increased air temperature and decreased precipitation will lead to drier soil in the SNC region, further impacting agriculture.</p> <p>(See Drought above for more information.)</p>	<p>Impacting overall forest health. Climate change is expected to further amplify evapotranspiration and moisture overdraft during drought, potentially increasing drought-related tree death in the Sierra by ~15%–20%.</p> <p>May lead to a lack of regenerative forest growth (especially after wildfire), and can result in permanent landscape conversion, less shade, and less habitat for wildlife</p>

CHANGE IN MEAN SUMMER SOIL MOISTURE 2036-2065

under RCP 8.5 Emissions



CHANGE IN MEAN SUMMER SOIL MOISTURE 2036-2065

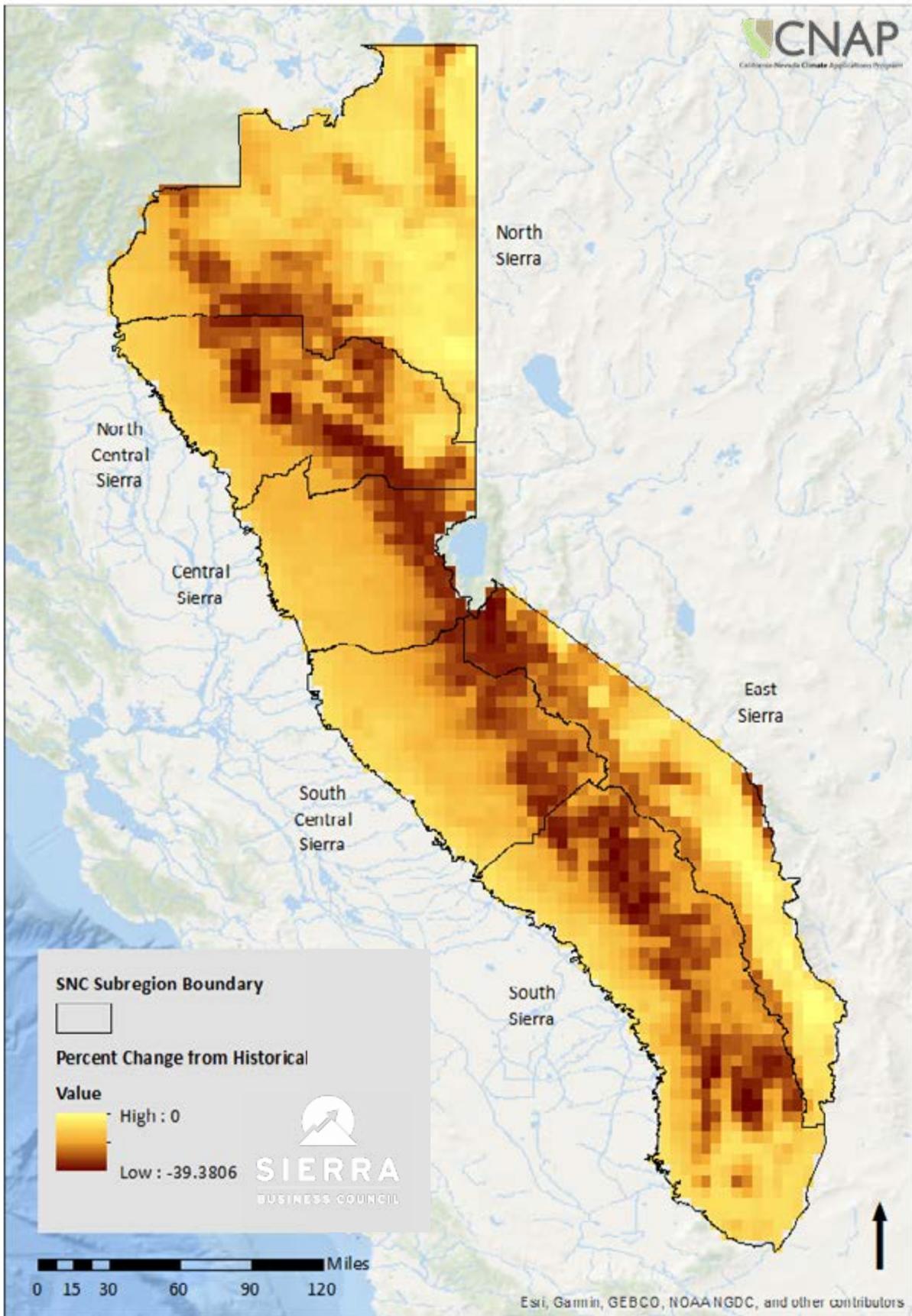
Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will decrease 0–20.4%	On average will decrease 5.3%
North Central Sierra	Will decrease 0.6%–26.9%	On average will decrease 11.4%
Central Sierra	Will decrease 1.9%–22.3%	On average will decrease 9.5%
East Sierra	Will decrease 0–24.4%	On average will decrease 6.6%
South Central Sierra	Will decrease 1.7%–21.8%	On average will decrease 8.7%
South Sierra	Will decrease 0.4%–24%	On average will decrease 9.6%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	-16.9
Amador	-7.8
Butte	-7.4
Calaveras	-5.9
El Dorado	-8.9
Fresno	-11.4
Inyo	-2.7
Kern	-4.6
Lassen	-4.8
Madera	-9.9
Mariposa	-8.1
Modoc	-3.6
Mono	-7.0
Nevada	-9.9
Placer	-11.1
Plumas	-13.3
Shasta	-8.8
Sierra	-14.9
Tehama	-7.9
Tulare	-11.4
Tuolumne	-10.6
Yuba	-5.7

Tables coincide with the map on the previous page (data points are represented by grid colors). The summer soil moisture is one dataset being used as a proxy for wildfire risk. For example: as seen in the subregion table, on average the North Sierra Region will experience a 5.3% decrease in summer soil moisture during the mid-century time period. On average Alpine county will experience a 16.9% decrease.

CHANGE IN MEAN SUMMER SOIL MOISTURE 2070-2099

under RCP 8.5 Emissions



CHANGE IN MEAN SUMMER SOIL MOISTURE 2070-2099

Subregion	Change Across the Subregion <i>Subregions Include Diverse Topographic Changes</i>	Average Change Across the Subregion <i>Average Includes Diverse Topographic Changes</i>
North Sierra	Will decrease 0–33.3%	On average will decrease 8.8%
North Central Sierra	Will decrease 1.5%–38.5%	On average will decrease 17.8%
Central Sierra	Will decrease 3.2%–33.6%	On average will decrease 15.7%
East Sierra	Will decrease 0–39.4%	On average will decrease 11.4%
South Central Sierra	Will decrease 2.4%–33.1%	On average will decrease 15.2%
South Sierra	Will decrease 1.3%–37.4%	On average will decrease 16.5%

County	Average Change in Percent <i>Average Includes Diverse Topographic Changes</i>
Alpine	-28.1
Amador	-13.0
Butte	-12.3
Calaveras	-10.2
El Dorado	-14.9
Fresno	-20.2
Inyo	-5.3
Kern	-7.3
Lassen	-7.8
Madera	-17.4
Mariposa	-14.1
Modoc	-6.5
Mono	-11.9
Nevada	-16.7
Placer	-17.6
Plumas	-20.3
Shasta	-14.4
Sierra	-22.7
Tehama	-12.7
Tulare	-19.1
Tuolumne	-18.6
Yuba	-10.7

Tables coincide with the map on the previous page (data points are represented by grid colors). The summer soil moisture is one dataset being used as a proxy for wildfire risk. For example: as seen in the subregion table, on average the North Sierra Region will experience an 8.8% decrease in summer soil moisture during the late-century time period. On average Alpine county will experience a 28.1% decrease.



These lush green, open habitats are important to ecology, and they are vulnerable to climate change.³⁷ Meadows rely on shallow water tables, input from surface flow, springs, seeps, and precipitation. Specifically, meadows in the Sierra are landforms characterized by the presence of shallow groundwater (<1 m depth), fine-textured surficial soils, and the dominance of herbaceous vegetation species that use surface water and/or shallow groundwater during a short growing season.³⁸

In the Sierra, 40%–60% of meadows are degraded due to past and current land use/mismanagement.³⁹ According to research, restoring Sierra meadows based on a historic baseline is unlikely to ensure that the restored meadow will be resilient. We define resilience as the capacity of an ecosystem to return to desired conditions and regain basic characteristics and functions after disturbance.

Although meadows cover less than 2% of the Sierra Nevada, they benefit many regional and ecological entities, including:

- Carbon storage
- Flood attenuation
- Late summer baseflow
- Groundwater recharge
- Sediment filtration/water quality improvements
- Biodiversity hotspots especially important to breeding birds and amphibians
- Headwater ecosystems that provide water for downstream natural and human communities
- Refugia for numerous species, including those at risk
- Listed species/species of conservation concern like Willow Flycatcher, Cascades frog, Yosemite toad, Sierra Nevada yellow-legged frog, Mountain yellow-legged frog
- Pollinators necessary for pollinating nearby croplands
- Climate refugia (lush green spots in the landscape that are important during drought because they retain water and can serve as natural fire breaks.)⁴⁰

Concerns

Public Health	Economic	Environmental
<p>Dry meadows that are no longer functioning become net emitters of carbon dioxide.</p> <p>Dry conditions and water shortages impact seed germination and may encourage encroachment of fuels and native upland plants. Conifer encroachment may lead to loss of desired edge habitat in addition to posing a high risk of fire.</p>		<p>Drying out/less greenery</p> <p>Water shortages and warming temperatures can result in invasive species and the emergence of invertebrates– that will influence pollination schedules.</p>



Forest health is an essential evaluation for gauging tree mortality, and vice versa. This is a complicated indicator that takes into account many variables, including but not limited to severe temperature change, precipitation and extreme runoff, and drought and groundwater shortages.

Severe Temperature Change

Warmer temperatures and infrequent precipitation can lead to non forest vegetation.⁴¹ However, higher summer temperatures pose a bigger threat than lack of precipitation. Warmer temperatures impact the rate of evapotranspiration of soil moisture, creating more competition for resources among trees. (See soil moisture above for more information)

Precipitation and Extreme Runoff

Extreme precipitation events often affect natural and social systems more compared to average changes, particularly on local-to-regional scales. ROS events can result in extreme runoff from fluctuating temperatures and snow elevations. However, more intense precipitation events (atmospheric rivers) could result in more flooding/mudslides, and these events wash away topsoil in forests and bring down dead and diseased trees.

Drought and Groundwater

California has lost over one million trees since 2010 due to drought and bark beetles. Over time, trees have become stressed after having to fight for resources (e.g., water, sunlight, and nutrients). Seed germination has increased in warmer seasons, but seedlings are not equipped to survive in very shady forests (high forest density) or in warmer-than-usual temps. After fires, many seedlings thrive from reduced competition. Still, they face many other threats in a warming forest, such as: hot soil surfaces that can burn seedling stems; high leaf temperatures that can reduce photosynthesis; dry soil from increased temperatures. Because of their limited root systems, younger trees are more sensitive to physical conditions compared to older trees. Early plant stages will be a bottleneck for tree regeneration.

Long-term drought consequences have resulted in compromised forest health, leaving trees vulnerable to bark beetles. The longer the drought lasts, the more intense the bark beetle invasion, leading to extreme tree mortality throughout California. Bark beetles will continue to increase unless precipitation levels return to normal or above normal.

Lack of consistent precipitation has killed native plants and left the bare ground vulnerable to invasive grasses. Cheatgrass is an invasive species that has invaded sagebrush regions. Cheatgrass dies in early summer, leaving large areas of long grasses as easy fuel for wildfires during a drought.⁴²

Forest Health Concerns

Public Health	Economic	Environmental
<p>Anthropogenic influences and increased tree mortality among dense forest stands under drought conditions has led to fuel buildup. Under these conditions, what are known as “megafires” (fires that exceed 100,000 burned acres) have become more frequent.</p>		
<p>Fire risk that results from poor forest health poses increased risk to poor air quality.</p>	<p>Landscapes that burn from megafires impact the outdoor recreation economy .</p>	<p>Megafires burn so strongly that forests are unable to regenerate in the burn scar.</p>

“While wildfires are a natural part of California’s landscape, the fire season in California and across the West is expanding in time and acreage each year. The length of the fire season is estimated to have increased by 75 days across the Sierra and seems to correspond with an increase in the extent of forest fires across the state.”

—Cal-Fire⁴³

WILDFIRE



WILDFIRE

In the last decade, California has seen more fires of greater magnitude than any fires in recorded history. Megafires are more severe compared to historical fires not just because of their size but also due to the drivers of climate change, and legacy of fire suppression, fuel build ups, and forest densification. Warmer temperatures, reduced snowpack, and earlier spring snowmelt creates longer, more intense dry seasons that increase moisture stress on vegetation and make forests more susceptible to severe wildfire.

While most wildfires are caused by humans (with a few exceptions attributed to lightning strikes), there is no doubt that increased air temperatures, poor forest health, and dry conditions all contribute to the intensity and likelihood of wildfires and megafires. There are varying increases in wildfire activity projected across the SNC subregions, with large changes projected across the Central Sierra subregion. The majority of the previous topics lead to increased wildfire in the region, greatly affecting social and natural systems.

This section will include Cal-Fire’s Fire Hazard Severity Zone data and Cal-Adapt’s acres burned projections to capture the potential future fire risk.

This assessment utilizes Cal-Fire’s state responsible zone (SRA) map showing the very high hazard severity zone metric to identify areas that are at risk of wildfire. Cal-Fire states that a “High Hazard Zone” or “Fire Hazard Severity Zone” (FHSZ) is a mapped area that designates zones (based on factors such as fuel, slope, and fire weather) with varying degrees of fire hazard (e.g., moderate, high, and very high). FHSZ maps evaluate wildfire hazards, which are physical conditions that create a likelihood that an area will burn over a 30- to 50-year period. They do not take into account modifications such as fuel reduction efforts. FHSZs do not predict when or where a wildfire will occur. They do, however, identify areas where wildfire hazards could be more severe and therefore are of greater concern. FHSZs are meant to help limit wildfire damage to structures through planning, prevention, and mitigation activities/requirements that reduce risk. FHSZs play a role in various documentation, including:

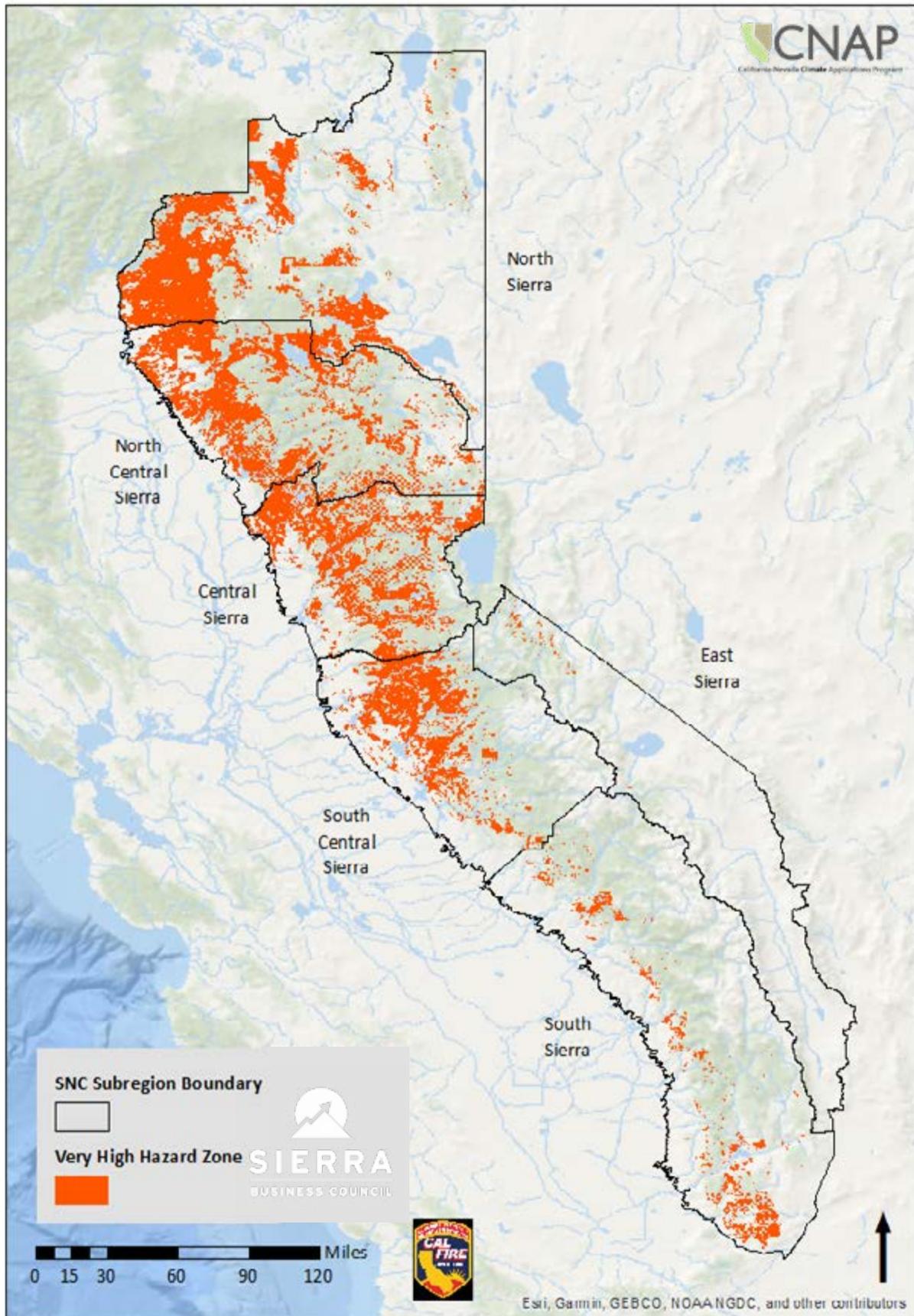
- Building codes (when designating areas where California’s wildland urban interface building codes apply to new buildings)
- Real estate disclosures
- General plans (local governments consider fire hazard severity in their safety elements)

Wildfire Concerns

Public Health	Economic	Environmental
<p>Increased risk of losing communities in the Sierra, dramatic increased risk of air quality, etc.</p> <p>Increase evacuation risk and displacement of families and communities</p>	<p>Economic drivers like tourism will be impacted by fewer visitors to the region due to smoke conditions, closed roads, recreation sites having no or limited access, etc.</p>	<p>Vegetation is not the only part of the ecosystem impacted by megafires. In the past, most animals have been able to flee wildfires, returning to their old territory once the fire is out. But the number of large mammals that typically make it out of fires is diminishing with megafires, and the destruction of suitable habitat will take longer to come back, if it comes back at all.⁴⁴</p>

See Forest Health section within this report for more information on wildfire impacts. For more information regarding wildfire potential impacts please visit: <https://riskfactor.com/methodology/fire>.

VERY HIGH HAZARD ZONES WITHIN STATE RESPONSIBILITY AREA



SUMMARY OF VERY HIGH HAZARD ZONES WITHIN THE STATE RESPONSIBLE AREA

North Sierra	2,040.8 sq mi
North Central Sierra	1,751.2 sq mi
Central Sierra	1,429.3 sq mi
East Sierra	25.9 sq mi
South Central Sierra	1,059.9 sq mi
South Sierra	880.3 sq mi

The acres-burned dataset from Cal-Adapt is meant to predict potential burning under future climate model parameters. This dataset should be used alongside the spatial map, so users can see where and how much acreage is at risk for wildfire in the region.

CAL-ADAPT: MID-CENTURY (2035-2064)
High Emissions Scenario Projection of Acres Burned
(County Averages; these are not exclusive to the SNC region)⁴⁵

County	Change	Average	% Change from Baseline (Average to Average)	Range	Units
Alpine	2112.5	4297.6	96.7	2860.2–5280.1	acres
Amador	1281.9	4906.6	35.4	4543.9–5451.4	acres
Butte	2987.7	8961.2	50	7482.3–12330.5	acres
Calaveras	1930.8	7952.4	32.1	7345.9–8916.0	acres
El Dorado	4228.2	12658.4	50.2	11321.7–14694.7	acres
Fresno	11998.2	25213.3	90.8	14812.1–39691.2	acres
Inyo	305.8	7373.7	4.3	4972.3–9707.4	acres
Kern	-526	16976.2	-3	14628.6–19351.5	acres
Lassen	1230.1	20782.8	6.3	15624.9–23754.6	acres
Madera	4650.7	11005.6	73.2	8147.6–14791.1	acres
Mariposa	3446	11978.5	40.4	11330.0–12832.7	acres
Modoc	1106.7	19215.3	6.1	14478.5–22320.7	acres
Mono	5423.1	12431.3	77.4	6436.5–19385.3	acres
Nevada	3015.1	8834.4	51.8	7570.6–10461.5	acres
Placer	3081.3	9405.7	48.7	8387.5–10441.1	acres
Plumas	11933.9	29097.4	69.5	26489.6–30555.2	acres
Shasta	12285	33224.8	58.7	29708.8–36766.6	acres
Sierra	4222.9	10378.9	68.6	10031.8–10744.1	acres
Tehama	5012.4	19185.7	35.4	18553.4–19635.5	acres
Tulare	7711.1	20186.1	61.8	14252.5–29632.7	acres
Tuolumne	8600.2	20509.8	72.2	18348.6–22433.9	acres
Yuba	965.7	3786.9	34.2	2983.8–5638.2	acres

The above table illustrates the projected average of the area projected to be at risk to burning in a year in acres over the mid-century.

Chapter 2 References:

- 1 California 4th Assessment, Regional Report
- 2 California 4th Assessment, Regional Report
- 3 California 4th Assessment, Regional Report
- 4 OECD, The Economic Consequences of Outdoor Air Pollution, https://read.oecd-ilibrary.org/environment/the-economic-consequences-of-outdoor-air-pollution_9789264257474-en#page1
- 5 CA.GOV, California Air Resources Board, <https://ww2.arb.ca.gov/resources/ozone-and-health>
- 6 EPA, Health Effects of Ozone Pollution, <https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution> and <https://www.epa.gov/outdoor-air-quality-data/air-data-multiyear-tile-plot>
- 7 EPA, Interstate Air Pollution Transport, <https://www.epa.gov/interstate-air-pollution-transport/interstate-air-pollution-transport>
- 8 EPA, Particulate Matter (PM Basics), <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>
- 9 EPA, Particulate Matter (PM Basics), <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>
- 10 EPA, Particulate Matter (PM Basics), <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>
- 11 SCIENCE.ORG, Increasing Co-occurrence of Fine Particulate Matter and Ground-level Ozone Extremes in the Western United States, <https://www.science.org/doi/full/10.1126/sciadv.abi9386?af=R>
- 12 USFS, Climate change effects in the Sierra Nevada, <https://www.fs.usda.gov/treearch/pubs/63216>
- 13 Cal-Adapt, <https://cal-adapt.org/>
- EPA, Climate Change Indicators: High and Low Temperatures, <https://www.epa.gov/climate-indicators/climate-change-indicators-high-and-low-temperatures> and EPA, A Closer Look: Temperature and Drought in the Southwest, <https://www.epa.gov/climate-indicators/southwest>
- CA.GOV, OEHHA: Extreme Heat Events, <https://oehha.ca.gov/epic/changes-climate/extreme-heat-events>
- 14 EPA, What Climate Change Means for California, <https://www.epa.gov/sites/default/files/2016-09/documents/climate-change-ca.pdf>
- 15 EPA, Climate Change Indicators: Heavy Precipitation, <https://www.epa.gov/climate-indicators/climate-change-indicators-heavy-precipitation>
- GlobalChange.Gov (CSSR), U.S. precipitation is becoming more intense, <https://www.globalchange.gov/browse/indicators/heavy-precipitation#:~:text=Extreme%20precipitation%20events%20are%20defined,National%20Centers%20for%20Environmental%20Information> & Fourth National Climate Assessment (NCA4), Volume I, <https://science2017.globalchange.gov/>
- NOAA, Ask the scientist: Extreme rainfall—why it happens and how we predict it, <https://www.noaa.gov/stories/ask-scientist-extreme-rainfall-why-it-happens-and-how-we-predict-it>
- 16 The Risk Factor source (https://riskfactor.com/?utm_source=floodfactor) uses RCP 4.5 parameters, and is one of the only updated sources available for flood risk as of 2022.
- 17 UNR Thesis: SNOWPACK CONTROLS ON HYDROLOGIC RESPONSE TO EXTREME RAIN-ON-SNOW EVENTS IN THE NORTHERN SIERRA NEVADA, Lisa J. Katz (2021)
- Risk Factor, Flood, https://riskfactor.com/?utm_source=floodfactor
- USGS, Rain-on-snow events in the western United States, <https://pubs.er.usgs.gov/publication/70032057>
- Water Resources Research, The Role of Rain-on-Snow in Flooding Over the Conterminous United States, <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019WR024950>
- 18 Risk Factor, Flood, https://riskfactor.com/?utm_source=floodfactor
- 19 USGS, Emergency Assessment of Post-Fire Debris-Flow Hazards, https://landslides.usgs.gov/hazards/postfire_debris-flow/
- 20 Scientific American, How Climate Change May Influence Deadly Avalanches, <https://www.scientificamerican.com/article/how-climate-change-may-influence-deadly-avalanches/>
- Protect Our Winters, How Climate Change Impacts Avalanche Conditions, <https://protectourwinters.org/how-does-climate-change-impact-avalanches/>
- <https://arc.lib.montana.edu/snow-science/objects/issw-1998-526-533.pdf>
- 21 EPA, What Climate Change Means for California, <https://www.epa.gov/sites/default/files/2016-09/documents/climate-change-ca.pdf>
- 22 Lawrence Berkeley National Lab, A low-to-no snow future and its impacts on water resources in the western United States, <https://www.nature.com/articles/s43017-021-00219-y#article-info>
- 23 Walton et al., 2017
- CA.GOV, OEHHA: Snow-water content, <https://oehha.ca.gov/epic/impacts-physical-systems/snow-water-content> and OEHHA: Precipitation, <https://oehha.ca.gov/epic/changes-climate/precipitation>
- EPA, Climate Change Indicators: Snowpack, <https://www.epa.gov/climate-indicators/climate-change-indicators-snowpack> , Climate Change Indicators: Snow cover, <https://www.epa.gov/climate-indicators/climate-change-indicators-snow-cover> , and Climate Change Indicators: U.S. and Global Precipitation, <https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation#tab-5>
- NRCS, SNOTEL: Historic Snow Data, <https://wcc.sc.egov.usda.gov/reportGenerator/edit/customWaterYearGroupByMonthReport/>
- Cal-Adapt, <https://cal-adapt.org/>

Lawrence Berkeley Labs, A low-to-no snow future and its impacts on water resources in the western United States, <https://www.nature.com/articles/s43017-021-00219-y#article-info>

USDA/USFS/EPA, Snowpack and Snow Cover Mapping Tools, <https://www.fs.usda.gov/managing-land/sc/data-dashboard>

USGS/USDI, Peterson, Smith, Stuart, et. al., 2005, Snowmelt Discharge Characteristics Sierra Nevada California

Rutgers University Global Snow Lab, <https://climate.rutgers.edu/snowcover/>

24 As shown, the general trend for April 1 SWE has been decreasing (although shows inconsistencies) from the 1990's. Since 2000, there has been, and models show a steady decline to the end of the 2090s. Between 1950 and 1990, Lake Tahoe averaged ~ 4 - 11 inches (~7in average) of measured SWE on April 1. However, in the last 20 years measured SWE has decreased to 2 - 4 inches on April 1. In the future, averages are projected to drop down to almost 0 inches of SWE by the 2090s.

25 As shown, the general trend for April 1 SWE has been decreasing (although shows inconsistencies) from the 1990's. Since 2000, there has been, and models show a steady decline to the end of the 2090s. Between 1950 and 1990, Lake Tahoe averaged ~ 4 - 11 inches (~7in average) of measured SWE on April 1. However, in the last 20 years measured SWE has decreased to 2 - 4 inches on April 1. In the future, averages are projected to drop down to almost 0 inches of SWE by the 2090s.

26 USGS, Streamflow and the Water Cycle,

https://www.usgs.gov/special-topic/water-science-school/science/streamflow-and-water-cycle?qt-science_center_objects=0#qt-science_center_objects , and Effects of Climate on Snowmelt and Water Availability for Reservoirs in the Southern

Sierra Nevada, https://www.usgs.gov/centers/ca-water/science/effects-climate-snowmelt-and-water-availability-reservoirs-southern-sierra?qt-science_center_objects=0#qt-science_center_objects

CA DWR, Daily Reservoir Storage Summary, <https://cdec.water.ca.gov/reportapp/javareports?name=RES>

Cal-Adapt, <https://cal-adapt.org/tools/streamflow/>

27 Roos and Anderson, 2006

28 CA.GOV, OEHA: Snowmelt runoff, <https://oehha.ca.gov/epic/impacts-physical-systems/snowmelt-runoff>

Cal-Adapt, <https://cal-adapt.org/>

29 As shown, the general trend for April 1 SWE has been decreasing (although shows inconsistencies) from the 1990's. Since 2000, there has been, and models show a steady decline to the end of the 2090s. Between 1950 and 1990, Lake Tahoe averaged ~ 4 - 11 inches (~7in average) of measured SWE on April 1. However, in the last 20 years measured SWE has decreased to 2 - 4 inches on April 1. In the future, averages are projected to drop down to almost 0 inches of SWE by the 2090s.

30 CA 4th Climate Assessment, 2018 Management of Groundwater and Drought Under Climate Change

EPA, What are the trends in the extent and condition of ground water and their effects on human health and the environment?,

<https://www.epa.gov/report-environment/ground-water> , and <https://www.epa.gov/environmental-topics/water-topics>

CA.GOV, Groundwater Threats, <https://oehha.ca.gov/calenviroscreen/indicator/groundwater-threats>

CA Water Board, Aquifer Risk Map Methodology (white paper)

<https://gispublic.waterboards.ca.gov/portal/sharing/rest/content/items/6a50a6cd22a144e9ac621e9070e01c44/data>

CA DWR, Drought and Water Shortage Risk Explorer: Self Supplied Communities https://tableau.cnra.ca.gov/t/DWR_Integrated-DataAnalysisBranch/views/DWRDroughtRiskExplorer-RuralCommunitMarch2021/Dashboard?:showAppBanner=false&:display_count=n&:showVizHome=n&:origin=viz_share_link&:isGuestRedirectFromVizportal=y&:embed=y , Countywide Drought and Water

Shortage Contingency Plans, <https://water.ca.gov/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/County-Drought-Planning> , and Drought and Water Shortage Risk Explorer: Small Water Systems, https://tableau.cnra.ca.gov/t/DWR_IntegratedDataAnalysisBranch/views/SmallWaterSystemRisk-March2021/Dashboard?%3AshowAppBanner=false&%3Adisplay_count=n&%3AshowVizHome=n&%3Aorigin=viz_share_link&%3AisGuestRedirectFromVizportal=y&%3Aembed=y

Groundwater in Fractured Rock Aquifers Well Location, Yield, and Sustainability, https://www.watereducation.org/sites/main/files/file-attachments/fractured_rock_aquifers_kirk.pdf

31 USGS, Groundwater Quality Research,

https://www.usgs.gov/mission-areas/water-resources/science/groundwater-quality-research?qt-science_center_objects=0#qt-science_center_objects , and Surface Water Information by Topic, https://www.usgs.gov/special-topic/water-science-school/science/surface-water-information-topic?qt-science_center_objects=0#qt-science_center_objects

EPA, How's my waterway: Informing the conservation about your waters, <https://mywaterway.epa.gov/state/CA/water-quality-overview> , Drinking Water Mapping Application to Protect Source Waters (DWMAPS),

<https://www.epa.gov/sourcewaterprotection/drinking-water-mapping-application-protect-source-waters-dwmaps> , and Climate Impacts on Water Quality, <https://www.epa.gov/arc-x/climate-impacts-water-quality>

CA.GOV, Groundwater Threats, <https://oehha.ca.gov/calenviroscreen/indicator/groundwater-threats> , and OEHA: Public Health Goals (PHGs), <https://oehha.ca.gov/water/public-health-goals-phgs>

CA DWR, Drought and Water Shortage Risk Explorer: Small Water Systems,

https://tableau.cnra.ca.gov/t/DWR_IntegratedDataAnalysisBranch/views/SmallWaterSystemRisk-March2021/Dashboard?%3AshowAppBanner=false&%3Adisplay_count=n&%3AshowVizHome=n&%3Aorigin=viz_share_link&%3AisGuestRedirectFromVizportal=y&%3Aembed=y

CA Water Board, Aquifer Risk Map Methodology (white paper),

<https://gispublic.waterboards.ca.gov/portal/home/item.html?id=6a50a6cd22a144e9ac621e9070e01c44>

32 As shown, the general trend for April 1 SWE has been decreasing (although shows inconsistencies) from the 1990's. Since

2000, there has been, and models show a steady decline to the end of the 2090s. Between 1950 and 1990, Lake Tahoe averaged ~ 4 - 11 inches (~7in average) of measured SWE on April 1. However, in the last 20 years measured SWE has decreased to 2 - 4 inches on April 1. In the future, averages are projected to drop down to almost 0 inches of SWE by the 2090s.

33 As shown, the general trend for April 1 SWE has been decreasing (although shows inconsistencies) from the 1990's. Since 2000, there has been, and models show a steady decline to the end of the 2090s. Between 1950 and 1990, Lake Tahoe averaged ~ 4 - 11 inches (~7in average) of measured SWE on April 1. However, in the last 20 years measured SWE has decreased to 2 - 4 inches on April 1. In the future, averages are projected to drop down to almost 0 inches of SWE by the 2090s.

34 EPA, Climate Change Indicators: Drought, <https://www.epa.gov/climate-indicators/climate-change-indicators-drought> & <https://www.epa.gov/climate-indicators/southwest>

Cal-Adapt: <https://cal-adapt.org>

35 CA.GOV, Current Drought Conditions, <https://drought.ca.gov/current-drought-conditions/>

36 USGS, Soil and Agriculture, <https://www.usgs.gov/special-topics/drought/science/soil-and-agriculture>

37 DataBasin, Meadow Vulnerability and Prioritization for Restoration and Conservation, 2019

38 Weixelman et al. 2011, Viers et al. 2013, Drew et al. 2016

39 See endnote 33

40 Reed et al. 2020, D'Antonio et al. 2004 Impacts of Climate Change and Invasive Plants in Sierra Meadows: Overview and Recommendations,

<https://www.cal-ipc.org/docs/ip/climateadaptation/ClimateChangeandInvasivePlantsinSierraMeadows.pdf>

Sierra Forest Legacy, Montane Meadows, https://www.sierraforestlegacy.org/FC_FireForestEcology/TH_MontaneMeadows.php

USFS, Headwater Meadow Restoration in the Sierra Nevada: Adapting to Climate Change, <https://www.fs.usda.gov/ccrc/adaptation/adaptation-examples/headwater-meadow-restoration-sierra-nevada-adapting-climate-change>

UC Davis, Beavers, Meadows and Climate Change, <https://watershed.ucdavis.edu/project/beavers-meadows-and-climate-change>

CalTrout, Source Waters Hold the Key to Combating the Effects of Climate Change, <https://caltrout.org/50th/sierra-meadows-strategy>

41 Davis et al. 2016, Rother and Veblen 2016

42 Cal-Fire, Tree Mortality GIS Data, <https://frap.fire.ca.gov/mapping/gis-data/>

US Forest Service, https://www.fs.fed.us/psw/topics/tree_mortality/california/index.shtml , Bark Beetles in California Conifers,

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5384837.pdf , and Synthesis of Research into the Long-Term Outlook for Sierra Nevada Forests following the Current Bark Beetle Epidemic,

https://www.fs.fed.us/psw/publications/fettig/psw_2019_fettig003_larvie.pdf (this has a really good/easy chart on page 15)

University of California, UCCE: Central Sierra, Tree Mortality, https://ucanr.edu/sites/CentralSierraForestry/Tree_Mortality/

PUBS, California forest die-off linked to multi-year deep soil drying in 2012–2015 drought, <https://www.nature.com/articles/s41561-019-0388-5>

43 Cal-Fire, <https://www.fire.ca.gov/>

44 WILDFIRE & WATER SUPPLY IN CALIFORNIA,

https://innovation.luskin.ucla.edu/wp-content/uploads/2021/12/Wildfire-and-Water-Supply-in-California.pdf?utm_source=Master+List+Created+on+1%2F23%2F2017&utm_campaign=6f23ba03f5-EMAIL_CAMPAIGN_2018_05_14_COPY_01&utm_medium=email&utm_term=0_0c851e413b-6f23ba03f5-187135670

45 While Shasta, Fresno, Plumas, Tuolumne, Tulare, and Mono counties are expecting the most acres burned in raw numbers, Alpine County is expected to see the most change from historical observations, followed by Mono, Madera, and Tuolumne counties. While these counties appear to rank above the rest, note that all counties in the region are anticipated to experience an increase in wildfires (with the exception of Kern County), and 18 of the 22 counties are expecting a 32%–96% increase from baseline. These are significant increases throughout the SNC region.

UNDERSTANDING UNDERSERVED POPULATIONS IN THE SNC REGION

Chapter 3 Summary:

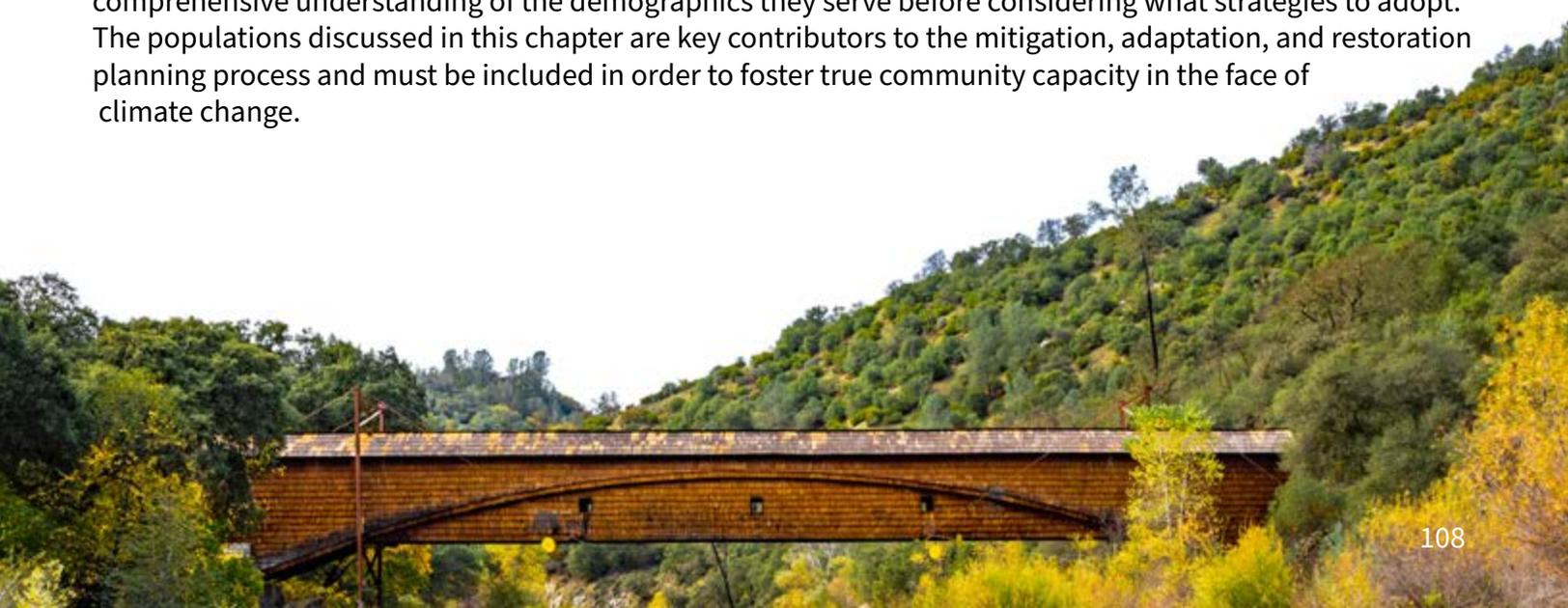
- Over 880,000 people live within the SNC region, of which more than half are underserved or disadvantaged.
- Groups most vulnerable to climate impacts have been historically marginalized, underserved, and underrepresented. These groups include: People of Color, California Native American tribes, individuals in poverty, and the disabled community. Across the SNC region, the greatest climate impact to vulnerable populations is wildfire.

Introduction

Underserved or vulnerable populations are more likely to experience harm to their health, economic, and social well-being due to their race, gender, age, disability, poverty status, and limited access to resources. While many of these adverse effects are systemically reinforced, it is critical that communities identify, mitigate, and resolve these challenges in order to build resilience and prosperity.

Sierra communities are uniquely vulnerable to climate change due to their geographical locations and environment, the lack of resources and essential services, and reduced representation of at-risk populations. Sierra communities tend to be defined by sparsely populated rural living, low tech, outdoor- and service-based jobs, outdoor adventure sports, and traditional values, where People of Color, people with disabilities, and families in poverty are present but silent, and sometimes exist as hidden populations.

The foundation to building community capacity is understanding who needs support and what that support looks like. When planners and policymakers go to the decision-making table, it is crucial that they possess a comprehensive understanding of the demographics they serve before considering what strategies to adopt. The populations discussed in this chapter are key contributors to the mitigation, adaptation, and restoration planning process and must be included in order to foster true community capacity in the face of climate change.





As of this publication, there is no research consensus on how underserved and vulnerable populations in the Sierra Nevada will be impacted by the climate change hazards discussed in chapter 2. This is due in part to the nature of climate science and projection data but also to the lack of social services that track demographics and real-time impacts in a systematic way. More research is needed from rural economists, social workers, and governments to understand who is already being affected, how they are being affected, what hazards pose the largest threat to specific groups, and what can be done to build resilience in the SNC region.

Underserved and Vulnerable Populations

Over 880,000 people live within the SNC region, of which more than 50% may be considered underserved or disadvantaged. It is important for community leaders to be aware of the vulnerable populations that reside in their communities. When reading this section, leaders should focus on the underserved and vulnerable groups listed below when considering their population demographics, along with the hazards that pose the most risk to these groups. If a community comprises a sizable proportion of the vulnerable population and is at a heightened risk of any of the climate hazards listed alongside that population, a focused plan should be designed to support those groups before, during, and after a climate hazard takes place.

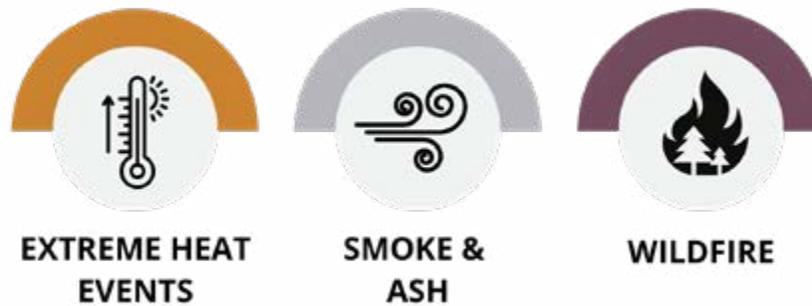
This chapter will define each vulnerable population and list the top three climate hazards and impacts corresponding to that population. The top three climate hazards and impacts were determined by the average health and financial vulnerabilities and level of community involvement for each population.

EXAMPLES OF VULNERABLE & UNDERSERVED POPULATIONS

Children

Children are defined as being 10 years of age and younger. As of 2019, there were more than 90,000 children living in the SNC region, making up 10% of the total population.¹ Children are uniquely vulnerable to climate change hazards due to “their immature physiology and metabolism; incomplete development; higher exposure to air, food, and water per unit of body weight; unique behavior patterns; and dependence on caregivers.”² While people of all ages are mentally impacted by climate change hazards, children are at a higher risk of suffering indirect consequences, including post traumatic stress, loss of a caregiver, disrupted education, and long-term displacement.

Top Risks:



Population of Minors in the SNC Region:

More than 180,000 people living in the region are under the age of 20.



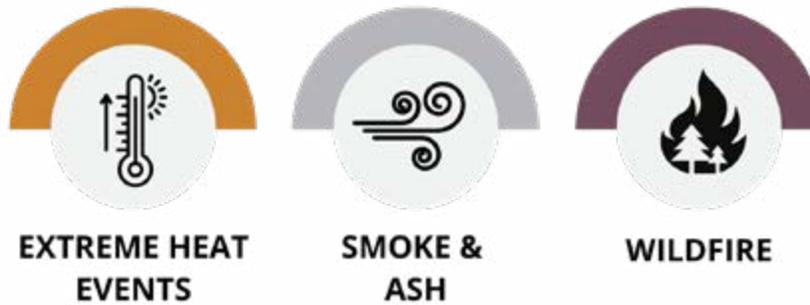
Children under the age of 10 are at a heightened risk of physical health impacts from climate change due to their smaller bodies and developmental stages. Data Resolution: Aggregated county subdivision data for the 22 counties within or partially within the SNC region.

Chart: Sierra Business Council • Source: U.S. Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C. reported by Headwaters Economics' Demographics • Created with Datawrapper

Senior Citizens

Senior citizens are defined as being 65 years of age or older. As of 2019, there were more than 200,000 senior citizens living in the SNC region.¹ Senior citizens make up a quarter of the population, but this portion will likely increase as climate change limits outdoor recreation and the tourism industry, forcing young people to leave rural areas in order to earn higher wages. Senior citizens are considered a population vulnerable to climate change due to their potential for reduced physical and mental capabilities (related to age, illness, or isolation) and potential reliance on medical facilities and/or caretakers. Senior citizens in rural communities face higher travel-related health care costs (e.g., gas, hotel, etc.). Public health officials need to be aware of vulnerable communities who will need help evacuating in the event of wildfire, flood, or power outages. Communities with large senior citizen populations will need to have more capacity to adapt to climate change (e.g., public spaces with air conditioning during heat waves, access to clean water, air purification for indoor living during high AQI levels, and so on).

Top Risks:



Population of Senior Citizens in the SNC Region:

More than 200,000 people are over the age of 65 in the region.



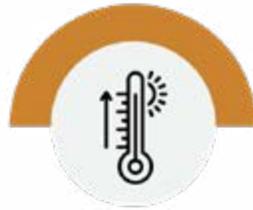
Data Resolution: Aggregated county subdivision data for the 22 counties within or partially within the SNC region.

Chart: Sierra Business Council • Source: U.S. Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C. reported by Headwaters Economics' Demographics • Created with Datawrapper

People with Disabilities or Chronic Health Problems

As of 2019, there are over 135,000 people living with disabilities in the SNC region.³ Disabled people may have a harder time receiving information about current events or issued warnings due to vision and hearing impairments, or because they lack mobility or the ability to perform activities without assistance. Some disabled people are at a higher risk of climate-related impacts due to comorbidities, weaker immune systems, and reliance on caregivers for daily well-being and/or transportation. This group is more vulnerable to multiday power outages due to reliance on medical devices or refrigeration for medicines. Disabled people need to be a part of the climate-adaptation process to communicate their needs and to determine the public's ability to service them in a crisis.⁴

Top Risks:



**EXTREME HEAT
EVENTS**



**SMOKE &
ASH**

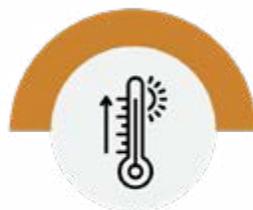


WILDFIRE

Outdoor Workers

This report defines outdoor workers as individuals aged 16 and up who work in farming, fishing, forestry, construction, extraction, or maintenance and repair. As of 2019, there were over 24,000 outdoor workers living in the SNC region.¹ This population makes up nearly 7% of the Sierra workforce, and—crucially—does not include outdoor recreation workers. Not only is this work labor-intensive, it can also expose the worker to physical risk and the potential for injury or harm. This group is critical to developing community capacity, as they can supply human and physical capital for adaptation. It is important for communities to support outdoor workers by providing living wages, adequate housing, and access to health care. This support will ensure this population is integrated into the local society and able to provide and receive necessary resources to boost capacity. Some proportions of this population speak English as a second language or not at all, and they may be living near or below the poverty line. Subsections of this population require more assistance in planning for, responding to, and recovering from climate hazards.

Top Risks:



**EXTREME HEAT
EVENTS**



**SMOKE &
ASH**

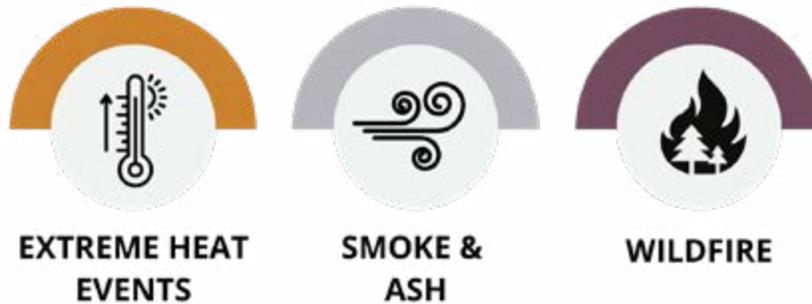


WILDFIRE

Unhoused People

The majority of jurisdictions in the SNC region do not have official statistics on the number of people experiencing homelessness in their county. This could be due to multiple factors, including: a lower population compared to metropolitan areas that track this data; a lack of social services that serve homeless populations in the Sierra; and the transient nature of some rural or mountainous towns. It has become increasingly popular for outdoor enthusiasts to live in retrofitted vans, trucks, and cars in order to reside in the Sierra. It can be difficult to decipher between those who can afford to be housed but choose not to and those without the means to house themselves. Planners and policymakers will want to consider focusing primarily on vulnerabilities faced by those who are homeless involuntarily. It can be assumed that unhoused people are experiencing financial hardship, but their situations result from a multitude of challenges, both systemic (e.g., health care debt, lack of health care, mental health challenges, or unemployment due to disability) and otherwise (e.g., access to resources like job training and affordable housing). In either case, homeless people have less capacity to plan for and adapt to climate hazards due to social isolation and financial instability.

Top Risks:



Indigenous People (Native American and Alaskan Native)

As of 2019, there were roughly 15,000 people living in the SNC region who self-identified as Native American.¹ This number equates to about 1.6% of the region's population—double the 0.8% Native American population in the entire state of California. Having a large Native population means that communities in the Sierra have a duty to protect and respect the systemically threatened Indigenous culture, economy, and physical and mental health. Many California Native American tribes have strong spiritual and physical connections to geography, specific species, and landmarks. Climate change hazards have already impacted this group by destroying important land via wildfire or drought. In general, subsistence or traditional living has become more difficult to sustain.⁵ Through historical colonization, many Indigenous people were systematically barred from accruing generational wealth, leaving many members of this group without adequate infrastructure or access to resources. This leaves parts of this group less capable of handling climate impacts. While environmental science has continually silenced or excluded Indigenous voices, there is a movement, albeit a slow one, to begin merging Indigenous knowledge into adaptation and mitigation planning.⁶ This will be necessary to protect the lands and practices intrinsic to the tribes of the SNC region.

Top Risks:



People of Color

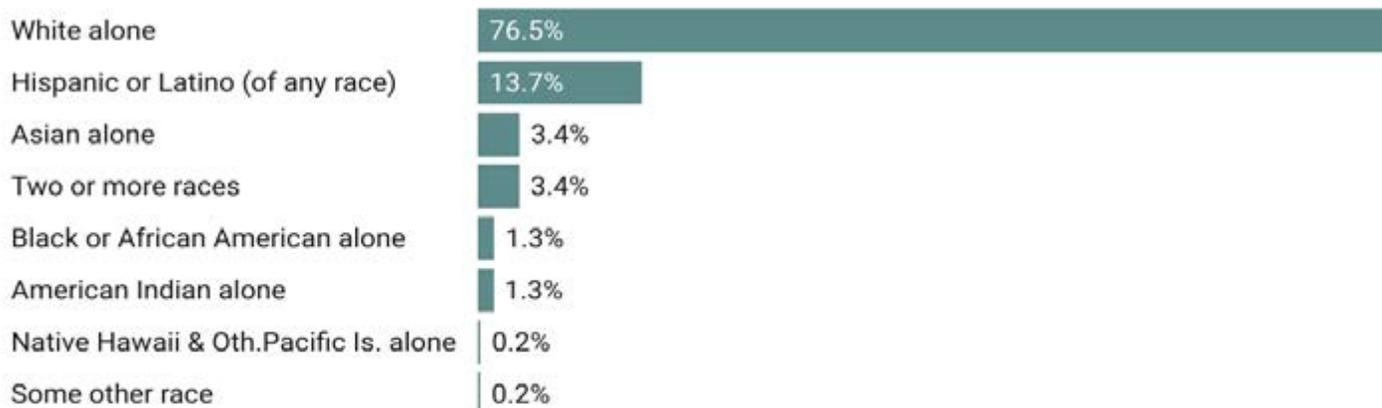
People of color (POC) are defined as individuals who self-identify as being Hispanic, Black or African American, Native Indian, Asian, Native Hawaiian or Pacific Islander, some other race, or a mix of two or more races⁷. As of 2019, there were approximately 205,000 POC living in the SNC region, making up nearly 25% of the population.¹ Over half the region’s POC population identifies as Hispanic. A lack of racial and ethnic diversity in the region could lead to less representation in positions of leadership, which can lead to inequality and less input in decision-making that could significantly impact POC. In many Sierra communities, racial segregation (through redlining and low-income housing placement in communities) and discrimination threaten community resilience. POC are faced with affordable housing built near environmental hazards, poor-quality housing and infrastructure, and systematic exclusion from accruing wealth/assets (e.g., through home ownership, job security, and higher education). A history of systemic racism in rural communities is compounded by the general lack of infrastructure and social services available in the region. The POC population may be one of the most underserved in the Sierra, a fact that will lead to less human and social capital to develop community capacity.⁸ More research needs to be done to understand the full risk climate change poses to this population in the Sierra and how adaptation strategies can fully support this group.

Top Risks:



People of Color in the SNC Region:

Nearly a quarter of the total SNC population identifies as a race other than White alone.



For comparison, over half the population of California identifies as a race other than White alone.

Data Resolution: Aggregated county subdivision data for the 22 counties within or partially within the SNC region.

Chart: Sierra Business Council • Source: U.S. Department of Commerce, 2020. Census Bureau, American Community Survey Office, Washington, D.C. via Headwaters Economics, Demographics, 2020 • Created with Datawrapper

People with Limited English Proficiency

The SNC region is home to over 30,000 people with self-rated English-speaking abilities of “not well” or “not well at all.”³ Most rural publications and media outlets do not offer translated updates, thereby potentially excluding people with limited English proficiency from important public safety updates. This group is most likely not involved in community adaptation planning, reducing the overall capacity of the community. In many industries, limited English proficiency can make it difficult to earn a living wage. In some cases, communities that do not speak English are isolated from the rest of the community. This adds to the lack of social and cultural cohesion in rural towns and can make climate planning slower with less community buy-in.

Top Risks:



Undocumented People

At the time of this publication, there is no population data available for undocumented people in the Sierra. While not recorded, it can be assumed that undocumented people are residing in the SNC region. The same risks faced by People of Color, people with limited English proficiency, and outdoor workers threaten undocumented people. Additionally, this group faces a unique challenge: a fear of legal action when receiving government assistance after or during a climate hazard. This can leave people without running water, electricity, or access to emergency updates and information for extended periods of time. More outreach needs to be done to meet the precise needs and advocate for undocumented people. Local planners should be prepared to communicate with this population through their customary channels (e.g. churches, ethnic grocery stores, family resource centers, etc.) and provide shelters during mandatory evacuations that prohibit access to ICE or other immigration authorities.

Top Risks:



Housing-Burdened Households

A household or individual is considered housing burdened if they spend more than 30% of their income on housing costs (i.e., rent or mortgage). In the SNC region, more than 100,000 households are considered housing burdened, meaning two out of five occupied housing units are not affordable.¹ Housing affordability in the Sierra can be viewed through three different lenses: (1) financial hardship for renters, (2) financial hardship for homeowners, and (3) impacts to local economies. Lack of affordable housing for renters typically results in residential crowding and people moving (frequently) to cheaper housing that is typically farther away from resources like schools, transit centers or town centers, health care, child care, grocery stores, and more. Crowded housing or physical isolation can lead to health problems, mental health problems, and diminished educational and work opportunities.⁹ Homeowners experiencing high mortgages are also more likely to face the housing insurance crisis. The homeowners insurance crisis in the Sierra is fueled by the increasing risk of wildfire. Insurance trade groups in California justify skyrocketing prices or dropping Sierra residents until it is clear that the state is actively working to mitigate wildfire risk.¹⁰ The overall housing crisis in the Sierra is fueled by unaffordable housing and is contributing to local employers' difficulty in finding and retaining employees at current wages. This leads to understaffing, poor services, and lack of economic opportunity for businesses in the Sierra. High housing costs contribute to less community capacity in the following ways:

- Residents have less time and money to spend volunteering or working toward adaptive measures.
- Residents with human, social, and physical capital are being forced to leave the area due to lack of housing.
- Weakened local economies result in less community wealth to fund adaptation programs.

Top Risks:



Housing-Burdened Households in the SNC Region

There are over 240,000 occupied housing units in the region. A third of owner-occupied and half of renter-occupied homes are unaffordable.



A household is considered housing burdened if more than 30% of monthly income is spent on housing costs. Data Resolution: Aggregated county subdivision data for the 22 counties within or partially within the SNC region.

Chart: Sierra Business Council • Source: U.S. Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C., reported by Headwaters Economics' Populations at Risk • Created with Datawrapper

Energy-Burdened Households

Energy-burdened households are defined as households spending more than 10% of their income on indoor energy bills. There is no available data on the number of electricity-burdened households in the Sierra, though it is fair to assume a portion of housing-burdened households are also in this group. Households that experience energy burden tend to have bundled hardships, meaning they typically experience other hardships like unaffordable housing or food insecurity in addition to unaffordable energy costs.¹¹ Household energy uses include: cooking, lighting, heating, cooling, cleaning, technology, and medical uses. Energy burden is typically thought of as an economic issue, so solutions typically include bill assistance but don't address other root issues, such as inadequate housing infrastructure, lack of renewable energy at the grid, or lack of energy efficiency measures in low-income homes. Sierra residents are usually prepared for temporary (one- to two-day) power outages caused by winter weather, but they will need to prepare for longer winter outages resulting from increased extreme precipitation events. Sierra residents have already had to adapt to planned power outages from utility companies during fire season. These outages, commonly referred to as Public Safety Power Shut Off (PSPS) or Public Safety Outage Management (PSOM) events, can occur for many days on end. Outages may become more frequent with increasing extreme heat, extreme precipitation, and frequency of wildfires in the Sierra. Some energy infrastructure in the Sierra is not adapted for extreme weather. In essence, climate change and extreme weather will impact the availability and consistency of energy. Lack of energy related to financial hardship or infrastructure issues will result in communities not having their basic needs met and with less capacity to deal with the impacts of climate change.

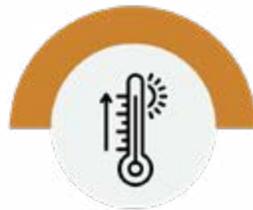
Top Risks:



Households without a Car

In the rural areas of the SNC region, many people live a mile or more from the nearest transit center or bus stop, and that's assuming there is a public transit system that connects to their neighborhood or community. Additionally, many Sierra communities lack bicycle infrastructure to allow for safe and efficient bike commuting. Even where such infrastructure exists, it is only accessible in the dry seasons. Exacerbating these transportation challenges is the fact that nearly 15,000 households in the region do not have a car.³ Because there is no reliable public transportation or biking infrastructure within walking distance to homes and work, owning or having access to a car is essential to living in the Sierra. Anyone who does not own or have access to a car most likely can't afford one. People who own cars are more likely to be employed, work longer hours, and make higher wages than those who do not.¹² This indicates that households without a car are experiencing financial hardship and therefore have less adaptive capacity. In general, the largest concern for households without cars is their inability to evacuate quickly in an emergency. There are secondary concerns as well; without access to a car people are less able to access public services like cooling centers, health care, or emergency response centers. Communities with high proportions of households without a car will need to plan for public transportation during mandatory evacuations.

Top Risks:



**EXTREME HEAT
EVENTS**



**SMOKE &
ASH**

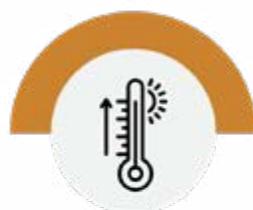


WILDFIRE

Households without Air Conditioning

More people in the SNC region will require air conditioning (AC) to keep healthy and comfortable during extreme heat events and warm nights. Populations at higher elevations and in more pine forest zones tend to have lower rates of home AC. More homes have AC in the foothills and northern Sierra, where hot temperatures are a normal part of the climate. Many people without AC rely on lower nighttime temperatures to keep their homes cool during the hotter summer months. Nighttime cooling may decrease with the projected increase in warm night temperatures and frequencies. Increasing wildfires will create longer spans of time with unhealthy air quality that will lead to less nights when it is safe to leave windows open, even when outside air temperatures are cooler. Lack of AC will significantly affect low-income families, people with disabilities, and senior citizens. Cooling centers will need to be available in most communities with low rates of AC, but also for people who have AC but cannot afford the increased costs of electricity. The community will need to have the capacity to provide cooling centers to people without AC, especially during power outages.

Top Risks:



**EXTREME HEAT
EVENTS**



**SMOKE &
ASH**



WILDFIRE

Individuals/Families in Poverty

There are over 100,000 individuals living below the poverty line in the SNC region. This population is made up of over 18,000 families, a majority with children under the age of 18. This equates to 10% of the region's total population living below the federal poverty line. Poverty in mountain towns, tourist destinations, and resource-rich regions is nuanced; wages in rural areas have not kept pace with urban areas, yet the cost of living in rural regions has continued to increase. While the data shows there are over a quarter million people living in poverty, there are plenty more with income levels above the poverty line that are not able to make ends meet in the Sierra.¹³ People living in poverty are more likely to be renters or mobile home residents, housing and electricity burdened, and have less capacity to plan for or respond to climate change.

Top Risks:



Poverty Prevalence in the SNC Region:

Over 100,000 people living in the region are in poverty.



A family is defined by the Census as two or more people who reside together and are related by marriage, birth, or adoption. Data Resolution: Aggregated county subdivision data for the 22 counties within or partially within the SNC region.

Chart: Sierra Business Council • Source: U.S. Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C., via Headwaters Economics, Populations at Risk, 2020 • Created with Datawrapper

Renters

Roughly 25% of homes in the SNC region are occupied rentals.³ As housing prices continue to rise, many Sierra communities are in need of achievable housing and affordable rentals for middle-class residents and young families working in Sierra industries like natural resources, outdoor recreation, environmental sciences, and the tourism sector. Many renters are forced to leave the area due to housing shortages and low wages. This lowers the overall capacity of communities to plan for and adapt to the climate emergency, and may contribute to skilled workers with local knowledge deciding to leave rural communities.

Top Risks:



Mobile Home Residents

As of 2019, mobile homes made up 10% of the occupied housing in the SNC region.³ While there is no specific data breakdown, many mobile home residents fall into two categories: senior citizens, low income, or both. Senior citizens and low-income households are considered vulnerable to climate change regardless of their housing situation; therefore, this group is doubly vulnerable to climate hazards. Mobile homes are more likely to experience damage in extreme weather, potentially causing harm to occupants. Additionally, mobile home owners do not have the same post disaster financial resources allotted to them due to the government's requirement of proving ownership of property. This indicates that this group will have less capacity to rebuild after a disaster and could be forced to relocate or look for alternative low-income housing options.

Top Risks:



Single-Access Road Residents

No data is currently available for the number of single-access road residents at the time of publication, but due to the rurality of the SNC region, it can be assumed that a sizable portion of the population live on single-access roads, or single-lane, one-way roads. Many of this group may enjoy social isolation and want to maintain their rural or mountainous way of life. This can lower community capacity by increasing factions within the community, or inciting pushback against adaptation strategies like increasing ingress/egress routes. Alternatively, this group may offer high levels of physical and human capital as well as longtime residents with pertinent knowledge to help build capacity. These residents are at an increased risk of extreme weather hazards if they are socially isolated, lack access to broadband internet or cell service, and have long, sometimes treacherous drives to town centers or freeway on-ramps.

Top Risks:



**DEBRIS FLOWS/
AVALANCHES**



DROUGHT



WILDFIRE



Part-Time Residents and Tourists

Part-time residents (typically second-home owners) and tourists simultaneously add to and subtract from community capacity. In some regions of the SNC territory, second-home ownership is soaring, with nearly one in five homes listed as a second home.¹ Second-home owners bring more financial and social capital to rural areas by “bridging” different social settings and professional skills, and they can offer a higher level of education and connection to policymakers.¹⁴ This can cause schisms between values and needs of “old-timers” vs. newcomers. An increase in second-home ownership will only be beneficial if it comes with a high level of financial and social capital that is shared with the community, along with an urgency to protect their property and the surrounding ecology/recreation that drew them to the area. While many Sierra regions rely heavily on part-time residents and tourists for economic growth and prosperity, this group may be disconnected from local knowledge and unaware of resources available during a crisis. They may not know how to sign up for emergency alerts, how to be prepared for evacuation in the case of wildfire, or how to handle heavy snowfall and power outages during winter months. This can place an extra burden on local authorities and quickly drain local resources intended for small populations.

Top Risks:



Second Homes in the SNC Region:

There are over 450,000 housing units in the region; nearly one in five is a second home.



Data Resolution: Aggregated county subdivision data for the 22 counties within or partially within the SNC region.

Chart: Sierra Business Council • Source: U.S. Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C. • Created with Datawrapper

Population Vulnerability Matrix

	 EXTREME HEAT EVENTS	 DROUGHT	 WILDFIRE	 SMOKE & ASH	 EXTREME PRECIPITATION	 DEBRIS FLOWS/ AVALANCHES
Children	5	2	5	5	2	1
Senior Citizens	5	3	5	5	4	2
Disabled/Ill People	5	3	5	5	4	2
Outdoor Workers	5	5	5	5	4	2
Unhoused People	5	2	5	5	5	2
Indigenous People	5	5	5	4	3	2
People of Color	5	5	5	4	3	1
Limited English	5	5	5	5	3	1
Undocumented People	5	5	5	5	3	1
Housing-Burdened	4	3	5	5	3	2
Energy-Burdened	5	3	5	5	3	2
No Car	5	2	5	5	4	3
No AC	5	3	5	5	2	2
Families in Poverty	5	3	5	5	3	2
Renters	5	4	5	4	3	2
Mobile Homes	5	2	5	5	5	2
Single-Access Road Residents	3	5	5	3	4	5
Seasonal/Tourists	3	2	5	4	3	1

Vulnerability Scores are on a 1-5 scale, with 1 being the least vulnerable and 5 being the most vulnerable. Vulnerability scores are based on a climate hazard's potential impact on a population and the population's capacity to manage/adapt to the hazard.



EXAMPLES OF RISK

Across Vulnerable Populations

AQI

Senior Citizens: A senior citizen is considered a “sensitive person” in the AQI measurement system, and for good reason. Older people experience adverse health effects at lower AQI ratings, and higher proportions of the senior population have cardiovascular or lung disease that put them at higher risk.¹⁵ These diseases contribute to higher hospitalization rates during periods of high AQI.¹⁴ Having high proportions of the population hospitalized during an extended wildfire/smoke season will lower the community’s capacity.

Electricity-Burdened Homes: Populations that are electricity burdened are less likely to have AC. Even if they do have AC, they most likely cannot afford to run it. This means they rely on cooler nighttime temperatures to cool their homes. With air quality projected to decrease due to wildfires, this group will be exposed to more dangerous levels of PM_{2.5}. Air purifiers are expensive, which means this group is less likely to own one and will suffer more pollution-related illnesses or discomfort.

Persons with Limited English Proficiency: This population makes up a large portion of the outdoor workforce and cannot afford to take time off of work because of poor air quality. Some may not have health insurance to receive medical attention for pollution-related illnesses. This group is more likely to live in poor-quality housing without proper ventilation or air conditioning.

Extreme Heat

Households without AC: The majority of homes in the Sierra do not have AC. As the Sierra endures higher temperatures and more extreme heat days and warm nights, it becomes harder for residents to cool their homes using nighttime temperatures. Lack of AC puts a large group of people at risk for heat-related illnesses.

Unhoused and/or Homeless Persons: This population has the least protection from extreme heat and extreme cold. Requirements restricting warming and cooling centers results in reduced year-round access to shelter, forcing people to endure extreme temperatures. Fatalities occur annually due to heat- and cold-related illnesses.

Outdoor Workers: Due to the nature of outdoor occupations, this group is exposed to the elements for extended periods of time. It is important that businesses and industries are trained on heat- and cold-related safety measures and provide the necessary conditions to maintain healthy body temperatures and hydration for workers. Temperature-related illnesses could force workers to miss or skip work and/or experience financial hardship, as well as result in lasting health impacts.

Drought

Indigenous People: Less water in the Sierra will disproportionately impact Indigenous people due to their reliance on ground and surface water for drinking, farming, and fishing. While most people in the Sierra will feel the effects of drought, California Native American tribes may also endure spiritual damages from the loss of sacred water sources and riparian species. Many tribes rely on wells. With decreasing precipitation projected for most of the Sierra, this group is at a higher risk of dry wells and does not possess the financial means or ability to drill deeper wells.

People of Color: Conditions from lack of water will become increasingly dire for farming communities for multiple reasons. Agricultural laborers will be impacted financially by drought conditions as more farmers leave farmland fallow. Less water means less crops, and less crops means less labor, which means less income for families. Farm workers will have their daily livelihood impacted dramatically if and when farmers begin to leave ground fallow. Latinx communities tend to live in agriculturally focused areas where drought has already dried up private wells. Many farmworkers and landowners are unable to afford digging deeper wells, effectively losing access to household running water

Single-Access Road Residents: Residents of the Sierra living far away from town or city centers are more likely to have private wells. Increasing droughts will mean less available groundwater, and more wells are projected to go dry. Without the financial resources or ability to drill deeper wells on their own, this group could experience limited to no household running water.

Reduced Snowpack

Renters: Many renters in the SNC territory are dependent on the outdoor recreation industry for employment. With projected reductions in snowpack, many outdoor recreation jobs in the ski, river rafting/ guiding, boating, fishing, and hunting industries will force some people to leave the area in order to find stable income or turn to alternative housing options (e.g., mobile homes, living out of cars, camping, couchsurfing, etc).

Floods/Debris Flows/Avalanches

Single-Access Road Residents: This group is more likely to become trapped in the event of an avalanche, debris flow, or wildfire that impacts roadway access. Such an event could leave this group without electricity (due to downed power lines), access to food, or emergency response vehicles/teams for days on end. Large communities that have one ingress/egress route should consider heeding early evacuation warnings, and local authorities will need to organize waves of exits during mandatory evacuations.

Extreme Climate Hazards

Disabled and Chronically Ill People:

- a. Evacuations: Many people with limited mobility do not have their own transportation, and many first responders are not fully trained on evacuating disabled people. Communities with large populations of people with limited mobility will need to have ample resources and training for staff in order to safely evacuate people who are bedridden or rely on wheelchairs or other transportation devices.
- b. Shelters: Evacuation centers need to be accessible for wheelchair users and have handicap accessible facilities (e.g., toilets, showers, handwashing, etc). In the event of a natural disaster like a wildfire or flooding, disabled people could be forced to temporarily or permanently relocate.
- c. Forced relocation: Forced or permanent relocation could result in the need to retrofit a new home for accessibility or finding new care and support systems. Disabled persons may not have the financial resources for proper relocation, which could force them to live with insufficient care or financial hardship.
- d. Power outages: Extreme wildfire in the Sierra has commonly been mitigated by extended power outages, or destroys infrastructure which provides power. Some disabled people rely on electricity for refrigeration of medication, heating and cooling, powering medical devices like oxygen, and charging electric wheelchairs and other automated tools.

Children: Children are dependent on adult caregivers to navigate and evacuate in extreme weather or events like wildfire and debris flows. This dependency lowers the overall capacity of communities to flee quickly and safely. In the aftermath of extreme weather, children’s outdoor recreation may become dangerous, unhealthy, and off-limits for play.

Families in Poverty: Living in poverty increases the odds of not having adequate housing or transportation and contributes to the likelihood of social exclusion.³ These factors make families living in poverty more vulnerable to natural disasters. This group will have less capacity to evacuate or comply with mandatory evacuations due to lack of transportation, inability to miss work, and having no place to relocate to. In the case of property damage due to natural disasters or hazards, this group is less likely to have insurance or cash capital to cover expenses and/or losses, lowering their ability to recover after extreme events.

Vulnerability Score Method

SBC used the Potential Impact and Adaptive Capacity Scoring Rubric (Rubric) provided by the APG alongside research cited in this chapter to determine impact and capacity scores for the climate hazards facing different populations in the Sierra. In the Rubric, there are only three available scores for impact and capacity: (1) low, (2) medium, and (3) high. This limits the ability to give nuanced scores for potential impact of climate hazards on specific groups, or to determine how adept groups will be at managing those hazards.

Potential Impact and Adaptive Capacity Scoring Rubric

Score	Potential Impact	Adaptive Capacity
Low	Impact is unlikely based on projected exposure; would result in minor consequences to public health, safety, and/or other metrics of concern.	The population or asset lacks capacity to manage climate impact; major changes would be required.
Medium	Impact is somewhat likely based on projected exposure; would result in some consequences to public health, safety, and/or other metrics of concern.	The population or asset has some capacity to manage climate impact; some changes would be required.
High	Impact is highly likely based on projected exposure; would result in substantial consequences to public health, safety, and/or other metrics of concern.	The population or asset has high capacity to manage climate impact; minimal to no changes are required.

Source: APG

After determining the scores for potential impact and adaptive capacity, SBC used the Vulnerability Score Matrix provided by the APG to assign vulnerability scores on a scale of 1 to 5 for climate hazards facing each population.

Vulnerability Score Matrix

Potential Impacts	High	3	4	5
	Medium	2	3	4
	Low	1	2	3
		High	Medium	Low
		Adaptive Capacity		

Population Data Limitations and Gaps:

- More research is needed to determine the long-term effects of the COVID-19 pandemic on demographics, poverty levels, and housing statistics in the Sierra.
- More research is needed on race and climate change, and environmental racism in the Sierra.
- Data is needed on the number of unhoused persons, undocumented persons, energy-burdened households, households with AC, and single-access road residents in the SNC region.
- Data in this chapter uses 2019 US Census data at the county subdivision level. County subdivision boundaries do not perfectly align with the SNC boundary. Planners and policymakers should conduct population analysis within their jurisdictional boundaries.
- In general, community-level socioeconomic data is not available within the SNC region.

Chapter 3 References:

- 1 US Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C. as reported in Headwaters Economics’ Demographics (headwaterseconomics.org/eps)
- 2 Global Climate Change and Children’s Health, The Council on Environmental Health et al., 2015
- 3 US Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C. as reported in Headwaters Economics’ Populations At Risk (headwaterseconomics.org/eps)
- 4 Disability and climate change—impact on health and survival, Marsha Saxton & Alex Ghenis, 2018
- 5 4th national Climate Assessment: Chapter 15: Tribes and Indigenous Peoples, Rachel Novak et al., 2018
- 6 How Indigenous Knowledge Is Changing The Way California Tracks The Effects of Climate Change, Manola Secaira, 2021
- 7 Racial categories are defined by the US Census. This report will use the US Census defined racial and ethnic categories in order to accurately reflect the data. SBC understands these terms may not adequately describe all people living within the SNC region.
- 8 Lessons on Climate Change and Poverty From the California Drought, Wendy Ortiz, 2015
- 9 WHO Housing and health guidelines, World Health Organization, 2018
- 10 California wildfires ignite an insurance crisis, Dan Walters, 2021
- 11 Energy, Poverty, and Health in Climate Change: A Comprehensive Review of an Emerging Literature, Sonal Jessel, Samantha Sawyer, Diana Hernández, 2019
- 12 Car ownership, employment, and earnings, Steven Raphael, Lorien Rice, 2002
- 13 More than three-quarters of a million elderly Californians ‘unofficially’ poor, Venetia Lai, 2015
- 14 The Social Value of Second Homes in Rural Communities, Nick Gallent, 2013
- 15 Impact of Climate Change on Elder Health, Bruce A. Carnes, David Staats, and Bradley J. Willcox, 2014

ECONOMIC VULNERABILITIES

WITHIN THE SNC REGION

Chapter 4 Summary:

- The regional economic drivers are tourism, recreation, natural resources, and agriculture. However, local government and social services (i.e., healthcare, education, and transportation) are the largest employers in the Sierra Nevada Region.
- Even though tourism is a primary economic driver in the SNC region (visitor spending exceeded \$9 billion in 2019), the tourism and recreation industry pays some of the lowest wages and is one of the drivers most vulnerable to climate impacts. New opportunities in natural resources may increase economic development in the region due to a growing biomass industry and increased forest management needs.
- Across the SNC region, the median household income does not meet the cost of living, and lack of affordable housing and access to quality infrastructure (e.g., broadband) limits a community's capacity to endure and recover financially from climate impacts.

Introduction

The Sierra Nevada is an ecologically and geographically diverse region with physical, emotional, and spiritual importance for many people. Most jurisdictions in the SNC region are dependent on one or more of four main industries: (1) tourism, (2) recreation, (3) natural resources, or (4) agriculture. While most regions of the Sierra Nevada are rural with relatively low numbers of year-round residents, many see dramatic population and visitation growth throughout the winter and summer seasons. Communities within the region require both fiscal and physical infrastructure in place to provide adequate services amidst seasonal population fluxes and extreme weather patterns like wildfire and heavy snowfall. These services will become even more important for the economic resilience of the Sierra as the region is forced to face the climate emergency.

Communities in the region have been impacted by devastating drought, record-breaking megafires, and increasingly intense precipitation events. The damage accrued in the past decade alone is significant, and recovery efforts may not be enough to support the region through future climate crises. Community leaders must be aware of the economic strengths and weaknesses in their communities and how to leverage this knowledge in order to build a healthy and robust local economy. Having witnessed the economic impacts due to wildfire, dense smoke, long droughts, and heavy snowfall, community planners must be prepared to support communities through such challenges and spearhead industry changes as necessary. Unsurprisingly, well-capitalized communities with plentiful and updated infrastructure are better equipped to mitigate, endure, and rebuild after catastrophic events. Where infrastructure is insufficient to support a modern rural community, residents are less able to maintain a healthy economy during and after catastrophic events.

This chapter addresses how industries, income type, median household income, built infrastructure, and social services will most likely be impacted by climate change hazards.

CLIMATE IMPACTS

on Sierra Economic Drivers

The four main industries in the region (tourism, recreation, natural resources, and agriculture) will face varying impacts from climate change.

Some climate impacts will increase opportunities for certain industries; for instance, the need for forest management will bolster the forestry industry. As expected, other climate impacts will negatively influence aspects of industry. For example, a reduced snowpack may decrease the number of ski resort operating days.

While these four industries have come to define communities throughout the SNC region, in modern times, they employ only a quarter of Sierra residents.¹ The majority of jobs in the region tend to be in the public support or local government sector, which are both at risk if communities collapse from climate disasters. More research is needed to understand the modern economic drivers and well-being of the region.



TOURISM

Tourism is defined as sectors that provide goods and services to visitors as well as locals. For the Sierra, this sector typically includes outdoor recreation, accommodation and food service, and retail trade. Tourists are attracted to the Sierra for its outdoor access and nature, with activities like scenic driving making up the majority of visitor activities.² Visitor spending in the region was over \$9.5 billion in 2019.³ Most visitor spending goes toward accommodation and food service, followed by recreation.³ Total tax revenue associated with travel spending in the region is nearly \$9 million.³

There are over 202,000 jobs in the tourism sector, with annual wages ranging from \$23,000–\$29,000, generating over \$7.7 million in earnings in 2019.⁴

Tourism-Related Employment

Jobs in the tourism industry make up 12% of total employment in the SNC region.



Data Resolution: Aggregated county level data for the 22 counties within or partially within the SNC boundary.

Chart: Sierra Business Council • Source: U.S. Department of Labor. 2021. Bureau of Labor Statistics, Local Area Unemployment Statistics, Washington, D.C. as reported in Headwaters Economics' Tourism • Created with Datawrapper

In 2020, accommodation made up 22.8% of total employment in Mono County, 19.7% in Mariposa County, and 7.7% in Inyo County, while the remaining SNC regional jurisdictions fell around an average of 1.5%.⁴ The economic impact of overnight and multiday tourism is clearly illustrated through the Transient Occupancy Tax (TOT). In 2019, Mammoth Lakes earned over \$20 million in TOT revenue, unincorporated regions of Mariposa County earned nearly \$15 million, and Truckee earned \$4.3 million.

Climate Impacts on Tourism

Top Hazards	Top Impacts	
 <p>WILDFIRE</p>	 <p>SMOKE & ASH</p>	 <p>ECOSYSTEM DEGRADATION</p>

Tourism will likely see heavy impacts due to climate hazards primarily from increased wildfire risk and subsequent poor air quality from wildfire smoke. Regions more reliant on a tourist economy will experience the most impact when outdoor recreation and sightseeing are deemed unavailable or unsafe due to increasing extreme events like active wildfire, wildfire smoke, and atmospheric river winter storms.

As fire risk increases and smoke reduces visibility and comfort, many visitors may choose an alternative travel destination. This unpredictability in visitation can pose long-lasting negative effects on businesses, many of which rely on summer tourism to ensure yearly profits. Restaurants, lodging operations, and retail shops will have to scale their operations up or down depending on wildfire impacts and visitation levels. The unpredictability of visitation could dissuade potential new businesses from opening in the Sierra, undermining the economic viability of small rural towns.

On the other hand, increases in extreme heat in the valley and coastal regions of California could drive more visitors to the mountainous areas of the SNC region. Communities at higher elevation may become climate havens when other hazards aren't present. If adequately prepared, hard-to-reach regions could see more visitation, prompting more economic development.

Sierra communities that rely on tourism will need to plan for crisis communication with visitors who may not be aware of the wildfire risk, evacuation routes, or how to safely deal with unhealthy air quality. Restaurants, hotels, and retailers could become information hubs for tourists. These businesses will need to have support from local authorities in order to share pertinent, up-to-date information with people unfamiliar with the region and its risks.

RECREATION

The Sierra Nevada region is the backbone of California’s growing \$92 billion outdoor recreation economy. Outdoor recreation in the Sierra encompasses many activities, some of which bring more direct and indirect revenue than others. Activities in the Sierra are wide-ranging, with access to world-class mountain bike trails and ski terrain, the John Muir Trail, unprecedented rock climbing, paddling, camping, horseback riding, and motorized vehicle trails.

Ski resorts generate a large portion of the outdoor recreation revenue in the Sierra. In the 2018/19 fiscal year, the 35 resorts under Ski California’s trade association generated \$3.2 billion in economic output. While 52% of that revenue was spent at businesses within the ski resorts, 48% was spent outside of the ski resort at local businesses. Ski resorts in California generated \$759 million in labor income across 22,000 year-round-equivalent jobs.⁵

While 22,000 year-round-equivalent jobs sounds impressive, in reality the majority of resort workers are seasonally employed. Resort summer operations only generated \$108 million in the summer of 2019, significantly reducing the need for employees. Senior management at ski resorts typically hold salaried, year-round positions, but these perks do not extend to seasonal workers. Assuming that only about 10% of workers employed by the 35 Ski California resorts work year-round, an estimated 40,000 seasonal employees (on average in the winter) earn around \$18,000 in a winter season. More on the cost of living in the Sierra and median income levels is discussed below.

Hunting and fishing on public lands is a highly coveted pastime in much of the Sierra Nevada. In 2019, revenue from sport fishing licenses surpassed \$67.7 million, and hunting licenses brought in more than \$26.5 million.⁶

While there is plenty of free year-round outdoor access in the Sierra, another way to quantify outdoor recreation in the snowy areas of the Sierra is by looking at the sales of SNO-PARK permits. During the 2019/20 season, more than 19,000 \$5 day permits and more than 7,000 \$25 season permits were sold to residents and visitors.⁷ These numbers jumped dramatically during the 2020/21 season, when the California Department of Parks and Recreation sold over 40,000 SNO-PARK day permits. While this revenue stream is not as large as those generated from downhill skiing or hunting and fishing, it illustrates the influx of seasonal tourists that spend money to recreate in the Sierra.

It is worth noting that revenue from hunting and fishing licenses and SNO-PARK permits goes to the State of California and is spent on conservation efforts, policy enforcement, and state land management.

Climate Impacts on Recreation



Outdoor recreation will be most affected by drought and wildfires, either directly by snow drought and evacuation warnings or indirectly by poor air quality, low surface water levels, and forest closures. It is likely the winter season will become shorter. California's Fourth Climate Change Assessment has reported a long-term decline in April snowpack throughout the Sierra Nevada since 1955, with declines recorded even in the highest regions of the Sierra. This will impact the number of ski days in a season, resulting in reduced income generated by ski resorts and ski-focused businesses, as well as reduced wages and employment. In general, declining snowpack will impact the ski industry in the lower elevations of the Central Sierra more than those in the Eastern Sierra. Higher elevations will most likely continue to hold a stable snowpack through most of the century.

Impacts to summer tourism will most likely be due to wildfire. As seen in recent summers, public land closures and AQI readings at unhealthy or hazardous levels dramatically reduce visitation and spending in the Sierra. Large swaths of Sierra populations were evacuated for long periods of time during the summer of 2021 due to catastrophic wildfires like the Dixie Fire and Caldor Fire, and local businesses endured immense economic damage. Once a devastating fire passes through an area, communities struggle to attract visitors. The perception of total devastation lingers, thereby compounding the negative economic impact.

People employed in recreation will have less job opportunities, shorter working seasons, and more hazardous work environments. Overall, this will reduce economic prosperity and increase healthcare costs for workers exposed to ongoing climate hazards. Most likely, recreation-based workers will be forced to decide between finding partial or full-time work in other sectors, living a lower quality of life, or relocating to areas where work opportunities in outdoor recreation pose less risk. Relocation will decrease the tax base that rural communities rely on to survive.



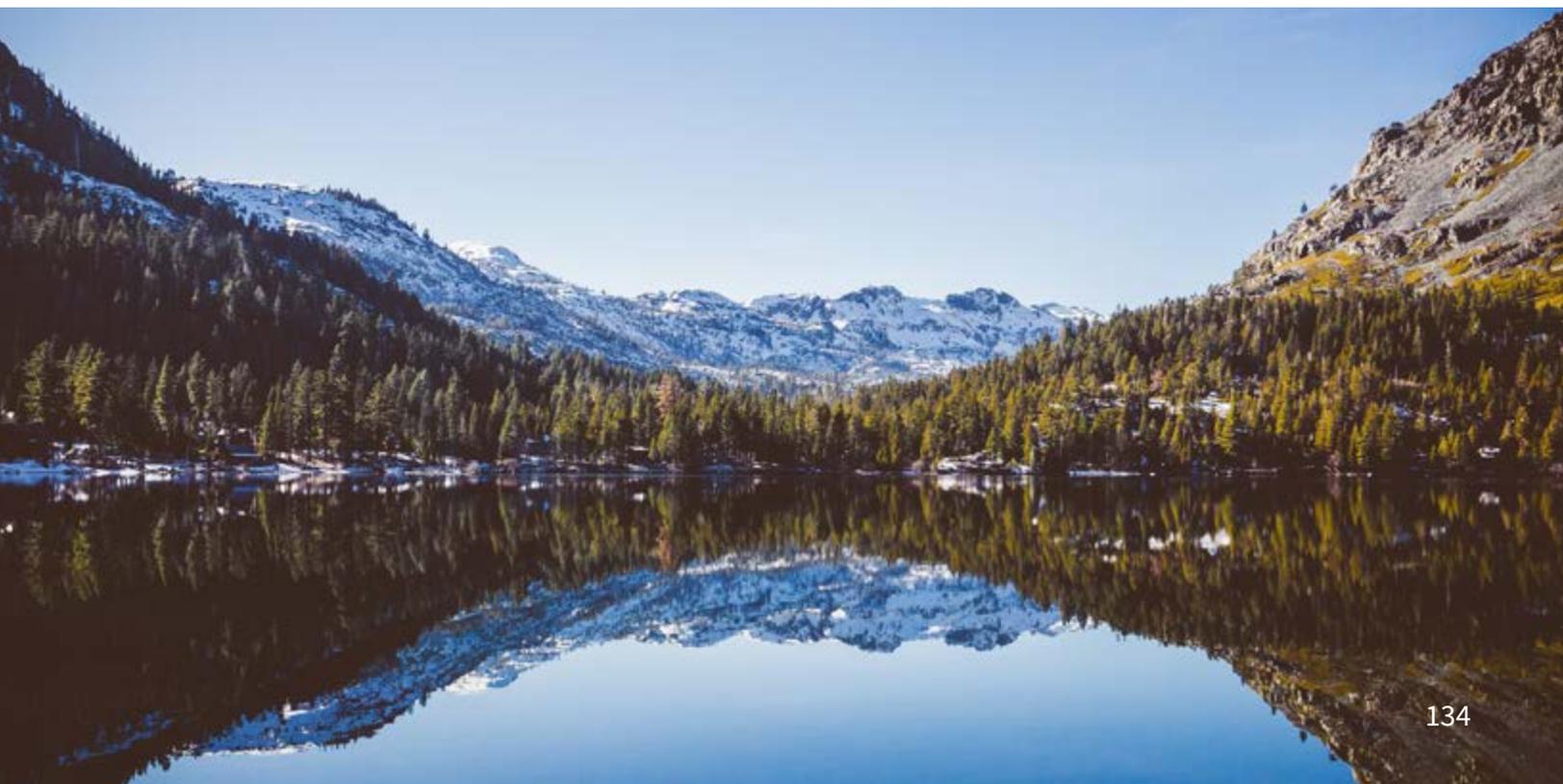
NATURAL RESOURCES

Most of the working lands in the Sierra Nevada region are forest and rangeland. Urban areas and agriculture make up less than 3% of the area, while forests, shrublands, and grasslands account for 90%.⁸ The Sierra provides essential natural resources like water, clean power, working lands, and wilderness access.⁸ Natural resources have been a critical export of the Sierra, and continue to be crucial for the well-being of Sierra residents and downstream communities reliant on Sierra resources.

Long before the Sierra was colonized, tribal communities indigenous to the region were stewards of the land. Many Native tribes practice land management with extensive community participation, using historical networks of localized knowledge referred to as Traditional Ecological Knowledge (TEK).⁹ An example of TEK is the cultural practice of controlled burning performed by the North Fork Mono to foster new growth and forest health.¹⁰ More than a century after Native tribes were forcibly removed from their lands in the Sierra and restricted from performing their cultural land management practices, new partnerships are now forming between Native tribal leaders and state and federal land management organizations.¹⁰ It will be important for land management in the Sierra to be led in part by Indigenous people in order to rebuild trust after more than a hundred years of exclusion, and to ensure the proper implementation of TEK.

Modern natural resources in the Sierra are less driven by the extractive industries of the 19th and 20th centuries; the gold rush and extensive timber industries that defined the Sierra for many years are in the past. The modern natural resource industry is focused on water, hydroelectric generation, forest health, biomass, and working lands.

The Sierra Nevada provides 60% of California's water supply, supplying over 29 million California residents with drinking water. Water management is a critical part of the Sierra's economy, making up roughly 1% of the state's GDP and accounting for over \$30 billion in 2019.¹¹ Water management in the Sierra provides water for domestic use, agricultural use, and power generation. Hydropower is a strong market in the Sierra, with 155 hydroelectric power plants in the region. At maximum capacity, the combined power output is 7,736 megawatts.¹² For reference, the average US home uses approximately 0.001 megawatt per month.¹³



Among counties within the SNC region, Shasta County has led the state’s timber harvest since 2012, bringing in over 13% of the total harvest.¹⁴ The timber industry is not as strong as it once was. Prior to 1970, there were over 250 wood products facilities in California. By 2016, that number was down to 80.¹⁵ Closures have resulted in employment decreases, leaving the industry with a workforce shortage. Based on existing conditions across the industry, a 10% decrease in forestry and conservation laborers, as well as logging and woodworking operators, is expected by 2028, while increases in environmental science positions are expected.¹⁶ A substantial increase in employment would be anticipated should the state decide to increase its financial commitment to forest restoration in order to meet policy goals of 1,000,000 acres per year of forest treatment. Minimal salary is another reason for the decreasing interest in forestry labor positions. Entry-level workers in forest thinning earn an average \$26,000 per year, whereas conservation scientists and administrators average more than \$60,000 per year.¹⁷

The Sierra’s timber business primarily consists of industry related to wood based-products and biomass utilization, including bioenergy, biofuels, bio-based products, mass timber products, and biochar or soils amendments. In 2016, public lands in California contributed 24% of the timber for biomass production.¹⁴ Careers in biomass utilization could increase the viability of a strong forest industry in the Sierra with median salaries well over six figures, even some nearing \$200,000 per year.¹⁸ The biggest barrier to a thriving bio-based product or biomass industry in the Sierra will be building a workforce across the forestry sector. Laborers must be available to remove logs and woody biomass from the forest and transport it to wood-processing facilities, where laborers will then transform it into usable bioproducts, lumber, or clean biomass energy. The future of the timber industry—and the potential for a healthy biomass sector within it—will depend on workforce education and training, as well as adequate pay that can support the high cost of living in the Sierra.

Many ecosystems have benefited from federal and state conservation, but there are many regulating agencies, and improving coordination and communication between them—as well as between agencies and local communities and project implementers—continues to be problematic.

Climate Impacts on Natural Resources



In general, the natural resources industry may see exponential growth due to climate change in some sectors while seeing declines in others. The majority of industry declines will be due to drought and reduced accessibility from increased fire intensity. Hydroelectric generation will be greatly impacted by less water in reservoirs and dams. Hydroelectric generation already saw extreme impacts in the summer of 2021, with a 40% loss in energy generated by hydro sources in June 2021 as compared to the previous year.¹⁹ As the Sierra snowpack declines and snow runoff contributes less to surface water storage with less predictable timing, keeping reservoirs full through the summer has become difficult. With increased grid unreliability and peak energy demand in the summer, many energy companies rely on hydroelectricity to supply

customers. The main energy companies that serve the Sierra are forced to conserve water in their reservoirs in order to generate electricity to meet demand in hotter months, potentially reducing the amount of water released for wetland conservation.¹⁹

Another impact of drought is increased tree mortality. This in conjunction with increasingly intense wildfires in the Sierra posing a great threat to forest industry workers who are often the first line of defense. As discussed above, the worker shortage within the forestry industry will impact the region's ability to prevent or control devastating wildfires because there is less available manpower for thinning treatments, brush removal, and controlled burns.

More dead trees will create an increased demand for the services of wood mills and biomass facilities. During the drought that spanned 2012 to 2016, wood mills were overwhelmed with the amount of timber coming in, and this trend continues today. As a result of recent massive fires, many commercial lumber mills are already at capacity from processing timber from their private lands and will no longer accept wood from public lands. In some cases, the damaged trees—if harvested quickly enough—can be milled for lumber, but most dead trees (lost to fire, bark beetle, or drought) bring in about 40% less profit when chipped or turned into mulch for compost.²⁰

The greatest growth opportunity may come in the form of restoration and land use management. In 2011, the US Forest Service Region 5 (which serves all of California's National Forests aside from the Humboldt-Toiyabe National Forest served by US Forest Service Region 4; the majority of the state's national forests fall within the SNC region) called for an increased scale and pace of forest restoration, citing that six to nine million acres of forest are in need of restoration.²¹ Preparing communities for wildfire and drought requires a strategic approach to land use planning. Watershed management plans, forest management plans, landscaping regulations, building codes, and local governments must have a cohesive mission to mitigate wildfire risk to development, and to help residents adapt to water shortages.²² This will require partnerships between local land management, CalFire, the Forest Service, and private landowners.



AGRICULTURE

Agriculture in California is led by four counties: Kern, Fresno, Monterey, and Tulare. While Fresno County, Kern County, and Tulare County are partially within the SNC region, their high-output regions mostly fall outside of it and therefore don't significantly contribute to the economic impact of the Sierra. Excluding these counties, the remaining SNC regional counties had a gross crop value of \$3.84 billion in 2019, accounting for 0.12% of California's GDP.²³ The primary outputs from the region are cattle, grain crops, and tree nuts.²⁴ While the overall ranking of agricultural outputs in the Sierra is lower than the rest of California, the economic power from this sector makes up sizable portions of some SNC regional communities' economies, notably in Madera, Butte, Tehama, Shasta, and Lassen counties.

Cropland and pasture/grassland accounts for over 2.7 million acres, more than a tenth of the region. Grassland makes up 87% of all agricultural land in the region, with less than 350,000 acres used for crop production.^{25 26} The majority of working farms and ranches within the SNC region are privately owned and provide services beyond crop yields or grazing grounds. These secondary services can mitigate climate change hazards by storing carbon, providing wildlife habitat, and mitigating urbanization or development on open land.²⁷ Across the region, working farms and ranches are using conservation easements to restrict commercial, industrial, or residential subdivision of the property. Conservation easements protect private land from being developed while also maintaining private ownership and ensuring working lands are protected and used as intended for the future.

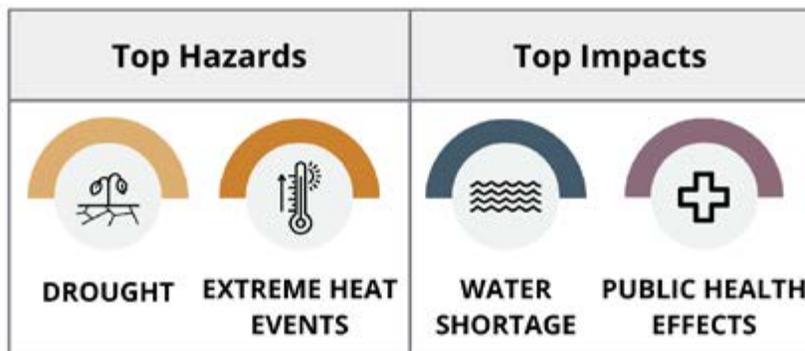
In California, agriculture provides roughly 425,000 full-time-equivalent jobs annually. Research has shown that there is a worker-to-job ratio of two-to-one, meaning that 850,000 people are employed in the agriculture sector across the state.²⁸ In the Sierra, approximately 16,000 people are employed by agricultural establishments.²⁸ This number does not account for undocumented workers or workers who have higher-paying jobs in another industry and work part time in agriculture.



In 2020, agricultural employers were mandated by the state-set minimum wage for H-2A (visas for temporary, nonimmigrant agricultural workers) workers to pay \$14.77 per hour in.²⁹ This wage equates to less than \$30,000 annually—\$12,000 lower than the average annual salary earned by agricultural workers in the Sierra as reported by the US Census in 2019. Since many farmworkers do not work the same job 12 months a year, they likely earn less than \$30,000.

A less documented crop in the region is marijuana. With legalized medicinal and recreational use of cannabis passed in 2016, California has seen an increase in legal and illegal grow operations, with reduced penalties for illegal cultivation. While marijuana can increase revenue for local jurisdictions through taxation, the adverse implications of illegal grows wreaks havoc on public lands, ecosystems, and water quality and availability within the SNC region. Some of the documented issues related to illegal grows discovered on public lands include: use of pesticides and rodenticides killing native wildlife; dewatering of small streams; and compaction of soil, which leads to erosion.³⁰ Illegal growers have taken to water theft in order to manage their operations, which exacerbates the water shortage across the region.³¹ Many illegal grows are located in remote rural areas near vulnerable Sierra watersheds. With increasingly sparse water flows through these natural waterways, even small diversions of water and water storage for legal domestic use can have massive impacts on ecosystems.

Climate Impacts on Agriculture



It is well documented that climate change hazards will greatly impact all of California’s agriculture industry. Not only will the region’s production be shaped by drought, rising temperatures, and wildfire impacts, these climate hazards will have a downstream effect on major agricultural hubs in the Central Valley and San Joaquin Valley that rely on water from the Sierra. Reduced water availability and rising temperatures across the state will threaten the state’s ability to produce the majority of the nation’s food products.

As extreme heat increases in the valley and in coastal areas, some crops that have defined those regions (e.g., wine grapes in Sonoma and Napa counties) may be forced to the Sierra foothills or even higher elevations or latitudes to avoid the heat. This could bring new agricultural markets to the SNC region.

Not only do physical hazards impact the well-being of crops and their potential income generation, but the people who labor on farms and ranches will be some of the most impacted populations. Extreme heat and wildfire-related air quality issues can pose devastating health outcomes for outdoor laborers. The livelihoods of agricultural workers will be impacted by reductions in crops as well as worked-land acreage reductions by landowners due to water shortages.

ECONOMIC BENEFITS of Sierra Ecosystems

It is common knowledge that trees improve air quality by carbon sequestration and storage, and that wetlands improve water quality through filtration. But more studies show that most land cover types in the Sierra can provide varying amounts of environmental benefits. In turn, these benefits can enhance the physical health of local and surrounding populations, increase visitation and tourism earnings, and magnify the sense of well-being in the region.

The benefits derived from ecosystems are referred to as ecosystem services. Ecosystem services are the systems and processes naturally occurring in species that help sustain life on Earth. Some of these services are ecosystem products, such as timber or fish, that can be sold on the market. But the majority of these services are not commodities that can be sold. Examples include air quality regulation, carbon storage, water storage and filtration, soil formation and nutrient cycling, erosion mitigation, and more.

Methods for determining the worth of ecosystem services are time- and cost-intensive because they require extensive site-specific data and analysis. As California becomes more focused on nature-based solutions (NBS), proper evaluation of the Sierra's ecosystem services should be a high priority, since 50% of California's forests are within the SNC region.

An alternative to an ecosystem services analysis is a benefit transfer analysis. The vulnerability assessment prepared for the Town of Mammoth Lakes, *Vulnerability in California's Eastern Sierra*, conducted a benefit transfer analysis within the Eastern Sierra's 18,000 square miles.³² SBC used the average dollar-per-acre values for ecosystem services in the *Vulnerability in California's Eastern Sierra* to evaluate services provided by the natural and working lands in the SNC region. It should be noted that these dollar values cannot be annualized to determine the yearly economic benefit of ecosystem services, and values will vary greatly depending on the health of the ecosystem providing the service.



Estimated Dollar Values for Ecosystem Services in the SNC Region

Land Cover Type	Acreage in SNC region	Value of Air Quality (\$ Millions)	Value of Water Quality (\$ Millions)	Value of Carbon Sequestration (\$ Millions)	Value of Carbon Storage (\$ Millions)
Evergreen Forest	10,172,513	1,900	35,800	1,900	339,000
Deciduous Forest	309,756	57	1,100	6.40	600
Wetlands	110,351	10	396	0.50	54.70
Shrubland	9,337,718	49	138,000	430	37,000
Open Water	429,475	0	689	0	149
Cropland	343,633	19	0	0.50	14.50
Grassland/Pasture	2,368,857	12	35,000	7.60	600
Developed Land	2,712,490	165	0	0	0
Total Value	25,784,792	2,212	210,985	2,345	377,418

The average (\$/acre) values determined by the *Vulnerability in California's Eastern Sierra* report team were calculated for a subset of the SNC region containing Alpine, Mono, and Inyo counties, as well as Yosemite, Kings Canyon, and Sequoia National Parks. This region of the Eastern Sierra is not ecologically or geographically representative of the entire SNC region. Therefore, the ecosystem service values presented here are merely rough estimations to conceptualize the immense worth of the Sierra's wilderness.

Restoration and conservation efforts in the Sierra could increase the economic value of ecosystem services provided—for free—by nature.

COST OF CLIMATE CHANGE

in the Sierra Nevada

The Sierra is already facing the costs associated with warming temperatures, reduced snowpack, and increased extreme hazards like wildfire.

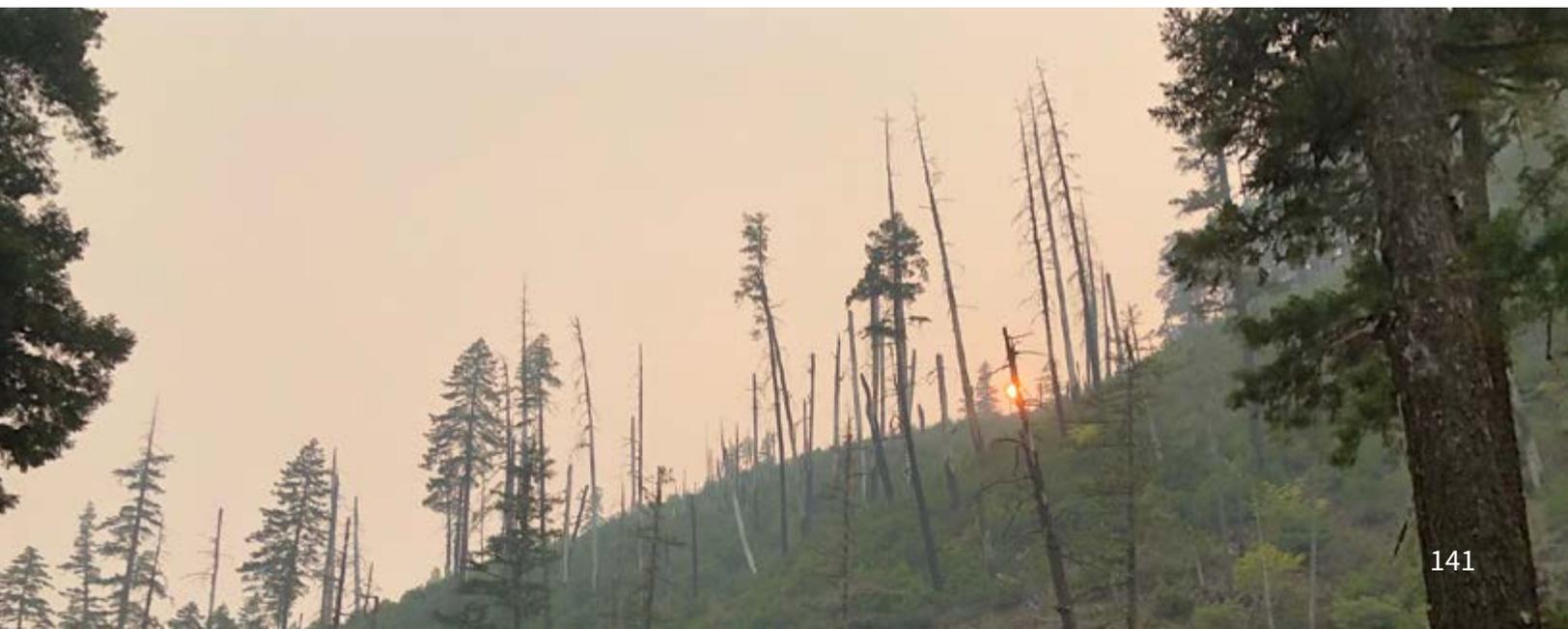
COST OF WILDFIRES

Wildfire could be the largest consequence of a warming climate in the Sierra. Not only does wildfire impact human health, ecosystems, and infrastructure, but fighting fires in rugged terrain is extremely difficult and expensive. As expanded development spreads into the wildland urban interface, more homes will be at risk of damage from wildfire.

Data from 14 fires that took place within the SNC region between 2006 and 2009 shows that the combined fires covered nearly 7 million acres, resulted in nearly a year's worth of firefighting days, and cost over \$215 million.³³ Over \$81 million of the total cost went to protecting homes. The cost of protecting a single home from wildfire averages around \$29,000.

It is well observed that wildfires have dramatically increased in size and severity over the past decade. The Dixie Fire alone covered nearly 1 million acres of land during the 2021 fire season. Initial calculations estimate that fire suppression requires \$630 million and over three months of active firefighting.³⁴ By this estimate, a single fire in 2021 cost three times more than 14 fires that took place in the region over the course of four fire seasons.

While these are just the costs of suppression, there are other costs associated with wildfires. Some incurred costs are felt in communities not even threatened by the actual wildfire. Unhealthy air quality and dense smoke leads to less visitors throughout the fire season. Some studies show more than 10% of visitors canceled trips to the Sierra in 2018 due to smoke in the region, representing a loss of \$20 million in visitor spending.³⁵



Another cost associated with wildfires in the SNC region is the ever-increasing unavailability and unaffordability of homeowner's insurance. Between 2015 and 2016, there was a 15% increase in companies denying renewal requests for customers in the Sierra's fire-prone regions.³⁶ In some communities, homeowners are seeing 300% increase in insurance rates, with some customers even getting quotes for \$7,000 a year.³⁷ In a region with a high housing-burdened, low-wage population, any increase in living expenses can force residents out of the region. In addition to cost barriers, obtaining accurate homeowners' insurance coverage in wildfire-prone regions is challenging, and made more difficult by rapidly changing property values across the region.

The financial squeeze of obtaining insurance is also felt by businesses, where insurance coverage can be cost-prohibitive pre- and post-fire.

COST OF PLANNED POWER OUTAGES

As a way of combating wildfire risks, public utility companies that serve the Sierra Nevada have begun planned power outages. Typically, these planned-outage events last one to two days, and affect all facilities (from residential to government buildings and private hospitals) within the region deemed at risk of fire. Utility companies are mainly concerned with aboveground transmission lines, which can generate sparks that can start deadly fires due to dry conditions in the Sierra. Not only do these outages cause inconvenience for the general population, but they create potentially dangerous conditions for people who rely on electronic medical and communication devices, as well as broadband internet. What's more, they have economic impacts.

PG&E calls these planned outages PSPS events, or Public Safety Power Shutoffs. In 2020, a PSPS event was initiated by the utility company due to high winds and high wildfire risk. PG&E shut off power to two million customers across 36 counties for 48 hours. Experts estimated this outage cost customers nearly one billion dollars.³⁸ While this event impacted residents and businesses outside the region, losses from planned power outages massively impact small communities within the Sierra. In 2019, a three day PSPS event affecting western Nevada County cost 323 restaurants within Grass Valley, Nevada City, and Penn Valley over a million dollars.³⁹ Assuming that these events can occur multiple times within an ever-expanding fire season, the financial impact on the region's communities could lead to economic turmoil for small, locally owned businesses.

In order to combat business losses and meet residential needs during power outages, many businesses and homeowners have taken to using gas-powered generators to supply electricity. With the use of these generators comes more expenses related to purchasing the generator, keeping a ready supply of gasoline and managing the costs associated with a potential building fire caused by misuse or misfiring of small generators. While many Sierra residents are used to relying on generators during power outages caused by winter storms, a new set of firesafe rules needs to be applied when using generators during fire season, especially when the power is out as a result of fire mitigation strategy.

For small energy users like small businesses and homes, firesafe energy sources are battery storage systems or solar-powered generators with battery backups. These alternative generators can provide low- to no-emission energy during power outages, and they typically have similar start-up costs associated with gas-powered generators.

Community-wide solutions to PSPS events or unreliable energy transmission will require extensive systemic changes to the current energy systems in the region. Distributed generation (on-site energy generation/microgrids) and increased building electrification will be essential for reliable energy. Modernizing utility infrastructure will be crucial for communities to adapt to increased heat and fire risk.

COST OF DROUGHT

Without organized and mandatory reporting of domestic dry wells, there is no accurate data source for the number of Sierra residents who have lost water supply due to decreases in groundwater. Across the state, 2,600 wells were reported to have gone dry from 2012–2016, and estimates predict nearly 4,000 more wells will go dry from 2021–2022.⁴⁰ These values are most likely low, as many rural residents on private domestic wells are not formally reporting dry wells to the state. In order to remedy a dry well, wells must be drilled deeper or the pump must be lowered. Bringing water back to the 4,000 wells predicted to go dry in 2021–2022 is estimated to cost \$21 million.⁴⁰ But much of this cost falls on residents. Drilling a new residential well can cost up to \$20,000, and because drillers are in high demand, some residents are on 12-month waitlists.⁴¹

In 2014, California fallowed 5% of cropland due to water shortages, which led to a loss of 7,500 farm jobs.⁴² With less cropland to grow, farmers are switching to high-value crops in order to maintain profit margins. This means lower-value crops (e.g., rice) will have lower yields. While data isn't precise for the SNC region, an overall loss of farm jobs in the state will likely impact Sierra farm jobs. Even though these jobs are typically low wage, some workers will not be able to pivot to other industries and will suffer household economic losses.

COST OF SNOWMAKING

As previously mentioned, the ski resorts in California generated over \$3 billion during the 2019 winter season. But this amount isn't all profits. The cost of snowmaking is significant; in order to open, resorts need to have enough snow coverage on enough runs to safely navigate hundreds of early season visitors down the mountain. As snow drought has come to plague many Sierra-based ski resorts, snowmaking has become a prerequisite for resorts to open before the busy Christmas season. Depending on the size and fiscal abilities of a resort, money spent on snowmaking can range from \$500,000 to \$3.5 million per resort per season.⁴³ Aside from the monetary costs, copious amounts of water and electricity are utilized to make dry-weather snow a reality. These costs can impact resort spending, which means resorts will hire less staff, forgo seasonal wage increases, and close terrain or services in order to save on operational costs.

Increasing snow drought is a likely scenario for much of the Sierra, which could result in an economic downturn for the communities dependent on a snow-sport driven economy. Similar to the impacts of the COVID-19 pandemic on ski resorts, lack of snow could force terrain closures, limits on skier numbers, and reduced job opportunities. All of these factors lead to less tourism when skiers choose to plan their ski trips in the Rockies or abroad, where higher elevations might maintain historical snow levels.

When ski resorts take an economic hit, it can be assumed that resort towns and surrounding communities feel that loss as well. Less ski visitors means less money spent on lodging, food and beverage, and retail, within the ski town and in destination gateway towns along the highway corridors.

Data from COVID-19 pandemic impacts on tourism has not been produced on a Sierra-wide or county-by-county scale. If and when this data becomes available, it will be valuable for planners in tourism-dependent communities to analyze, as climate impacts pose a similar threat.

INFRASTRUCTURE

in the Sierra Nevada

Historically, infrastructure in the Sierra has been slow to keep up with urban areas in the state. Many residents chose to live in rural areas to get away from densely populated cities and to have access to open spaces. The rugged reality of living in the Sierra is considered a desirable way of life, and full-time residents are proudly self-sufficient. The current level and condition of infrastructure in the Sierra cannot serve the growing population and tourism, nor protect people and ecosystems from the increasing risks of climate hazards. When it meets a community's needs, infrastructure can add to a region's capacity to deal with stressors like increased visitation, growing populations, heightened risk for wildfire, and changing precipitation patterns.

Across the region, the top two most vulnerable populations are people that are housing burdened and people without access to broadband. These factors are rooted in an absence of infrastructure, and they impact a person's ability to respond to and recover from climate hazards. The following section covers the lack of affordable housing and broadband in the Sierra, as well the deficiency of healthcare facilities and higher education opportunities. Improving infrastructure to meet these basic needs has the potential to increase the population's capacity to adapt to climate change. Increasing the built environment in rural areas is difficult due to a polarizing mix of property ownership, strict development laws, a lack of funding, and conflicting views on new development in the Sierra. Increasing the quantity and quality of the built environment will continue to mitigate capacity in the region.

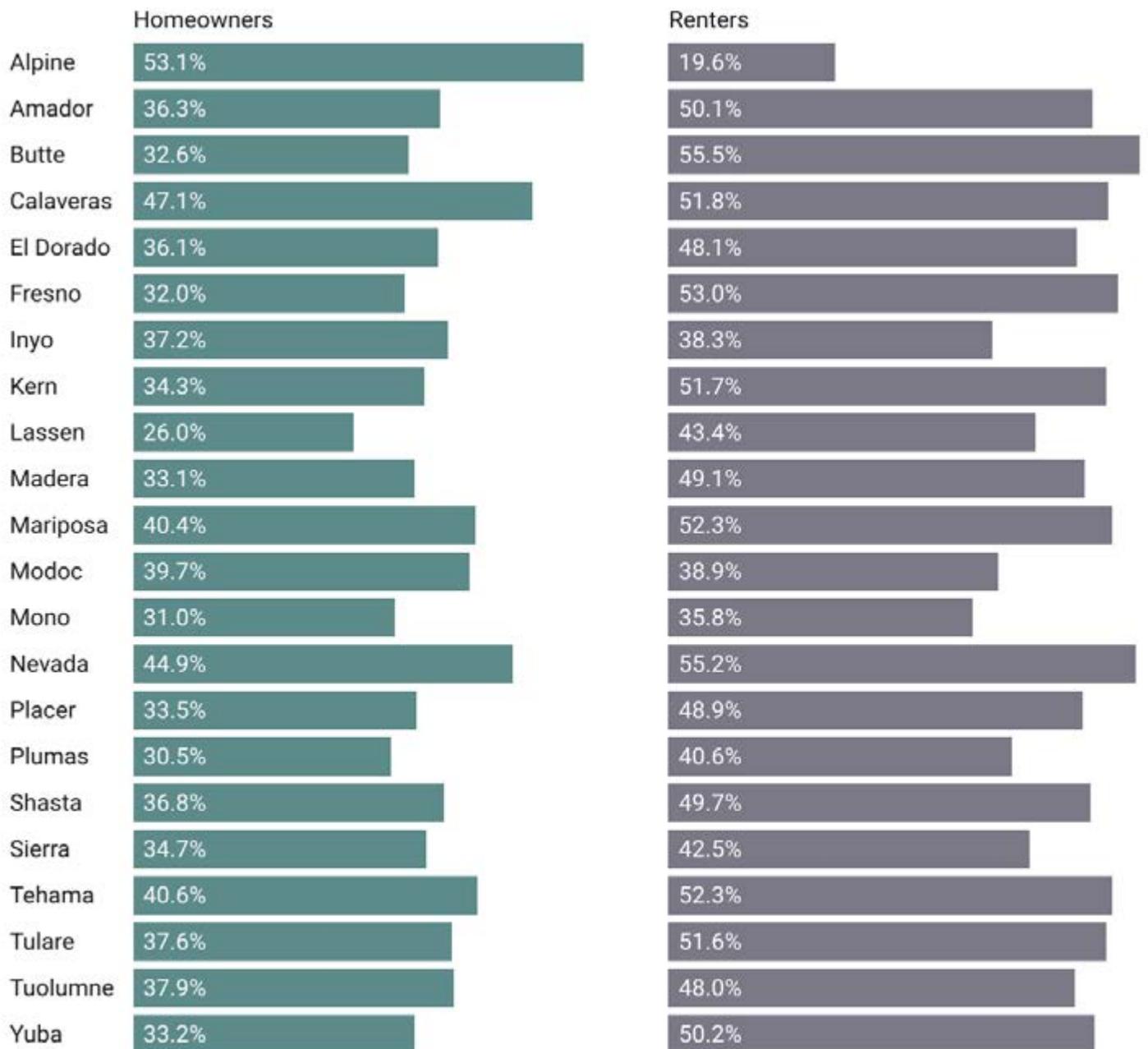
HOUSING

In 2019, more than half of renters in the region did not have affordable housing, meaning they spent nearly a third of their monthly income on rent and utilities. The monthly costs for homeowners exceeds 30% of income for over 35% of residents in the SNC region. Multiple factors influence housing affordability, including:⁴⁴

1. Population growth: from 2010 to 2019, the SNC region saw a 5% population growth.¹ With more people moving to the Sierra, housing has become more competitive, driving higher costs.
2. Stagnant income: wages in the Sierra have remained relatively stagnant for decades. For example, across the region the median salary in the tourism industry in 1990 was \$21,266. By 2019 it was \$24,081.⁴ Income levels in the Sierra have not kept pace with the cost of housing.
3. Income from outside the region: an increased number of people living in the SNC region and working remote, high-paying jobs creates a disconnect between median income from local jobs and locally generated incomes. This can increase competition for housing and raise housing costs faster than local wages increase.
4. Wealth: in regions with a high number of people living off Dividend, interest, and rent (DIR) payments or passive income, housing costs tend to be higher.
5. Recreation premium: counties with high recreation opportunities tend to attract wealthy residents and people who can generate income from outside the region, growing the population and increasing the reliance on DIR payments or other passive income. This can lead to more housing competition and higher housing costs.

Unaffordable Housing in the SNC Region

Percentage of residents in each county who spend more than 30% of their monthly income on housing costs.



Monthly costs for homeowners: The sum of payment for mortgages, real estate taxes, various insurances, utilities, fuels, mobile home costs, and condominium fees. Monthly costs for renters: The amount of the contract rent plus the estimated average monthly cost of utilities and fuels if these are paid for by the renter.

Chart: Sierra Business Council • Source: Data Sources: U.S. Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C. via Headwaters Economics, Demographics, 2020 • Created with Datawrapper

Affordable housing has been an issue in the Sierra for many years, with home values skyrocketing to record-breaking amounts in 2021. For instance, a typical home in Truckee in Nevada County was worth \$955,000 in 2021, a price increase of \$244,000 in just one year. Typical homes in Inyo County have jumped \$7,000, and Lassen County saw a \$34,000 increase from 2020 to 2021.⁴⁵ This increase in home values is most likely due to remote workers moving to the region and wealthy people choosing to move to less populated areas during the COVID-19 pandemic, both arriving with income levels unrivaled by those earned in the local workforce. Lack of affordable housing for the local workforce can lead to employee shortages, long commute times (contributing to more emissions and lower air quality), and a working population with less financial resources to adapt to climate change hazards.

With rising rent costs in the Sierra, more families are at risk of being pushed into poverty. Poverty is one of the strongest contributors to compromised health and reduced ability to adapt to natural hazards.⁴⁶ The housing crisis in the Sierra will likely continue to be one of the largest barriers to capacity building in the region. In the aftermath of a wildfire, people living in poverty are less likely to rebuild due to financial constraints. This leads to relocation and a loss of income tax revenue for the region. Residents who chose to rebuild in high-risk regions are less likely to find affordable house insurance coverage, potentially increasing the burden of housing costs for this population.

BROADBAND

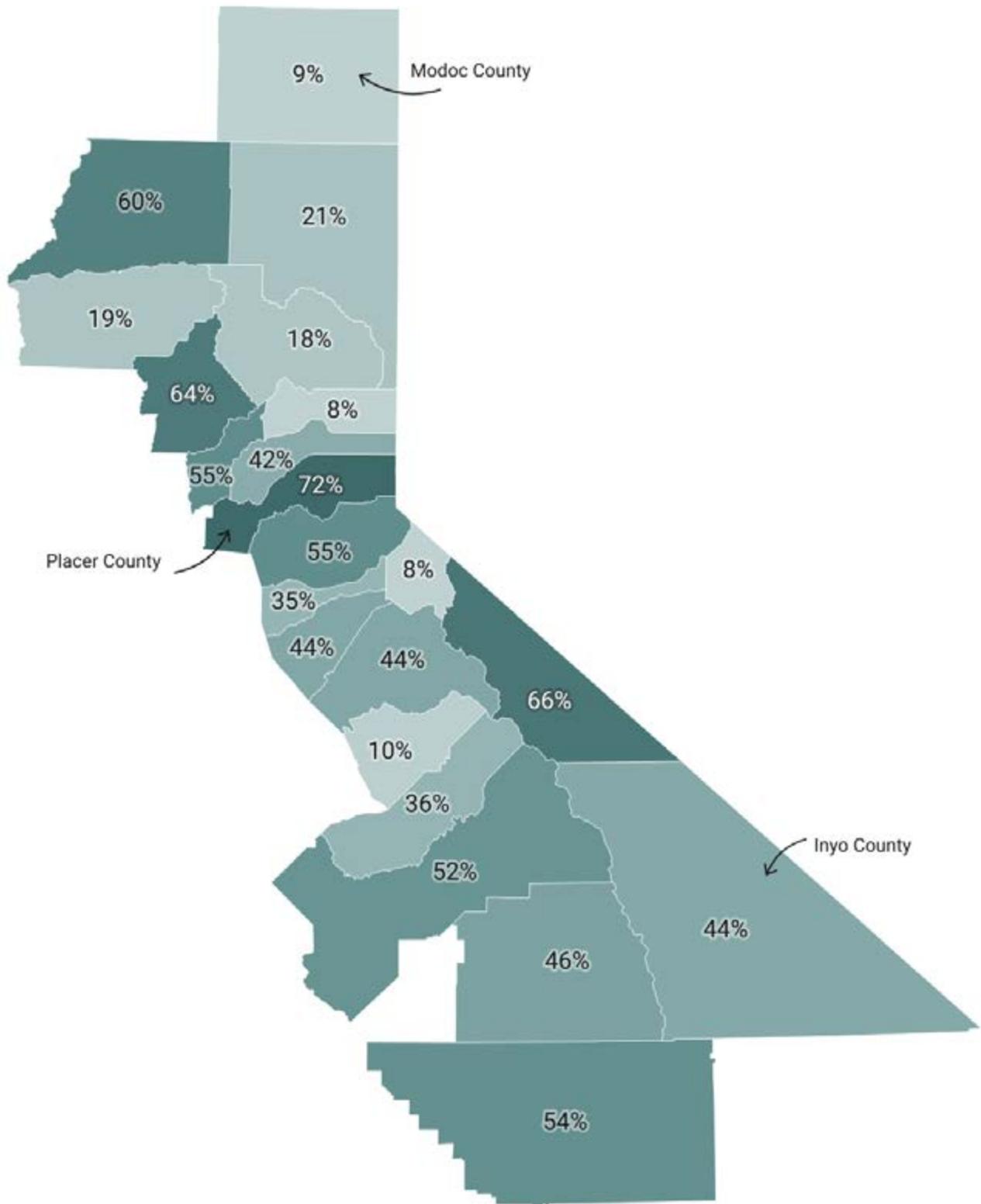
Access to high-speed internet is similarly scarce in the Sierra Nevada. According to the FCC, broadband is defined as 25Mbps download speed.⁴⁷ The FCC relies on self-reporting by internet service providers to define internet availability and speeds. According to the FCC, nearly 90% of the region has access to broadband.⁴⁸ As the majority of residents in the SNC region can confirm, access to 25 Mbps broadband is scarce. In fact, only 40% of residents on average have access to broadband, with pockets of rural areas having no internet coverage at all. This leaves some households dependent on cell service for broadband connectivity, and for some rural areas, cell service and broadband are either not available or not reliable.

Insufficient broadband has far-reaching impacts, ranging from public safety to economic development. As made evident during the COVID-19 pandemic, access to high-speed internet is essential to modern living. A lack of access inhibits educational and employment opportunities, hinders businesses from expanding to online sales, prevents access to tele-medicine, and reduces access to public events (e.g., city council meetings) for people unable to attend in person. Overall, a lack of high-speed, reliable internet prohibits rural regions from developing businesses and accessing technical assistance, and it limits their ability to apply for grants and funding opportunities. This can reduce the ability of a community to respond to and recover from climate hazards.

For communities without reliable access to the internet, mobile devices are used for broadband connectivity and communication. In the event of a climate hazard, evacuation alerts and disaster updates are sent out via cell phone text messages by Nixle and emergency response authorities. Cell towers, cables, and antennas upholding mobile networks are not designed to withstand extreme weather like megafires and extreme snowfall. Further, cell phone infrastructure is reliant on backup battery power, which has a very limited reliability factor. Major cellular networks serving the region are vulnerable to climate hazards. This was already evident in 2018, when 51 cell towers were impacted by the 2018 Camp Fire, blocking more than 2.1 million phone calls during the deadly wildfire event.⁴⁹ Without reliable broadband or cell service, rural communities must rely on door-to-door updates and radios for wildfire evacuation notices, which puts both first responders and residents at increased risk.

Broadband Access in the SNC Region

Percentage of people accessing broadband at 25Mbps or higher.



Broadband data based on usage in October 2020 as collected by Microsoft. Percentages on the map are rounded to the nearest whole number. Data Resolution: County Level.

Map: Sierra Business Council • Source: Microsoft • Created with Datawrapper

While the federal government and the state of California have increased spending to expand access to broadband in rural areas, it is unlikely to happen before the next megafire makes its way over the Sierra Crest. Data shows the cost of implementing internet infrastructure in rural communities can run nearly \$16,000 per household, versus \$3,000 per household in urban areas.⁵⁰ Creating a network in rural areas takes skilled labor and access to new technology like fiber cables, real estate acquisition, and construction. Even after the facilities are in place, the network still needs to be maintained with full-time staff. This implementation can lead to high costs; with a smaller customer base compared to other parts of the state, rural customers will pay higher broadband fees.⁵¹ These extra costs will be a challenge for residents who are also housing-burdened and earn lower overall incomes than their urban counterparts. Grant funding will be necessary for development, and subsidies for affordable internet programs may be necessary to make broadband accessible for all customers in the region.

HEALTH CARE FACILITIES

Across all of the SNC region's 25 million acres, there are just 29 hospitals: three owned by the US Army, 14 Critical Access Hospitals (CAHs), and 12 short-term hospitals.⁵² CAHs were created in the late 1990s in response to massive waves of rural hospital closures across the US by the Centers for Medicare and Medicaid Services. This designation is designed to reduce the financial vulnerability of rural hospitals by providing them cost-based reimbursements for Medicare and allowing for flexible services and staffing.⁵³ While CAHs provide an essential service, rural communities must maintain their designation by meeting the following conditions:⁵³

1. Have 25 or fewer acute care inpatient beds
2. Be located more than 35 miles from another hospital
3. Maintain an annual average length of stay of 96 hours or less for acute care patients
4. Provide 24/7 emergency care services

This illustrates the reduced capacity of a CAH compared to a large hospital that can provide long-term care. To supplement hospital care, the region also has 54 rural health clinics, which increases access to primary care in rural communities.⁵² This means that, at the very most, the region has 725 hospital beds available to service well over 2 million residents living full time in the region. This is a ratio of roughly 0.0035 hospital beds per 1,000 people, much lower than the national average of 2.4 beds per 1,000 people⁵⁴. During the height of the COVID-19 pandemic, health care facilities in the Sierra quickly maxed out and at times were unable to care for more patients. While the COVID-19 pandemic continues to force urban and rural regions across the globe to the brink, the limited capacity of SNC regional healthcare facilities in particular will pose a larger issue as the population is forced to endure more climate hazards. Within the region, senior citizens, families in poverty, and families without a car will be impacted the most by long travel times required to reach adequate healthcare.

SCHOOLS AND HIGHER EDUCATION

There are over 430,000 school-aged children in the region with a right to free public education.¹ There are approximately 175 public school districts to serve them, ranging from small school districts like Alpine County Unified (serving 100 students) to larger districts like Rocklin Unified School District (serving nearly 12,000 students).⁵⁵ But beyond high school, there are only seven community colleges in the region, all with

less than 40% transfer rates to a four-year college.⁵⁶ Less than 20% of graduating high school seniors head to a CSU or UC.⁵⁷ While this figure doesn't account for students who attend colleges out of California or at private schools, it is substantially lower than the 30–50% of Bay Area students who attend a public four-year university in California following high school graduation. While a college education isn't the only path to success, it is indicative of the type of professional experience the region will rely on to deal with the climate hazards of the Sierra's future, including city planners, civil engineers, climate scientists, foresters, and economists.

In light of the many climate hazards rural communities will face (e.g., more dry wells, more frequent power outages, and fires that are more deadly) an increased need for skilled workers in the Sierra will be critical. Local knowledge will also be essential. As new land use plans are developed, evacuation routes planned, and energy efficiency measures implemented, people who have lived in the region for many years will possess the local knowledge necessary for adaptation planning. This means more students raised within the SNC region will need access to higher education, trade schools, and worker training programs. Increasing educational opportunities in the Sierra will take massive investments in programs like home-to-school transportation, increased scholarships for students, and worker training hosted in rural, hard-to-reach communities.

Overall, the region will need to invest substantially in social services ranging from the topics discussed above to public transportation, free and reliable access to warming and cooling centers, and access to backup energy supplies. This effort may require technical assistance in order for public agencies to access the necessary resources to plan for the economic impacts of climate change and best prepare their populations to deal with climate hazards.

CLIMATE IMPACTS ON INFRASTRUCTURE

As discussed above, a lack of infrastructure can increase the vulnerability of the population, decreasing the population's capacity to adapt to climate hazards. Even the existing infrastructure in the Sierra is vulnerable to climate hazards, and its ability to withstand those hazards will dictate how well a community can respond to and recover from climate impacts.

In general, most infrastructure in the Sierra is at high-risk to wildfire damage. With growing populations and increasing construction, new development will likely be pushed further into the wildland-urban interface, where the risk of wildfire and lack of defensible space increases. Communities that reside farther from town centers or on the periphery of fire districts will be at higher risk for wildfire damage and property loss because firefighters will have less access to those homes and communities.

Longer dry spells across the SNC region increase the risk of intense wildfire and impact water infrastructure. Many landowners in rural communities who rely on domestic wells have seen wells go dry without the community, county, or statewide systems in place to supply them with more water. Many landowners cannot afford to drill deeper wells. Without more water storage and transportation infrastructure in the Sierra, some communities will be forced to rely on deliveries of bottled water or temporary water tanks filled by the state.

Extreme precipitation as rain and earlier runoff seasons could lead to increased flood risk for lower elevations or property owners positioned in areas prone to flood. When extreme precipitation occurs in areas with burn scars, debris flows and mudslides can cause catastrophic damage to buildings, power lines, cell towers, roads, and bridges.

Extreme precipitation as snow can result in multiday road closures, prohibiting access to health care or emergency services, as well as reducing the ability of first responders to reply to crises like house fires or accidents. In some cases, storms bringing in heavy snowfall have knocked out power lines, leaving residents without power for days, and even weeks, on end.

As discussed above, the region lacks the proper infrastructure needed to serve its existing populations. Any loss of the built environment from climate hazards will potentially result in far-reaching impacts on local economies. The costs of restoring transmission lines and cell towers, clearing and repaving roads, rebuilding bridges, and recovering from damage on private property are extremely expensive in urban areas, but these costs increase in regions that are rural and hard to reach.

Without essential infrastructure, Sierra communities will struggle to recover their industries after an event. Road closures or damage to resorts may limit recreational opportunities and tourist spending. Reduced access to forests will impact restoration projects, and any damage to the already slim biomass infrastructure could put the timber industry at risk.

For more detailed information on how the hard infrastructure of the Sierra Nevada may be impacted by climate change, please refer to the Vulnerability Assessment published by the US Forest Service.



HOUSEHOLD ECONOMICS in the Sierra Nevada

As climate change impacts the economic drivers of the Sierra (i.e., tourism, recreation, agriculture, and natural resources) and threatens local infrastructure, it is important for planners and policymakers to be aware of the microeconomics in their communities. By understanding how local income is earned and how it relates to the cost of living in the Sierra, authorities can better understand the fiscal weaknesses or strengths of their region. Household income levels and wealth disparity can impact a community's capacity to respond to and recover from climate hazards. In general, wages in the Sierra are low and the cost of living is high.

The bulk of labor income earned in the Sierra is in professional and social services and local government. Residents in these careers may be more insulated from the impacts of climate change, but they will also likely be on the frontline as climate hazards impact the Sierra with more severity and regularity. More research is needed to determine whether or not the current level of workers in these sectors will be able to meet the increasing needs of the Sierra.

Across the counties within the SNC region, income levels do not cover living expenses even for a small family. It is well known that the Sierra is home to pockets of extreme wealth in tandem with extreme poverty. Nearly one in every ten families in the region are living in poverty.¹ Families living in poverty are more likely to experience more hardships related to climate change.



Labor Income vs. Nonlabor Income Types

In the United States, personal income is made up of two categories: labor income and nonlabor income (NLI). In the Sierra, labor income makes up the majority of total household earnings, but the proportion of earnings coming from labor income has shifted dramatically in the last 50 years. Labor income in the SNC region made up 71% of household earnings in 1970, 66% in 2000, and just 58% in 2020. Sierra residents earned the remainder of their income from nonlabor sources. The contribution of NLI to the Sierra's economy may come as a surprise to planners and policymakers. NLI is defined as money earned from sources other than the supply of labor or work.

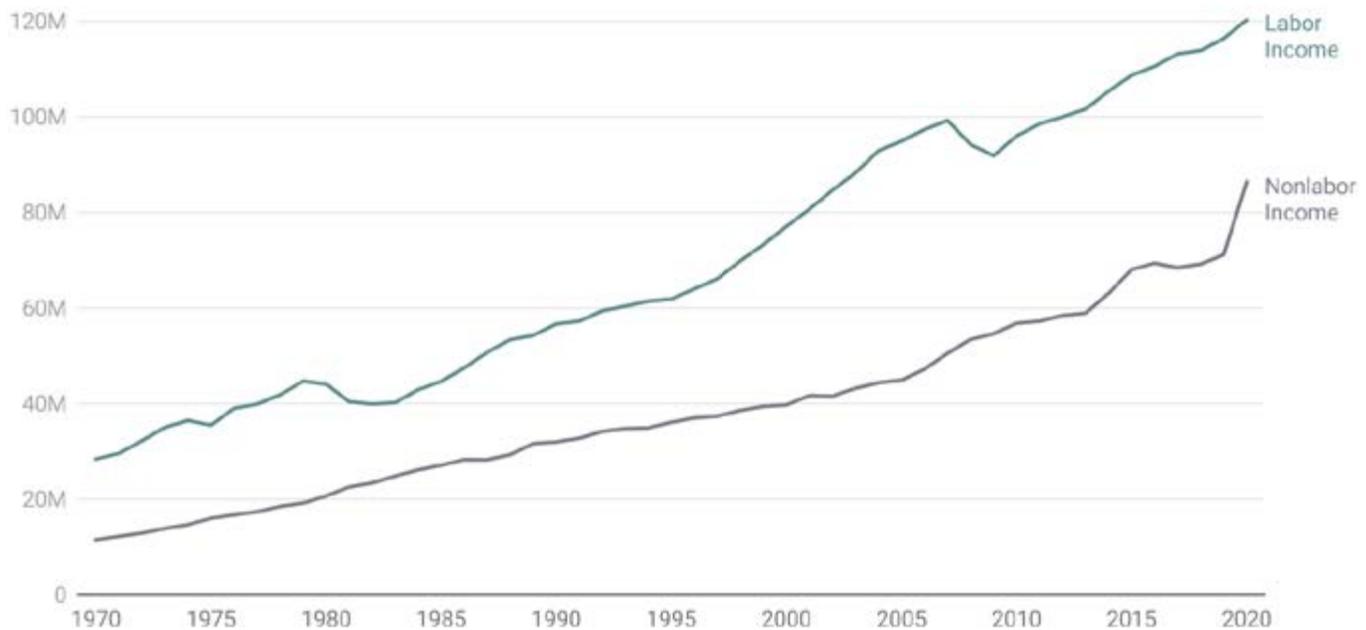
There are three categories of NLI:⁵⁸

1. Dividends, interest, and rent (DIR)
2. Age-related payments (e.g., Social Security and Medicare)
3. Hardship-related payments (e.g., Medicaid, unemployment benefits, and income maintenance)

NLI more than doubled from 2000 to 2020, making up 42% of total household earnings in the Sierra by 2020. This shows a surprisingly strong reliance on NLI in the Sierra.

Labor Income and Nonlabor Income Levels

Total personal income for the combined SNC territory is the sum of labor and nonlabor income.



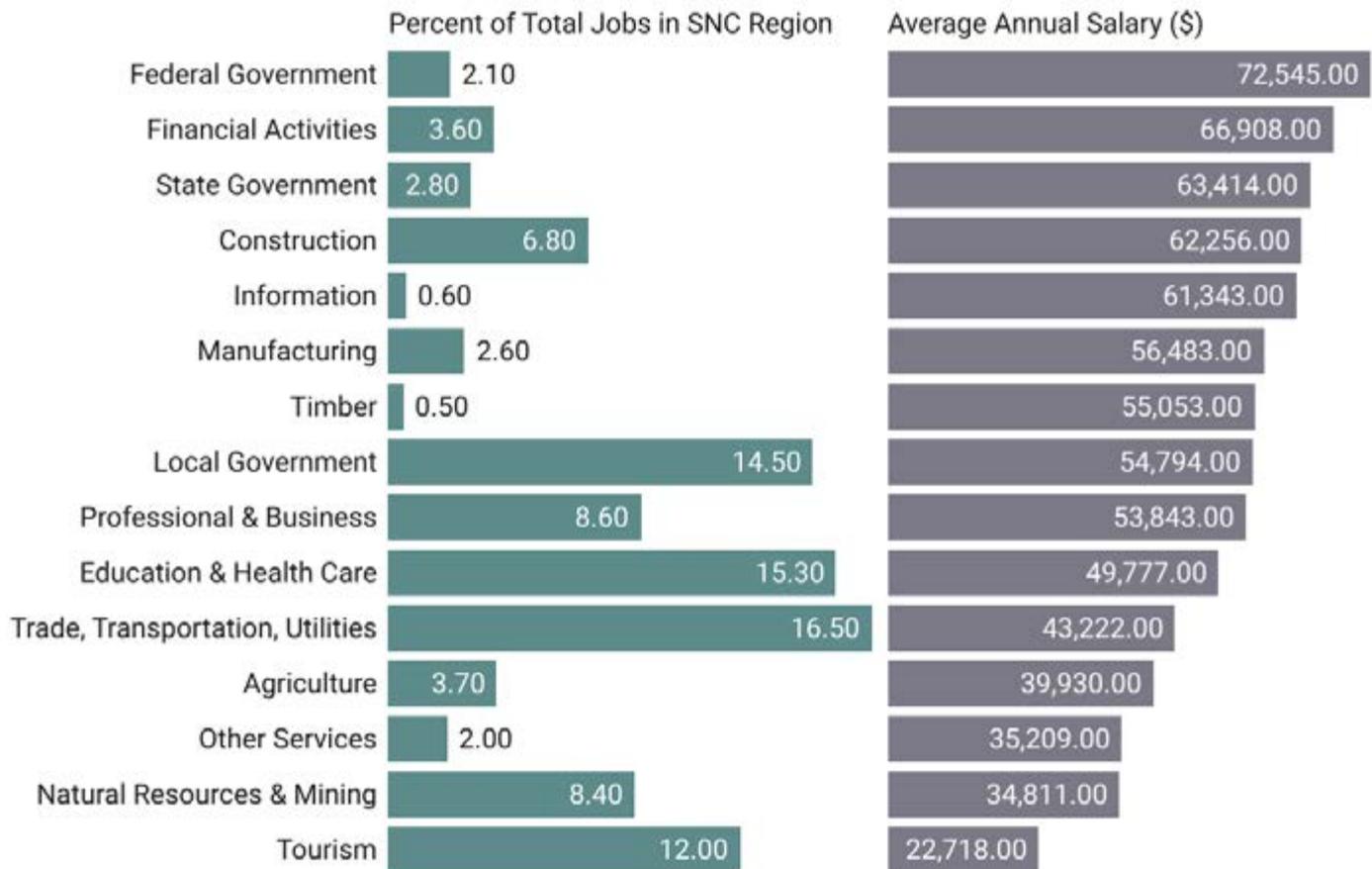
All income data are reported by place of residence and are shown in 2020 dollars.

Chart: Sierra Business Council • Source: Data Sources: U.S. Department of Commerce, 2021. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C., reported by Headwaters Economics, Socioeconomic Trends, 2020 • Created with Datawrapper

NLI affects local economies, while labor earnings give insight into what jobs a community's members hold and the knowledge and skill sets present in a region. Industries with higher employment levels may indicate how a region will cope and/or adapt to climate hazards in order to maintain economic well-being.

Share of Workforce and Salary for Industries in the SNC region

Most workers in the SNC region earn less than \$50,000 annually.



Average Annual Salary reported in 2019 dollars.

Data Resolution: Aggregated county level data for 22 counties within or partially within the SNC region.

Chart: Sierra Business Council • Source: U.S. Department of Labor, 2020. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Washington, D.C., reported by Headwaters Economics' Economic Profile System, Demographics • Created with Datawrapper

While much of the Sierra economy is believed to be tourism-based, employment data shows that the majority of workers don't work in tourism-focused industries. In fact, the majority of workers are employed in the service sector, ranging from social services (e.g., education and utilities) to professional services (e.g., law and real estate). While these numbers are not indicative of each county's unique job market, it does show that a wide range of skill sets is prevalent in the Sierra. Recent arguments have been made that rural counties don't have the human capital (i.e., a college-educated or professionally trained workforce) to combat many of the issues climate change presents. But growing employment in local government, education and health care, and professional and business sectors shows that the human capital does in fact exist, and what the Sierra really lacks is knowledge of climate change risks, strategies for adaptation, and funding for implementation.⁵⁹

Overall, the health care, local government, construction, and utility sectors may see an increased demand for employees as climate change impacts and populations increase in the region.

Increases in health care will result from impacts on health related to heat, poor air quality, and increased risk

of physical injury due to wildfire, floods, falling trees, and debris flows. Increases in construction and utilities will result from the need to rebuild after climate hazards like wildfire and snowstorms damage and destroy infrastructure. More jobs will still be needed in local government to build capacity at the town and county level. Climate mitigation and adaptation strategies will need to be developed and implemented, requiring an increase in skilled staff. While this can be a good thing for communities that have an ability to meet increasing demands, other regions might have trouble hiring enough skilled workers in these fields and will see a decline in the capacity to deal with climate hazards.

On the low end of the salary spectrum are the two industries that have defined the Sierra Nevada for much of modern history: natural resources and tourism/recreation. In California, a minimum living wage is considered \$18.66 per hour equating to an annual salary of \$37,320.⁶⁰ On average, neither of these industries pay a living wage. This is a critical misstep for the Sierra. Outdoor recreation and natural resources (e.g., lumber, water, and public land access) are the Sierra's greatest "exports." While the service sectors are critical for supporting life in the Sierra, tourism drives a continual influx of capital from outside the region.

Wage differences are prolific among industries in the Sierra Nevada. While some industries pay average annual salaries above \$50,000, these jobs typically employ less people and/or have low turnover rates, which means job openings are rare and highly coveted. For example, jobs in the information sector in the SNC region pay an average annual salary of \$65,000 but employ less than 1% of the population, while three



out of five employees in the region make less than \$55,000 annually. This wage discrepancy leads to multiple issues for the community welfare within a jurisdiction, including:

1. Out-migration of young, talented residents leaving the Sierra in hopes of higher paying jobs (i.e., brain-drain).
2. Less ability to staff low-paying jobs, typically in tourism and natural resource sectors.
3. Wealth disparities within communities, fostering a culture of “haves and have-nots.”

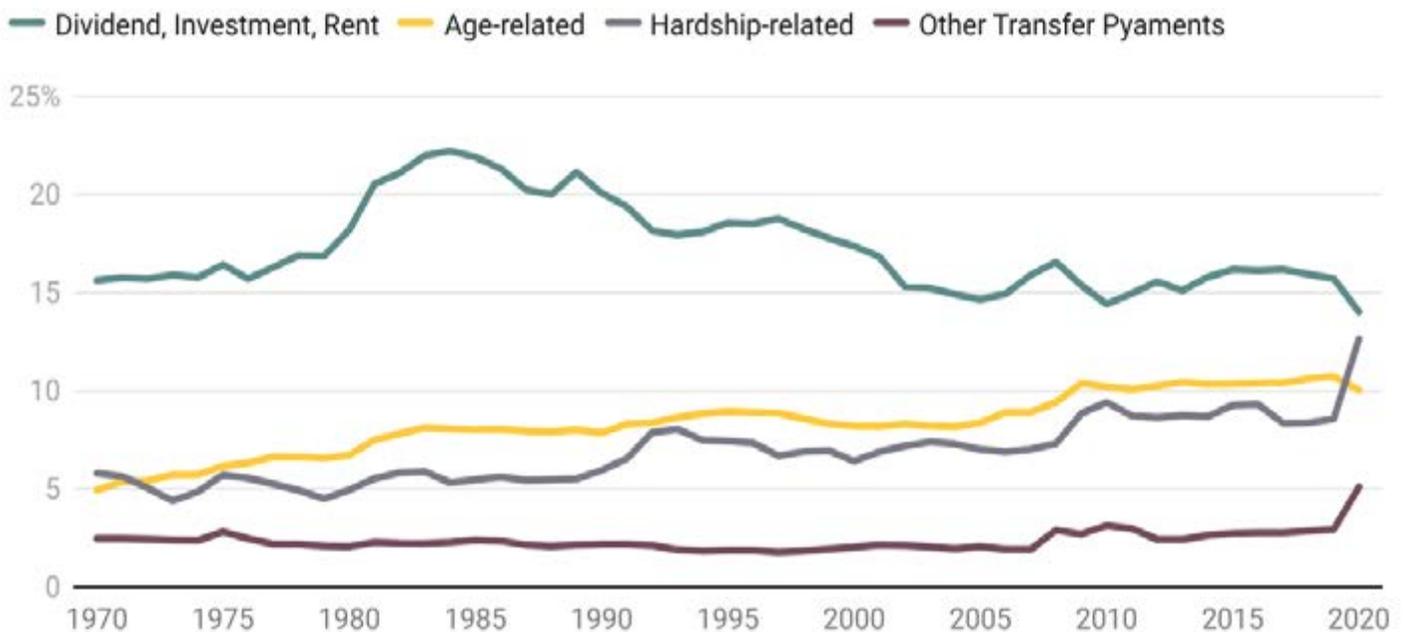
While wealth discrepancies can be identified within the average wages paid per sector, NLI widens the income gaps seen across the Sierra.

Different NLI types can influence a community’s economy in different ways. For example, a county with a high population of people earning DIR income is more likely to consist of people that are wealthy, college-educated, and middle aged or older. This community is likely to positively influence the construction industry through building or renovating homes, and they may increase spending in retail and food services. Truckee and Mammoth Lakes are examples of communities influenced by DIR NLI. Conversely, a community with a large population of retirees or people dependent on Medicaid will see a higher demand in local health services due to their reliance on age-related or hardship-related payments. Downieville and Lake Almanor Peninsula are examples of communities with more age-related payments.

Due to the Sierra’s dependence on NLI, it is important to distinguish between the different types of nonlabor payments, and for jurisdictions to identify what type(s) of NLI influences their local economic development.

Proportions of Nonlabor Income Types

The percentage of nonlabor income types in the combined SNC region.

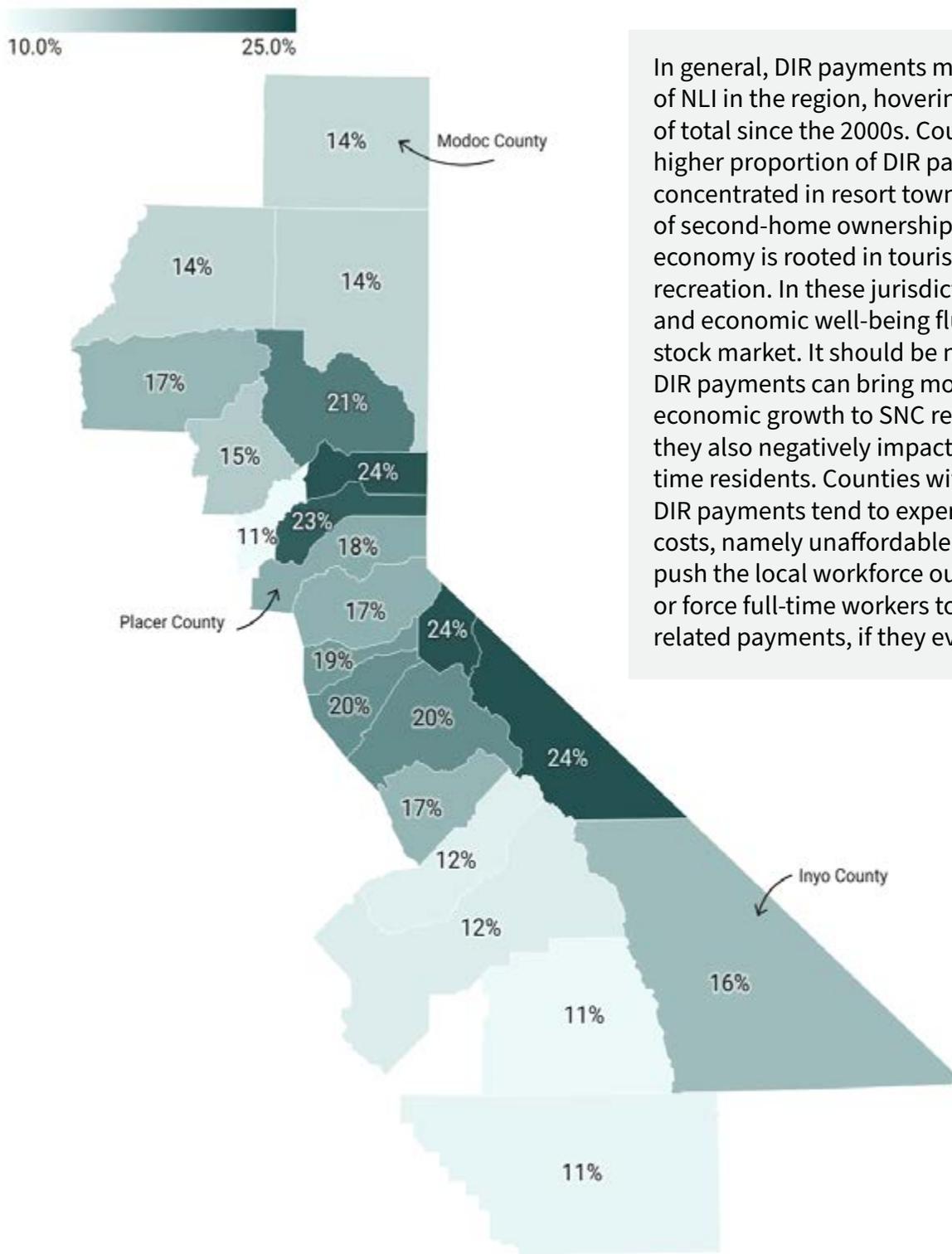


All income data are reported by place of residence.

Chart: Sierra Business Council • Source: Data Sources: U.S. Department of Commerce. 2021. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C., reported by Headwaters Economics, Non-Labor Income, 2020 • Created with Datawrapper

Total Personal Income from Dividends, Investments, and Rent

Percentage of total personal income from DIR payments in 2020.



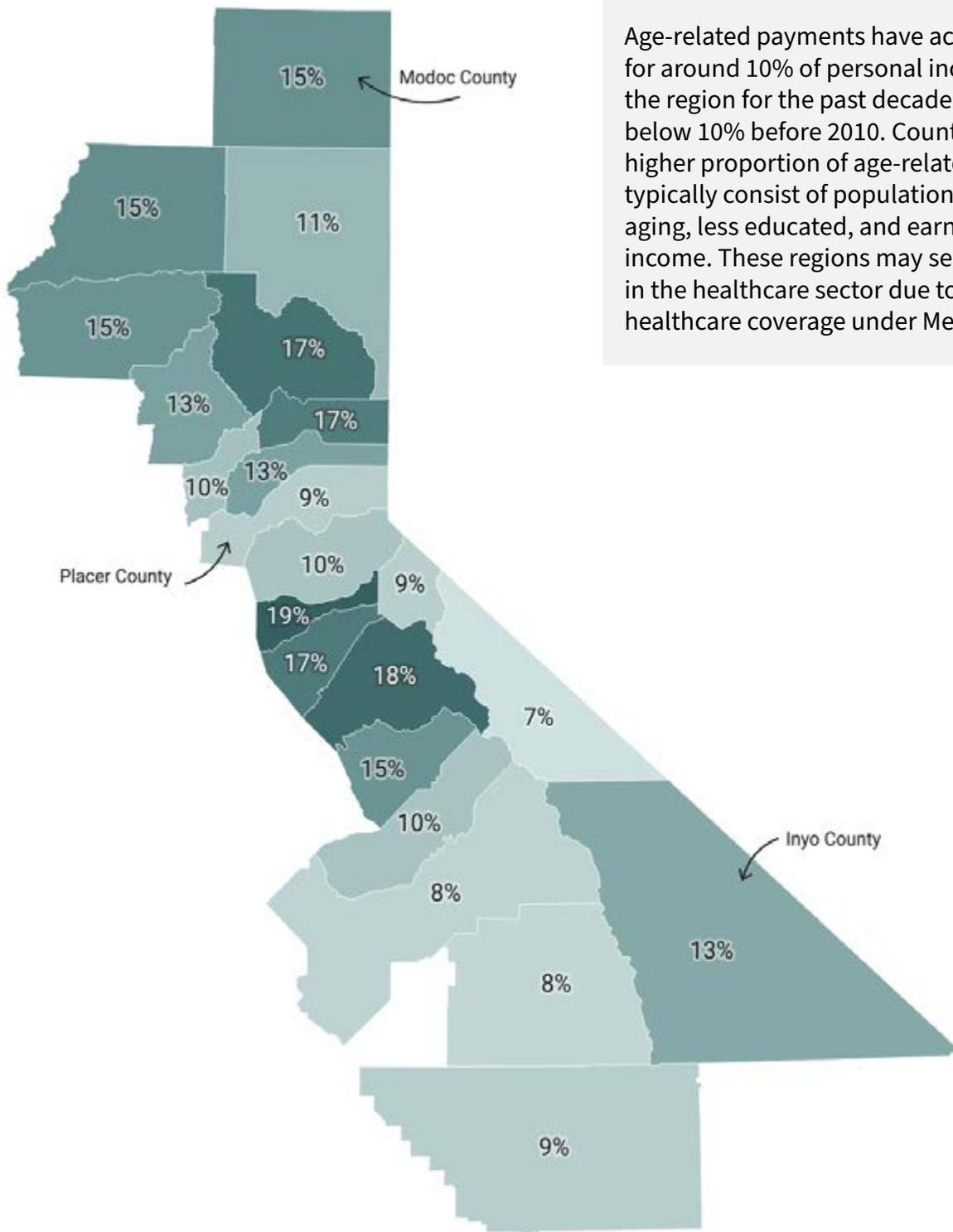
In general, DIR payments make up the majority of NLI in the region, hovering around 15% of total since the 2000s. Counties with a higher proportion of DIR payments tend to be concentrated in resort towns with larger shares of second-home ownership, where the local economy is rooted in tourism and outdoor recreation. In these jurisdictions, local spending and economic well-being fluctuates with the stock market. It should be noted that while DIR payments can bring more spending and economic growth to SNC regional counties, they also negatively impact long-term, full-time residents. Counties with more shares of DIR payments tend to experience higher living costs, namely unaffordable housing. This can push the local workforce out of the region, or force full-time workers to utilize hardship-related payments, if they even qualify.

DIR payments come from personal dividend income, personal interest income, and rental income of persons with capital consumption adjustments that are sometimes referred to as "investment income" or "property income."
 Data Resolution: County Level.

Map: Sierra Business Council • Source: U.S. Department of Commerce. 2021. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C., reported by Headwaters Economics' Non-Labor Income, 2020 • Created with Datawrapper

Total Personal Income from Age-Related Payments

Percentage of total personal income from age-related payments in 2020.



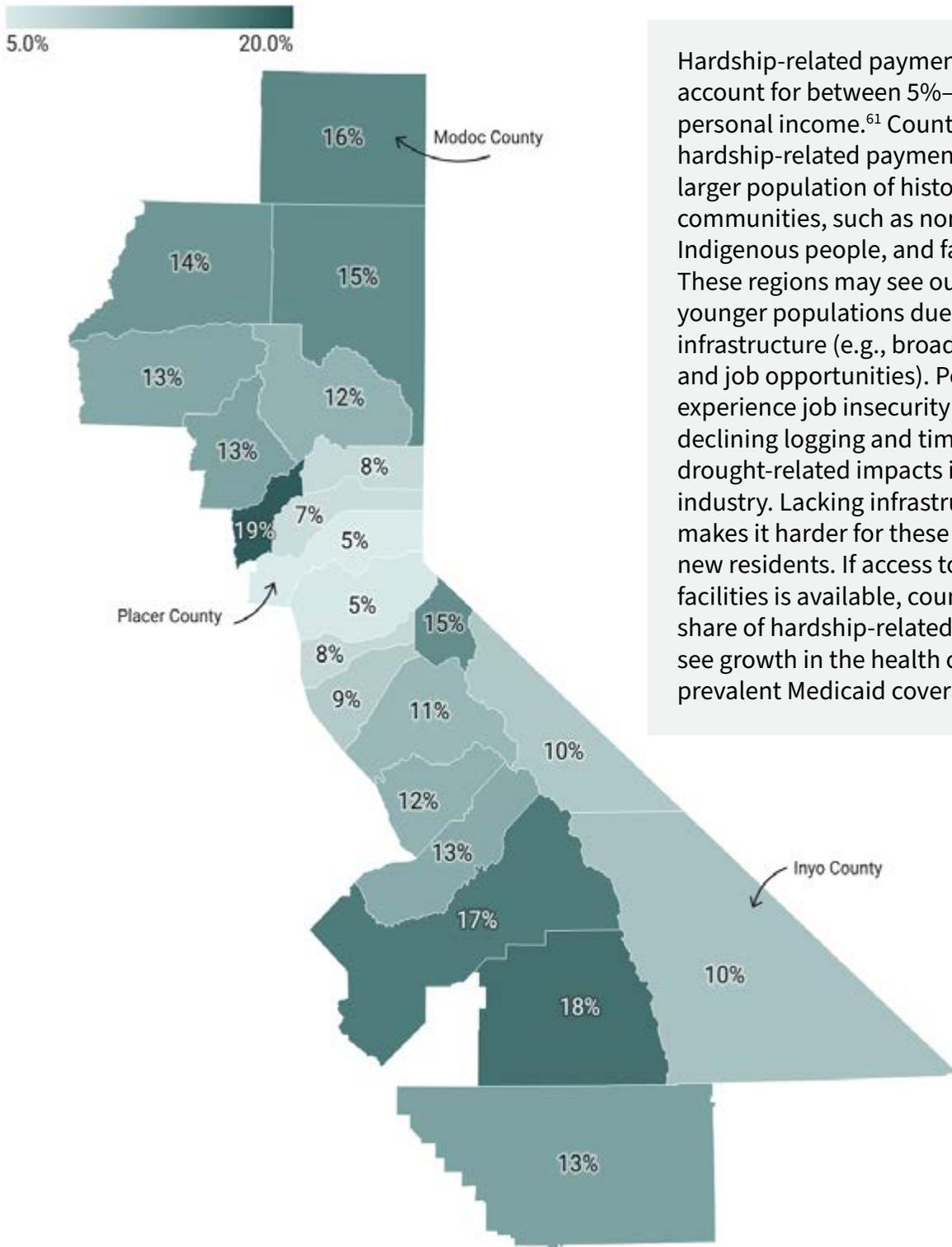
Age-related payments have accounted for around 10% of personal income in the region for the past decade, dipping below 10% before 2010. Counties with a higher proportion of age-related payments typically consist of populations that are aging, less educated, and earning lower income. These regions may see a growth in the healthcare sector due to access to healthcare coverage under Medicare.

Age-related payments come from Medicare and Social Security benefits. Data Resolution: County Level.

Map: Sierra Business Council • Source: U.S. Department of Commerce. 2021. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C., reported by Headwaters Economics' Non-Labor Income, 2020 • Created with Datawrapper

Total Personal Income from Hardship-Related Payments

Percentage of total personal income from hardship-related payments in 2020.



Hardship-related payments traditionally account for between 5%–10% of total personal income.⁶¹ Counties with more hardship-related payments likely have a larger population of historically marginalized communities, such as non-English speakers, Indigenous people, and families in poverty. These regions may see out-migration of younger populations due to insufficient infrastructure (e.g., broadband, schools, and job opportunities). Populations will experience job insecurity or loss due to declining logging and timber industries and drought-related impacts in the agriculture industry. Lacking infrastructure and industry makes it harder for these counties to attract new residents. If access to healthcare facilities is available, counties with a higher share of hardship-related payments may see growth in the health care sector due to prevalent Medicaid coverage.

Hardship-related payments are associated with poverty and include Medicaid, Food Stamps (SNAP), Supplemental Security Income (SSI), Unemployment Insurance, and other income maintenance benefits. Data Resolution: County Level.

Map: Sierra Business Council • Source: U.S. Department of Commerce. 2021. Bureau of Economic Analysis, Regional Economic Accounts, Washington, D.C., reported by Headwaters Economics' Non-Labor Income, 2020 • Created with Datawrapper



NLI will likely continue to increase in the SNC region for a few reasons:

1. The majority of baby boomers will likely retire before 2030. This will increase age-related payments in communities with lower wages and lower educational attainment, and it will increase DIR payments across the region as retirees move to the area.
2. While the Sierra faces a wide range of climate hazards, the region could become a climate refuge from some climate hazards impacting California's foothill and coastal regions, such as extreme heat and rising sea levels. This may cause an in-migration of wealthier residents with more reliance on DIR payments than historically seen in rural, mountainous regions. Relocation to the Sierra will put residents at risk from climate hazards impacting the state, like wildfire and drought.
3. Climate change hazards like drought and reduced snowpack could force many Sierra residents working in the tourism and recreation industries to rely on hardship-related payments as the winter season shortens and there are less job opportunities.
4. Policy changes at the state and federal levels can impact health care payments, retirements, and welfare payments. Reforms may increase or decrease NLIs.

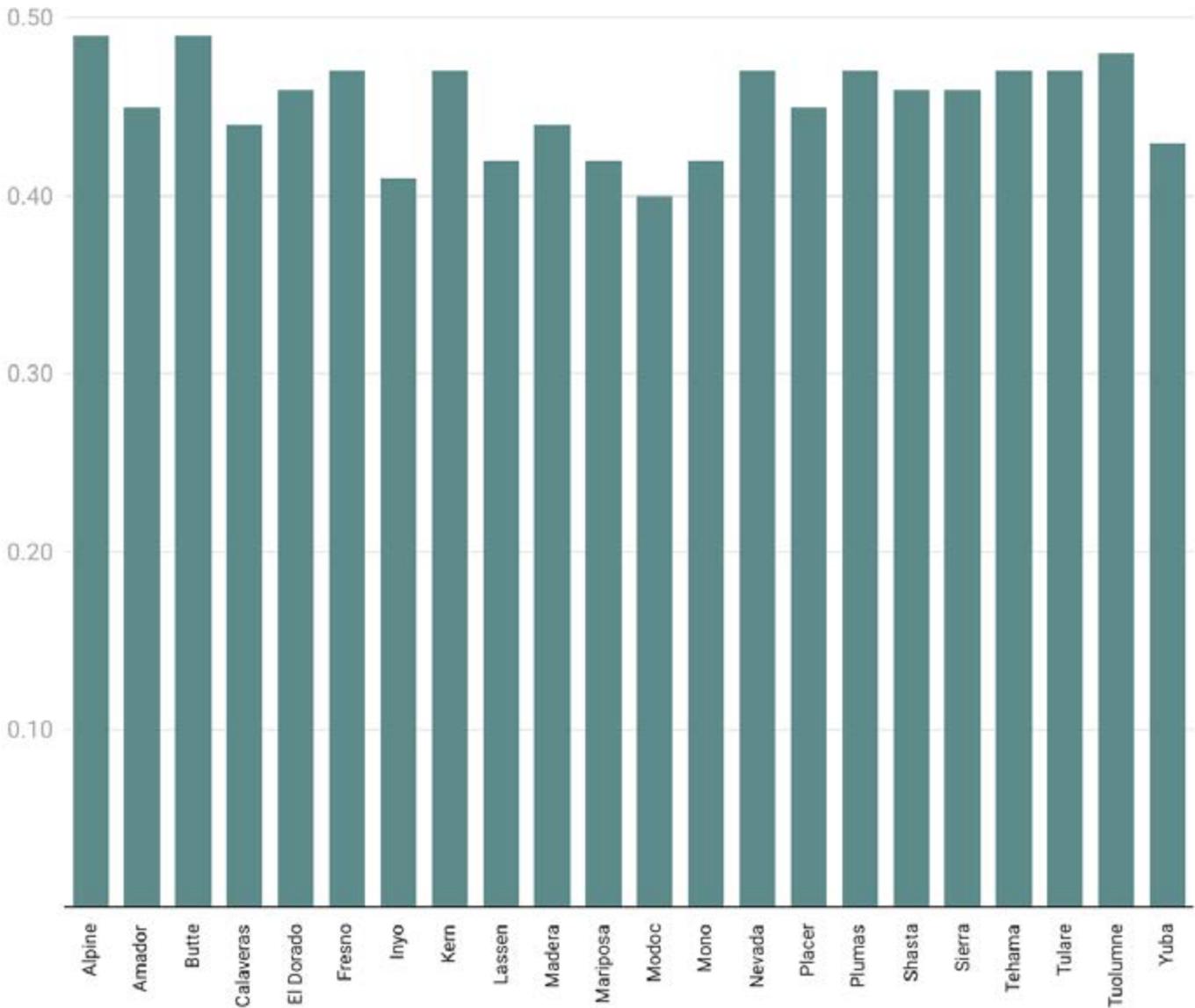
When jurisdictions are aware of the influences NLI has on their local economies, they can prepare for economic fluctuations and understand the demographics they serve to better plan for climate hazard mitigation and adaptation. Communities with higher age- and hardship-related payments typically have a more vulnerable population with less industry. These communities may not have the human capital nor infrastructure necessary to adapt to extreme heat events or more intense fire seasons. Communities with higher DIR payments are more reliant on outdoor recreation and have more wealth disparities. These communities need to begin to adapt to shorter winter seasons and a potential influx of wealthy residents who push the local workforce out.

Median Household Incomes and the GINI Index

When thinking about communities with wealth disparities, it is important to consider impacts from nonlabor and labor income. Traditionally in the Sierra, many high-earning residents rely on dividend, investment, and rent payments, not income from earnings, to lead more luxurious lives than the average resident. Since 2020, there has been an increase in wealthier people living in the Sierra full-time, working remotely, and earning a level of income that would otherwise be unavailable in the region. Some counties in the Sierra saw double the in-migration of former Bay Area residents in 2020 as compared to 2019.⁶² High-paying, remote jobs will increase the wealth discrepancy in the Sierra, resulting in a higher cost of living with stagnant local wages. One way to analyze wealth discrepancies is with the Gini Index.

County-Level Gini Coefficients

A measure of wealth inequality across the SNC region in 2019.



Gini coefficients are on a scale of 0–1. Values closer to 0 indicate more equally distributed wealth. For reference, at the state level, California has a coefficient of 0.49.

Chart: Sierra Business Council • Source: U.S. Department of Commerce, 2020. Census Bureau, American Community Survey Office, Washington, D.C. as reported in Headwaters Economics' Demographics (headwaterseconomics.org/eps) • Created with Datawrapper

All counties in the SNC region hover between 0.40 and 0.49, and most are below California's Gini coefficient of 0.49.⁶³ It is important to note that the Gini coefficient measures wealth inequality as opposed to income inequality. Wealth inequality is typically associated with power imbalances among a group of people in a shared society, whereas income inequality addresses the labor market. As discussed earlier in this chapter, labor markets in the SNC region have created income inequality, with few occupations garnering annual salaries above \$60,000.

In simple terms, a Gini coefficient nearing 0.50 indicates that 50% of the population holds all of the wealth in the region—a measurement halfway between perfect equality (everyone has the same level of wealth) and perfect inequality (one person has all of the wealth). Since the Gini coefficient more accurately describes power imbalances than income level, it is fair to deduce that nearly half of the SNC region’s population is underrepresented or underserved—at least when it comes to resources or services requiring monetary inputs or influence.

Counties in the SNC region with higher Gini coefficients may have a higher overall capacity to handle climate change risks and hazards due to a small population of wealthy residents who bring financial, human, and physical capital into their communities. But higher capacity regions with higher Gini coefficients will likely have pockets of extreme poverty where underserved populations will endure the most severe impacts from climate change.

Counties in the SNC region with lower Gini coefficients may have lower overall capacity to handle climate change risks and hazards. While more equal wealth distribution tends to result in more equity, it may indicate less available wealth for public or community use in rural regions like the Sierra. These counties likely have less resources and older infrastructure, and they will face more widespread, universal impacts from climate change.

Counties with lower Gini coefficients and higher capacity likely have high social capital and a willingness to work together to overcome universal hardships, such as inadequate infrastructure or damage to buildings after a wildfire.

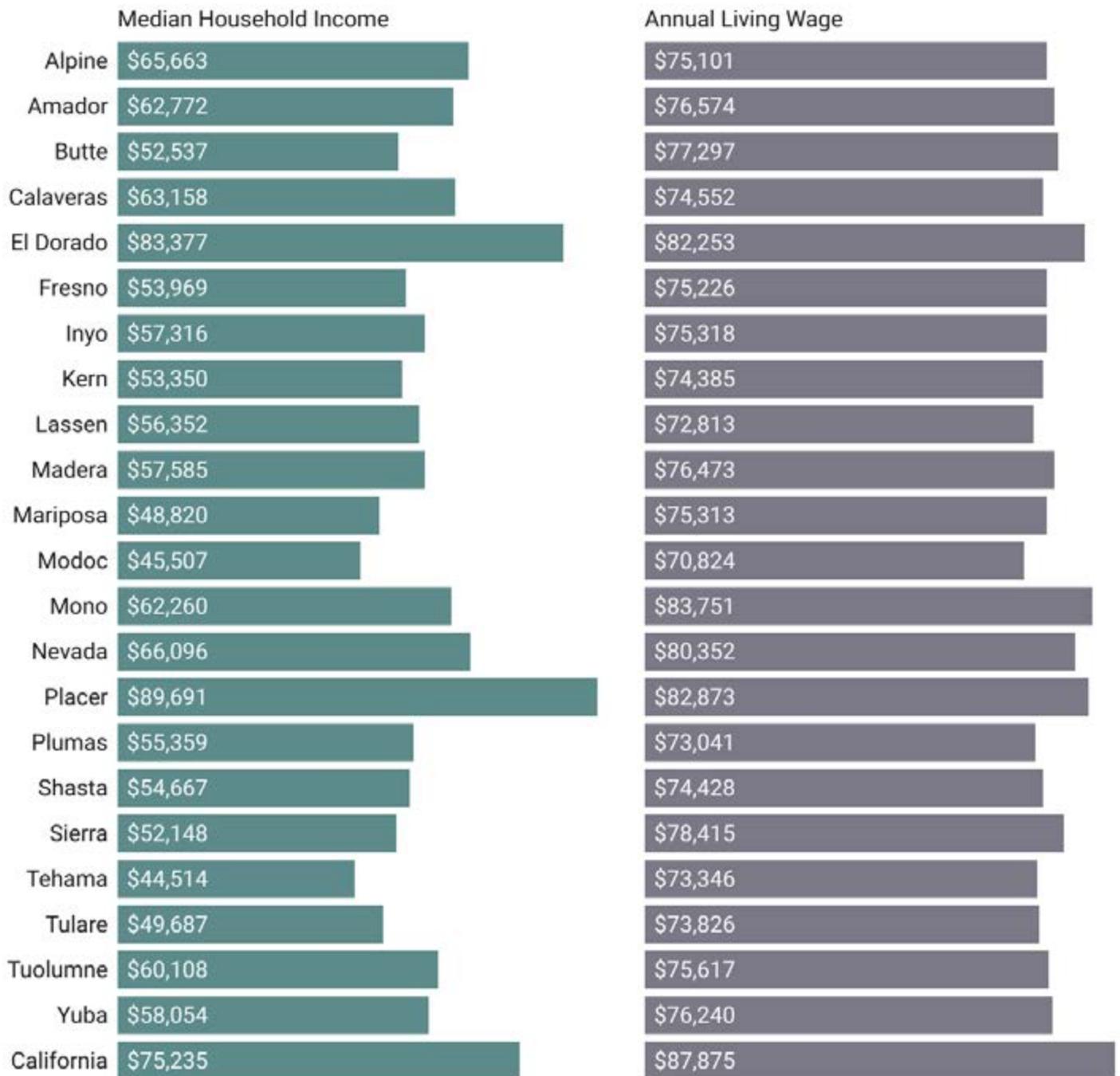
Median Household Income (MHI) refers to income earned by a specific household where half the homes in the region earn more and half earn less. A household is defined as all people living within a housing unit as their primary residence; a single person who lives alone, a married couple with two children, and four roommates are all defined as a household. It is useful to compare MHI to the costs of living in a region. In the figure, the MHI for counties within the SNC region is compared to the annual wage necessary for a two-income household to raise a child. Note, there are only two counties in the region, Placer County and El Dorado County, where the MHI exceeds the necessary living wage for a couple raising a child.

In general terms, it is true that the cost of living in the Sierra is lower compared to some metropolitan areas in California. For example, a two-income family with one child living in Sacramento County or Los Angeles County must earn \$82,630 or \$92,039, respectively. Yet, the MHI data indicates more than half of Sierra residents do not earn incomes sufficient to support a small family.⁶⁰

It is well documented that people with lower economic status will face more hardship and need more assistance to endure physical hardships caused by a warming climate. Jurisdictions with lower MHI levels will need to take more steps to ensure adaptation to hotter temperatures, extreme climate hazards, evacuations, and increased power outages are achievable and available for all residents.

As of this publication, there is no research consensus on how underserved and vulnerable populations in the Sierra Nevada will be impacted by the climate change hazards discussed in chapter 2. This is due in part to the nature of climate science and projection data but also to the lack of social services that track demographics and real-time impacts in a systematic way. More research is needed from rural economists, social workers, and governments to understand who is already being affected, how they are being affected, what hazards pose the largest threat to specific groups, and what can be done to build resilience in the SNC region.

Median Household Income and Living Wage in the SNC Region



A household is defined as all people who occupy a housing unit as their primary residence. Annual living wage is defined as the annual combined salary necessary for two working adults with one child. MHI and living wages reported in 2019 dollars. Data Resolution: County Level.

Chart: Sierra Business Council • Source: MHI: U.S. Department of Commerce, 2020. Census Bureau, American Community Survey Office, Washington, D.C. as reported in Headwaters Economics' Demographics | Living wage: Living Wage Calculator, MIT, 2020. • Created with Datawrapper

Socioeconomic Data Limitations and Gaps

- More analysis is needed to understand the economic impact of snow drought in towns reliant on ski-related visitor spending, and whether or not the ski industry will need to increase summer operations to make up for winter revenue losses by midcentury.
- Studying the economic impact of developing biomass sectors in the Sierra will be key to understanding how to prioritize and increase biomass utilization.
- Research by rural economists is needed to determine solutions to maintaining a stable labor workforce in tourism, recreation, and natural resource industries.
- A comprehensive analysis on ecosystem services should be conducted across the SNC region.
- Data in this chapter relies on county-level US Census data. Socioeconomic data at the county level can mask high poverty levels and wealth disparities, and can fail to represent hard-to-reach communities and communities with shifting demographics that are definitive of rural areas with high levels of seasonal employment. Planners and policymakers should conduct a socioeconomic analysis at the community level where data is available.

Chapter 4 References:

- 1 US Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C. as reported in Headwaters Economics' Demographics (headwaterseconomics.org/eps)
- 2 Impact of Wildfire on Tourism in the Sierra Nevada, Jackson Wilson, Patrick Tierney, Carl Ribaud, 2020
- 3 California Travel Impacts 2010–2019, Visit California (Dean Runyan Associates)
- 4 US Department of Labor. 2021. Bureau of Labor Statistics, Local Area Unemployment Statistics, Washington, D.C. as reported in Headwaters Economics' Tourism (headwaterseconomics.org/eps)
- 5 Ski California, Economic Impact Report, 2020
- 6 CA Department of Fish and Wildlife
- 7 Tahoe's Sno-Parks have never been more popular. And it's causing all kinds of problems, Gregory Thomas, 2022
- 8 California's 4th Climate Change Assessment, Sierra Nevada Region Report
- 9 Integrating Tribes and Culture Into Public Land Management, David Flores and Gregory Russell, 2020
- 10 To Manage Wildfire, California Looks To What Tribes Have Known All Along, Lauren Sommer, 2020
- 11 Water and the California Economy, Ellen Hanak, Jay Lund, Barton "Buzz" Thompson, et al.
- 12 Map: Hydroelectric Power Plants in the Sierra Nevada Region, SNC
- 13 US Energy Information Administration
- 14 California's Forest Products Industry and Timber Harvest, Kate C. Marcille, Todd A. Morgan, Chelsea P. McIver, et al., 2016
- 15 2016 Forest Industries Data Collection System (FIDACS) census
- 16 State Employment Projections - Projections Managing Partnership (PMP)
- 17 US Bureau of Labor Statistics, 2015
- 18 California's Wildfire and Forest Resilience Action Plan, CA Forest Management Task Force
- 19 California Walking a 'Tight Rope' as Hydropower Supply Fades, Brian Eckhouse, 2021
- 20 Too Many Dead Trees: Sierra Sawmills Face a Backlog, Alice Daniel, 2015
- 21 State of Sierra Nevada Forests, Sierra Nevada Conservancy
- 22 Land use planning can reduce wildfire risk to homes and communities, Headwaters Economics
- 23 County Crop Reports, CDFA
- 24 California Agricultural Statistics Review 2019-2020, CDFA
- 25 CroplandCROS
- 26 California Land Use and Ownership Portal, UCANR
- 27 Working Farms & Ranches, Eastern Sierra Land Trust
- 28 How many workers are employed in California agriculture?, UCANR
- 29 Thousands of farmworkers get pay raises thanks to a lawsuit, Melissa Montalvo, 2021
- 30 National Forest Visitors Advised To Watch For Illegal Marijuana Gardens, US Forest Service
- 31 How Does Cannabis Cultivation Affect California's Water?, PPIC, 2021

32 A Changing Climate | Vulnerability in California's Eastern Sierra
33 Northern California, Homes, and Cost of Wildfires, Headwaters Economics
34 Dixie Fire finally contained after 103 days, Damon Arthur, 2021
35 California's Tourism Industry Hit Hard by Wildfires, Jeremy Siegal, 2018
36 'Increasingly Unavailable and Unaffordable': Home Insurance Threatened Amid Wildfire Crisis, Marissa Lagos, 2019
37 The cost of fire insurance across California is rising at a frightening pace if you can get it at all, Mike Duffy, 2020
38 California power outages could cost region more than \$2bn, some experts say, Mario Koran, 2019
39 County, Grass Valley and Nevada City send letter of concern to CPUC detailing PSPS effects on Nevada County, YubaNet,
2019
40 How Better Data Can Help California Avoid a Drinking Water Crisis, PPIC, 2014
41 Dry Wells in Northern California Bring Home the Costs and Stresses of Drought, Brett Walton, 2021
42 What If California's Drought Continues?, PPIC, 2015
43 Cost of Snowmaking, Casey Flynn
44 Housing in recreation-dependent counties is less affordable, Headwaters Economics
45 Western States Unprecedented Housing Prices, Headwaters Economics
46 The unequal impacts of wildfire, Headwaters Economics
47 For reference, 25Mbps broadband speed is necessary for a single device to stream a movie on Netflix in 4K Ultra HD, but a
connection speed of 5Mbps should suffice for streaming HD content (<https://help.netflix.com/en/node/>).
48 Fourteenth Broadband Deployment Report, FCC
49 CPUC
50 CPUC
51 How we can close the digital divide in California, CalMatters, 2021
52 Rural Health Information Hub
53 HRSA Map Tool
54 Total Hospital Beds, KFF
55 California Department of Education, Public Districts Data File, Educational Data Management Division, February 10, 2022
56 The path from California community colleges to bachelor's degrees, EdSource
57 Rate of high school seniors enrolled in UC/CSU, EdSource
58 Economy Surprisingly Dependent on Non-Labor Income, Headwaters Economics
59 How Small Towns And Cities Can Use Local Assets To Rebuild Their Economies: Lessons From Successful Places, EPA,
2015
60 MIT Living Wage Calculator
61 2020 was the first recorded year that hardship-related payments made up more than 10% of personal income and
contributed more to total personal income in the Sierra than age-related payments. This uptick in hardship-related payments is
presumably due to impacts on employment in the Sierra related to the COVID-19 pandemic.
62 New Research: People are Leaving SF, But Not California, Sean Coffey, 2021
63 While the Gini index is not a perfect scoring system, many experts believe it is overly sensitive to changes in the middle
class and under-sensitive to changes at either extreme. It can be used as a reliable tool to compare regions to each other. For more
information on how Gini Coefficients are calculated, see [here](#)

COMMUNITY CAPACITY ASSESSMENT

Written by The Sierra Institute for Community and Environment

Chapter 5 Summary:

- These assessments are based on information obtained in community-held workshops, and scores assigned by community member participants in the workshops.
- Scores are relative to other communities within the SNC region.
- The goal of these workshops was to gain insight on community capacity, and the ability of communities to respond to stressors, including climate impacts.



Introduction

Findings in this report were informed by community workshops held across the region as part of an engagement process to identify community capacity and build understanding of climate impacts and willingness to engage in solutions. Sierra Business Council (SBC) contracted Sierra Institute on this task based on their experience and prior work in the region assessing community capacity. This chapter was compiled and written by Sierra Institute.

The Sierra Institute for Community and Environment (SI) has a long history conducting well-being and needs assessments of rural communities throughout California. SI has developed a framework and methodology for assessing community well-being, including measures for community capacity and socioeconomic condition. This chapter builds on the idea of community capacity described in the introduction to this assessment as it relates to the specific communities within the SNC region. Community capacity is defined as the ability of communities to respond to internal and external stressors, and for this work, residents' ability to respond to climate hazards and meet the needs of all residents. This includes the ability of a community to take advantage of opportunities. Community capacity can be identified as the culmination of five capitals as defined by Sierra Institute:¹

Financial Capital

Availability of funds for use on local projects and pressing local needs. These may be public funds or private funds, with private funds tightly linked to community interests.

Human Capital

Individuals with the knowledge and ability to address conditions and stressors of concern. Also describes the experience and capabilities of local residents and their willingness to use these skills locally.

Social Capital

The ability and willingness of local residents to work together toward community ends and purposes.

Cultural Capital

The prevalence of a strong shared local bond and way of life, and the unique identity it cultivates.

Physical Capital

The "hard infrastructure" of a community, such as roads, sewers, schools, etc., including the quality of this infrastructure and its ability to meet local needs.

This chapter provides an assessment of the community capacity within the SNC region. This work is a summary of community workshop findings, along with expanded assessments that were specifically done for this report. Climate change has and will continue to present stressors for communities throughout the Sierra. The current well-being and capacity of communities to respond to these changes determines their vulnerability to climate change impacts.

Community capacity scores were assigned by census block group aggregations within a county, and only these areas within the SNC region were consulted. Workshop participants were asked to give scores relative to communities within the region, not outside the region (i.e., comparing Sierra Nevada region communities to themselves, not to metropolitan cities). Due to the COVID-19 pandemic and continuous wildfire evacuations, workshop participation and diversity were impacted. A number of workshops were held virtually. In the future, we would like to expand our community outreach when the pandemic no longer impacts in-person communication.

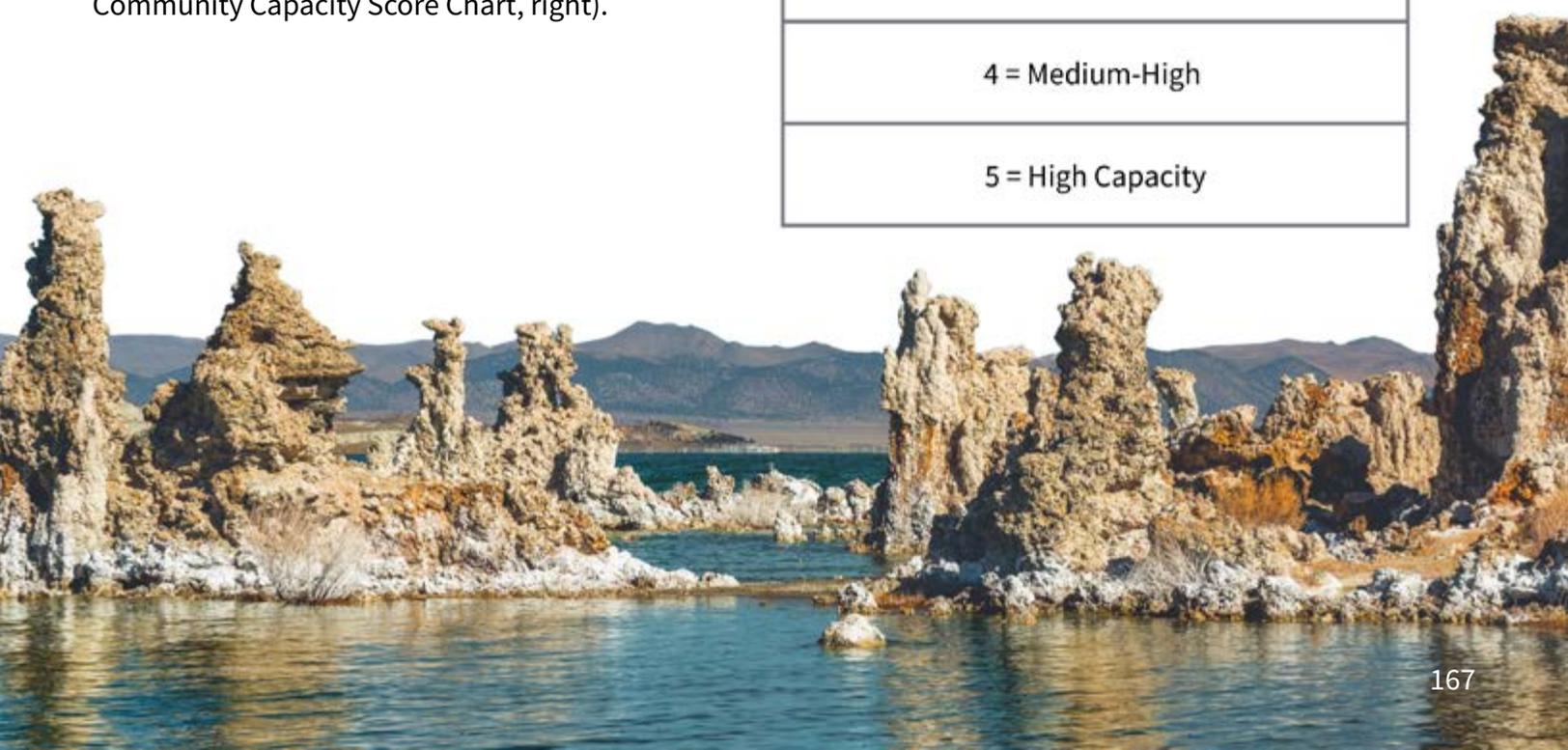
Community Assessment Results

Below are maps and summaries of community capacity scores throughout the SNC region. For full narratives detailing individual community capacity scores, see Appendix 13.

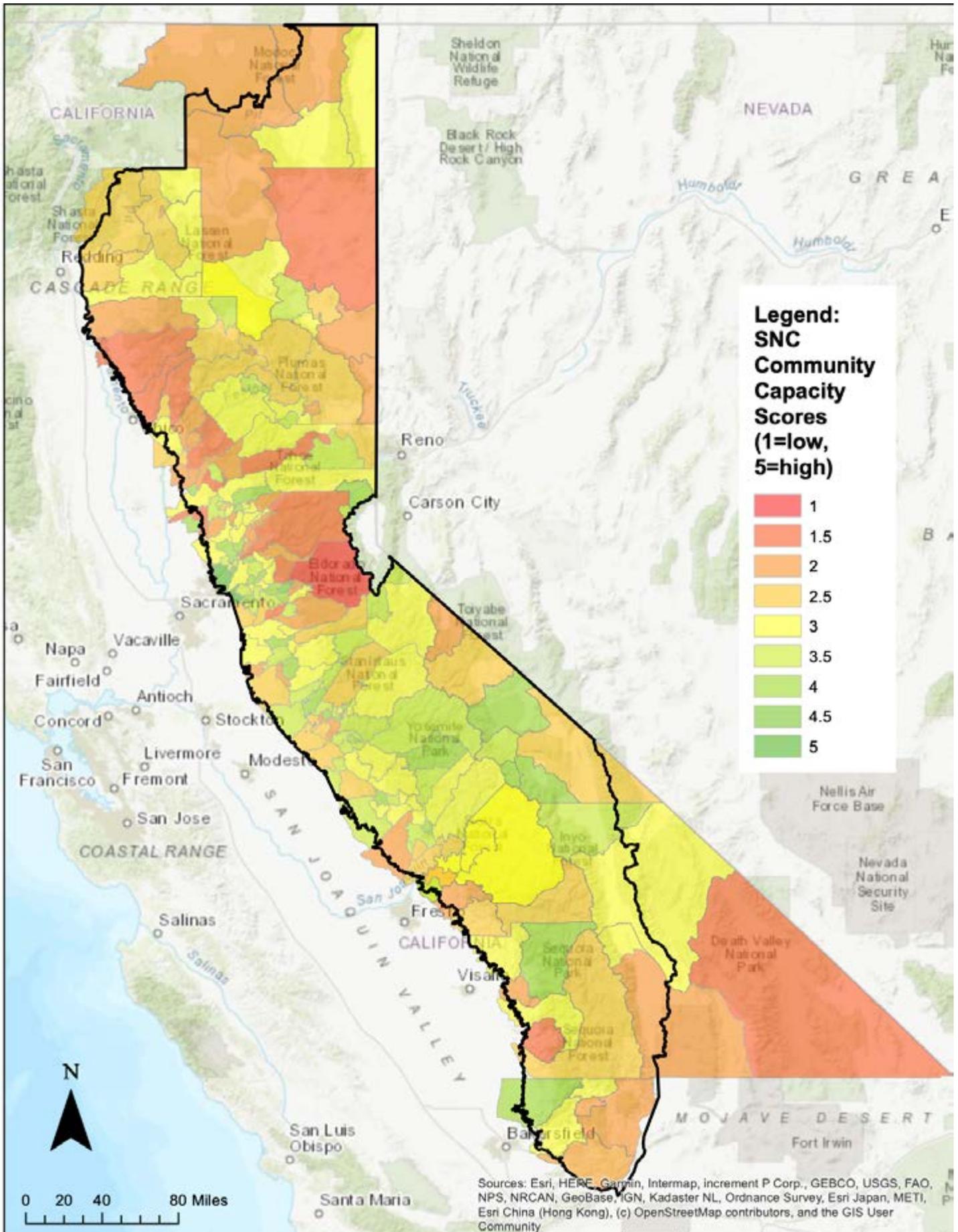
Capacity Analysis for the SNC Region

Below is a map of all capacity scores across the SNC region (see Map 1). Scores range on a 1–5 scale, with scores of 1, 2, 3, 4 and 5 indicating low, medium-low, medium, medium-high, and high levels of community capacity, respectively. Across the SNC region, a score of 3 was most commonly designated, followed by a score of 2. The average community capacity score for the region was 2.9 (see Community Capacity Score Chart, right).

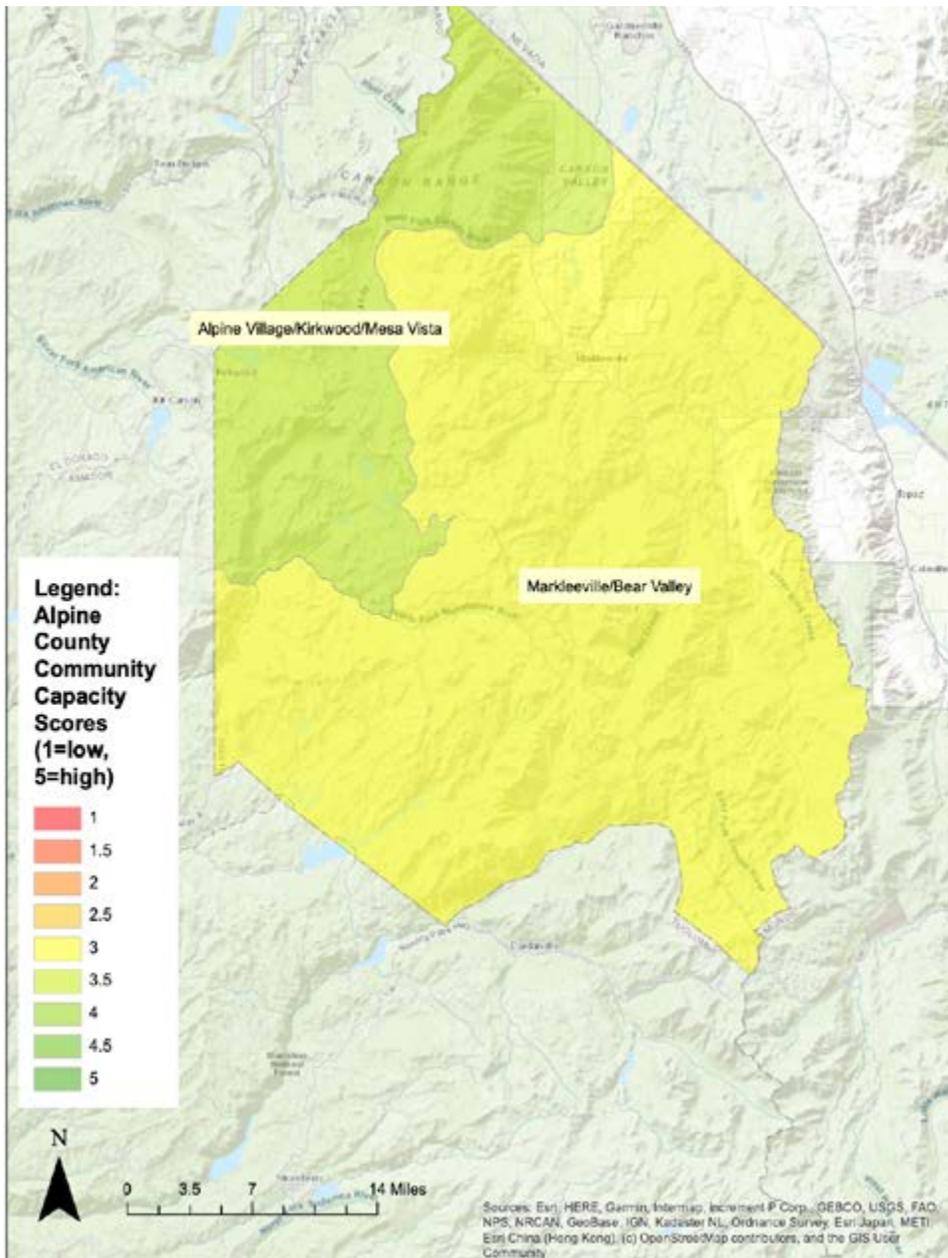
Community Capacity Scores
1 = Low Capacity
2 = Medium-Low
3 = Medium
4 = Medium-High
5 = High Capacity



Map of Community Capacity Scores for the Entire SNC Region



ALPINE COUNTY

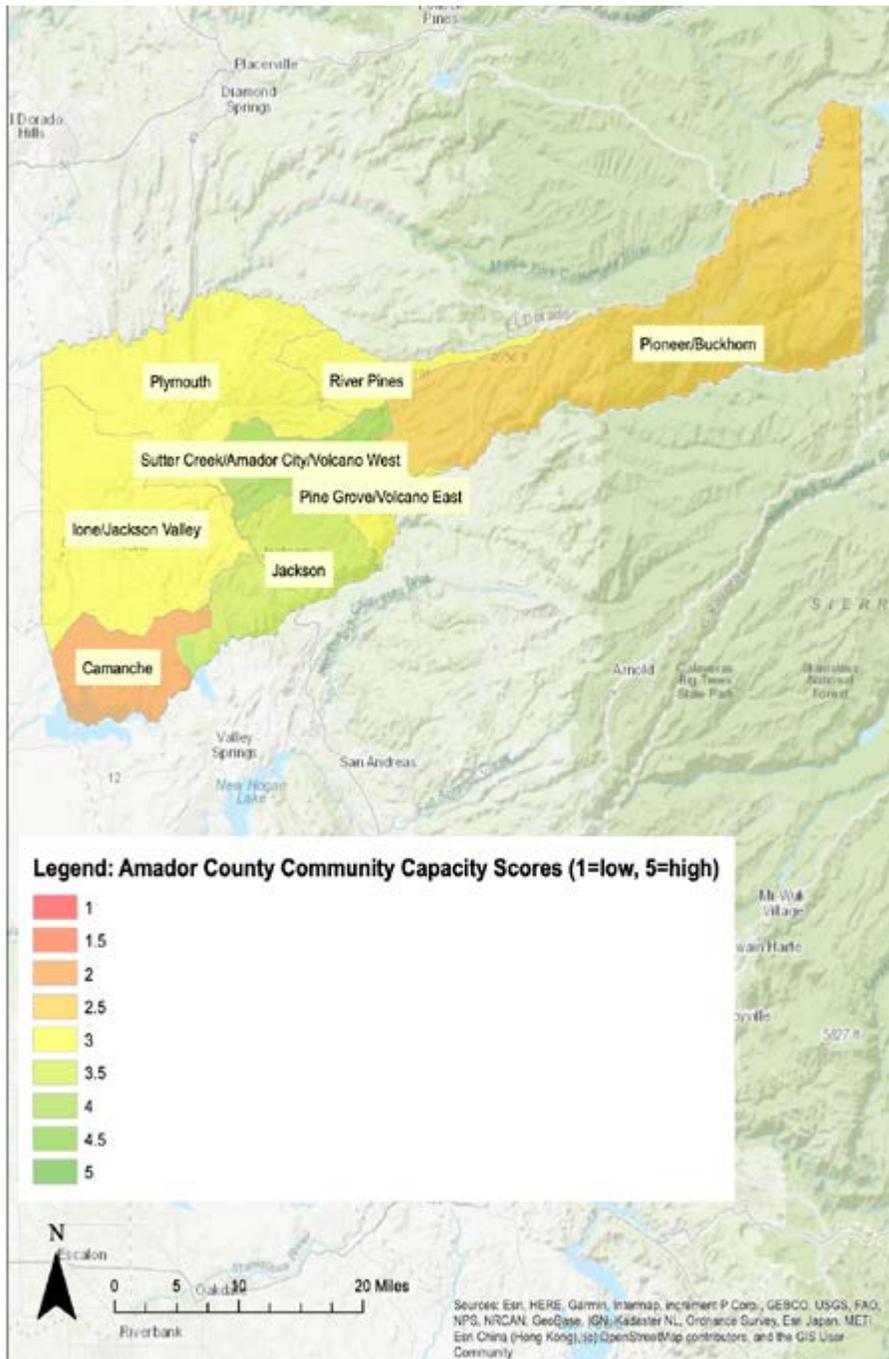


Alpine County is a small county with only two communities, Markleeville/Bear Valley and Alpine Village/Kirkwood/Mesa Vista. Alpine Village/Kirkwood/Mesa Vista was rated slightly higher than Markleeville/Bear Valley, with capacity scores of 3 and 3.5, respectively. On a 1–5 scale, both communities are classified as having a roughly medium level of capacity to respond to stressors.

Workshop participants emphasized the high level of financial capital in Kirkwood, with wealthy weekenders and second-home owners who are “good at using money for community assistance,” and are willing to work together and share skills and expertise to meet areas of critical community need. Once outside of Kirkwood, however, problems start to multiply, making it difficult to rate the area. Markleeville/Bear Valley has a small population that is scattered across a rural landscape, and reaching critical mass for political

decisions or maintaining organizations presents a challenge. However, Health and Human Services, the Watershed Council, and county schools were all mentioned multiple times as being well run. The Washoe Tribe in Woodfords is also well led, however, they experience extreme unemployment and poverty in their community.

AMADOR COUNTY



The most common capacity score in Amador county was a 3, a medium level of capacity. The community of Sutter Creek/Amador City/Volcano West was rated as one of the areas with the highest capacity in the county, largely due to high levels of financial, social, human, and cultural capitals in the city centers of Sutter Creek and Amador City.

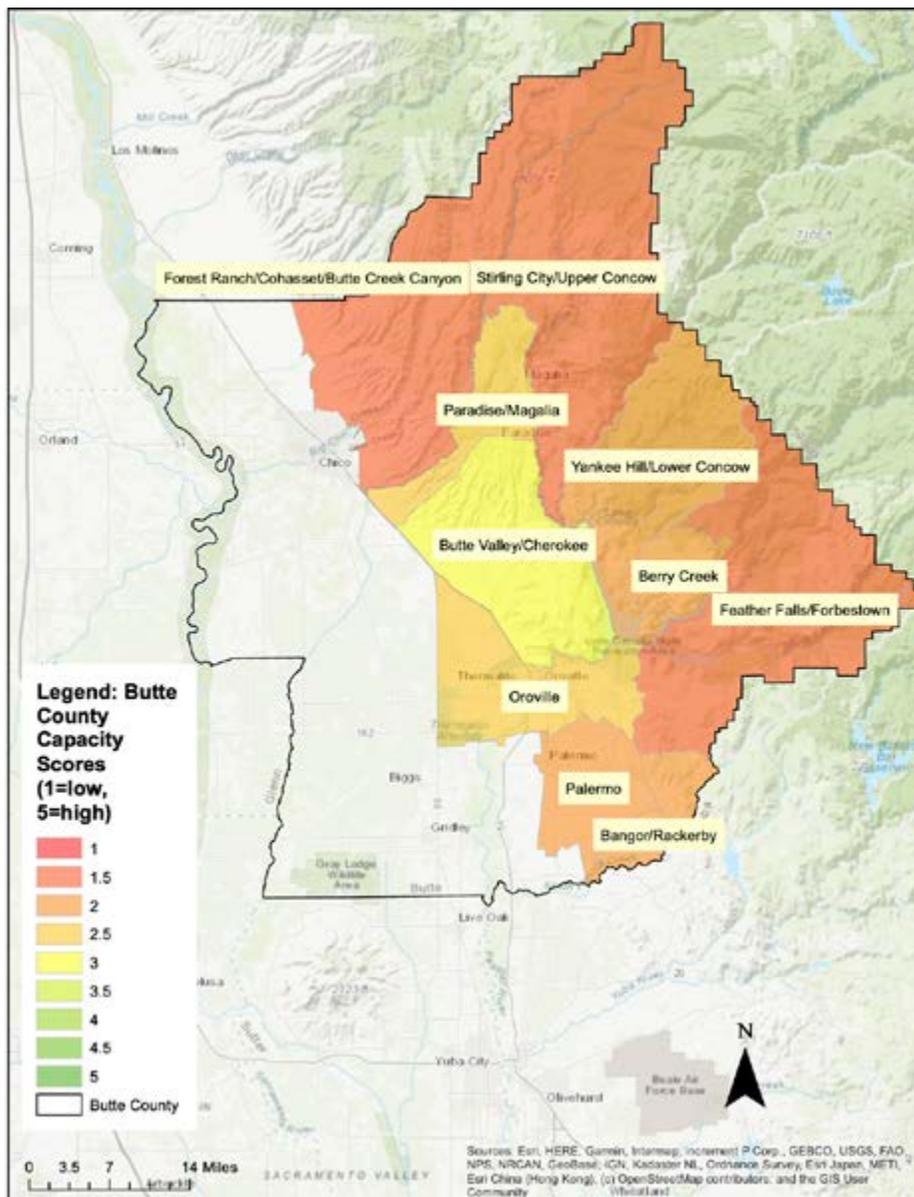
Many affluent residents in this area reportedly donate to local causes, and the populace collaborates well together to solve civic problems. Sutter Creek was also identified as a thriving tourist destination.

For communities that scored at a medium level of capacity, workshop participants identified feuding factions as a barrier to getting things done. Conflicts of interest were reported between the emerging winery industry and old ranching communities in Plymouth, as well as between retirees and other community residents over issues such as local school involvement in Pioneer/Buckhorn. Lone/Jackson Valley is reportedly seeing big changes through grant funding received from the Jackson Valley Irrigation District (JVID) for physical capacity improvement.

A new water system and a casino are being built in Buena Vista. The Jackson Valley Fire Protection District is reportedly a leader in this community, however, as participants noted, they operate off of a limited staff budget.

Lack of growth potential due to limited physical capital was cited multiple times as hindering capacity in the county. It was reported that while Amador County promotes tourism in the Pine Grove/Volcano East region, economic growth potential is limited in part due to a lack of affordable housing in Volcano East. Camanche was one of the lowest rated communities in the county, largely due to infrastructure challenges. Challenges cited by participants included a lack of schools in the community, poor road conditions and internet, and a sewer moratorium that has lasted 15 years from a lack of treatment capacity.

BUTTE COUNTY



Capacity scores for Butte County are skewed to the lower end of the 1–5 score range, with the most common scores being a 1.5 and a 2, meaning participants identified communities in this county as having low to medium-low capacity. This is reflected in the county average score of 2.0, compared to the regional average of 2.9.

For many communities in the county, however, one area of noted strength in capacity is the common experience of fire danger that has created a shared culture and strengthened social bonds, particularly in the communities of Feather Falls/Forbestown, Stirling City/Upper Concow, and Yankee Hill/Lower Concow. It is important to note that the capacity assessment workshop for this region predated the 2018 Camp Fire in Paradise by several weeks. However, this event reflects the ubiquity of concern about fire danger throughout the county. In Feather Falls/Forbestown, it was noted that local fire safe councils from each town have cultivated a relationship with the community

over the last ten years, allowing residents to identify where capacity needs exist.

Fire burned down half of the homes in Feather Falls in 2017, initiating a yearlong recovery process. Following the fire, community members came together and community fundraisers and events sprouted up in support, but cultural capital faltered as the population dwindled. In Stirling City/Upper Concow, the threat of fire fosters a shared interest across the community. Fires have burned over Stirling City, and Upper Concow in particular, multiple times. The area lost at least 60 structures, and participants estimated 80,000 to 120,000 acres burned, resulting in a mass exodus of residents. For the Yankee Hill/Lower Concow community, participants reported that a strong group of residents run the Yankee Hill Fire Safe Council, work on road maintenance, respond to tree mortality, and cultivate a culture of preparedness.

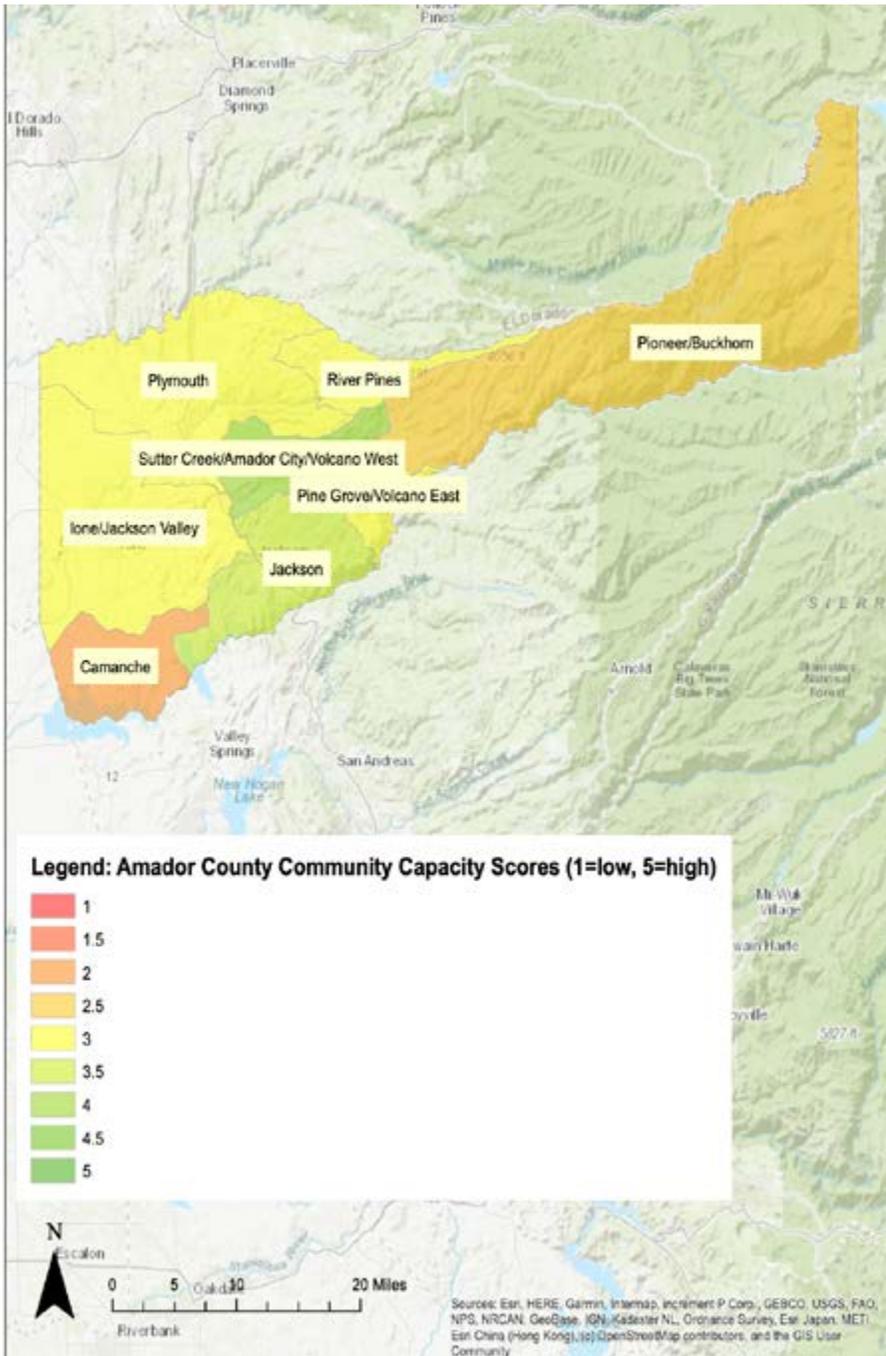
Generally, the communities in the rural upper foothills of Butte County were described as “tough” and

possessing a “can-do attitude”; still, the lower capacity scores in this county reflect sparse populations, lack of resources, and poverty. Even for the Butte Valley/Cherokee community, which received one of the highest scores in the county due in part to a broad financial base from land-rich farmers, potential community resources from these large land parcels may not be available to meet local needs. As is commonly experienced in natural resource-dependent areas, many communities in Butte County operate on the historical boom-and-bust nature of the foothills. One participant notably commented that people “sign up for the cyclical wild west experience of community growth and atrophy when they move out to rural areas.”

Lack of growth potential due to limited physical capital was cited multiple times as hindering capacity in the county. It was reported that while Amador County promotes tourism in the Pine Grove/Volcano East region, economic growth potential is limited in part due to a lack of affordable housing in Volcano East. Camanche was one of the lowest rated communities in the county, largely due to infrastructure challenges. Challenges cited by participants included a lack of schools in the community, poor road conditions and internet, and a sewer moratorium that has lasted 15 years from a lack of treatment capacity.



CALAVERAS COUNTY



The highest scoring communities in Calaveras County are largely in the southern portion of the county, with lower scoring communities to the northeast. The most common capacity score was a 3.5, and the average score was a 3.1. This is higher than the average for the entire SNC region, which was 2.9.

The highest scoring communities were Mokelumne Hill/Paloma and Murphys/Douglas Flat. Mokelumne Hill/Paloma was characterized as having high social and cultural capital, with a population that consists of a mix of college-educated professionals who relocated to the area and local residents who grew up there, both of which reportedly bring a wide range of skills and willingness to work on community projects. The high capacity rating of Murphy/Douglas Flat reflects more capital from Murphys, described as a vibrant town with a lot of businesses, a good real estate market, high home values, a strong tourism economy and “the best social and financial capital of the county.” The community as a whole has high

physical capital, demonstrated by public water and sewer and a well-maintained highway and road system.

For some communities in the county, the Butte Fire resulted in severe impacts and a loss of capacity. Blue Mountain Communities reported better physical capital prefire, as well as long-term impacts to community members, especially for the Native American population, some of whom were described as still living in 40-year-old trailers without roofs. The Mountain Ranch/ Sheep Ranch/Calaveritas community has also struggled with recovery. Financial disparities were made worse postfire, especially for the agricultural community. Population displacement was widespread and included a diaspora of local leadership. Many

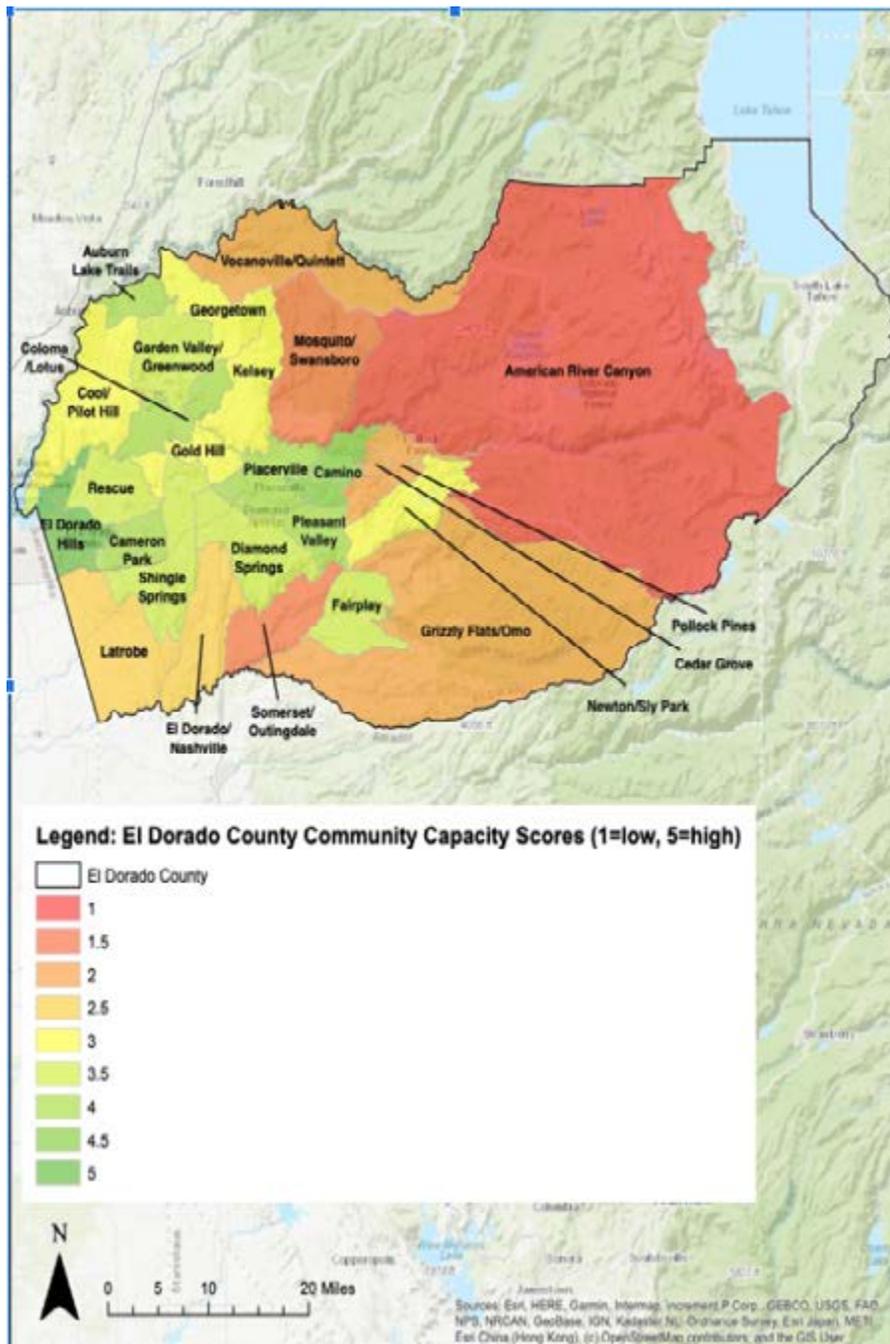
homes have still not been rebuilt, and approximately fifteen firefighters lost homes while battling flames. Cultural, social, human, and physical capitals were all rated much higher prefire. Forests, water, roads, and streams fell into “a mess” after the burn, and schools have closed.

Another factor contributing to lower capacity in the area includes, for some communities, a dichotomous social fabric. Copperopolis/Copper Cove in particular was described as a divided community with an “us-versus-them” mentality, with conflicting groups loosely defined as lake/gated versus old timers/blue collar. Additionally, one of the lowest scoring communities, Valley Springs/ Rancho Calaveras/La Contenta/Jenny Lind, was defined as four subcommunities that “don’t play well together,” owing to the distinctiveness of each area’s economic, cultural, and demographic makeup.

Additional concerns were expressed regarding the flux of cannabis business and money coming into the region, with accompanying issues related to marijuana regulation.



EL DORADO COUNTY



Communities in El Dorado County tended to score higher on the west side of the county compared to the east, but overall the county scored as having a medium capacity to respond to stressors, with an average capacity score of 3 out of 5.

Sources of financial capital for many communities in the county include agricultural and winery activities. These can also contribute to social capital. Camino, for example, was described by workshop participants as having a very strong community action committee with a large agricultural presence, including the Apple Hill Growers' Association. Cedar Grove was also described as having a strong shared farm culture and agricultural lifestyle, despite pockets of poverty. Recreational opportunities also contribute to capacity for communities in the county. Coloma/Lotus, for example, was rated highly due to its unique geography leading to a strong rafting and recreational tourist industry (e.g., biking, hiking, riding horses), with an estimated 400,000 visitors to the American river and Marshall Gold Discovery State Historic Park annually. Social capital can result in the form of

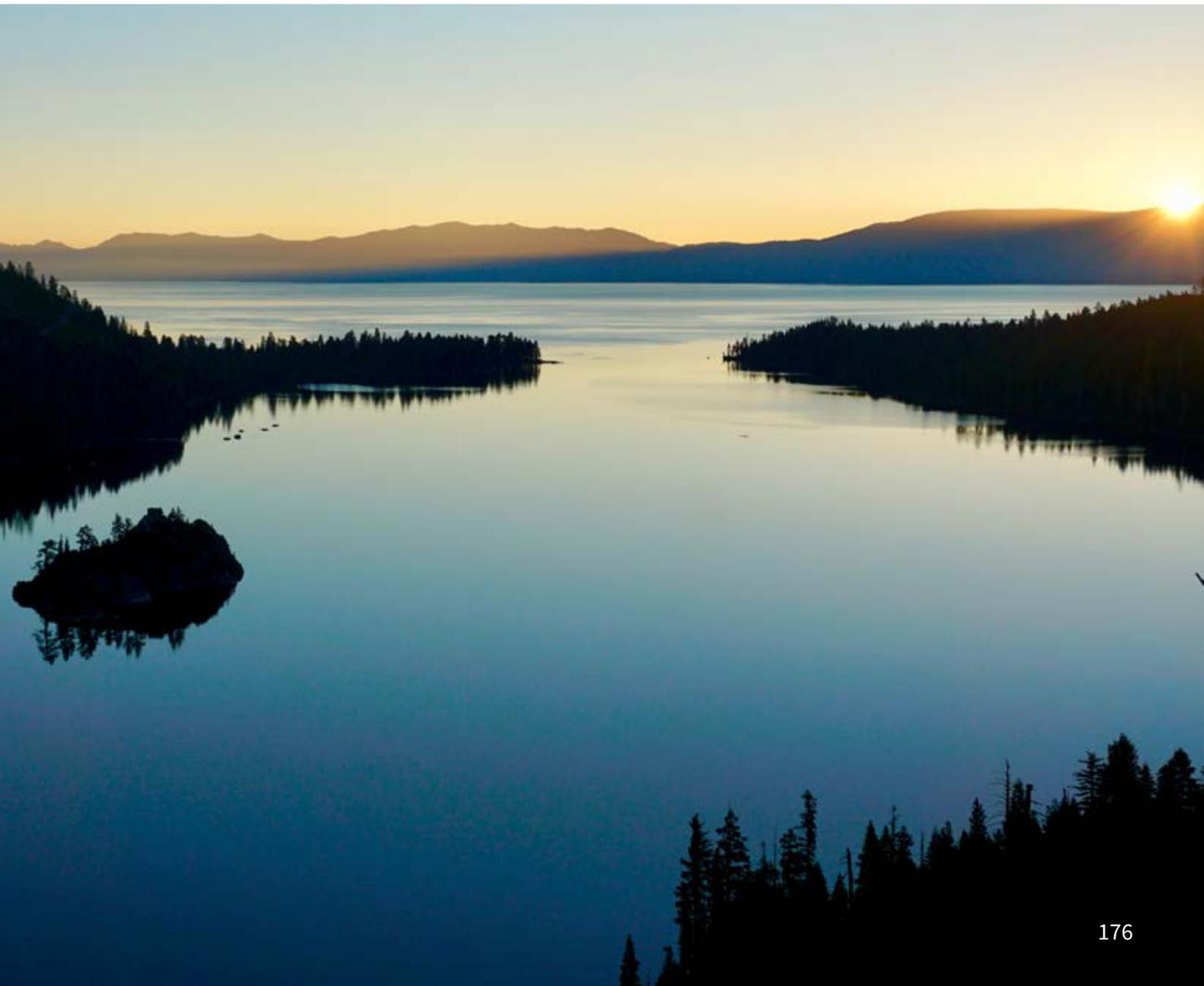
a strong “river community” identity, or a historical community sense of place with residents who actively participate in planning efforts and projects.

Even for communities with lower levels of financial capital or challenges with infrastructure, workshop participants pointed to a number of different attributes that contribute to strong human, cultural, and social capital. Overall, for many rural communities in the county, there is very good human, cultural, and social capital, but there are challenges with physical and financial capital. To name a few examples, the Diamond Springs community maintains a good level of local expertise to solve local problems, and the Diamond Springs Fire Department and the Union Mine High School both rally community action when needed. In

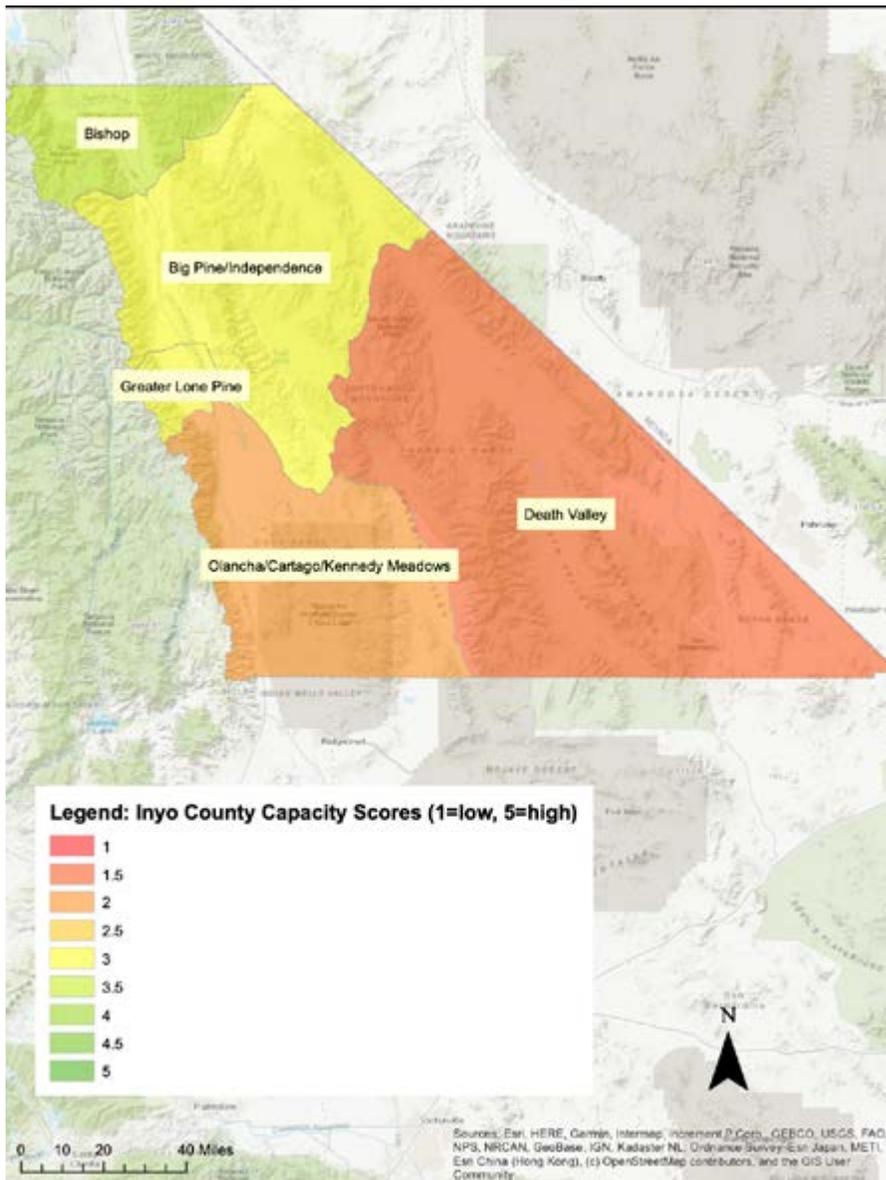
Grizzly Flats/Omo, the fire safe council tends to pull the community together and can sometimes address larger issues, such as school and water issues. Social capital in Kelsey is demonstrated by the community coming together to meet at various community events, such as the Kelsey school breakfast program and the collaboration that occurs to host the community farmers' market.

Vulnerability to natural disasters were commonly cited concerns that lowered capacity scores in El Dorado County. American River Canyon was rated as the lowest in the county due to scarcity of resources and threat of wildfire, with overgrown roads and limited evacuation routes. Fire evacuation capacity concerns were cited for a number of communities, including Auburn Trails, Cool/Pilot Hill, Mosquito/Swansboro, Placerville, and Somerset/Outingdale. Concerns included lack of egress routes, lack of reliable cell service or broadband internet, and poorly maintained roads.

Communities including Grizzly Flats/Omo and Somerset/Outingdale also cited community social and health concerns over increased homeless encampments, dumping, and drug use along river corridors. These issues pose hazards to downstream communities from sediments and contaminants that reach the river, and there is a lack of community capacity to respond to them. Another common concern cited in the county was worry over private wells running dry.



INYO COUNTY



On average, Inyo County had lower community capacity scores relative to the SNC region as a whole. The average score was 2.6, compared to a regional average of 2.9, with scores ranging from 1.5–3.5. Scores generally declined moving from the northern portion of the county to the south.

Bishop, as the highest-scoring community in the county, has been called the hub of the Eastern Sierra, and was described by participants as being the strongest in the county in terms of resource availability and resilience. It is a regional center for state and federal offices, and participants noted that the city is able to provide services and remain financially balanced. However, participants noted a lack of capacity to expand services or commit capital to nonessential projects, such as downtown revitalization, tourism amenities, etc. While there is some private capital in the community, there is a lack in methods for philanthropists to invest in the area, specifically in regard to a lack of infrastructure

to support awareness of planned giving and estate donations. One participant noted that it is a popular destination for enthusiastic and educated individuals, but the realities of living there (housing being a notable challenge) make it hard to retain people.

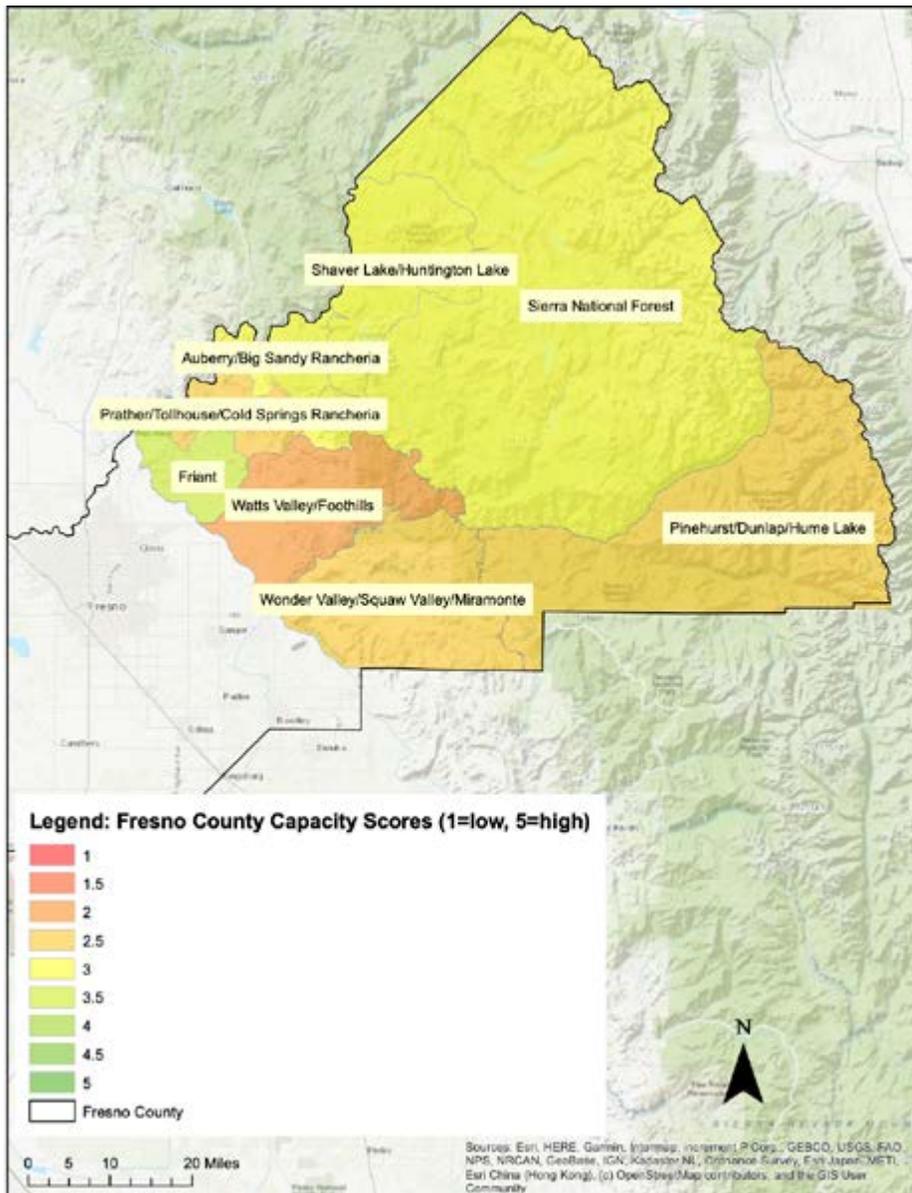
Big Pine/Independence and Greater Lone Pine were both given a score of 3, or a medium level of capacity. Both Big Pine and Independence were described as being very self-sufficient, with a culture of independence to the point that officials reported pushback to holding meetings in Bishop. Both areas are also unincorporated with sparse populations, which contributes to a scarcity of resources. Participants also expressed concern over the disconnect existing between the tribal community and the rest of the community. For Greater Lone Pine, community experts emphasized an endearing and productive element to the area's human and social capital, with an ability of residents to take advantage of the capital that does exist. This was exemplified by the development of a healthcare delivery system, which took advantage of an almost defunct hospital and skilled nursing community. One participant noted that there might be more

capacity here than what is obvious from an outside perspective.

Olancha/Cartago/Kennedy Meadows and Death Valley were given the lowest scores in the county. Both areas are very isolated with low population densities and a strong sense of individuality. The community made up of Olancha/Cartago/Kennedy Meadows reportedly experiences low levels of infrastructure capital and availability of funding for public use. Notably, a decrease in the youth population resulted in the local school closing many years ago, and there is no access to basic services closer than Lone Pine. Regarding Death Valley, the community is largely Death Valley National Park, which means that there is an ebb and flow of the population base with the tourist season. Financial capital here is mixed due to varying levels of tourism, the presence of large corporations, and substantial mining operations.



FRESNO COUNTY



Fresno county had many scores reflecting a medium level of capacity, with scores of 2.5 and 3 being the most common. The county average capacity score was 2.7, which is slightly lower than the average for the SNC region of 2.9. Generally, communities in the northern portion of the county scored higher than those in the south. It is important to note that only communities within the SNC region were scored, meaning that the entirety of Fresno County was not included in this assessment.

Friant was the highest scoring community in the county, largely due to massive development in recent years. There is also strong, tribal involvement in this community and the Table Mountain Casino possesses a high level of financial capital. There are still challenges, though, as stakeholders described poverty in the community despite pockets of wealth, as well as a culture clash between recent development and the traditional foothill lifestyle.

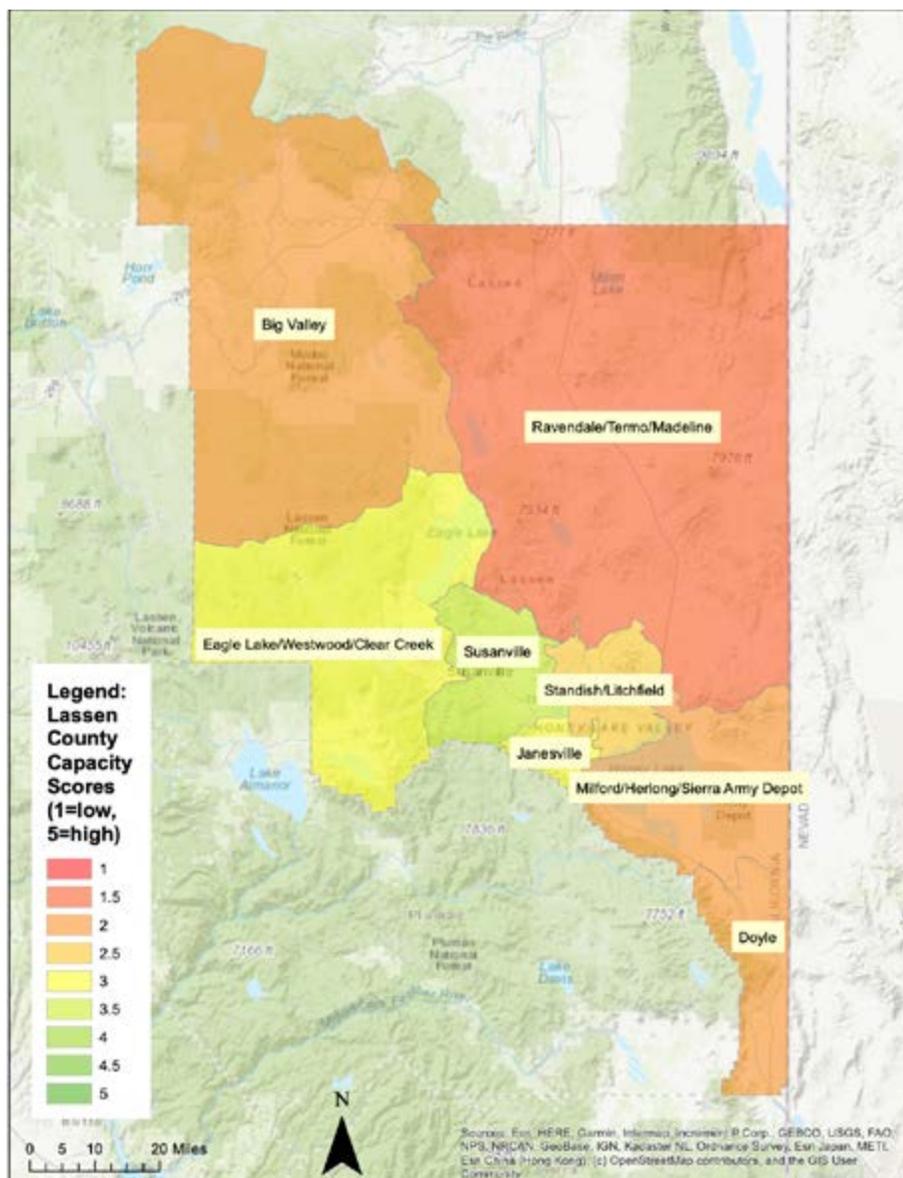
Of all the communities, participants identified Auburn/Big Sandy Rancheria as the social, human, and cultural center of the region, due to the presence of PG&E's hydroelectric headquarters, various churches, and the Mountain Press newspaper headquarters in Auburn. Wealth disparities were commonly reported throughout the county and in this community, and they are even greater closer to the Cold Springs Rancheria and Big Sandy Rancheria, despite the presence of a casino and the economic stimulus it brings.

The Shaver/Huntington Lake community is home to a solid recreational industry, however, human, cultural, and social capital are impacted by a seasonal absentee population, which is reliant on tourism. The Sierra National Forest community is largely composed of USFS personnel living temporarily in the area. USFS personnel and locals reportedly have a tenuous connection, but, nevertheless, they share a culture dependent on the forest. Increased internet access was recommended as a service to broaden connections between small enclaves in the area.

In the southern portion of the county, Watts Valley/Foothills, Wonder Valley/Squaw Valley/Miramonte, and Pinehurst/Dunlap/Hume Lake were all described as having relatively lower capacity compared to communities in the north, given the rural nature of the area and low population numbers. Hume Lake, however, was identified as a notable outlier but (due to census tract limitations) was scored in consideration with Pinehurst and Dunlap.



LASSEN COUNTY



The average capacity score for communities in Lassen County was 2.5. Communities that scored low to medium-low levels of capacity in the county were Doyle, Milford/Herlong/Sierra Army Depot, Standish/Litchfield, and Big Valley. All these communities, while faced with their own unique capacity challenges, share many similarities in that they are all isolated, rural areas with sparse populations, low levels of financial capital, limited economic opportunity, and inadequate physical infrastructure. There is generally a shared culture of living in an isolated, rural area, with workshop participants noting that many residents enjoy the solitude that these communities offer.

There are positive indicators of social capital in that residents tend to look out for their neighbors. Herlong specifically has many active social groups, with town hall gatherings to discuss issues. There is some nostalgia for when Herlong was a thriving community, and residents will often talk of the “good old days.” As one stakeholder

commented, “there is a sense of despair but hope for better things to come.”

Eagle Lake/Westwood/Clear Creek and Janesville were both rated as having a medium capacity to respond to stressors. Westwood and Clear Creek in particular were given this rating due to high social capital. While these communities are lower in income, workshop participants pointed to good attendance at meetings and public events, long-established residents, strong community leaders, and resources like the Chimney Fund and Family Resource Center. In Janesville, community residents reportedly gather amicably, with strong participation in community meetings. However, like in many rural areas, this capacity is still limited given the small nature of the community, and many residents manage stressors with little or no help from others.

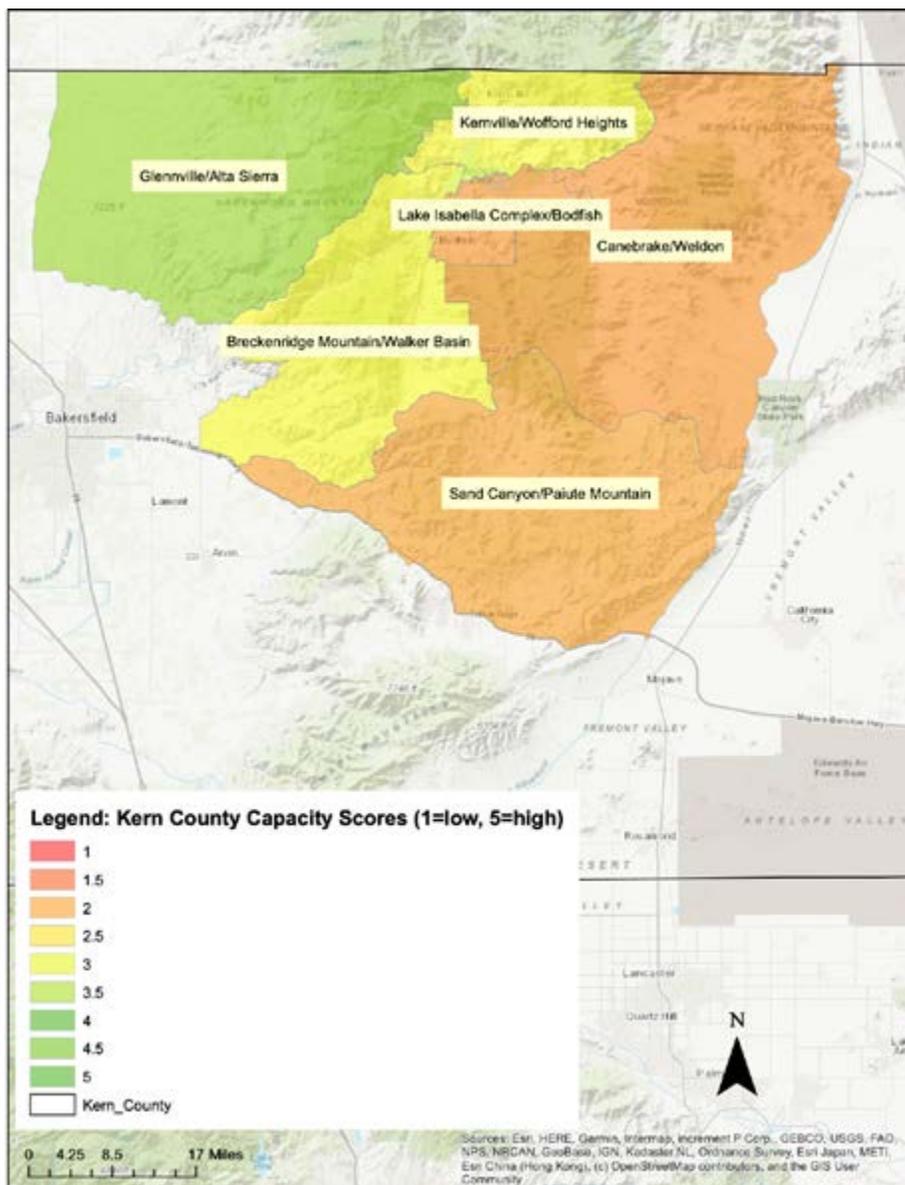
Stakeholders agreed that Susanville has the most overall capacity, particularly financial capital, of any community in the county. There are many individuals and groups that are staunch advocates for the region. However, complacency and lack of funding (despite having relatively high financial resources compared to other communities in the county), economic opportunities, revitalization, and workforce were identified as

the largest challenges. Workshop participants agreed that the community will come together during difficult times, but participants commented that in general there is a lack of organization and collaboration, without a shared goal for positive change.

Lassen County had an average capacity score of 2.5, with no community scoring higher than 3.5. This average is lower than the SNC region as a whole, which had an average capacity score of 2.9. The Ravendale/ Termo/Madeline community was the lowest scoring community in the county; Susanville scored the highest.



KERN COUNTY



Kern County had an average capacity score of 2.6, which is lower than the average of 2.9 for the SNC region as a whole. The most common, and lowest, score was a 2, which was assigned to the communities of Lake Isabella Complex/Bodfish, Canebrake/Weldon, and Sand Canyon/Paiute Mountain. Breckenridge Mountain/Walker Basin and Kernville/Wofford Heights both received scores of 3, indicating medium capacity. Glennville/Alta Sierra, with a score of 4, was the highest-scoring community in the county. Please note that this assessment only included communities in Kern county within the SNC region.

Canebrake/Weldon and Sand Canyon/Paiute Mountain were rated relatively low for similar reasons. Both communities are sparsely populated, with low levels of infrastructure, including mostly dirt roads. Lake Isabella and Bodfish suffer from low levels of financial capital and consist of primarily low-income families. Stakeholders identified that people in this community have difficulty in coming together to take care of

the needs of the community, which, according to one participant, is “because so many people are struggling just to take care of themselves and their families.” Utilities and other services were also reported to be fairly expensive, including a high cost of water and trash service, gas, groceries, and housing. Housing costs used to be cheaper compared to surrounding areas, but costs are rising..

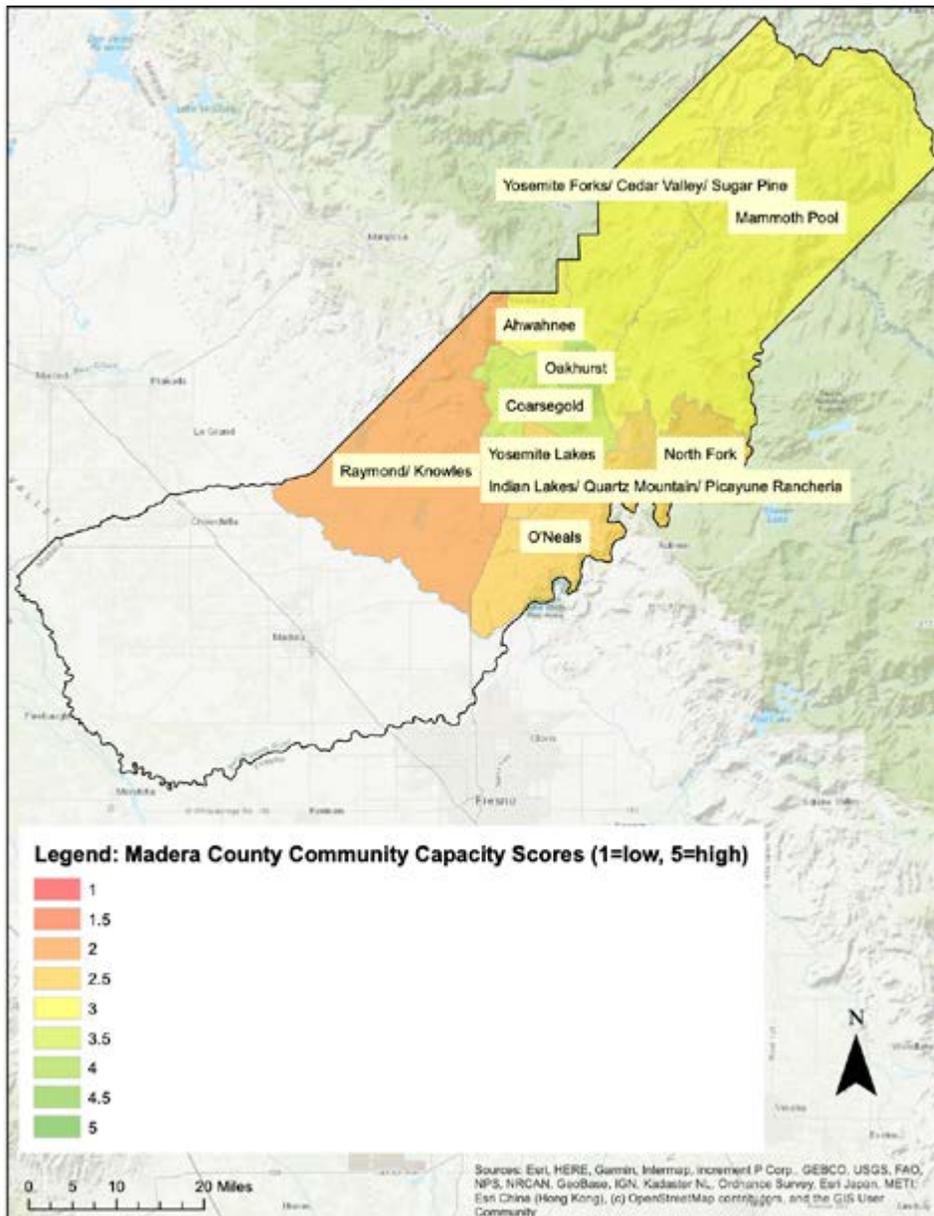
Kernville/Wofford Heights were rated at a medium level of capacity but represent mixed capital. The Kern River Valley is generally a depressed area socioeconomically. Kernville, however, was characterized as the least depressed of the communities in the area, with a fair level of social capital through strong community pride and volunteer-based organizations. However, for other communities in the area, including Wofford Heights, Lake Isabella, and Bodfish, one participant noted that “If it’s not Kernville, we’re all kind of in the same boat.” There is a similar dynamic in that these areas lacking in financial capital and economic opportunity share a survival mindset that tends to limit participation in community-oriented events and

activities. There are serious income gaps present between Kernville and Wofford Heights, with students of different means attending school together and living within a few miles of each other.

Glennville/Alta Sierra received the highest rating of Kern County communities in the SNC region. It was characterized as being tight-knit and like-minded, with a combination of permanent residents and vacation homes. People reportedly tend to come together to meet community needs, and this sense of community was clear when they worked together with the fire department to save their community during the French Fire in 2021. Specifically in Alta Sierra, there is also a community group that works together to meet many of their own infrastructure needs (e.g., water, internet, snow plowing, etc.).



MADERA COUNTY



Madera County scores are normally distributed, with all communities scoring in the 2–4 range, a score of 2.5 and 3.0 being the most common. On the whole, Madera County has middling scores, closely aligning with the SNC regional average community capacity score of 2.9. The community of Raymond/ Knowles possesses the lowest community capacity with a score of 2, while the community of Oakhurst has the highest capacity with a score of 4.

As the highest-scoring community, Oakhurst is more city-like compared to other rural parts of the county, with plenty of investment in area businesses. Oakhurst is perceived as being able to leverage resources from other communities, possessing knowledgeable, educated residents to address local issues, and having unified neighborhoods with several social groups that meet and share knowledge (e.g., Rotary Club). However, while Oakhurst has many opportunities, challenges remain from a

number of subcommunities with needs and limited funding. Oakhurst is situated in the mountains, though it is more urban than other surrounding communities. Workshop participants discussed how the county does not address many issues in the mountains; rather, the county tends to focus efforts in the valley. Community experts characterized the neighboring community of Ahwahnee as an area “suffering from rural foothill challenges,” including low financial capital and inadequate infrastructure, though the community has demonstrated an ability to manage and participate in funding opportunities. Led by a couple of neighborhoods with higher human capital, Ahwahnee successfully completed several development projects, including Ahwahnee Park.

Coarsegold was another relatively high-scoring community. Despite a limited tax base and small dispersed population, there is a town center that helps to maintain the local culture, and the annual rodeo is an important community event in town. There is also a veteran’s memorial, peddlers fair, and a farmer’s market. Relative to other Madera communities, Coarsegold is located en route to Yosemite National Park,

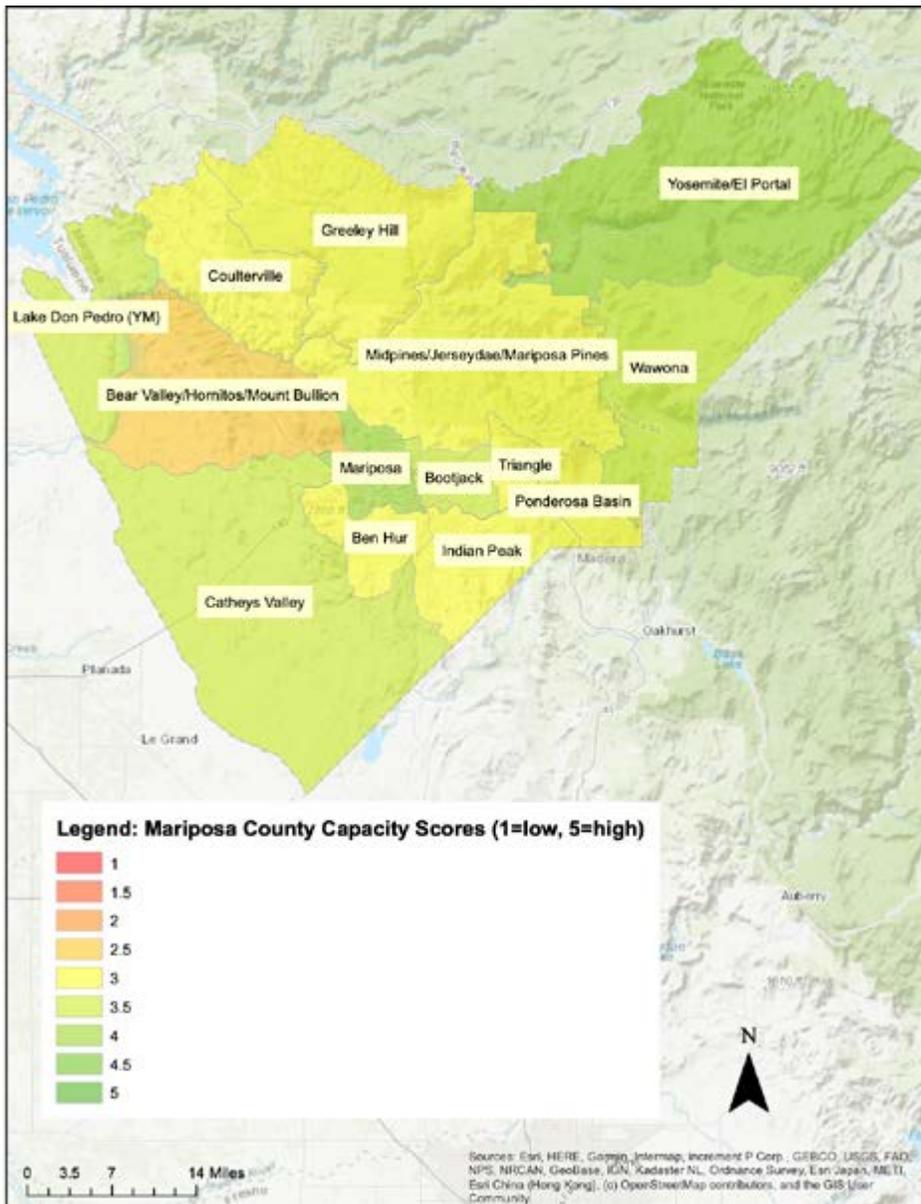
presenting access to tourist dollars and less isolation compared to other communities in the county, such as North Fork or Raymond.

While North Fork scored relatively low, participants also noted strengths in the area, including a good deal of investment in the community and residents who strongly identify with being from North Fork. Raymond/Knowles was characterized by participants as “disadvantaged,” owing to limited capacity, “low social enthusiasm to improve,” inadequate infrastructure, and a community that is deteriorating. Concerns were expressed regarding the low population and how that affects the community’s competitiveness for funding opportunities. Nonetheless, the aging infrastructure and low population make infrastructure repairs expensive, with limited opportunities for collaboration or consolidation due to the remote location.

Respondents also highlighted the importance of collaboration with Native tribes in the county, including engagement with the logging industry, Forest Service, resource conservation districts, and other volunteer groups.



MARIPOSA COUNTY



Community capacity scores for Mariposa County are not normally distributed, with all communities scoring in the 2.5–4 range, a score of 3 being the most common. With no communities scoring below 2.5, and an average county capacity score of 3.25 versus the SNC regional average of 2.9, Mariposa County is one of the highest-scoring counties in the region.

Known as the “Gateway to Yosemite,” and economic center to a number of successful businesses, the Mariposa community was viewed by participants as one of the highest-capacity areas in the county, with an unwavering sense of identity. High levels of social and cultural capital were persistently reported for higher-scoring communities in the county, with a varied population possessing diverse knowledge, skills, and abilities. Strong social capital in the Mariposa community is demonstrated by the community coming together during the fire and floods of recent years (e.g., the Detwiler Fire in 2017), and through strong community participation in

volunteer groups and associations, the community fair, and the butterfly festival.

Respondents for the Ben Hur community also mentioned various indicators of high social capital, including neighbors looking out for each other during fire evacuations, community members watching for escaped livestock, established families with strong local knowledge of community history, and community-supported events in Long Ranch, such as hikes, classes, and civil war reenactments. In Yosemite/El Portal, community members tend to identify with the park on some level and will reportedly come “out of the woodwork” when things need to be done. Participants noted that people feel Yosemite is a special place to live, recreate, and work. These are just a few examples, but communities throughout the county consistently mentioned strong support for community events and organizations, shared values, and a unified cultural identity as demonstrative of a higher level of capacity.

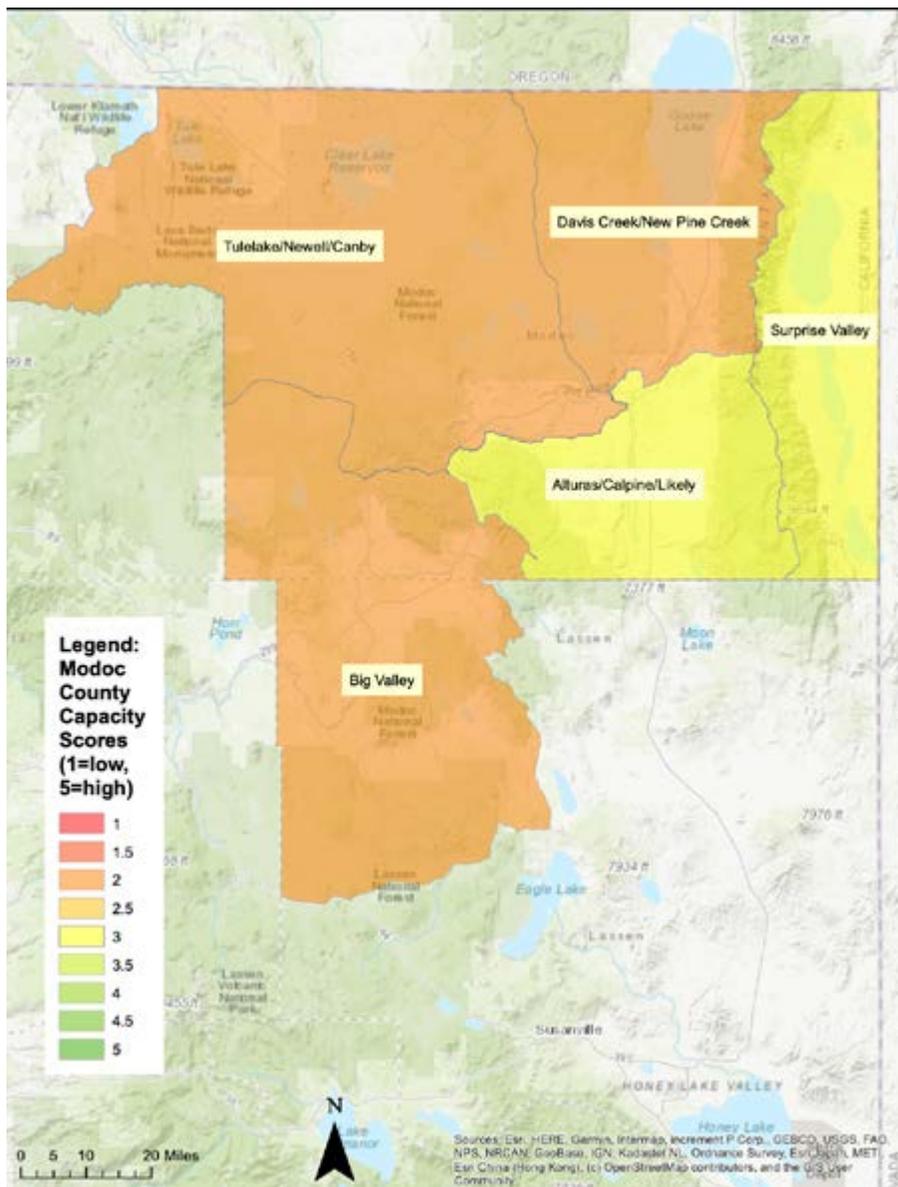
However, concerns were consistently raised regarding disparate levels of financial capital and communities

lacking physical infrastructure. The community of Bear Valley/Hornitos/Mount Bullion received one of the lowest scores in the county, with respondents reporting pockets of impoverishment as well as issues with internet and phone connectivity, poorly maintained roads (except the roads that are the responsibility of CalTrans), poor conditions of water and sewer systems, and a lack of schools or post offices in the area. The communities are situated in an area prone to fire and flooding, which can wash out roads. Catheys Valley also reportedly contains pockets of concentrated wealth and lacking infrastructure, citing a lack of potable water at the city hall and school. Participants also described this community as being vulnerable to wildfire, with minimal county support for weed abatement, creating defensive space, and road/erosion control. From a park ranger's perspective, Yosemite has a huge unmet need for sufficient funds to hire staff to improve and protect the park. Access to housing, health care, infrastructure, and other issues make the Yosemite/El Portal community a difficult place to live long-term.

Tree mortality, and a lack of ability to address the issue, was also frequently cited as a stressor for various communities in Mariposa County, including Ponderosa Basin, Midpines/Jerseydale/Mariposa Pines, and Triangle. Triangle in particular has reportedly been devastated by pine beetles, drastically altering the community's visual image from the lush landscape they were previously known for and creating a buildup of biofuels in the forest from three years of pine beetle attacks.



MODOC COUNTY



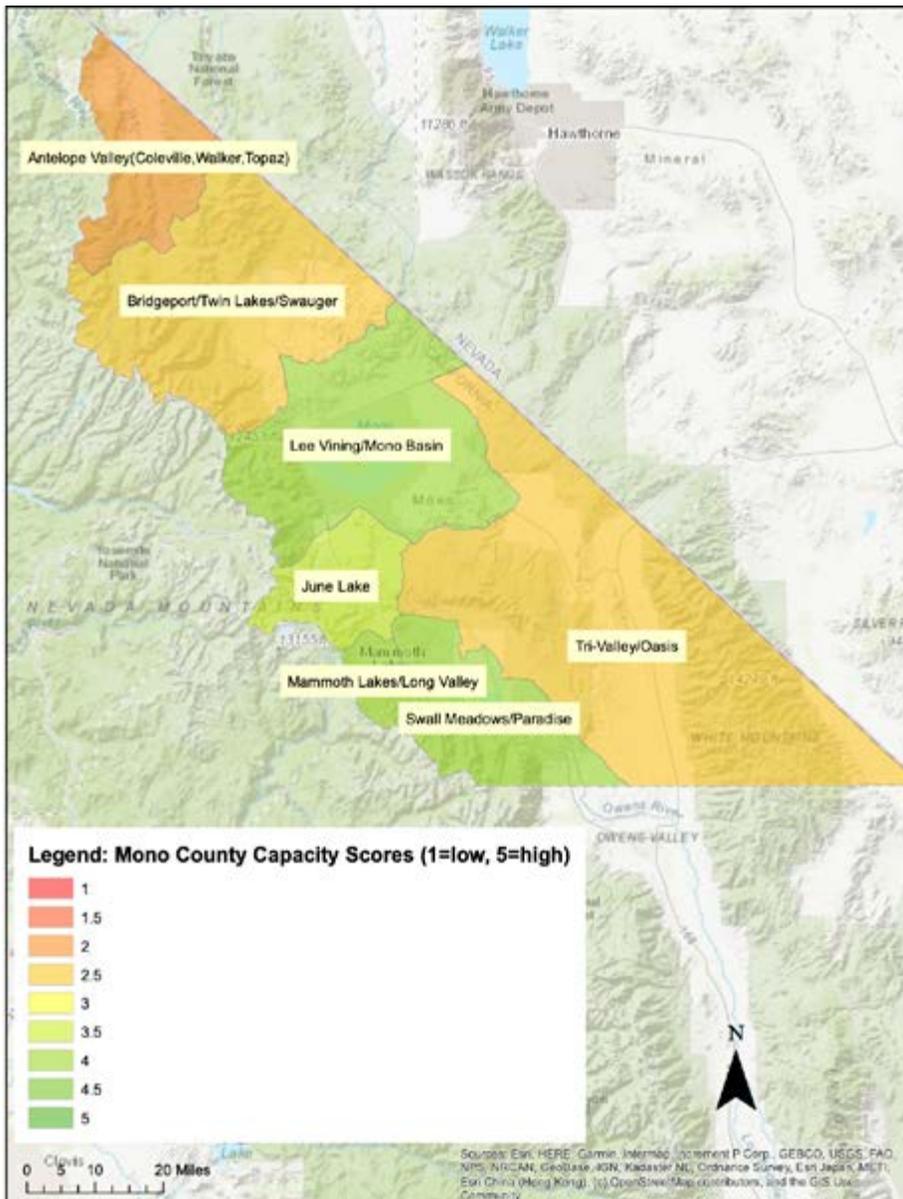
Modoc County community capacity scores were all within the range of 2-3, with an average score of 2.4. Workshop participants identified the area as having medium-low to medium ability to respond to stressors. Notable is that some communities (Tulelake/Newell/Canby and Big Valley) extend beyond county boundaries. Input from county officials concluded that the Tulelake community encompasses part of Siskiyou county, and Big Valley includes a portion of Lassen county.

The average capacity score for Modoc County was 2.4, slightly below the entire SNC region average of 2.9.

Communities rated with relatively higher levels of capacity in the county tended to have higher levels of social capital through successful programs, community organizations, and dedicated community members committed to seeing these areas grow, in spite of often limited financial resources. However, common concerns of lacking capacity in the county

included physical infrastructure, specifically housing and high-speed internet, needed to attract new residents to the area. Workshop participants also noted concern that there did not seem to be new generations moving in to replace the old ones.

MONO COUNTY



The average community capacity score in Mono County was 3.2, giving it a higher average capacity than the SNC region as a whole, which was 2.9. Lee Vining/Mono Basin, Mammoth Lakes/Long Valley, and Swall Meadows/Paradise were identified as having the highest levels of capacity in the county, with Antelope Valley (Coleville, Walker, and Topaz) scoring the lowest.

Antelope Valley scored low, and it was described by participants as one of the poorest communities in the county. The community was recently devastated by the Mountain View Fire in 2020. Many residents who lost their homes in the fire are choosing not to rebuild—or cannot afford to rebuild—and are relocating from the area. Many had issues with being underinsured or uninsured. However, this area was rated more highly in regard to social capital, given that residents came together really well after the Mountain View Fire. There is also reportedly a dedicated set of community activists who are involved in addressing issues. But, as with

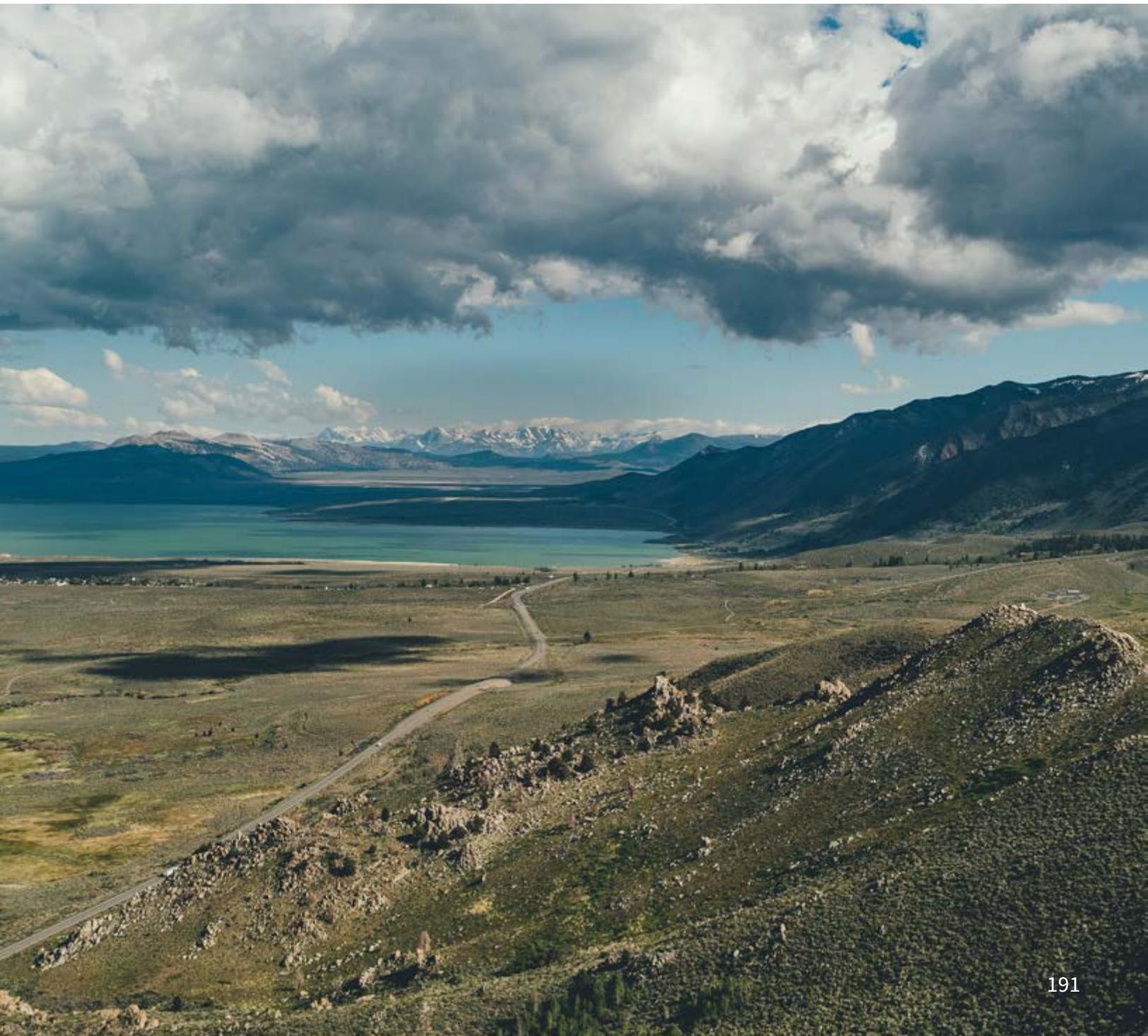
many rural areas, this tends to be the same small group of a few people facing challenges of burnout and changing community dynamics when the demographic ages out or long-time residents move away.

Tri-Valley/Oasis was also rated low, but with a culture distinct from the rest of the county. This community is much more rural, sparsely populated, and heavily influenced by agriculture. Residents here tend to be wary of outsiders, which can make it difficult to provide assistance, despite the fact that there are lower incomes and real estate values, and many individuals are focused elsewhere for work.

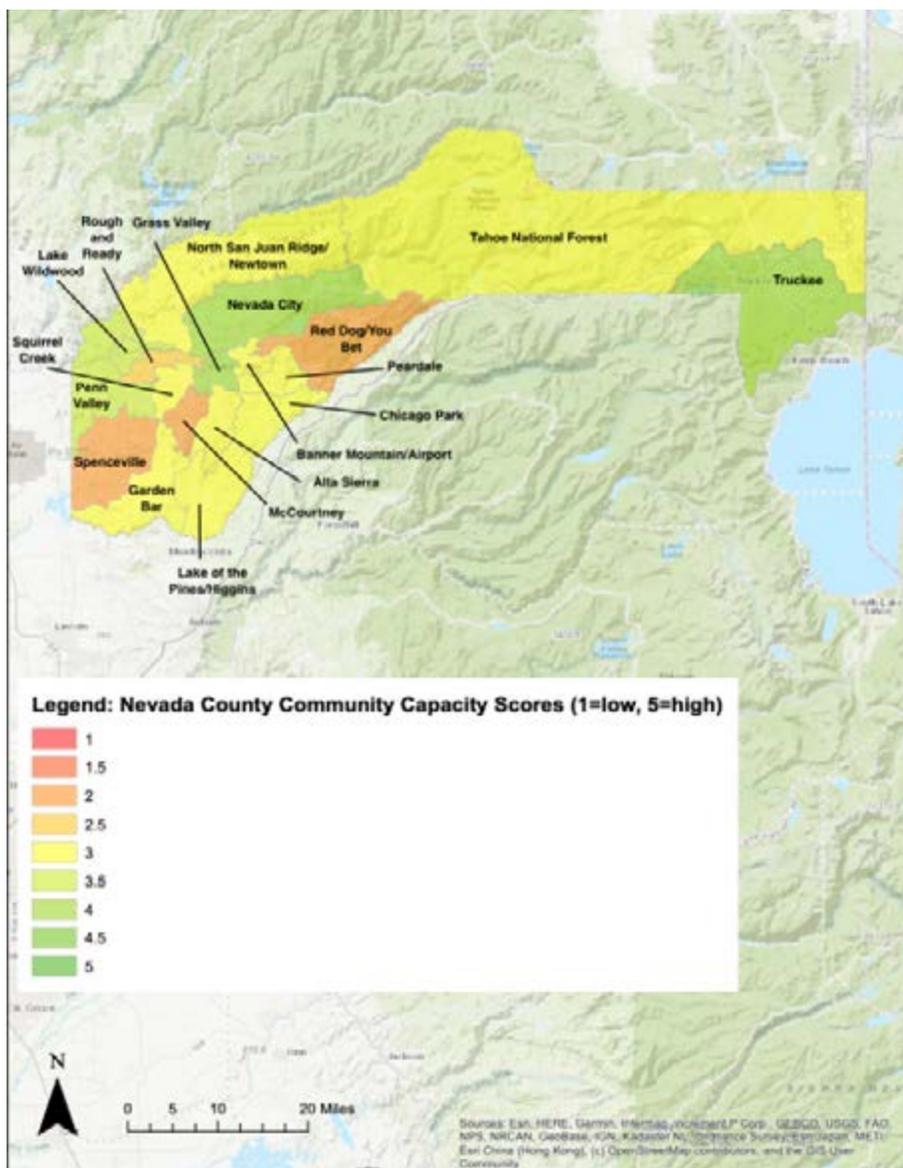
Lee Vining/Mono Basin, Swall Meadows/Paradise, and Mammoth Lakes/Long Valley were rated as the highest-capacity communities in the county. Mammoth Lakes/Long Valley and Swall Meadows/Paradise in particular were characterized as having very high levels of financial capital resulting from high-income residents, high-income visitors (and second-home owners), community foundations, and other

organizations. When the 2015 Round Fire impacted Swall Meadows, there was a tremendous outpour of financial support for those who lost their homes. These areas also reported high levels of human, social, and cultural capital, with residents being very knowledgeable, engaged, and willing to contribute time and effort to community interests. Culturally, Mammoth Lakes and Long Valley in particular were characterized as mountain towns, with mountain culture. This is why most people live, play, and recreate there. However, the high expense of living and recreating there also limits the inclusion of all people. Participants commented that the entire region lacks in racial diversity, and more focus needs to be placed on the integration and inclusion of their Hispanic community.

A lack of adequate egress routes was communicated multiple times as a concern for physical capital. Swall Meadows/Paradise and June Lake only have one route for emergencies, prompting concern over highway closures during emergency events such as blizzards or wildfires.



NEVADA COUNTY



Communities in Nevada County were often characterized as having a medium level of capacity, with an average and most common score of 3. This is closely aligned with the average score of the SNC region overall. Some higher scoring communities are located closer to the greater Sacramento area and foothills, where commuting to work in the city is common. Other, more rural areas deeper in the Sierra Nevada exhibit lower scores due to contributors like lower population, reduced financial capital, and poor infrastructure. The county has benefited from urban development despite the distance of some communities from the metropolitan areas of Sacramento and Reno.

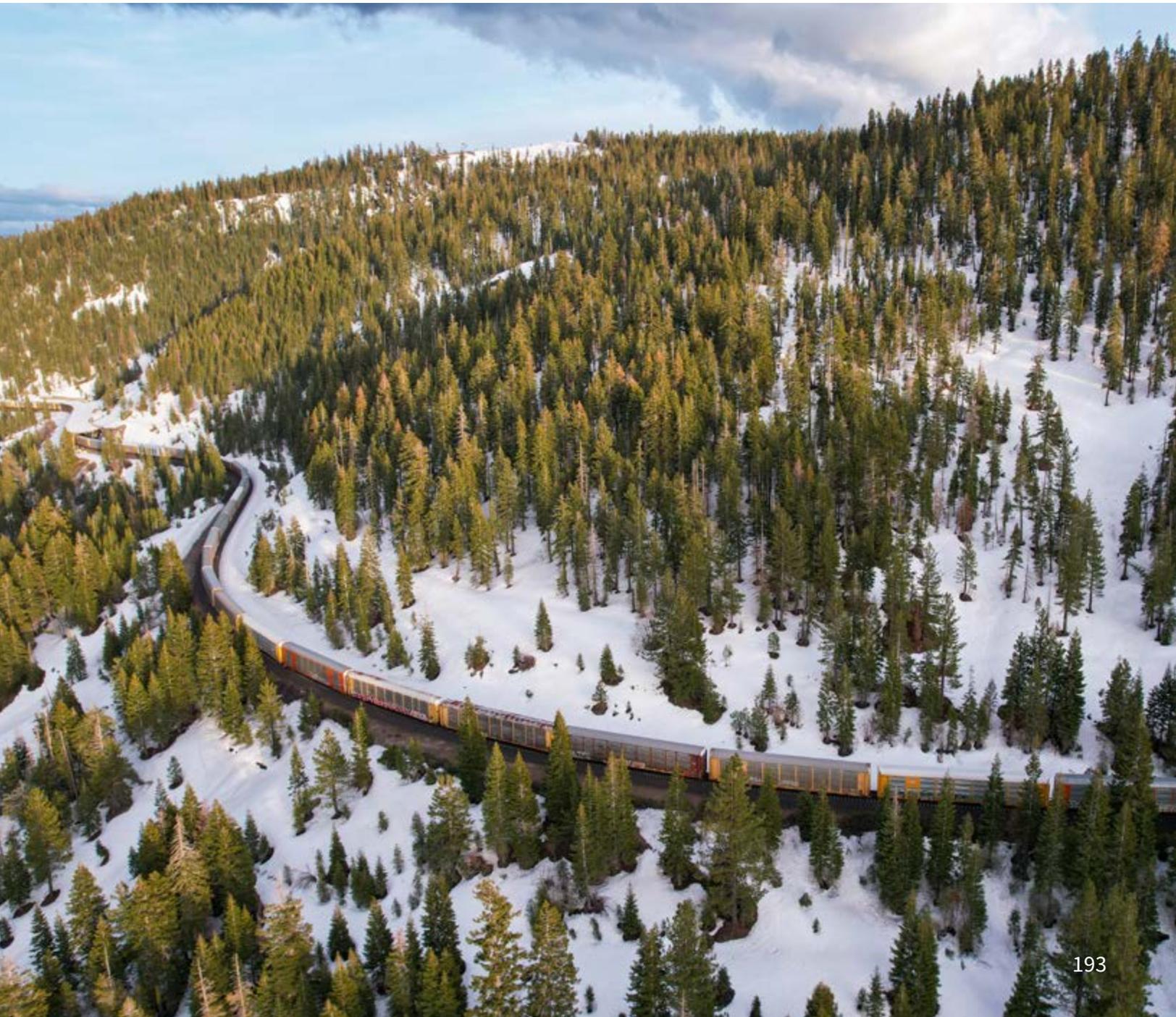
There is a dichotomy present in the county between the influence of urban interests from commuters and new retirees and that of longtime residents with rural backgrounds. Chicago Park, for example, was reported to contain a mixed group of residents, some of whom are newer and moved from

urban areas while others are older residents who work or formerly worked in forestry or agriculture. In Grass Valley, stakeholders reported the presence of longtime residents who struggle to survive economically, and who tend to resent the retirees that can afford to live comfortably in the community. This was also reported for the communities of McCourtney and Nevada City, both of which were characterized as displaying a diversity of socioeconomic well-being with a contrast between thousand-acre horse ranches and older trailers on small parcels, as well as between well-heeled retirees and long-term residents living on a shoestring budget.

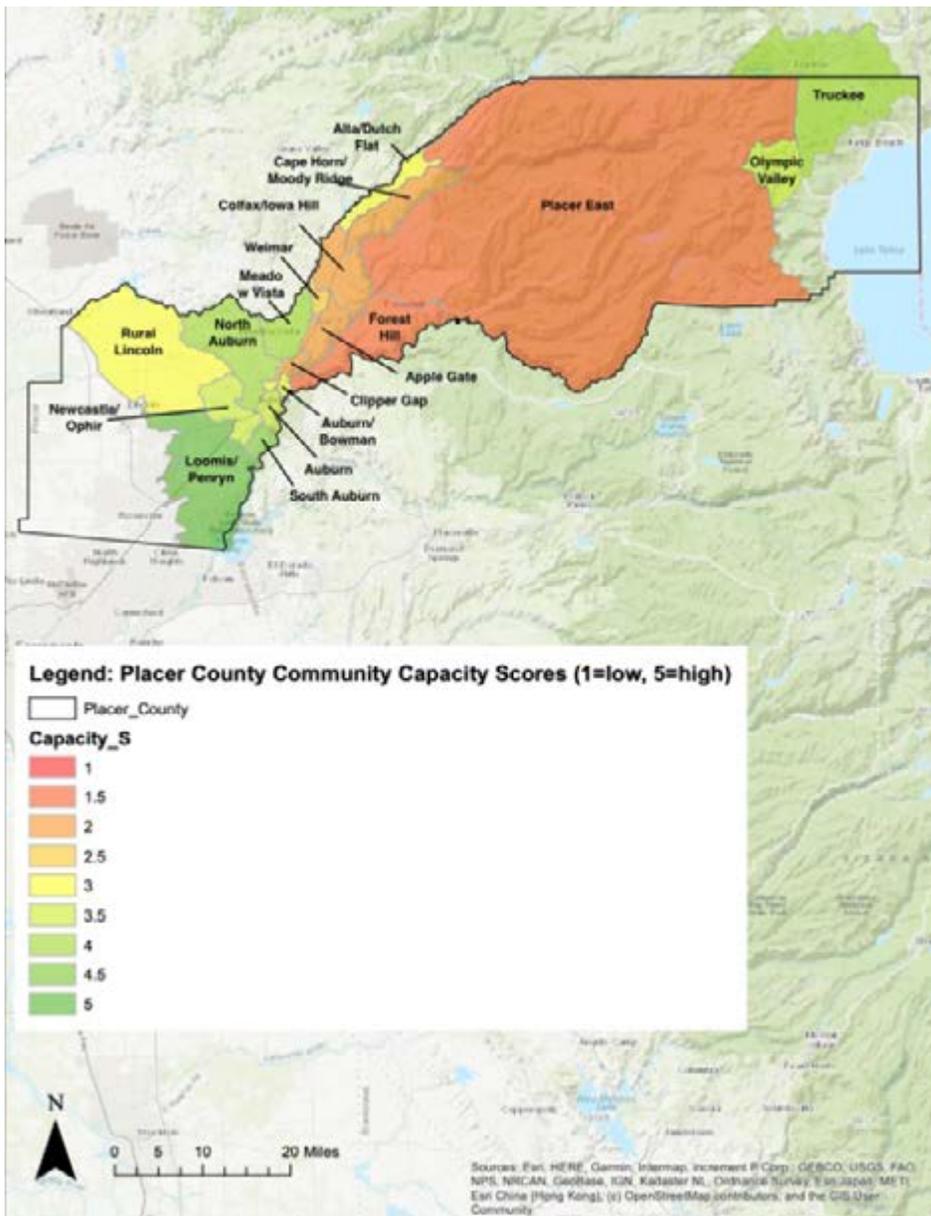
A common capacity strength in many of these communities was an ability to organize and establish community events and gatherings. It was recognized that for many areas, community residents would be able to effectively leverage funding were they to receive it. San Juan Ridge is an example of this, with a strong “ridge” culture and unity, as one participant noted, “If they had funding, these people could mobilize and do something great.” Truckee and Grass Valley were also both characterized as having high levels of social and cultural capital through the presence of effective community organizations and civil engagement.

In Penn Valley, residents come together through events like the Penn Valley Rodeo, Easter egg hunt, and through community groups such as the Penn Valley Park District, Chamber of Commerce and Municipal Advisory Council. Overall, participants believed that these communities have the overall capacity to respond well to external and internal stressors given their high level of social, cultural, and human capital, despite pockets of poverty.

However, for some of the more rural communities in the county, such as Red Dog/You Bet, Rough and Ready, and Squirrel Creek, there persists a culture of independence and a desire to be left alone. Human capital in these areas may be offset by a lack of shared services.



PLACER COUNTY

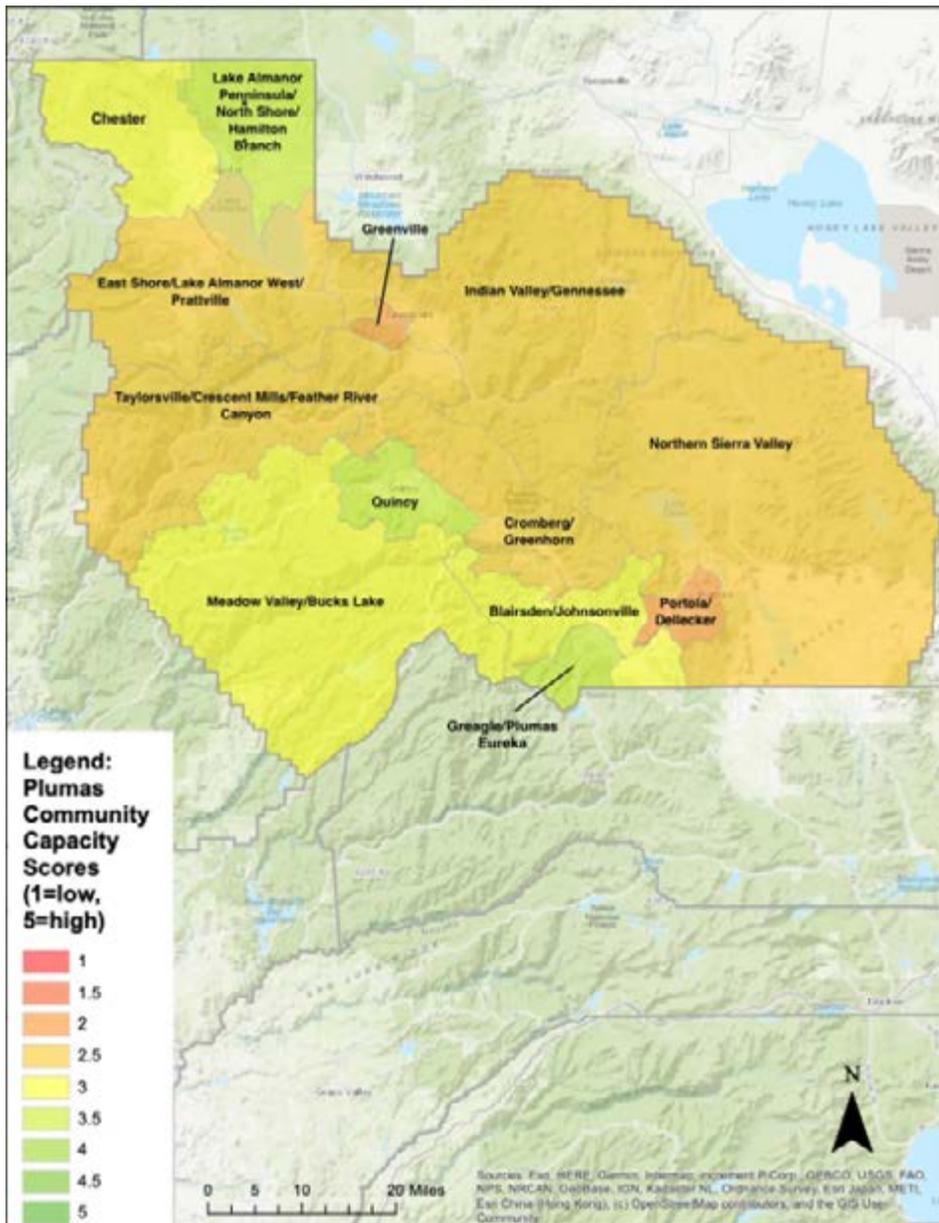


Communities in Placer County had an average community capacity score of 2.9. There are a number of high-scoring communities in the county that were rated as having a medium-high to high level of capacity to respond to stressors, meaning that they scored between 4 and 5. These communities included Loomis/Penryn and Meadow Vista, both of which were characterized as having a number of wealthy people residing in the community, with high levels of education. Auburn and surrounding communities were also rated relatively high. Auburn is growing as a result of the influx of people moving from high-density population areas. However, participants noted that more infrastructure is needed to handle the population influx.

Communities of lower capacity in the county, including Placer East, Forest Hill, and Clipper gap, are more rural, with dispersed populations. In Placer East and Forest Hill in particular, a large portion of the land is owned by the United States Forest Service,

Bureau of Land Management, or California State Parks. As with many rural Sierra communities, contraction of the timber and mining industries have left these communities without economic bases to support community residents. Infrastructure challenges also persist. In the Colfax/Iowa Hill community, for example, participants reported that residents just recently received phone service but still lack integrated systems for water, sewer, and power. Everyone relies on generators, wells, and septic systems, and roads in Iowa Hill are maintained by the county. The school recently closed due to a lack of students.

PLUMAS COUNTY

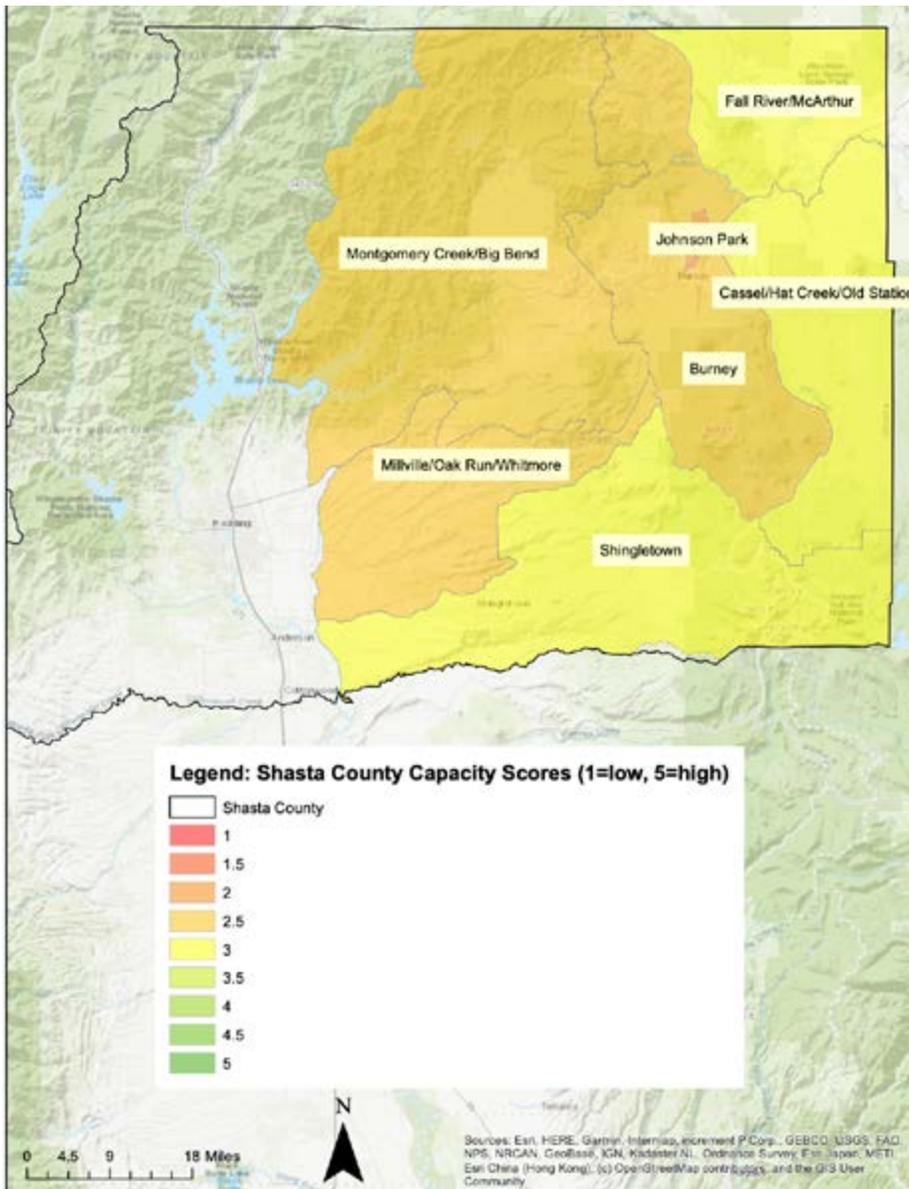


Community capacity ratings in Plumas County ranged from 2 to 3.5, with 2.5 being the most common score. This overall medium-low capacity score reflects the rural, sparsely populated areas that are common throughout the county. Quincy was recognized by workshop participants as one of the high-capacity communities, its location as the county seat and a relatively higher presence of young and educated professionals contributing to its enhanced capacity.

Communities with lower scores commonly cited issues with severe poverty and infrastructure challenges as contributors to low capacity, with the need for improvements for schools, sewers, and drinking water. As with many rural areas, there are pockets of wealth throughout Plumas County, and these can skew county-level measures, like MHI statistics for sparsely populated areas. In the Lake Almanor Peninsula/North Shore/Hamilton Branch community,

for example, workshop participants noted that extreme wealth in Hamilton Branch and some parts of the Peninsula contrasted with poorer residents located in the North Shore and other parts of the Peninsula. This is also true for other communities in regard to the presence of large ranches and wealthy landowners.

SHASTA COUNTY

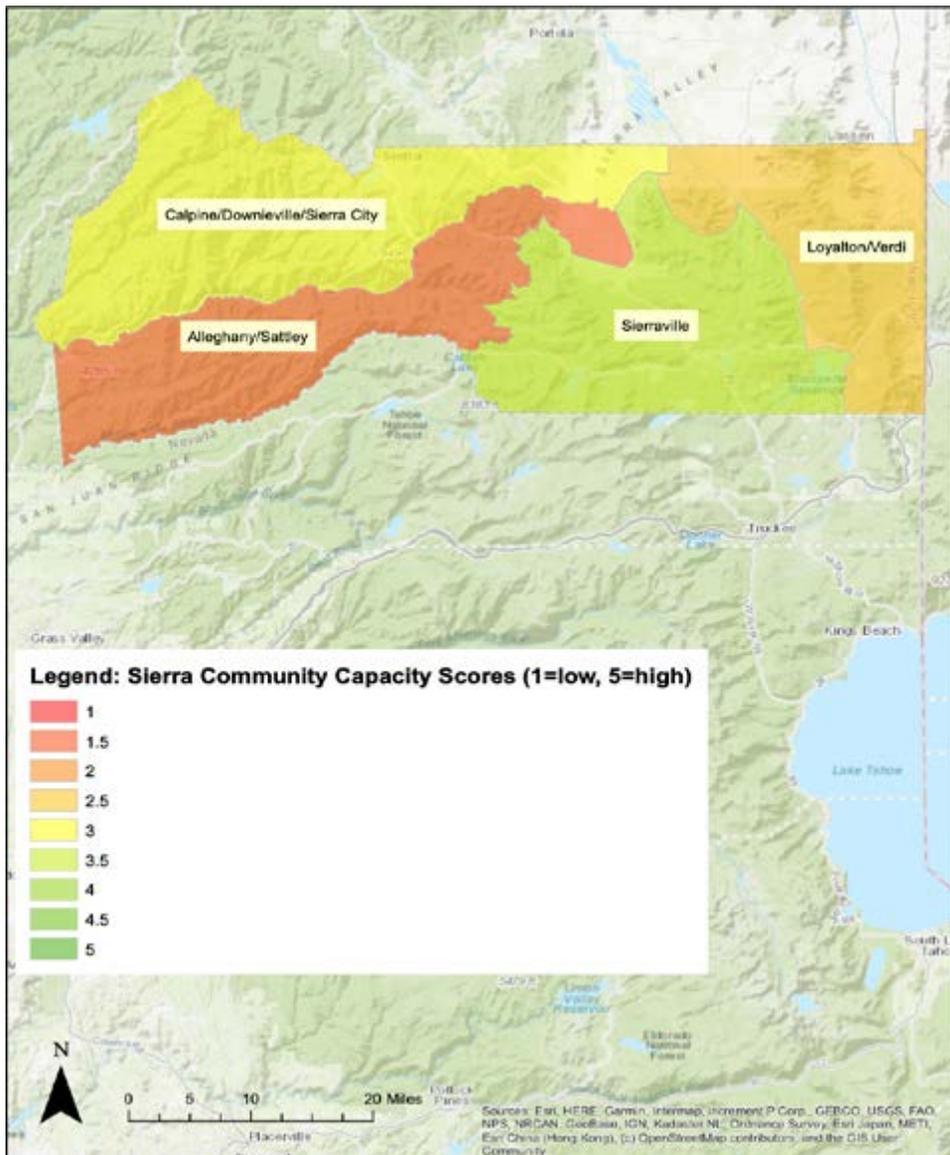


Community assessment in Shasta County was conducted for communities within the SNC region, which includes only those communities east of Redding. For this portion of Shasta County, the communities of Cassel/Hat Creek/Old Station, Fall River/McArthur, and Shingletown were the highest capacity communities in the area with a score of 3, underscoring the generally lower capacity scores for communities in the area.

Many lack the array of resources and resident involvement in diverse activities that characterize high capacity communities. Burney, Montgomery Creek/Big Bend, and Millville/Oak Run/Whitmore, with a capacity score of 2.5 (a medium-low rating) were the second-highest rated capacity communities in the study area. Johnson Park was rated a 2, mainly because it is geographically compact and offers limited local town services, and because residents don't come together much as a community, since many activities are absorbed by nearby Burney.

As is true of many rural places, according to interviewees and workshop participants, there are a handful of people who tend to get things done, but this trend varies from one community to another. Shingletown in particular was noted as having an impressive level of social capital due to an active town council, but it still reportedly comes down to a handful of people. In Burney/Johnson Park and Hat Creek/Cassel/Old Station, there is limited citizen engagement in PTA and the volunteer fire department. In Big Bend, workshop participants recognized that people tend to come together to help their neighbors, but resources are limited. Overall, sports rivalries and a few big events such as Burney Basin Days and the Inter-Mountain Fair bring these communities together in support of schools, the volunteer fire department, or other groups. Fall River/McArthur has more resources and a stronger culture that contributes to community pride and engagement compared to some of the other communities. Wealthy celebrity second-home owners and vacationers (who helped fund the new hospital), along with high-capacity retirees and long-standing ranching families, help cultivate active community organizations and maintain infrastructure and amenities.

SIERRA COUNTY



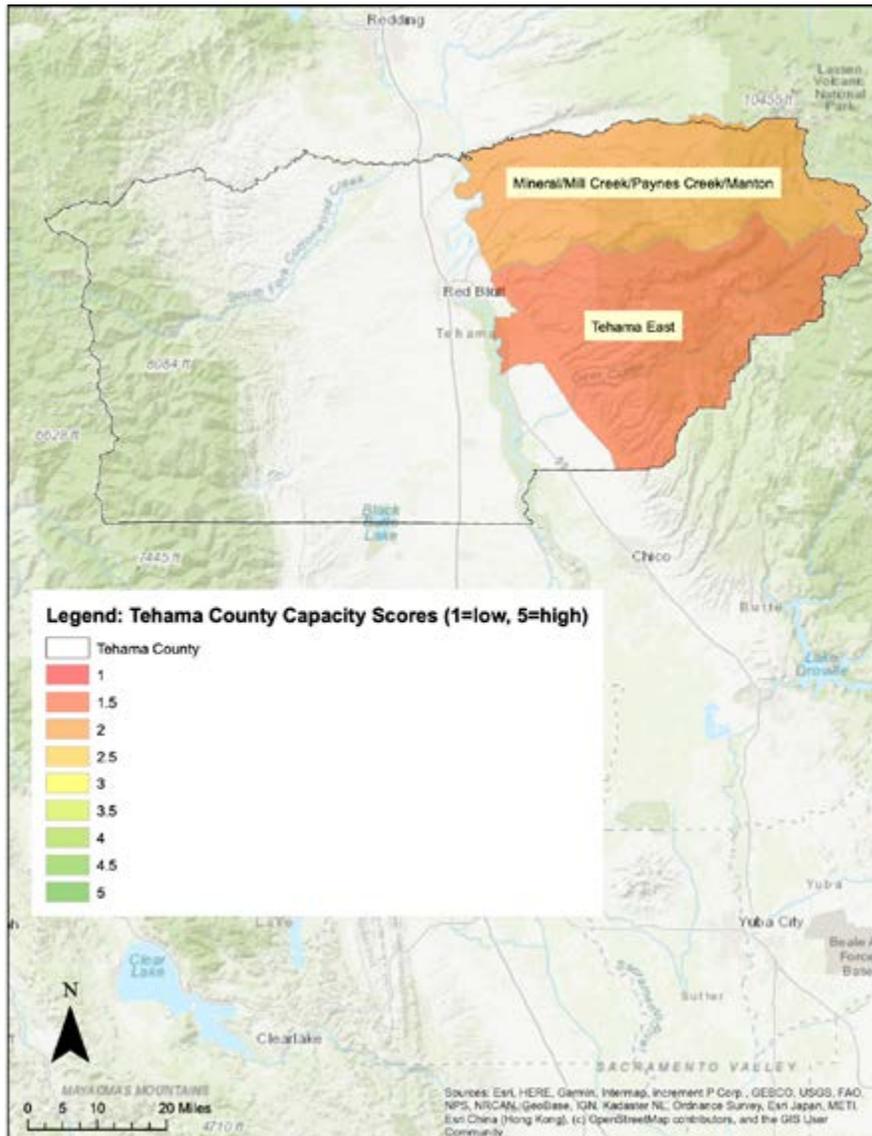
Sierra County had a relatively lower number of communities with a wider range of scores, from 1.5 to 3.5, and an average capacity score of 2.6. It was noted that there is a clear divide between the east side and the west side of the county, with more transient tourism on the west compared to more agriculture and ranching on the east.

Sierraville in particular was characterized as both a community of ranchers and bedroom community for Truckee commuters. Community dynamics in both Sierraville and Verdi (which was described as a bedroom community to Reno) are increasingly commuter-oriented, with many commuters driving their kids to school in Reno or Truckee due to a lack of bus service in Sierra county. Participants expressed concern for declining school enrollment and a lack of contribution

to community health as a result. One participant expressed that social capital is often higher in the lower socioeconomic areas, facilitating stronger support systems than exist in the more bedroom-community-oriented areas.

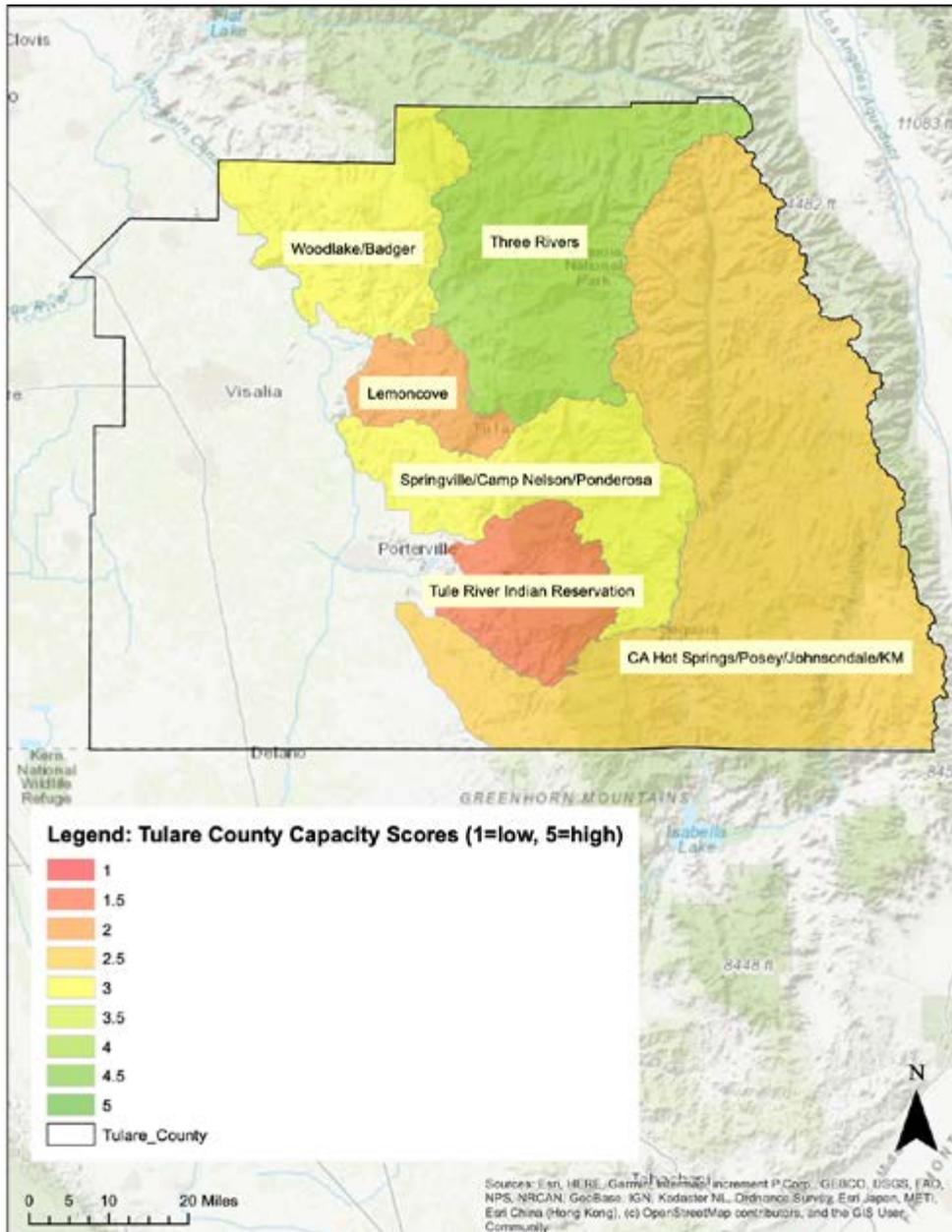
Areas with a lower capacity score were largely scored this way due a lack of financial resources and limited infrastructure. They were characterized as including vacant homes, reliance on volunteerism for utility systems, limited broadband, and more, compounded by a culture of fierce independence. For example, in Alleghany, one participant noted, “We tried to do a grant in Allegheny years ago, everyone qualified, definitely disadvantaged. Even with money in the pot, they didn’t want people to come into their homes to fix things.” However, some communities in the county, such as Sierra City and Downieville, were given relatively higher capacity scores as a result of high social capital to get things done even in the face of financial and infrastructure challenges. These communities were described as being very effective in fundraising, evidenced by several community supported programs, volunteer fire departments, and school and community members working together to better the community. High levels of volunteerism were reported consistently throughout multiple communities in the county, including Alleghany/Sattely and Calpine/Downieville/Sierra City.

TEHAMA COUNTY



Tehama County is only partially contained within the boundary of the SNC region, including rural and sparsely populated communities in the eastern portion of the county. The two communities scored in this assessment ranged from 1.5–2, meaning that participants identified this area as having low to medium-low ability to respond to stressors. The average capacity score was 1.75, which was lower than the average of 2.9 for the SNC region as a whole. Overall, this area was characterized as having low financial resources, limited infrastructure, and sparse populations. The Mineral and Mill Creek areas were identified as having relatively high financial and social capital in the county, with tourism-based economies and community residents that reportedly work well together.

TULARE COUNTY



Tulare County had an average capacity score of 2.6, which is lower than the average of 2.9 for the SNC region as a whole. Note that only communities within the SNC region were scored, meaning that the entirety of Tulare County was not included in this assessment. Therefore, considering only the communities under SNC regional jurisdiction, the highest scoring community in the county was Three Rivers, and the lowest scoring were Lemon Cove and the Tule River Indian Reservation.

According to participants, the main factor driving community capacity in Three Rivers, separating it from neighboring communities, is the presence of Sequoia National Park. The community has significant access to public money because of the park, which is a major source of funding for land management, as well as a source of jobs. However, a notable detriment to this community's capacity is physical infrastructure.

Workshop participants felt that the town can feel overrun during peak tourism seasons, and that there is not enough infrastructure to meet demand. According to them, greater investment is needed in features like public bathrooms, public river access, the town center, and more.

The Springville/Camp Nelson/Ponderosa and Woodlake/Badger communities were rated as having a medium level of capacity. Springville/Camp Nelson/Ponderosa was scored this way as a result of mixed socioeconomic and social capacity in the area. A relatively higher level of capacity was attributed to Springville, which has access to a larger tax base, increasing local businesses, and a higher percentage of year-round residents. Camp Nelson and Ponderosa are more isolated, with a greater proportion of second-home owners and seasonal residents. The Woodlake/Badger community is limited in financial capital, as the area contains many disadvantaged and severely disadvantaged communities. However,

the medium capacity rating was largely due to a high level of social capital, particularly in Woodlake. Workshop participants identified community organizations that come together for the benefit of the town. They have a community garden to help disadvantaged youth gain useful life skills, and they also host different community activities around the holidays when churches, the fire department, police department, community organizations, and local volunteers come together to host events free of charge for the community.

The communities of California Hot Springs/Posey/Johnsondale/Kennedy Meadows, Lemon Cove, and the Tule River Indian Reservation all scored as having low to medium-low levels of capacity, largely due to isolation and lack of available resources. The Tule River Indian Reservation scored highly in social and cultural capital, with a strong sense of community, particularly around supporting and caring for elders and children, as well as a strong appreciation for and promotion of culture. However, challenges of historical trauma and racism against the tribe have diminished opportunities for external partnership. There are also challenges regarding physical infrastructure, including a lack of access to reliable, sustainable water sources. The tribe relies on groundwater for more than half of its domestic water, an unreliable source that has been scarce for the past eight years, give or take, due to drought. New wells have come up dry, and many locations on the reservation are not or cannot be connected to a centralized water system. Physical infrastructure is also limited in Lemon Cove and California Hot Springs/Posey/Johnsondale/Kennedy Meadows. Notably, California Hot Springs only has a one-room schoolhouse that often faces financial challenges due to its size.

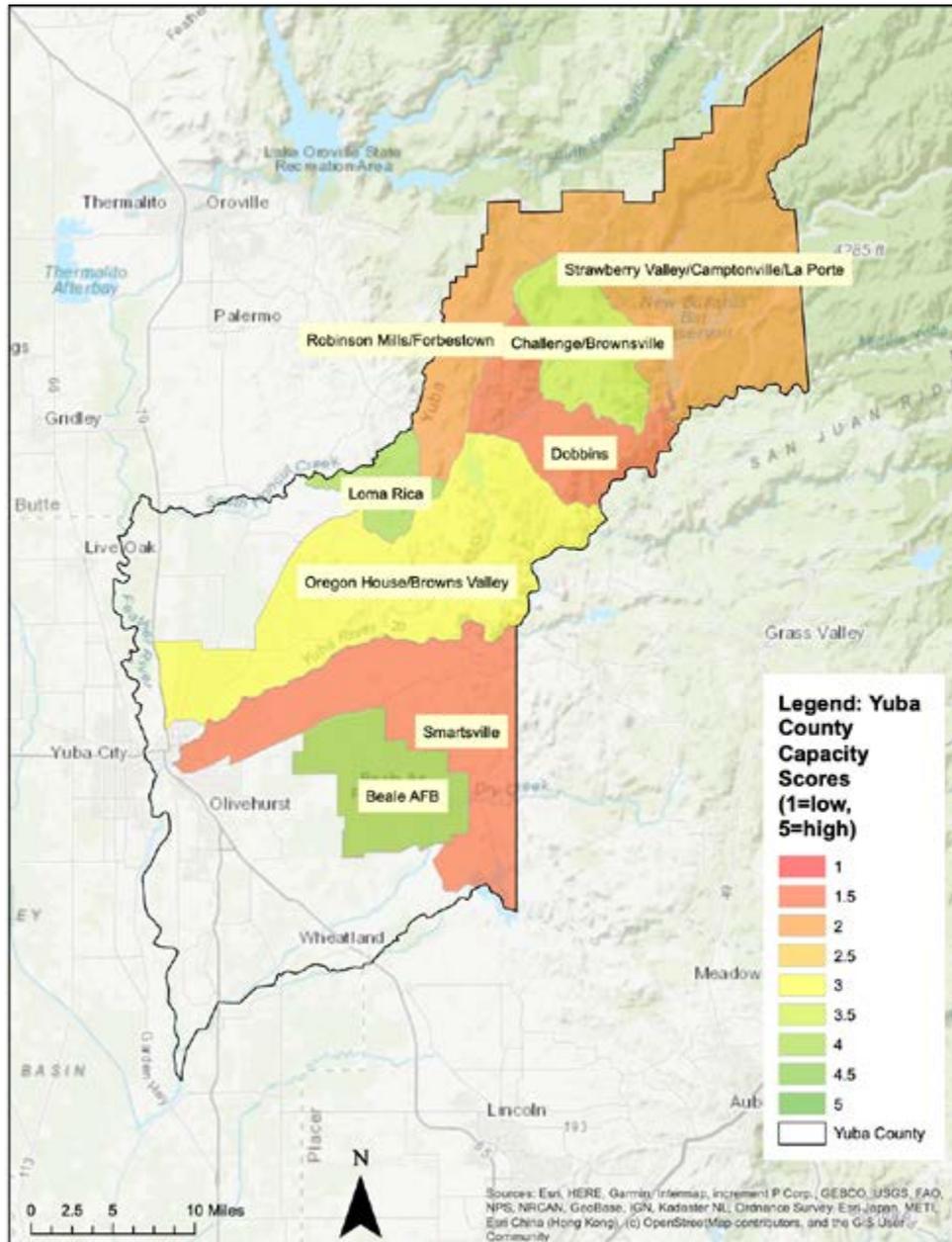


The casino puts money back into the local economy, and the Tribe influences the surrounding area's culture. Tribal leaders are effective community voices.

The eastern portion of the county is largely occupied by the Groveland/Yosemite community, though very few people actually live in this community. There are, however, a number of core, high-end lodges that provide economic benefit. The few scattered residents are associated with high-end tourism and recreation in Yosemite National Park. Capacity is low, but there is no substantial community need for it either. Growth in this community is unlikely to be possible without some infrastructure and expanded services.



YUBA COUNTY



Yuba County community capacity scores are skewed to the lower end of the 1–5 score range, with the most common scores being 1.5 and 2. Yuba County communities, with the exceptions of a few communities like Beale Air Force Base (Beale AFB) and Loma Rica have lower capacity scores relative to the rest of the SNC region.

The average community capacity score is 2.6 for the county. Beale AFB and Loma Rica were rated higher, primarily due to high financial capital. Beale AFB is considered an “odddity” in an otherwise rural foothill region, as the base is federally funded. Loma Rica also ranked high due to economic status (most residents are ranchers, active business people, or retired) and quality of infrastructure, including active schools, community organizations, good roads, and reliable wells (though no sewers).

For other foothill communities in Yuba County, water infrastructure is a major concern. For example, water infrastructure in the Brownsville/Challenge community was described as “antiquated,” with Challenge having very little infrastructure and the system in Brownsville serving approximately 800 connections for consumption and fire suppression. Participants expressed concern regarding an ability to fund infrastructure improvement or afford the costs of drilling wells. Residents in Smartsville remain on a failing septic system that has resulted in a moratorium on expansion. Generally, very little sewer or water infrastructure exists in many communities in this area, although irrigation is delivered to multiple communities.

Regarding social capital, there are pockets of high engagement and an ability to fundraise. Camptonville in particular was highlighted for its “approximately 20-year effort to build community capacity,” giving it an advantage in social and human capital over some other areas. Participants discussed a small core group of 10–20 people who actively spearhead activities to increase the well-being of children and adults.

Participants agreed that it is “the best organized community in the foothills.” Despite having one of the lowest capacity scores, Smartsville was also noted for a remarkable ability to fundraise, exemplified by their efforts to raise hundreds of thousands of dollars to reconstruct the local Catholic church. Other communities in the county face an issue common to rural foothill areas throughout the Sierra, namely a reliance on a small, often aging, core group of active community members to tackle local needs. It was reported that seemingly “the same five people” do everything in both Oregon House and Dobbins. For the Strawberry/Camptonville/La Porte communities, participants noted that the social fabric in the area, including engagement in the water board and school district, can easily shift if key community members pass away or move.

Ch. 4 References

1 Well-being in forest dependent communities, part I: a new approach. In Sierra Nevada ecosystem project: final report to Congress, Jonathan Kusel, 1996



RISK PROFILES FOR COUNTIES IN THE SNC REGION

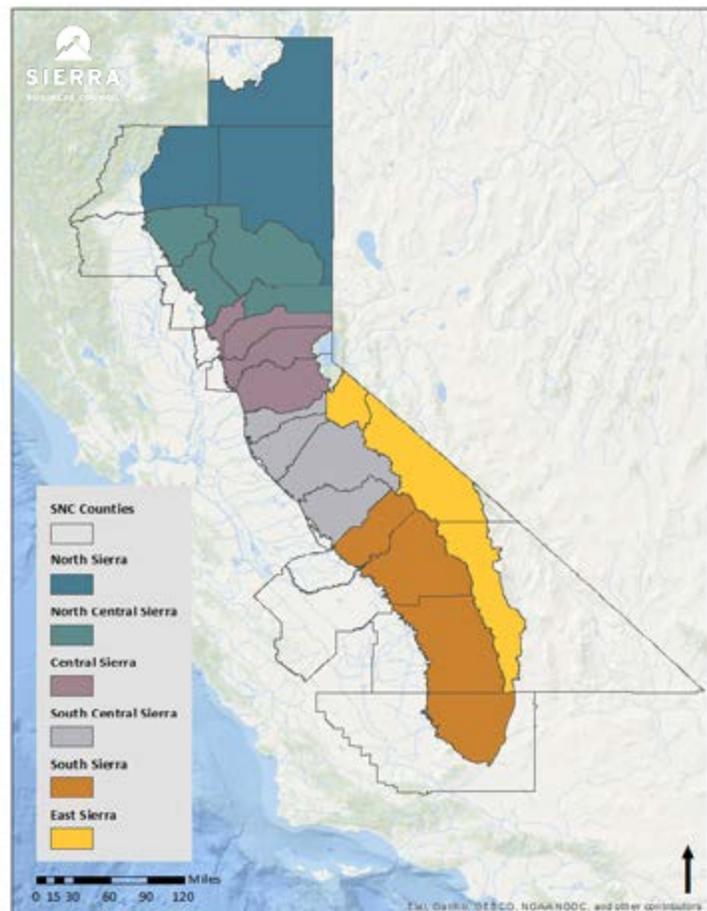
Chapter 6 Summary:

- These profiles highlight county-level climate vulnerabilities and risks that could impact the SNC region's populations, economies, and communities.
- Summaries can be used to assist with developing climate resiliency. Scores are presented for each of the 22 counties within the SNC region. Higher scores indicate increased severity of climate change impacts.
- Most counties within the region will see the greatest increases in extreme heat days and acreage burned by wildfires, while the vulnerable groups with the highest county populations are the housing burdened, residents without high-speed internet, People of Color, and senior citizens.

Risk Profiles:

Alpine County	208
Amador County	210
Butte County	212
Calaveras County	214
El Dorado County	216
Inyo County	218
Fresno County	220
Lassen County	222
Kern County	224
Madera County	226
Mariposa County	228
Modoc County	230
Mono County	232
Nevada County	234
Placer County	236
Plumas County	238
Shasta County	240
Sierra County	242
Tehama County	244
Tulare County	246
Tuolumne County	248
Yuba County	250

Subregions of the Sierra:



Introduction

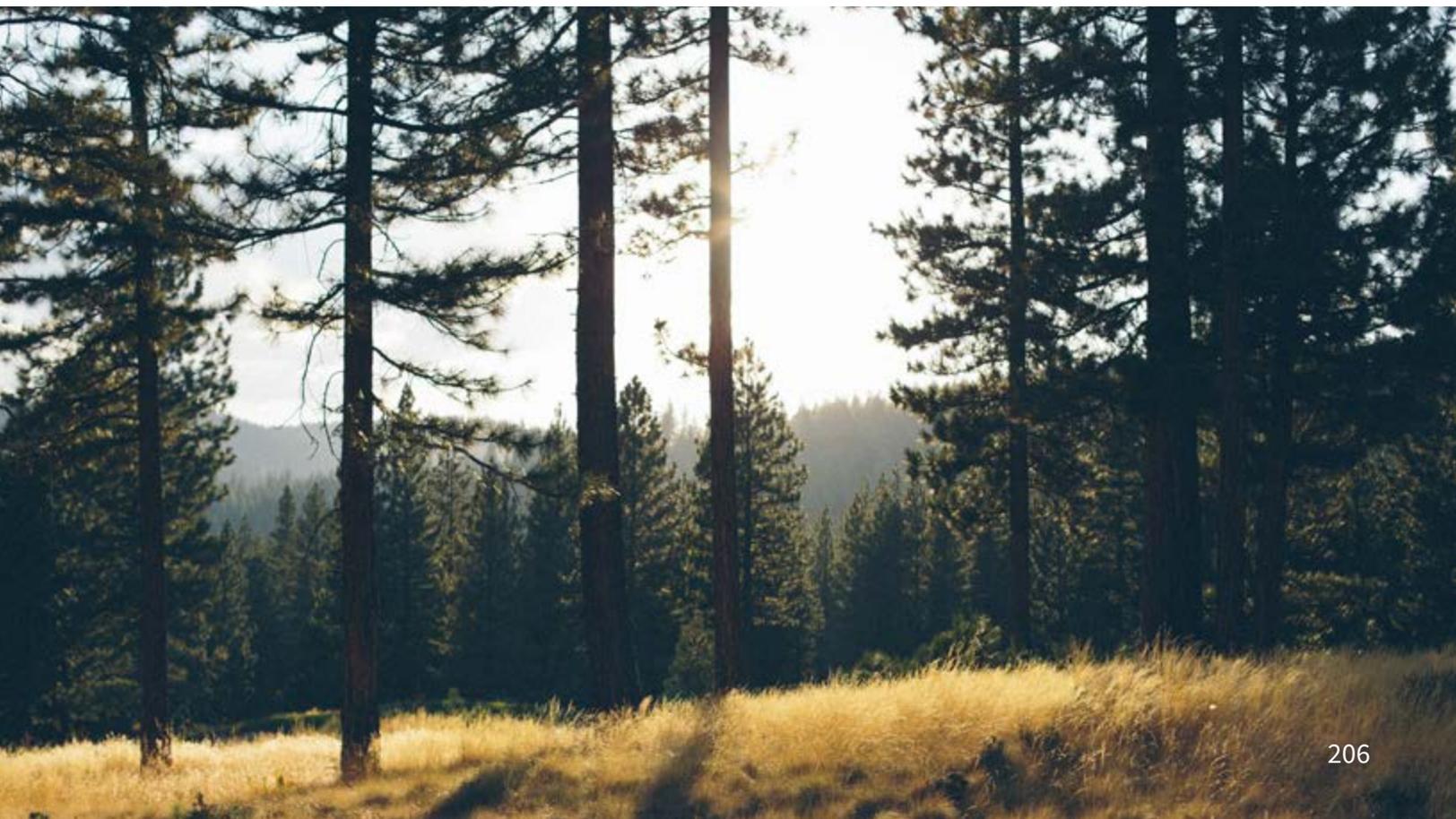
In this chapter, historical climate data and mid-century projection climate data is shared for each county. It is traditional for climate science to compare future climate projections to the 30-year span between 1961 and 1990, referred to as historical data. Historical data provides a stable reference for monitoring long-term climate variability and change. While this chapter will compare past and future climate data for each county within the SNC region, it is pertinent that planners and policymakers keep current climate data top of mind. Physical hazards posed by climate change are already greatly impacting Sierra communities. For in-depth climate data and impacts on the SNC region, refer to chapter 2.

The current impacts from drought, wildfire, and other climate hazards affecting the region today indicate that planners and policymakers must make adaptation and mitigation plans a top priority. Sierra communities have endured great loss and hardship due to climate change in the past 30 years, and future projections paint a more devastating future for the region. Project funding and implementation for climate change adaptation is urgently needed.

This chapter provides risk profiles at the county level for county jurisdictions within the SNC region. Each county has been assigned three risk scores: an Overall Risk Score, a Climate Hazard Risk Score, and a Human Impact Score. While the scores can help planners and policymakers assess risk at the county level, more weight should be given to climate data projections and shares of vulnerable populations in each county. These datasets will help jurisdictions prioritize strategies to protect their vulnerable populations from the increasing severity of climate hazards.

The three scores illustrate how each county compares to the rest of the region. The Overall Risk Score is calculated by multiplying the Climate Hazard Risk Score by the Human Impact Score.

Overall Risk Score = Climate Hazard Risk Score x Human Impact Score



The Climate Risk Score accounts for the projected change in four mid-century (2035–2064) climate hazards identified by Cal-Adapt.

For more information on climate hazards analyzed in this chapter, refer to chapter 2.

The Human Impact Score takes into account current (2018–19) socioeconomically vulnerable populations. Socioeconomic data used and presented in this chapter is from the 2020 American Community Survey from the US Census Bureau.¹ Multiplying the Climate Hazard Risk and Human Impact scores together indicates that climate risk is influenced by projected climate change hazards and the capacity of the local community. More information on how these scores were calculated can be found in the Methods Section of this assessment. As can be seen in the county profiles, higher overall risk scores are typically due to a high Climate Hazard Risk Score and a high Human Impact Score. Higher scores indicate greater risk.

Keep in mind that the three scores are relative to the rest of the region. Therefore, a low score does not necessarily correlate to low risk; most low scores still include projected increased risk.

Planners should also review risks in neighboring counties, as physical hazards are not governed by county borders, and neighboring populations may show corresponding vulnerabilities. Overall, the entirety of the Sierra is at high risk for climate change impacts. The purpose of these county profiles is to provide insight into each jurisdiction’s hazards, populations that need the most assistance, and how and where to prioritize investments. Community planners should take all scores and data sets into account when developing climate adaptation strategies. Adaptation and recovery are dependent on all residents having information, resources, and strategies available to them.

Fresno County and Kern County were notable outliers and were omitted from the scoring calculations. These counties have sparsely populated areas, and their overall demographics differ from the majority of the other 20 counties in the Sierra. While Fresno and Kern counties will be impacted by the climate emergency, their metropolitan areas and higher populations may prioritize them for more access to federal, state, and local resources. As a result, scores are not included in their county profiles.

¹ US Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C. as reported in Headwaters Economics’ Economic Profile System (headwaterseconomics.org/eps)

ALPINE COUNTY

Overall Risk Score (87.26/100)

Climate Hazard Risk Score (9.45/10)

With more extreme heat days above 82.5°F and warm nights above 49.2°F, residents and visitors of Alpine County will experience more heat-related illnesses, longer and more intense droughts, and increased fire risk. Projections show water supplied by snowpack decreasing by half and wildfires doubling in size. More extreme fire seasons could heavily impact Alpine County's tourism industry.

Hazards	Modeled Historical (1961-1990)	Projected Range (2035-2064)	Average Percent Change from Historical
 DAYTIME HEAT	4 days	17-59 days	700%
 WARM NIGHTS	4 nights	12-42 nights	575%
 ACREAGE BURNED	2,185 acres	2,860-5,280 acres	97%
 APRIL 1ST SWE	19 inches	3.3-18.9 inches	-53%

Human Impact Score (9.24/10)

Population of Alpine County is ~1,034 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	92%
Housing-burdened residents	44%
People of Color	47%

With 92% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Alpine County had over 1,400 vacant houses, with over 1,300 vacant homes used occasionally by second-home owners, and only 30 available for rent. ¹

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.

Alpine County has the lowest population density of all counties in California. While this means the county has a smaller population to communicate with and care for in times of crisis, it also indicates less available human and social capital to build capacity.

¹ US Department of Commerce. 2020. Census Bureau, American Community Survey Office, Washington, D.C. as reported in Headwaters Economics' Economic Profile System (headwaterseconomics.org/eps)



AMADOR COUNTY

Overall Risk Score (30.63/100)

Climate Hazard Risk Score (5.19/10)

With extreme heat days above 96.8°F and warm nights above 62.1 increasing sixfold, and a more than 60% decrease in water supply from snowpack, the wine and outdoor tourism industries in Amador County will be greatly affected. Amador County is well versed in drought conditions; in 2021, the Amador Water Agency required all residents to reduce water use by 20%. This is projected to become a more significant issue by 2035. Increased acreage lost to wildfire and the smoke resulting from it will also impact public health and the local economy by impacting visitor numbers and agricultural industry.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	4 days	13–49 days	650%
 WARM NIGHTS	4 nights	16–51 nights	625%
 ACREAGE BURNED	3,625 acres	4,544–5,451 acres	35%
 APRIL 1ST SWE	3.5 inches	0.4–3.2 inches	-66%

Human Impact Score (5.91/10)

Population of Amador County is ~38,429 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	65%
Housing-burdened residents	41%
Senior citizens (65+)	27%

With 65% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of a flood, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing-burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or afford repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Amador County had over 3,700 vacant houses, with over 2,200 vacant homes occasionally used by second-home owners, and only 200 available for rent.

Senior citizen populations face a multitude of potential challenges:

- Fixed incomes
- Reduced physical capacity to drill deeper wells as groundwater becomes less available
- Difficulty affording homeowners/renters insurance
- Difficulty evacuating in times of crisis
- Reduced means or physical capacity to install household AC

All of these challenges indicate that the community will have less ability to prepare for climate-related crises and will have less resources to rebuild after a crisis takes place.

BUTTE COUNTY

Overall Risk Score (61.69/100)

Climate Hazard Risk Score (7.23/10)

Butte County has already experienced devastating wildfires and drought, with indications of increasing threat. Extreme heat days above 100.1°F and lack of water could heavily impact the agricultural industry in the region, especially for high-water-yield crops like almonds. Extreme heat can become a public health concern, especially for the 8% of residents without household AC, with the number of warm nights above 64.8°F predicted to increase nearly sixfold.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	4 days	11–43 days	600%
 WARM NIGHTS	4 nights	11–44 nights	575%
 ACREAGE BURNED	5,974 acres	7,482–12,331 acres	50%
 APRIL 1ST SWE	1.8 inches	0.2–1.4 inches	-72%

Human Impact Score (8.54/10)

Population of Butte County is ~225,817 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Housing-burdened residents	45%
Residents without broadband	36%
People of Color	28%

With 45% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Butte County had over 11,000 vacant houses, with over 2,000 vacant homes occasionally used by second-home owners, and 2,900 available for rent. The housing shortage in Butte County has been impacted by property loss and damage due to wildfires.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.

CALAVERAS COUNTY

Overall Risk Score (35.90/100)

Climate Hazard Risk Score (5.74/10)

Calaveras County is predicted to have a sixfold increase in extreme heat days above 98.3°F and only a quarter of historical water supplied by snowpack. This could lead to devastating drought and wildfire conditions that impact the recreation industry at Bear Valley Mountain Resort and visitation for summer outdoor activities. Increased fire danger leaves 74% of populated areas exposed to direct sources of wildfire, like nearby flammable vegetation.

Hazards	Modeled Historical (1961-1990)	Projected Range (2035-2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	13-50 days	625%
 <p>WARM NIGHTS</p>	6 nights	18-56 nights	466%
 <p>ACREAGE BURNED</p>	6,022 acres	7,346-8,916 acres	32%
 <p>APRIL 1ST SWE</p>	1.3 inches	0.1-1.0 inches	-77%

Human Impact Score (6.25/10)

Population of Calaveras County is ~45,514 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	56%
Housing-burdened residents	49%
Senior citizens (65+)	28%

With 56% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Calaveras County had over 11,000 vacant houses, with over 8,500 vacant homes occasionally used by second-home owners, and 165 available for rent.

Senior citizen populations face a multitude of potential challenges:

Fixed incomes

Reduced physical capacity to drill deeper wells as groundwater becomes less available

Difficulty affording homeowners/renters insurance

Difficulty evacuating in times of crisis

Reduced means or physical capacity to install household AC

All of these challenges indicate that the community will have less ability to prepare for climate-related crises and will have less resources to rebuild after a crisis takes place.



EL DORADO COUNTY

Overall Risk Score (28.81/100)

Climate Hazard Risk Score (6.48/10)

El Dorado County’s largest industry comes from tourism. Increased extreme heat days above 92.4°F and reduced snowpack, and therefore water supply, could greatly impact the level of income from visitation. If visitation does not decrease but the same projected climate hazards occur, there could be an immense public health threat due to drought, heat-related illnesses, and lack of resources to supply water and care.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	13–49 days	650%
 <p>WARM NIGHTS</p>	4 nights	13–43 nights	575%
 <p>ACREAGE BURNED</p>	8,430 acres	11,322–14,695 acres	50.20%
 <p>APRIL 1ST SWE</p>	5.2 inches	0.8–4.7 inches	-62%

Human Impact Score (4.44/10)

Population of El Dorado County is ~188,563 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	45%
Housing-burdened residents	40%
People of Color	22%

With 45% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, El Dorado County had over 19,000 vacant houses, with over 16,000 vacant homes occasionally used by second-home owners, and 700 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



INYO COUNTY

Overall Risk Score (24.12/100)

Climate Hazard Risk Score (3.15/10)

Inyo County is uniquely situated to include Death Valley and Mount Whitney. This gives the county a small advantage in dealing with the climate crisis; the population is well versed in extreme heat and has a relatively protected water supply due to its high elevation mountains. Still extreme heat days above 100.8°F and warm nights above 68.8°F can pose a threat to residents without AC and natural and working lands. An increase in extreme weather will likely impact the tourism industry, which makes up 35% of employment opportunities in the county.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	22–64 days	800%
 <p>WARM NIGHTS</p>	4 nights	14–46 nights	600%
 <p>ACREAGE BURNED</p>	7,068 acres	4,972–9,707 acres	4.30%
 <p>APRIL 1ST SWE</p>	1.0 inches	0.5–1.3 inches	-20%

Human Impact Score (7.66/10)

Population of Inyo County is ~17,977 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	56%
Housing-burdened residents	38%
People of Color	38%

With 56% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Inyo County had over 1,600 vacant houses, with over 776 vacant homes occasionally used by second-home owners, and 130 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



FRESNO COUNTY

Scores for Fresno County were not published in the report. For Fresno County scores, please contact Sierra Business Council.

Climate Hazards

Fresno County may see increasing temperatures and, along with reduced snowpack in the mountainous regions of the county, less annual precipitation. This has the potential to greatly impact the agricultural industry, as well as outdoor workers. With three to more weeks potentially reaching above 95°F, residents without access to household AC or community cooling centers could experience heat-related illnesses. There is a potential for a dramatic increase in acreage burned by wildfires. Reaching populations that do not speak English should be a high priority to ensure all communities have access to wildfire information and updates.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	4 days	20–58 days	750%
 WARM NIGHTS	4 nights	15–46 nights	600%
 ACREAGE BURNED	13,215 acres	14,812–39,691 acres	91%
 APRIL 1ST SWE	6.3 inches	2.3–7.4 inches	-16%

Human Impacts

Population of Fresno County is ~984,521 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
People of Color	70%
Residents without broadband	48%
Housing-burdened residents	44%

With 70% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Inyo County had over 1,600 vacant houses, with over 776 vacant homes occasionally used by second-home owners, and 130 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



L A S S E N C O U N T Y

Overall Risk Score (62.09/100)

Climate Hazard Risk Score (8.71/10)

Lassen County may experience more drought-like conditions due to a dramatic increase in extreme heat days above 91.9°F and warm nights above 51.3°F. There may be reduced availability of water in the region resulting from less snowfall. While these two factors will most likely lead to an increase in acreage burned by wildfire, it will also impact the local economy, which depends partially on Lassen National Park tourism and the affiliated natural resource management industry.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	3 days	12–50 days	833%
 WARM NIGHTS	4 nights	9–46 nights	575%
 ACREAGE BURNED	19,553 acres	15,625–23,755 acres	6%
 APRIL 1ST SWE	1.6 inches	0.3–1.3 inches	-63%

Human Impact Score (7.13/10)

Population of Lassen County is ~30,818 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	79%
Housing-burdened residents	34%
People of Color	35%

With 79% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Lassen County had over 3,500 vacant houses, with over 1,500 vacant homes occasionally used by second-home owners, and 130 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



KERN COUNTY

Scores for Kern County were not published in the report. For Kern County scores, please contact Sierra Business Council.

Climate Hazards

This data represents all of Kern County. While the amount of snowpack in Kern County is historically low compared to more mountainous areas of the Sierra region, the county can expect less annual precipitation by mid century. Reduced precipitation in tandem with increasing temperatures will result in more drought-like conditions. The number of extreme heat days above 100.8°F and warm nights above 69.7°F are both predicted to increase sixfold. Dry conditions can impact agriculture and tourism industries and increase the risk for wildfires. The projected average acreage of land burned by wildfires shows a slight decrease from historical acreage burned, but there is a high potential for fires to burn with more severity. Dry conditions will exacerbate wildfire risks.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	4 days	16–48 days	600%
 WARM NIGHTS	3 nights	10–38 nights	633%
 ACREAGE BURNED	17,502 acres	14,629–19,352 acres	-3%
 APRIL 1ST SWE	0.0 inches	0.0–0.0 inches	0%

Human Impacts

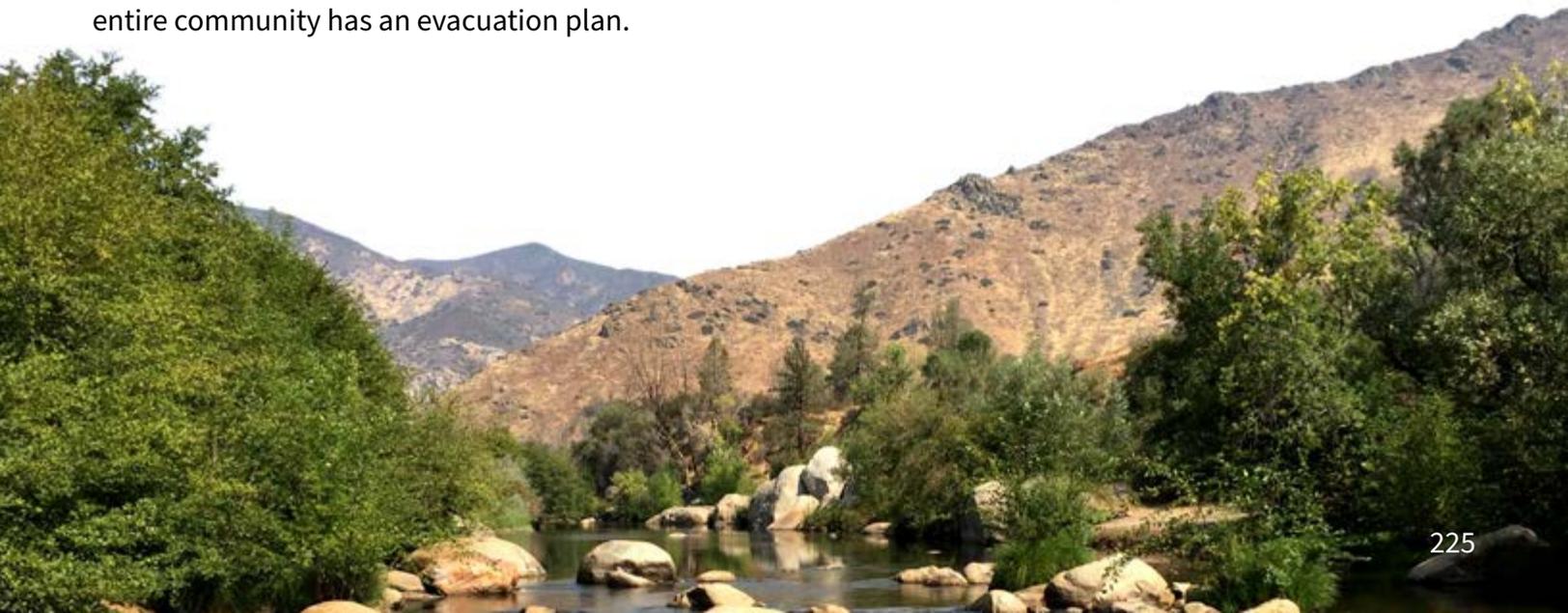
Population of Kern County is ~887,641 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	46%
Housing-burdened residents	43%
People of Color	66%

With 46% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Kern County had over 27,800 vacant houses, with over 7,000 vacant homes occasionally used by second-home owners, and 6,200 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



MADERA COUNTY

Overall Risk Score (58.47/100)

Climate Hazard Risk Score (10/10)

Madera County has the highest Climate Hazard Score out of the 20 regional counties scored. Extensive drought has plagued Madera County for years. The year 2021 proved especially catastrophic; diminishing groundwater led to a record number of agricultural and domestic wells drying up.²The drought, in conjunction with the projected sevenfold increase in extreme heat days above 96.1°F and more warm nights above 61.6°F, could be disastrous for the agricultural industry, and could pose health risks for outdoor agricultural workers. Along with drought, Madera County is familiar with wildfire, and it is projected to experience a nearly 75% increase in acreage burned within the next 40 years. Increased wildfire smoke in the region may impact the tourism industry, which makes up 15% of jobs in the county. Increased fires, heat, and drought will likely impact the forestry and natural resources industries in Madera County, which make up 16% of jobs in the county.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	4 days	17–61 days	725%
 WARM NIGHTS	4 nights	14–52 nights	650%
 ACREAGE BURNED	63,545 acres	8,148–14,791 acres	73%
 APRIL 1ST SWE	6.3 inches	1.9–6.6 inches	-38%

² Madera County residents and farmers face groundwater challenge of a lifetime, Danielle Bergstrom. 2021

Human Impact Score (5.87/10)

Population of Madera County is ~155,433 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	64%
Housing-burdened residents	40%
People of Color	66%

With 64% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Madera County had over 5,700 vacant houses, with over 2,000 vacant homes occasionally used by second-home owners, and 680 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



MARIPOSA COUNTY

Overall Risk Score (42.71/100)

Climate Hazard Risk Score (5.37/10)

Mariposa County is at a high risk of severe drought conditions. Looking back at the drought in 2015, some Mariposa County residents were asked to reduce water use by 50%. With decreasing snowpack and rain runoff projected in tandem with increasing extreme heat conditions, these reductions may become the norm. Extreme heat days above 94.7°F and warm nights above 59.9°F are expected to increase sixfold and fourfold, respectively. Less water and more heat increases risk of wildfire. Drought and increased fire risk or impacts from fire will likely impact the tourism industry, which makes up over 40% of the jobs in Mariposa County.

Hazards	Modeled Historical (1961-1990)	Projected Range (2035-2064)	Average Percent Change from Historical
 DAYTIME HEAT	4 days	15-59 days	675%
 WARM NIGHTS	5 nights	11-48 nights	440%
 ACREAGE BURNED	8,533 acres	11,330-12,833 acres	40%
 APRIL 1ST SWE	6.3 inches	1.8-6.6 inches	-38%

Human Impact Score (7.95/10)

Population of Mariposa County is ~17,420 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	90%
Housing-burdened residents	46%
Senior citizens (65+)	27%

With 90% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Mariposa County had over 2,700 vacant houses, with over 1,200 vacant homes occasionally used by second-home owners, and 330 available for rent.

Senior citizen populations face a multitude of potential challenges:

- Fixed incomes
- Reduced physical capacity to drill deeper wells as groundwater becomes less available
- Difficulty affording homeowners/renters insurance
- Difficulty evacuating in times of crisis
- Reduced means or physical capacity to install household AC.

All of these challenges indicate that the community will have less ability to prepare for climate-related crises and will have less resources to rebuild after a crisis takes place.
and will have less resources to rebuild after a crisis takes place.

MODOC COUNTY

Overall Risk Score (30.76/100)

Climate Hazard Risk Score (4.08/10)

With the number of extreme heat days above 92.4°F increasing sixfold, and water supplied by snowpack decreasing, intense and longer dry spells can be expected in Modoc County, where an estimated 49% of households rely on wells. Increased dry spells will reduce available groundwater supplies and lead to shallow or dry wells. Less surface water due to longer dry spells may impact grazing fields for cattle and reduce crop harvests, impacting a major economic resource for the county. With warm nights above 53.3 °F increasing fivefold, extreme heat events are also a public health concern for the farming and ranching sectors, as they rely on outdoor manual labor.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	4 days	15–47 days	650%
 WARM NIGHTS	4 nights	11–45 nights	550%
 ACREAGE BURNED	18,109 acres	14,479–22,321 acres	61%
 APRIL 1ST SWE	0.7 inches	0.1–0.6 inches	-72%

Human Impact Score (7.54/10)

Population of Modoc County is ~8,907 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	91%
Housing-burdened residents	39%
Senior citizens (65+)	27%

With 91% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Modoc County had over 1,600 vacant houses, with over 580 vacant homes occasionally used by second-home owners, and only 6 available for rent.

Senior citizen populations face a multitude of potential challenges:

- Fixed incomes
- Reduced physical capacity to drill deeper wells as groundwater becomes less available
- Difficulty affording homeowners/renters insurance
- Difficulty evacuating in times of crisis
- Reduced means or physical capacity to install household AC.

All of these challenges indicate that the community will have less ability to prepare for climate-related crises and will have less resources to rebuild after a crisis takes place.



MONO COUNTY

Overall Risk Score (24.26/100)

Climate Hazard Risk Score (7.41/10)

Mono County may experience a sixfold increase in extreme heat days above 84.4°F and a fourfold increase in warm nights above 48.4°F. Increasing temperatures may contribute to increased acreage burned during wildfire seasons over the next 40 years. Due to the overall high elevation of Mono County, the water supply may be relatively protected. Wildfire and wildfire-related impacts like smoke and forest closures are likely to cause the biggest impact to the local economy, as 61% of jobs are reliant on tourism and recreation.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	21–72 days	625%
 <p>WARM NIGHTS</p>	6 nights	16–49 nights	433%
 <p>ACREAGE BURNED</p>	7,008 acres	6,437–19,385 acres	77%
 <p>APRIL 1ST SWE</p>	6.7 inches	2.3–8.0 inches	-31%

Human Impact Score (3.28/10)

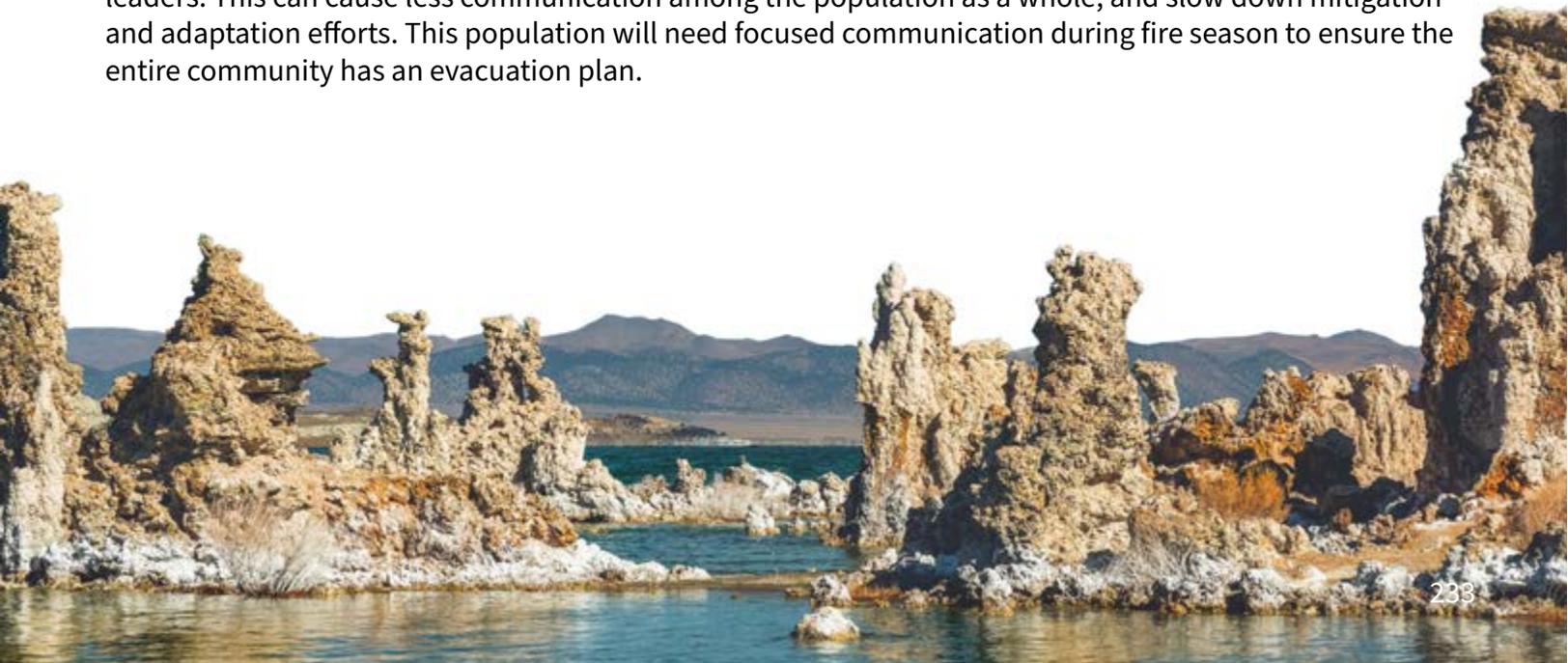
Population of Mono County is ~14,310 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
People of Color	35%
Residents without broadband	34%
Housing-burdened residents	33%

With 34% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Mono County had over 9,300 vacant houses, with over 7,700 vacant homes occasionally used by second-home owners, and 1,000 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



NEVADA COUNTY

Overall Risk Score (26.20/100)

Climate Hazard Risk Score (5.74/10)

Nevada County is projected to experience a sixfold increase in extreme heat days above 92.2°F, along with a fivefold increase in warm nights above 57.7°F. This will make it more difficult for people to cool their homes when over 35% of Nevada County residents do not have household AC. With water supply from snowpack dropping by half, and acreage burned in wildfires increasing by over 50%, Nevada County could experience very severe fire damage. Lack of water for recreation and increasing wildfire impacts like smoke and forest closures will likely impact the tourism industry, which makes up 27% of jobs in the county.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	12–49 days	650%
 <p>WARM NIGHTS</p>	4 nights	11–44 nights	575%
 <p>ACREAGE BURNED</p>	5,819 acres	7,571–10,462 acres	52%
 <p>APRIL 1ST SWE</p>	7.4 inches	1.4–7.2 inches	-57%

Human Impact Score (4.56/10)

Population of Nevada County is ~99,244 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	58%
Housing-burdened residents	49%
Senior citizens (65+)	26%

With 58% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Nevada County had over 13,000 vacant houses, with over 10,400 vacant homes occasionally used by second-home owners, and 370 available for rent.

Senior citizen populations face a multitude of potential challenges:

- Fixed incomes
- Reduced physical capacity to drill deeper wells as groundwater becomes less available
- Difficulty affording homeowners/renters insurance
- Difficulty evacuating in times of crisis
- Reduced means or physical capacity to install household AC.

All of these challenges indicate that the community will have less ability to prepare for climate-related crises and will have less resources to rebuild after a crisis takes place.



PLACER COUNTY

Overall Risk Score (15.60/100)

Climate Hazard Risk Score (4.44/10)

Extreme heat days above 93.3°F in Placer County are expected to increase sixfold, along with a fivefold increase in warm nights above 60.4°F. This could pose a threat from heat-related illnesses for the 10% of residents without household AC. More extreme heat days combined with nearly double the acreage burned in wildfires could cause major impacts to the strong tourism and retail industries in Placer County, especially with assumed increases in planned power outages. Water supplied by snowpack is projected to decrease by more than 60%, which will impact the recreation sector as well as residents reliant on groundwater and surface water from Folsom Lake.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	12–48 days	650%
 <p>WARM NIGHTS</p>	4 nights	12–44 nights	575%
 <p>ACREAGE BURNED</p>	6,324 acres	8,388–10,441 acres	49%
 <p>APRIL 1ST SWE</p>	6.9 inches	1.1–6.1 inches	-62%

Human Impact Score (3.51/10)

Population of Placer County is ~385,512 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Housing-burdened residents	39%
Residents without broadband	28%
People of Color	27%

With 39% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Placer County had over 21,000 vacant houses, with over 14,900 vacant homes occasionally used by second-home owners, and 2,000 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



PLUMAS COUNTY

Overall Risk Score (53.56/100)

Climate Hazard Risk Score (9.26/10)

In Plumas County, extreme heat days above 90.6°F and warm nights above 49.6°F are projected to increase sixfold. This could pose a public health threat, as over 90% of households do not have AC. Along with extreme heat day increases, water supplied from snowpack is expected to decline by nearly 70%. This could lead to more local water shortages, dry wells, and dry vegetation. These factors all increase risk of wildfire, which is projected to burn nearly 70% more acreage. After the Dixie Fire in 2021, this is a devastating possibility.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	12–53 days	650%
 <p>WARM NIGHTS</p>	4 nights	9–48 nights	600%
 <p>ACREAGE BURNED</p>	17,164 acres	26,490–30,555 acres	70%
 <p>APRIL 1ST SWE</p>	7.8 inches	1.2–6.4 inches	-68%

Human Impact Score (5.79/10)

Population of Plumas County is ~18,660 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	82%
Housing-burdened residents	34%
Senior citizens (65+)	27%

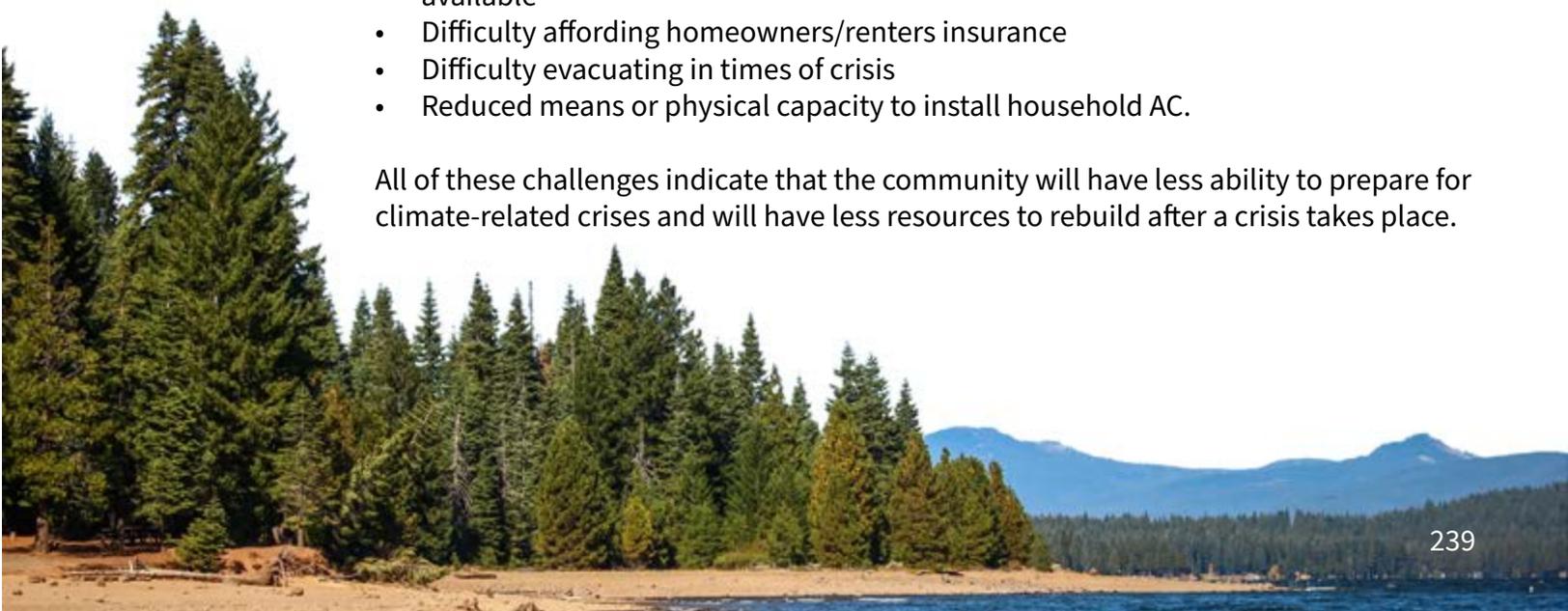
With 82% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Plumas County had over 7,300 vacant houses, with over 6,200 vacant homes occasionally used by second-home owners, and 140 available for rent.

Senior citizen populations face a multitude of potential challenges:

- Fixed incomes
- Reduced physical capacity to drill deeper wells as groundwater becomes less available
- Difficulty affording homeowners/renters insurance
- Difficulty evacuating in times of crisis
- Reduced means or physical capacity to install household AC.

All of these challenges indicate that the community will have less ability to prepare for climate-related crises and will have less resources to rebuild after a crisis takes place.



SHASTA COUNTY

Overall Risk Score (40.03/100)

Climate Hazard Risk Score (6.11/10)

Shasta Lake is the second largest reservoir in California and supplies water to nearly half of the counties in the state. Shasta Lake was at its second-lowest recorded depth in the 2020–2021 water year. In October 2021, the state’s Department of Water Resources was providing hauled and bottled water to small water districts in Shasta County because they were unable to supply water to their customers.³ Warmer temperatures and less water contributes to the increase in fire risk. With close to 50% of the populated areas directly exposed to wildfire, wildfire in Shasta County could wreak havoc on the community. Extreme heat days above 97.4°F and warm nights above 58.5°F are expected to increase fivefold.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	11–38 days	525%
 <p>WARM NIGHTS</p>	4 nights	10–43 nights	525%
 <p>ACREAGE BURNED</p>	20,940 acres	29,709–36,767 acres	59%
 <p>APRIL 1ST SWE</p>	3.5 inches	0.7–2.9 inches	-63%

³ State of CA, Drought Update 2021

Human Impact Score (6.55/10)

Population of Shasta County is ~179,212 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Housing-burdened residents	43%
Residents without broadband	40%
Senior citizens (65+)	20%

With 43% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, ShastaCounty had over 7,400 vacant houses, with over 2,500 vacant homes occasionally used by second-home owners, and 880 available for rent.

Senior citizen populations face a multitude of potential challenges:

- Fixed incomes
- Reduced physical capacity to drill deeper wells as groundwater becomes less available
- Difficulty affording homeowners/renters insurance
- Difficulty evacuating in times of crisis
- Reduced means or physical capacity to install household AC.

All of these challenges indicate that the community will have less ability to prepare for climate-related crises and will have less resources to rebuild after a crisis takes place.



SIERRA COUNTY

Overall Risk Score (29.85/100)

Climate Hazard Risk Score (6.30/10)

Sierra County is projected to have a sixfold increase in extreme heat days above 88.9°F and a fivefold increase in warm nights above 50.4°F. This could be a health threat to the 95% of residents without household AC. Extreme heat days and a nearly 65% decrease in water supply from snowpack could cause more dramatic drought conditions. This could impact the ranching communities and the tourism industry, which makes up 44% of local jobs. Landowners, tourism, and public health will most likely be heavily impacted by the almost 70% increase in acreage burned by wildfire, either due to direct exposure or exposure to wildfire smoke.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	4 days	13–52 days	650%
 WARM NIGHTS	4 nights	9–44 nights	550%
 ACREAGE BURNED	6,156 acres	10,032–10,744 acres	69%
 APRIL 1ST SWE	10.8 inches	1.6–9.5 inches	-65%

Human Impact Score (4.74/10)

Population of Sierra County is ~3,040 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	92%
Housing-burdened residents	38%
Senior citizens (65+)	29%

With 92% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Sierra County had over 1,000 vacant houses, with over 841 vacant homes occasionally used by second-home owners, and just 2 available for rent.

Senior citizen populations face a multitude of potential challenges:

- Fixed incomes
- Reduced physical capacity to drill deeper wells as groundwater becomes less available
- Difficulty affording homeowners/renters insurance
- Difficulty evacuating in times of crisis
- Reduced means or physical capacity to install household AC.

All of these challenges indicate that the community will have less ability to prepare for climate-related crises and will have less resources to rebuild after a crisis takes place.



TEHAMA COUNTY

Overall Risk Score (61.12/100)

Climate Hazard Risk Score (6.11/10)

Tehama County is expected to see a more than 600% increase in extreme heat days above 99.2°F and a 500% increase in warm nights above 62.0°F. While most of the residents have household AC, this massive increase in extreme heat days could impact outdoor workers and further exacerbate the ongoing drought. Water supplied by snowpack is projected to decrease by nearly 60%, which is likely to increase drought conditions and cause more wells to go dry. This will most likely impact residents as well as the agriculture industry, which has seen an increase in orchard planting in recent years.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	3 days	8–36 days	667%
 WARM NIGHTS	4 nights	10–41 nights	500%
 ACREAGE BURNED	14,173 acres	18,553–19,636 acres	35%
 APRIL 1ST SWE	4.2 inches	1.0–3.4 inches	-60%

Human Impact Score (10/10)

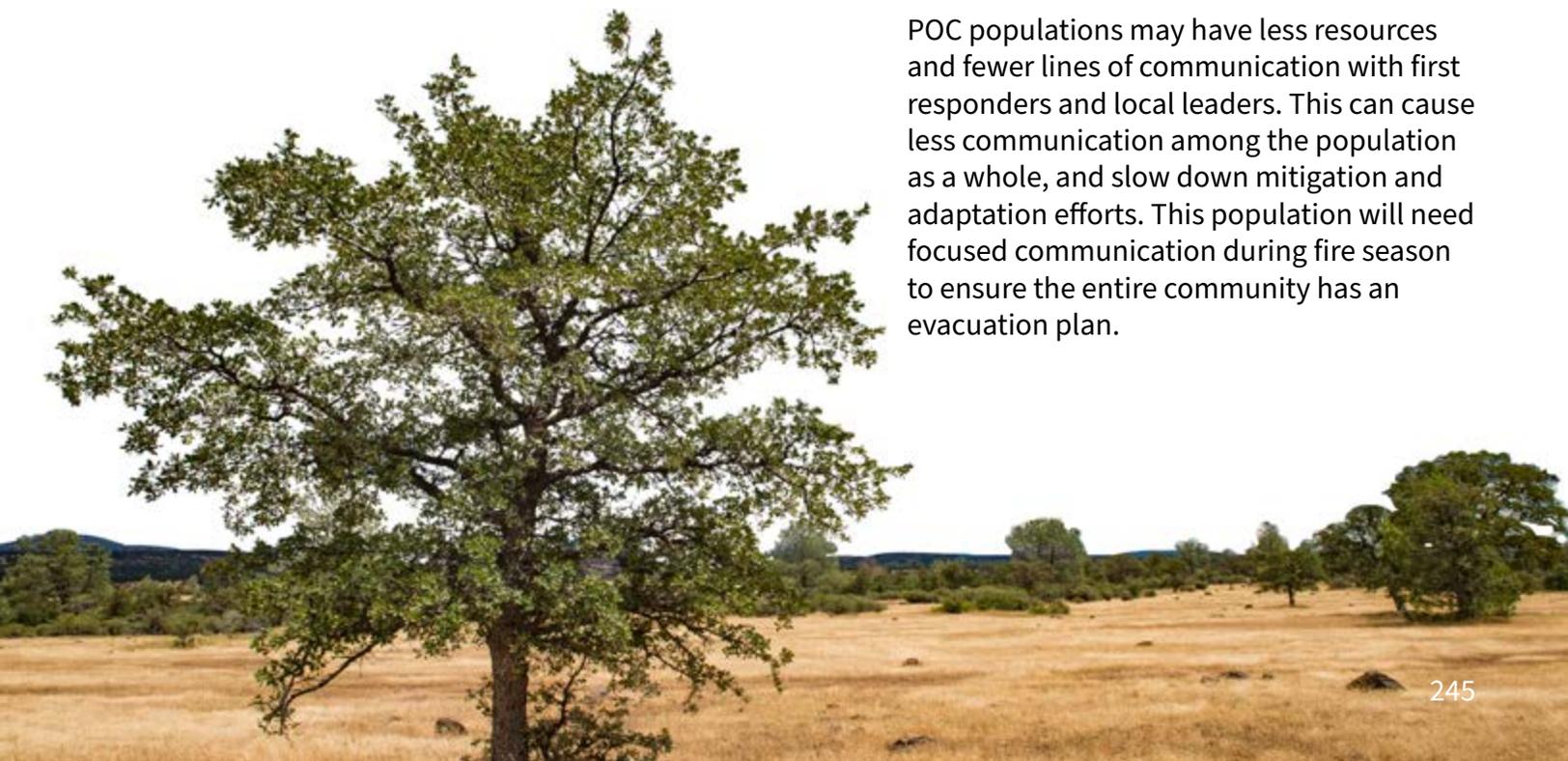
Population of Tehama County is ~63,912 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	81%
Housing-burdened residents	46%
People of Color	32%

With 81% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Tehama County had over 3,300 vacant houses, with over 1,000 vacant homes occasionally used by second-home owners, and 290 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



TULARE COUNTY

Overall Risk Score (53.39/100)

Climate Hazard Risk Score (6.66/10)

Tulare County is the largest-producing agricultural county in California. A sixfold increase in extreme heat days above 92.9°F and warm nights above 60.3°F combined with a 40% decrease in water supplied by snowpack will continue to wreak havoc on the agricultural industry. Residents of Tulare County are well versed in drought; many wells have already gone dry, and 10% of the population is considered “water insecure.”⁴ Increased risk of wildfire and impacts of wildfire also pose a threat to residents, especially for outdoor workers who are at a higher risk of heat-related illnesses and impacts of wildfire smoke.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 DAYTIME HEAT	5 days	22–59 days	620%
 WARM NIGHTS	4 nights	14–44 nights	600%
 ACREAGE BURNED	12,475 acres	14,253–29,633 acres	62%
 APRIL 1ST SWE	4.8 inches	1.5–5.6 inches	-40%

⁴ Drought in Tulare County never ends, Julie Cart, 2021

Human Impact Score (8.01/10)

Population of Tulare County is ~461,898 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
People of Color	71%
Residents without broadband	54%
Housing-burdened residents	45%

With 62% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Tulare County had over 10,700 vacant houses, with over 2,600 vacant homes occasionally used by second-home owners, and 1,700 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



TUOLUMNE COUNTY

Overall Risk Score (52.15/100)

Climate Hazard Risk Score (7.96/10)

In Tuolumne County, extreme heat days above 88.6°F are expected to increase sevenfold and warm nights above 53.9°F may become four times as likely. Water supplied by snowpack is expected to decline by nearly 40%. These factors could exacerbate the drought conditions in Tuolumne county, causing more wells to go dry and impacting household water uses, businesses, and agriculture. Less available water makes the 70% or more increase in acreage burned by wildfire more daunting, since dry conditions will lead to megafire conditions. Extreme heat, drought, and wildfire or wildfire impacts will all likely affect the tourism industry, which makes up 30% of jobs in the county.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	16–58 days	700%
 <p>WARM NIGHTS</p>	6 nights	16–55 nights	450%
 <p>ACREAGE BURNED</p>	11,910 acres	18,349–22,434 acres	72%
 <p>APRIL 1ST SWE</p>	12.7 inches	3.8–13.8 inches	-37%

Human Impact Score (6.55/10)

Population of Tuolumne County is ~54,045 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	56%
Housing-burdened residents	42%
Senior citizens (65+)	26%

With 56% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Tuolumne County had over 9,000 vacant houses, with over 7,000 vacant homes occasionally used by second-home owners, and 370 available for rent.

Senior citizen populations face a multitude of potential challenges:

- Fixed incomes
- Reduced physical capacity to drill deeper wells as groundwater becomes less available
- Difficulty affording homeowners/renters insurance
- Difficulty evacuating in times of crisis
- Reduced means or physical capacity to install household AC.

All of these challenges indicate that the community will have less ability to prepare for climate-related crises and will have less resources to rebuild after a crisis takes place.



YUBA COUNTY

Overall Risk Score (69.68/100)

Climate Hazard Risk Score (8.35/10)

Yuba County is projected to have a sixfold increase in extreme heat days above 101.2°F and warm nights above 65.9°F. While the majority of households have AC, many may not be able to afford to run it. This increases the risk of heat-related illness in the region. While Yuba County is not directly impacted by reduced snowpack in the county, they will feel the squeeze as water shortages continue to increase in the state. Water infrastructure will need to be updated to enable easier transport of water to jurisdictions in need.

Hazards	Modeled Historical (1961–1990)	Projected Range (2035–2064)	Average Percent Change from Historical
 <p>DAYTIME HEAT</p>	4 days	13–45 days	650%
 <p>WARM NIGHTS</p>	4 nights	13–48 nights	650%
 <p>ACREAGE BURNED</p>	2,821 acres	2,984–5,638 acres	34%
 <p>APRIL 1ST SWE</p>	0.1 inches	0.0–0.1 inches	-100%

Human Impact Score (8.36/10)

Population of Yuba County is ~76,360 residents (2019)

Sensitive Groups with Highest Populations	Percentage of population
Residents without broadband	45%
People of Color	45%
Housing-burdened residents	41%

With 45% of the population lacking high-speed internet access, most residents will have to rely on mobile devices for network connectivity. In the event of flooding, fire, or extreme heat, communication infrastructure (e.g., cell towers and power lines) will likely be impacted/damaged. This can cause delays in evacuation and emergency responses, further exacerbating dangerous situations.

The housing burdened statistic represents the percentage of rented and owned households paying more than 30% monthly income on housing-related costs. Housing-burdened populations have less disposable income to help them endure physical hazards. This population is less likely to afford homeowners or renters insurance, temporary relocation due to evacuations, or repairs/recovery in the aftermath of a natural disaster. They may have less long-term plans to stay in the community due to unaffordability. In 2019, Yuba County had over 2,200 vacant houses, with over 370 vacant homes occasionally used by second-home owners, and 470 available for rent.

POC populations may have less resources and fewer lines of communication with first responders and local leaders. This can cause less communication among the population as a whole, and slow down mitigation and adaptation efforts. This population will need focused communication during fire season to ensure the entire community has an evacuation plan.



SUGGESTED ADAPTATION

FRAMEWORK & STRATEGIES

Chapter 7 Summary:

- Utilizing California’s Adaptation Planning Guide (APG) as well as other resources using best practices
- Aggregated tools and resources for new users
- Examples of adaptation case studies

Introduction

Since 2005, the State of California has responded to growing concerns over the effects of climate change by adopting a comprehensive approach to addressing mitigation and adaptation efforts in the public and private sectors through legislative action. State law requires that local governments address greenhouse gas (GHG) emissions in their local planning and environmental review process, and develop climate adaptation strategies in their local long-range planning process.

California mandates and guidance on measuring and reducing GHG emissions include the California Global Warming Solutions Act (AB 32, 2006) and its successor bill (SB 32, 2016), the California Clean Energy and Pollution Reduction Act (SB 350, 2015), and the Sustainable Communities and Climate Protection Act (SB 375, 2008). The California Government Code, where it relates to Planning and Zoning, was amended by SB 379 and SB 1035 to require local governments to include information about and strategies that address climate adaptation and resiliency in the safety elements of their respective general plans. The safety element update must include (a) a vulnerability assessment that clearly identifies the risks and impacts that climate change poses to the entity, (b) a set of goals, objectives, and policies or actions based on a vulnerability assessment, and (c) a set of feasible implementation strategies to carry out goals, objectives, and policies (SB 379, 2015).

Policy Context

Climate adaptation is the process by which the impacts of climate change can be minimized and resulting vulnerability reduced through the implementation of strategies, policies, practices, and tools. Adaptive capacity is the ability to take advantage of resilience opportunities, or to respond to potential climate hazards. In response to the impacts of climate change, many communities in California are taking responsibility for addressing both mitigation and adaptation actions at the local level. Due to the current climate emergency, a twofold approach by climate planners, practitioners, and decision makers is necessary. This includes developing hazard mitigation plans for inevitable climate-related disasters and hazards in parallel with the development of GHG reduction and carbon-capture plans that mitigate their respective contribution to emissions and climate change.

Through proactive measures related to land use, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can dramatically reduce emissions and increase adaptation and resilience in their communities. The California state climate policies encourage local governments and public agencies to develop even more effective solutions at the local level. However, the goal of achieving truly substantial regional climate resilience cannot be achieved by local governments alone; achieving meaningful results will require a community wide effort that includes the private sector and individuals alike.

The SNC region could substantially benefit from expediting the process of reducing GHG emissions and adapting to climate change. Accelerated climate action implementation could make meeting regulatory mandates easier for local governments, as well as reduce the costs associated with operations and increase resilience to climate change and subsequent interruption of essential services, environmental damage, and economic collapse. It is essential to reduce emissions and plan for impacts simultaneously; efforts to adapt will be overwhelmed by the harm done by climate change if emissions are not reduced.

This process and the types of programs resulting from it will likely encourage increased capital investment in the region, not just for clean energy, technology, and adaptation interventions but also for businesses and private sector entities implementing the programs. Reducing GHG emissions and adapting to climate change today could reduce public health impacts and costs in the future.



What is Adaptation?

Adaptation is the adjustment of natural and human systems in response to actual or expected changes in climate conditions in order to reduce the harmful effects of actual or expected changes, including increased frequency and intensity of climate-related hazards, sensitivities, and conditions.¹ Adaptation and resilience are related but distinct climate responses. Resilience is the capacity to prepare for disruptive conditions, recover from those conditions, and adapt for future effects, and it can be measured by the ability to withstand the ongoing impacts of climate change. Adaptive capacity is the ability of communities and assets to withstand the impacts of climate change, recover from those impacts, and foster a more resilient future.

The purpose of developing adaptation strategies is to increase both the physical and social resilience of a community's people, natural environment, built systems, and economy. Adaptation planning seeks to address exposures identified through the vulnerability assessment and develop adjustments that can moderate harm or increase beneficial opportunities. The resulting strategies can be organized by the following sectors:²

- Human – can include social and cultural systems such as health services (i.e., physical and mental health), emergency services (e.g., fire preparedness and response and law enforcement), leadership and governance (e.g., government staff, elected leaders, informal civic leadership, and key stakeholders), and vulnerable and underrepresented populations (e.g., housing-burdened populations, People of Color, senior citizens and youths, disabled people, seasonal and/or low-income workers, etc.), as well as important cultural groups, such as Native American tribes, faith groups, community based organizations, and local cultural groups.
- Built – can consist of the following systems: water (i.e., wastewater, stormwater, residential water, and industrial/agricultural water), transportation, energy (e.g., production and distribution), buildings (residential and industrial), utilities, municipal planning, and engineering and construction.
- Economic – can consist of businesses and industries, forestry, agriculture, and recreation/tourism, as well as local business associations.
- Natural – can consist of the following systems: terrestrial (i.e., forest) and aquatic (i.e., rivers and lakes) environments, as well as parks and public lands.

Throughout the adaptation planning process, it is imperative to foster cross-sector coordination, as climate change affects all sectors, populations, and resources. While planning at the local government level can successfully focus on a single specific resource or sector, this approach is potentially detrimental to developing a robust and impactful adaptation strategy framework, suffering from strategies and implementation actions that are redundant, waste resources, reduce capacity, or create conflict between sectors.

1 California Adaptation Planning Guide
2 Climate Ready Communities

Framework: Guidelines to Follow

Adaptation strategy development convenes all of the major identifiable climate vulnerabilities and risks into implementable actions and policies, and involves balancing adaptation needs against goals, timing and funding restraints, and other climate-related uncertainties. Developing effective adaptation strategies that are suited to local or regional context, including the natural environmental setting, economic conditions, and social and political systems, is imperative to achieving climate goals and community resilience. An adaptation strategy framework can be used as a starting point from which to develop adaptation strategies and policies that will be locally or regionally effective. The framework specifies policies and implementable strategies for adapting to the impacts of climate change and addresses the specific sensitivities and risks identified in the vulnerability assessment.

These findings should inform a framework that is consistent with the vision, goals, and desired outcomes of the community, as well as provide direction through the planning process and implementation. Prioritizing adaptation strategies must be based on local social, cultural, political, built, economic, and environmental context.

First published in 2012 and updated in 2020, the California APG is the recommended tool that local governments, tribal governments, agencies, organizations, and communities use to inform their adaptation planning efforts with best practices that align with California's most recent plans, programs, science, regulations, and policies. The updated APG presents a multiphase process that is applicable to communities and jurisdictions of varying sizes, resources, and capacities to address many impacts of climate change, including extreme heat, wildfire, drought, and flooding. These updates include the latest requirements for local adaptation planning and the release of documents and tools, such as California's Fourth Climate Change Assessment, the Safeguarding California Plan: 2018 Update, and the Governor's Office of Planning and Research's Adaptation Clearinghouse.

The adaptation planning process is best developed through a collaborative process that clearly identifies how the community will address the impacts identified in the vulnerability assessment given its resources, goals, values, needs, and regional context. Adaptation policies and strategies can inform or be codified, implemented, or incorporated into a variety of climate planning and action efforts, which may be new or already existing in the community. These include but are not limited to the following:

- Agency policies and procedures
- Community general plan documents (specifically the safety element)
- The local hazard mitigation plan
- A community-wide climate action plan
- Other zoning or land use codes
- Capital improvement plans
- A stand-alone adaptation plan
- Integrated regional water management efforts
- Emergency operations plan
- Tribal and Indigenous community plans
- Community health improvement plans

The climate change adaptation planning process is thorough and ongoing. Phasing the process and steps is best achieved by following the guidelines outlined by the APG. Regardless of the desired level of adaptation planning, every community and agency can navigate through the same process, working step-by-step to develop strategies that are actionable, implementable, and will increase the community's resilience. The APG encourages local governments and adaptation practitioners to establish equity, outreach, and

engagement practices throughout the decision-making processes, and supports a process that leads to co-ownership between local government and the community to become resilient to climate change impacts.

The purpose of developing an adaptation framework is to increase both the physical and social resilience of a community's people, natural environment, and built systems by identifying specific policies and strategies that can be implemented to adapt to the impacts of climate change. Once a community has determined their adaptation planning vision and identified key vulnerabilities, preparation of the adaptation framework and strategies can begin.

Ideally, all strategies have one or more co-benefits (additional benefits resulting from a single resiliency action) and can be linked to other climate actions and initiatives. Throughout the framework development process, it is important to foster alignment with equity principles so that strategies are transformative and address social inequities while tackling the impacts of climate change. The framework should clearly highlight the co-benefits of strategies, as this emphasizes the value of climate adaptation planning to the community as well as decision makers and stakeholders.

Strategy development is iterative, and developing strategies with agency and community stakeholders identifies opportunities to integrate adaptation planning into multiple community programs and plans, bolstering overall resilience. The APG provides examples and strategy-drafting instructions to fit the structure and requirements of a variety of implementation mechanisms. According to the APG, the following steps should be taken when developing an adaptation strategy framework:

1. Summarize vulnerabilities
2. Prepare vision and goals
3. Prepare adaptation strategies
4. Prioritize adaptation strategies
5. Inform finalizing strategies with outreach and engagement

Adaptation strategies should be developed and prioritized within the policy framework that is most suitable and consistent with the policy and/or planning document where the strategies and policies will be documented and codified. As plan types, programs, and projects have varying terms and approaches, it may be appropriate to use strategies written in general statements of policy direction, whereas others may require specific implementation direction and contain a high level of detail.

To support Sierra Nevada adaptation planning efforts, Appendix 4 contains adaptation tools and resources that can be used as a jumping-off point for local or regional planning and implementation. While not intended as a comprehensive strategy framework for the Sierra Nevada, the example adaptation strategies are organized by the sector outlined in this document and consider cobenefits and potential implementation needs, such as agency and funding sources. Local governments, agencies, and organizations should also examine all potential implementation resources, tools, collaborative partnerships, and funding opportunities to develop a robust framework.

In order for climate adaptation to be successful across the SNC region strong partnerships need to be developed between local government, community organizations, and state and federal governments. These partnerships can boost capacity at the regional level by allowing for funding partnerships and technical assistance. Since a large portion of the SNC region is managed by the federal government, communities and federal agencies will need to foster collaboration to develop shared solutions to cope with climate change impacts. This report does not disclose possible strategies to foster these partnerships, but acknowledges that these partnerships will be necessary to implement many of the adaptation strategies shared further in this chapter.

EXAMPLES OF ADAPTATION STRATEGIES

for the Economic Drivers of the
Sierra Nevada Region



RECREATION AND TOURISM:

Some ways the Sierra could respond to recreational and tourism impacts

Climate Hazard	Adaptation Strategy	Benefit
 <p>WILDFIRE</p>  <p>SMOKE & ASH</p>	<p>More public restrooms, trash receptacles, and public transportation to public land access points will become more necessary.</p>	<p>There will be increased visitation to regions of the Sierra experiencing less physical hazards, like smoke or forest closures, and built infrastructure will need to be in place to protect the environments facing increased human use.</p>
 <p>EXTREME HEAT EVENTS</p>  <p>WILDFIRE</p>	<p>Design connected trail networks, including shaded areas.</p>	<p>Fuel breaks and access to hard-to-reach areas for firefighters. Shaded areas to decrease heat-related illnesses and create accessible outdoor recreation during extreme heat events.</p>
 <p>DROUGHT</p>	<p>Increase “bikeability” of Sierra roads. Due to a lack of bike lanes, two-lane highways without sufficient shoulders, and unpredictable drivers, Sierra roads can be dangerous for cyclists.</p>	<p>With shorter winter seasons and less snow on the roads, the Sierra could become one of the most scenic and challenging road-bike mecas. This could increase visitation of road bikers</p>
 <p>ECOSYSTEM DEGRADATION</p>	<p>Increase Transient Occupancy Tax or create additional taxes on tourists. Tourist taxes could be presented as additional nominal fees on car rentals, boat rentals, or gear rentals and deposited into a special fund at the local jurisdictional level.</p>	<p>Increased jurisdictional revenue with dedicated spending budgets would increase conservation efforts, the feasibility of updated water infrastructure, broadband for all, and other social services. An example of this is the off-highway vehicle (OHV) fund.</p>

NATURAL RESOURCES:

Some ways the Sierra could respond to shifting natural resource needs

Climate Hazard	Strategy	Benefit
 <p>WILDFIRE</p>  <p>DROUGHT</p>  <p>ECOSYSTEM DEGRADATION</p>	<p>Apply for state and federal grants focusing on integrated resource management for large land use and landscape planning.</p>	<p>Better land use planning would mitigate new development in WUI regions while maintaining open spaces for wildlife, water storage, carbon storage, and other ecosystem services.</p>
 <p>ECOSYSTEM DEGRADATION</p>	<p>Improved economic analysis of public land use shows the monetary value of high water quality, forest health, and thriving ecosystems. This analysis should be used to manage public lands by alleviating the pressure from the idea that development is the only economic driver.</p>	<p>The economic analysis shows there is no “economy vs. environment” argument when public lands are managed in a healthy way that allows for ample human use (e.g., recreation, water quality, and wildfire mitigation).</p>
 <p>ECOSYSTEM DEGRADATION</p>  <p>WILDFIRE</p>	<p>Increase wages in entry-level natural resource careers.</p>	<p>Increased workforce for forest management, wildfire mitigation, and bioenergy sectors. Increasing young, educated populations in rural regions will revitalize bedroom communities and increase community adaptation capacity.</p>

AGRICULTURE:

Some ways the Sierra could respond to threatened agricultural practices

Climate Hazard	Strategy	Benefit
 <p>DROUGHT</p>	<p>Begin transitioning growing seasons for crops where applicable, and also transitioning to drought resistant crops like alfalfa and other forage crops.</p>	<p>Economic resilience.</p>
 <p>DROUGHT</p>  <p>ECOSYSTEM DEGRADATION</p>	<p>Developing smaller, organic farm initiatives in order to provide fresh vegetables to local residents where there is otherwise limited access to fresh food.</p>	<p>Farmers' Markets and local Community Supported Agriculture (CSA) programs can foster community cohesion, healthy lifestyles, and sustainable growing practices.</p>
 <p>DROUGHT</p>  <p>ECOSYSTEM DEGRADATION</p>	<p>Alternative water storage in wetlands and groundwater basins.</p>	<p>Revitalizing wetlands could allow some dams and water diversion methods to be removed. Oftentimes, a healthy wetland ecosystem can store more water than a man-made reservoir.</p>
 <p>DROUGHT</p>  <p>ECOSYSTEM DEGRADATION</p>	<p>Lower costs and requirements for legalizing cannabis operations.</p>	<p>More legal growth means more enforced regulations and more tax revenue for local jurisdictions.</p>

Climate Hazard	Strategy	Benefit
 <p>EXTREME HEAT EVENTS</p>  <p>SMOKE & ASH</p>	<p>Creating safety nets for outdoor laborers by enforcing public health initiatives like access to drinking water, adequate shade and cooling centers, and free approved face masks during unhealthy air quality.</p>	<p>Economic resilience for industries reliant on outdoor workers like agriculture and construction.</p>
 <p>EXTREME HEAT EVENTS</p>  <p>SMOKE & ASH</p>  <p>DROUGHT</p>  <p>WILDFIRE</p>	<p>Introduce pathways to citizenship or greencards, health care access, and other social services for migrant workers.</p>	<p>Economic resilience for industries reliant on migrant workers, like agriculture and construction.</p>
 <p>DROUGHT</p>	<p>Upgrade and harden ditch water transportation systems.</p>	<p>Mitigate ditches being washed out by atmospheric river events or mudslides leading to agricultural water shortages.</p>

CASE STUDY:

Plumas County and Sierra County Technical Assistance with Adaptation Planning

In an effort to improve planning and better prepare for funding opportunities, SBC developed a technical assistance framework in consideration with the adaptation planning guide. Technical assistance from outside organizations serves as an adaptation strategy that assists with capacity building and accelerates local government compliance with SB 379. Additionally, vulnerability assessments at the county and incorporated city level provide more relevant data for assessing climate hazards and planning for the safety and well-being of local constituents. On a more regional level, technical assistance helps the Sierra Nevada community as a whole accomplish its cross-sector climate resilience goals and implement key regional policies.

Technical assistance consists of three main considerations:

1. Analyzing agency needs: assessing previous outcomes of adaptation planning efforts, gathering information during stakeholder workshops, exploring complementary adaptation planning efforts in the community, and commencing public engagement.
2. Establishing goals and intended outcomes: working with the TA recipient—whether jurisdiction or community—to establish expectations, goals, and opportunities for refinement and adjustment as needed.
3. Building an implementation structure: choosing an approach to best address the needs and goals outlined in prior steps.

These elements, in conjunction with the California Governor’s Office of Emergency Services’ *Adaptation Planning Guide*, serve as the framework for SBC’s team technical assistance strategy.

Sierra Business Council has leveraged its partnership with CivicSpark (a program administered by CivicWell [formerly the Local Government Commission]) to assist and build capacity for local governments while addressing emerging environmental and social equity resilience challenges.

For the past two years, SBC has facilitated a support system for CivicSpark Fellows to pursue climate vulnerability projects for two jurisdictions in the SNC region: Plumas County and Sierra County. These two counties serve as case studies of how counties and cities without capacity can implement SB 379 requirements.

Issues addressed included but were not limited to:

- Developing a project involving collaboration between different members of the community
- Assisting in understanding and completing adaptation planning per SB 379
- Building a shared understanding of resilience across local government departments
- Bringing stakeholders together to discuss innovative mitigation solutions
- Identifying adaptation strategies for funding mechanisms
- Preparing local adaptation partnerships with background research
- Understanding social vulnerability and equity within the county
- Exploring adaptation needs analysis with community participation
- Integrating adaptation principles into other planning mechanisms as needed
- Synchronizing planning agencies at the local level with larger, regional efforts

DISCUSSION & CONCLUSION

Regional Knowledge Summary

We are already feeling the impacts of climate change. According to the Intergovernmental Panel on Climate Change (IPCC), much of the damage to our natural systems is irreversible, and continued atmospheric warming impacts will worsen over time if drastic measures are not taken. The Sierra Nevada region is predicted to continue to experience scenarios ranging from extreme precipitation to extreme drought. These conditions will continue to impact regional snowpack and wildfires. As a region, we can build resilience by understanding and preparing for these impacts to our communities through general planning, adaptation strategies, and policy implementation.

The Sierra Nevada Climate Vulnerability Assessment is designed to build capacity for stakeholders to undertake SB 379 implementation, climate planning, and priority-project identification for 22 counties within the Sierra Nevada region. This report focuses on climate impacts to the economy, environment, and community, and reveals unique vulnerabilities to the SNC region.

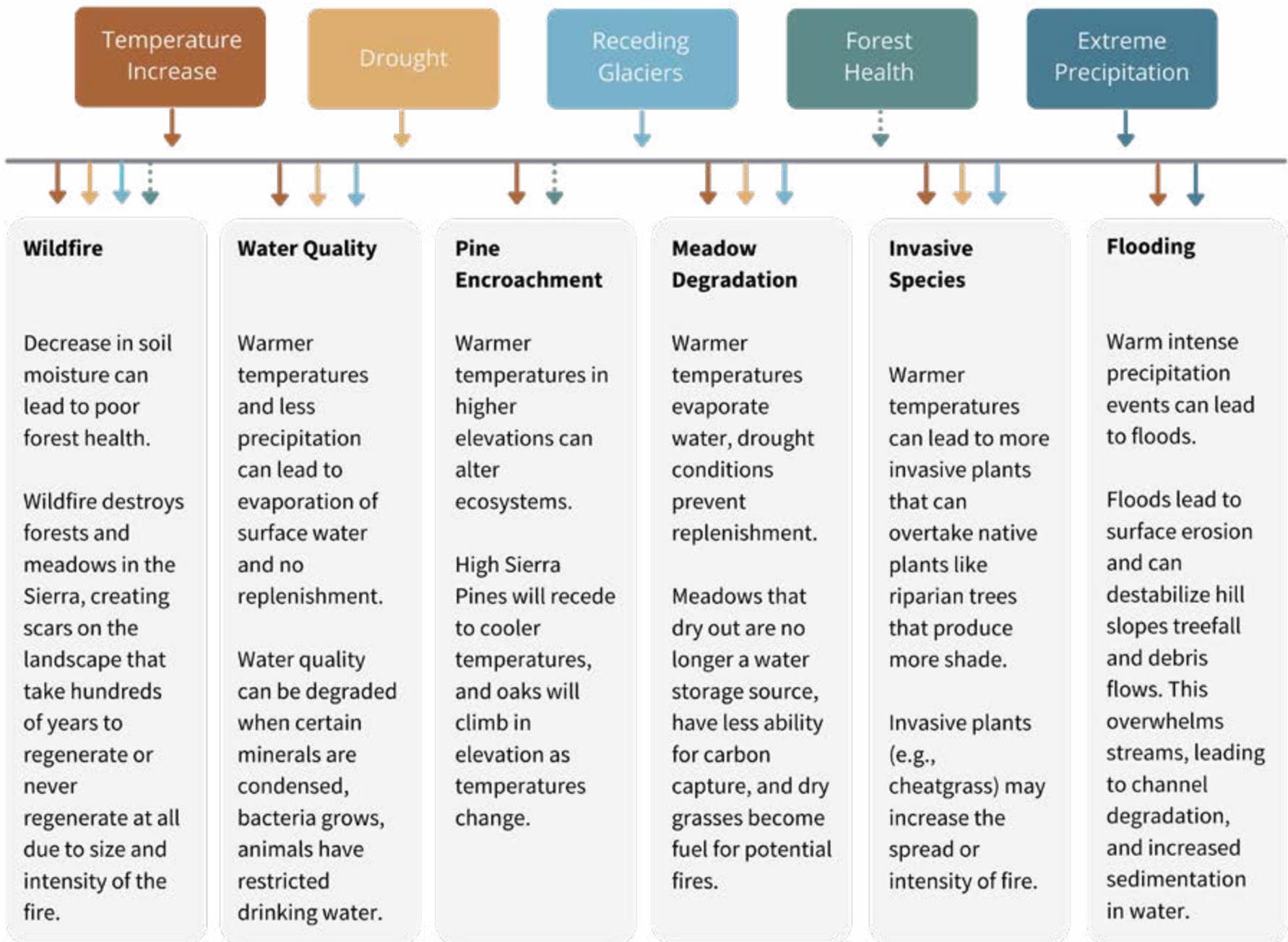
In addition to being a guide for implementing SB 379, this report is also designed to be an informative tool that helps educate stakeholders and policy makers when making decisions about the Sierra Nevada region. Although the primary audience for this assessment is city and county planners and policy makers, SBC hopes that community members and climate-curious individuals will find this document informative and use it as a launchpad for future projects.

Discussion

In short, this assessment presents aggregated datasets that illustrate vulnerability and risk within the SNC region; more specifically, it demonstrates how these communities and economies are and will be impacted by climate change.



Climate Data Summary



Climate Data Summary

The Sierra Nevada region is already experiencing dramatic changes due to climate change, and this will only continue. California has exceeded a 1°F increase, with some areas in the state experiencing increases in temperatures in excess of 2°F. Overall, daily maximum temperatures are expected to increase between 4.4°F and 5.8°F during the mid century (2035–2056). On average, people in California can expect to experience extreme heat events that last two weeks longer than historical averages. The Northern Sierra can anticipate extreme heat events to occur four to ten times more frequently during the mid century compared to historical averages.¹

As temperatures continue to increase, resulting in evaporation and evapotranspiration, moisture levels will increase in the atmosphere (while decreasing soil moisture). This has been and will continue to be a cause of changing patterns of precipitation. As the region has already begun to experience, these precipitation events will be inconsistent but more dramatic than ever, causing events like heavy snow, rain-on-snow, flooding, and landslides.

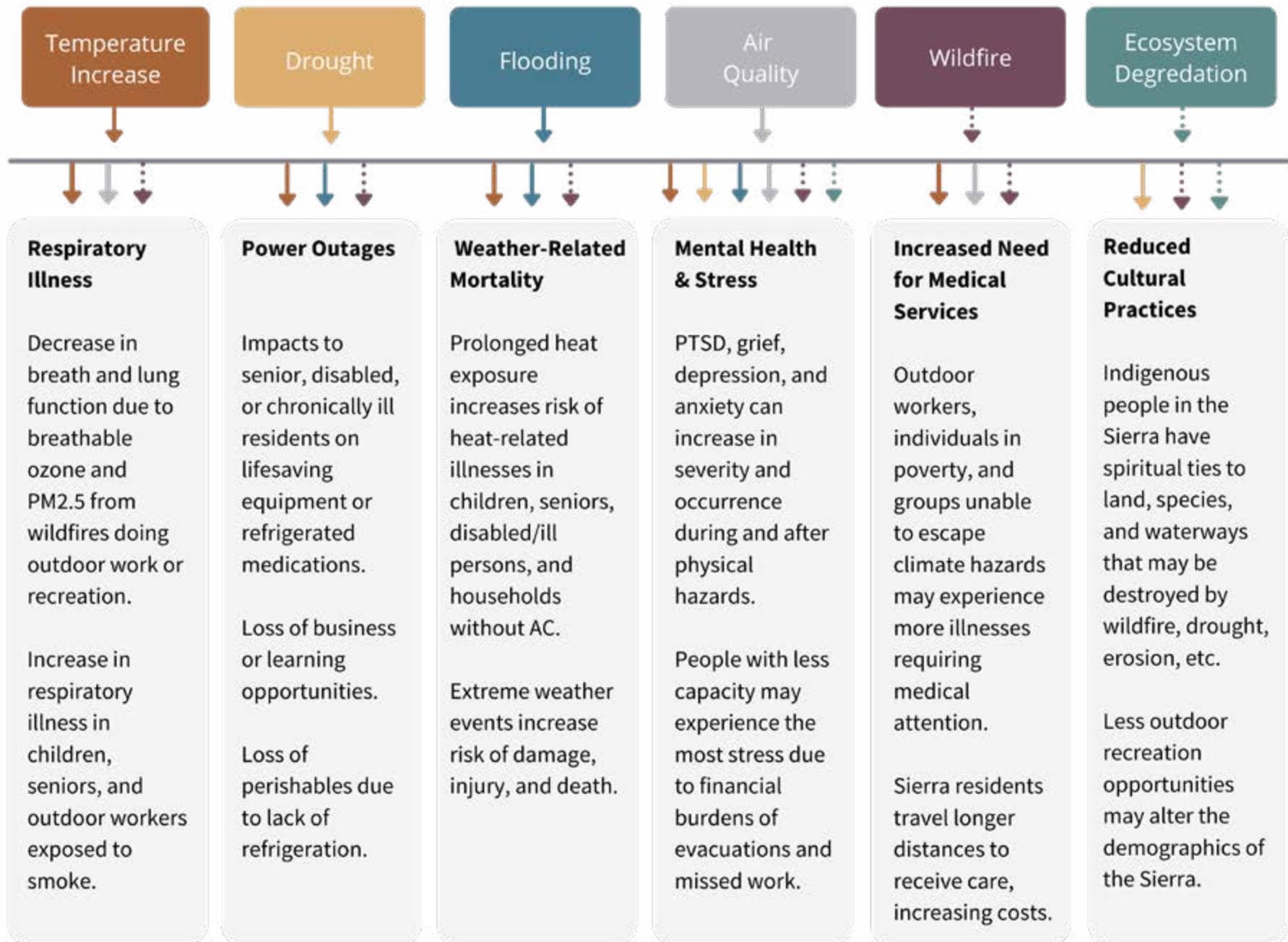
The amount of precipitation falling as rain has begun to increase in the past four years, and warming temperatures will only exacerbate the issue. The rate of precipitation falling as snow is predicted to continue decreasing significantly, while snow levels continue to rise in elevation. Dramatic changes to the historical snowpack will permanently alter ecosystems throughout the region. Water shortages will become more common and soil moisture and water quality will continue to be impacted, setting the stage for wildfires of greater intensity.

Wildfires and megafires are expected to continue increasing in magnitude and frequency every year. Such extended and damaging wildfire seasons will continue to escalate smoke conditions, permanently damage landscapes and ecosystems, and threaten communities.

These events are cyclical and will continue to snowball as one event leads to another. The only way to slow down the climate emergency process is to decrease or completely eliminate emissions as quickly as possible and eventually move toward carbon sequestration.



Population Data Summary



Population Data Summary

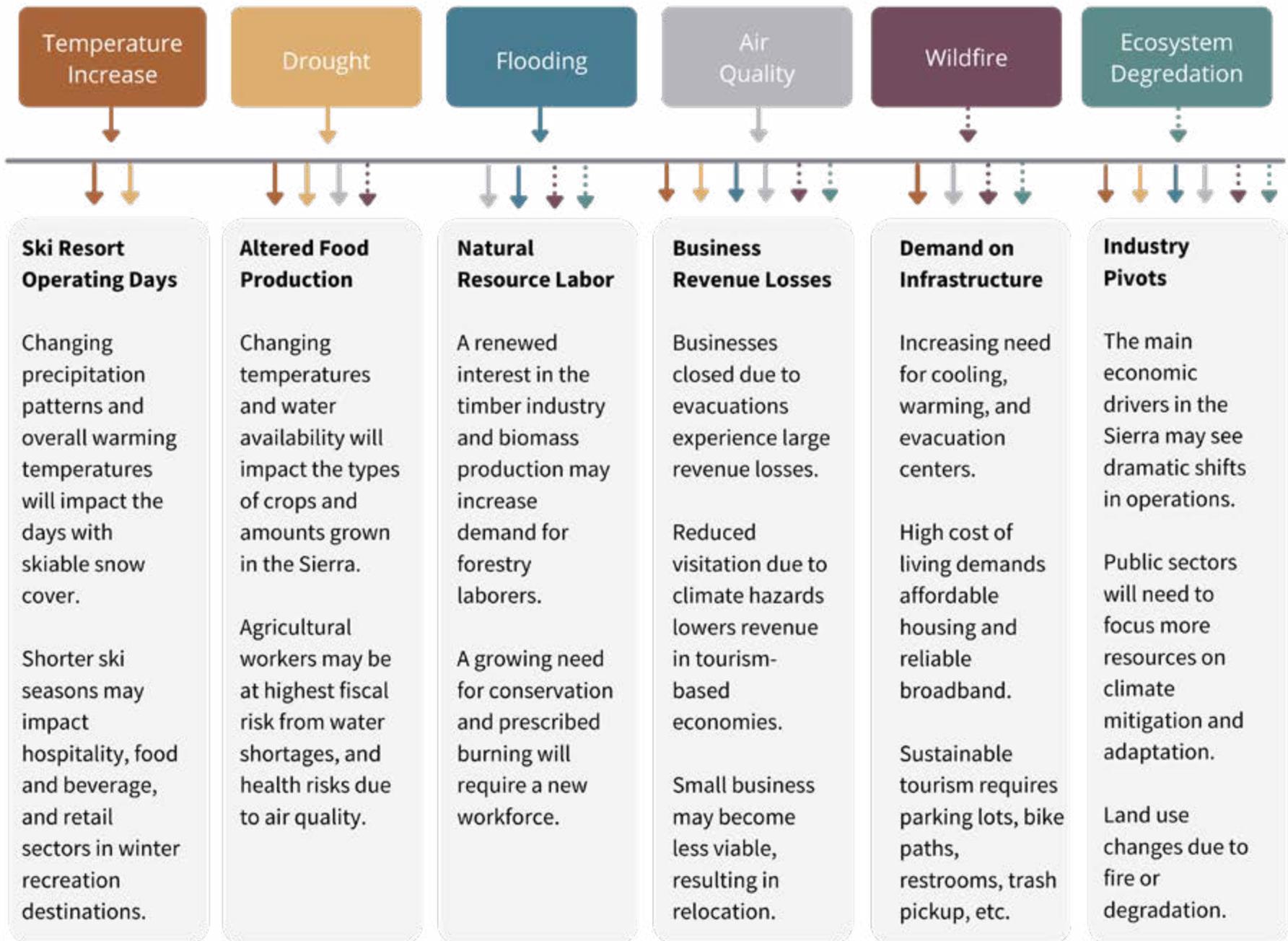
The SNC region has historically been defined as a rugged terrain populated by rugged individuals. While many residents appreciate living rural lifestyles, there are demographic groups in the region who have been systemically underserved and will require more support and resources to deal with climate change. These historically underserved groups include People of Color, the disabled community, Indigenous people, and people living in poverty. Together these groups make up over half of the total population of the SNC region. These groups are more likely to have been denied access to building generational wealth, obtaining higher education, and living near public resources like schools, hospitals, and grocery stores. Overall, these groups have commonly been left out of community planning processes and will require the most support during severe climate hazards.

Across the SNC region, housing-burdened residents represent the demographic group with the largest population. Over 40% of SNC regional households are housing burdened, and the majority of people in this group are renters. With housing costs increasing across the region, more long-term residents with high levels of local knowledge may be forced to leave. This will reduce the workforce and human capital in the region. Communities with high populations of housing-burdened people will have less capacity to deal with climate hazards and implement adaptation and mitigation efforts.

Populations with the highest risk to climate hazards are senior citizens, children, outdoor workers, and single-access-road residents. Senior citizens and children share similar risks due to their limited physical ability to protect themselves from harm. Outdoor workers are at high risk of physical injury from climate hazards like poor air quality and extreme heat due to their high exposure levels. People living on single-egress/ingress roads are at high risk of becoming trapped during climate hazards, with limited to no access for first responders.



Economic Data Summary



Economic Data Summary

The top four economic drivers in the SNC region are tourism, recreation, agriculture, and natural resources. Each of these industries will be impacted by climate change.

The tourism industry will experience reduced visitation primarily due to wildfire impacts (e.g., evacuations, air quality, and forest closures), resulting in revenue losses and reduced job opportunities. Accommodation and food services generate the highest revenues from visitor spending, and less overnight visitors will greatly impact local economies. Destination gateway communities and recreation-based economies will be heavily impacted. Small businesses may become less viable in these communities.

Recreation opportunities will be impacted by snow drought, lower surface water levels, and wildfires. USFS data shows that when recreation opportunities are disrupted due to climate hazards, visitors often choose a different destination entirely, rather than postponing their trip to the Sierra or choosing different recreational activities. Communities reliant on winter recreation will experience shorter ski seasons by mid century, resulting in longer shoulder seasons with negative economic impacts.

Agriculture within the SNC region will primarily be impacted by shifting and warming growing seasons and extensive drought. The primary crops within the region are grain crops like rice, hay, and alfalfa. More than 85% of working land in the SNC region is used for ranching, resulting in large swaths of open grassland. As crops and livestock become harder to maintain due to lack of water, many private landowners will begin to feel the economic squeeze to sell off land. This may lead to private, open lands being subdivided into commercial, industrial, or residential developments. Urbanization of private land will decrease the ecosystem services currently provided by agricultural land.

Specific natural resource sectors in the SNC region might experience a boom as forest management, biomass utilization, and conservation efforts become a key mitigation strategy to climate change. Other sectors, like water management, may see declines as drought becomes more prevalent, lowering the ability of hydroelectric facilities to operate. Land use practices may become more informed by Traditional Ecological Knowledge (TEK), with controlled burning and other traditional Indigenous practices becoming more essential.

While the four main economic drivers (tourism, recreation, agriculture, and natural resources) generate the most revenue, they do not employ the majority of the population, nor do they pay the highest wages. In fact, all four sectors pay the lowest entry wages in the region. The two sectors that employ the majority of the population are local government and social services (e.g., health care, education, and utilities).

In the SNC region, the average median annual household income hovers just below \$60,000, while the average cost of living for a couple with one child is over \$75,000 annually. Low wages are common in rural areas of the state, but the cost of living in the Sierra typically exceeds income levels. Crucially, this has led to high levels of housing burden and a working class that is forced to live farther from town centers, commute long distances for basic needs, or even leave the region.

One reason for the dramatic increase in cost of living in the region is that many wealthy individuals with access to nonlabor income or high-paying remote work have relocated to rural areas. This in-migration of wealthier residents is likely to continue to grow as people flee rising sea levels and extreme heat in the coastal and valley regions of California.

The most vulnerable industries in the Sierra are likely tourism and recreation due to their reliance on visitor access to the outdoors. Workers in these industries will be heavily impacted by reduced visitation. Since these careers have the lowest pay in the SNC region, this group of workers will have less capacity to adapt to climate hazards and reduced work opportunities. This may lead to a mass out-migration of the working class.

The majority of the population in the region will be impacted by climate hazards, with limited resources to manage them. While there are varying levels of household wealth, education, and community ties among residents, there are universal barriers to building community capacity within the SNC region.

The primary barrier is a lack of quality infrastructure, specifically reliable energy grids, drinking water supply, and access to high speed internet. More extreme heat, atmospheric weather events, and wildfire will increase demand for in-home cooling, heating, and ventilation, while causing more power outages. More severe drought will cause private wells to dry out leaving residents with expensive repairs or alternative solutions. Cities with public water services will also experience water shortages, and more communities will face restrictions in water use. Without access to broadband, many rural communities will be left without a means of reliable communication with authorities during severe weather events.



COMMUNITY CAPACITY

Workshop Summary

SBC partnered with SI to conduct community capacity workshops for communities within the SNC region. Due to the COVID-19 pandemic, these workshops were conducted virtually, and workshop participation levels varied across the region. Participants were asked to share local knowledge regarding infrastructure conditions, community collaboration, and wealth disparity (along with other indicators of capacity), and to score the level of capitals present in their community. As defined in chapter 5 of this assessment, the five capitals that define community capacity are:

- Financial capital
- Human capital
- Social capital
- Cultural capital
- Physical capital

Community members ranked the average capacity score for the SNC region at 2.9 (out of 5). A community capacity score of 3 indicates medium capacity to deal with climate change hazards and community stressors, like passing local development measures, building cross-cultural relationships, and implementing adaptation and mitigation strategies at the local level. It is important to note this average value is not representative of individual scores for each community.

Within the SNC region, capacity scores can swing from 1 to 4 among neighboring communities, even within the same county. Current climate projection data cannot provide accurate models at the community level; therefore, it is impossible to determine which communities will be hit the hardest by climate change. It will be important for communities to build relationships in order to support each other during climate change impacts.

Communities in the SNC region that scored themselves as having lower levels of capacity to deal with climate hazards typically have lower physical and cultural capital compared to other communities in the region. This indicates that cohesive communities with high-quality, equitably distributed infrastructure can better withstand climate hazards. Additionally, workshop scores indicated that communities with more capacity tend to have high levels of financial and human capital. High-capacity communities tend to have higher populations of younger residents with higher education levels who frequently organize in order to further community projects.

Due to the rural nature of the SNC region, one of the greatest challenges to climate resilience is a lack of local government and small business capacity to deal with climate hazards. Many smaller communities have less representation at the state, and even county, level. This, along with state metrics that rank the SNC region as having a lower climate hazard risk, have caused the region to be left behind in terms of project prioritization and funding resources.

CLIMATE

Workshop Summary

On average, workshop attendees gave their communities a capacity rating of 3 on a 1–5 scale (attendees' ratings ranged from 2 to 4, with no communities receiving a 1 or 5 score).² Some communities were rated higher and some were rated lower, but they were comparing their capacity to communities within the region rather than California as a whole (even then, capacity is rated 60% at best). Even with assistance from outside organizations like NGOs, communities expressed a lack of capacity to follow through on essential projects. Many (if not all) of these towns and cities are unprepared for the climate emergency and fear the increasing magnitude of wildfires. Unlike California's metropolitan areas, the SNC is predominantly Wild Urban Interface (WUI), and the risk of structure damage is exceedingly higher. Many businesses and families that lost structures to wildfires in the past year (2021) will never recover. Home hardening strategies are not always an option when wildfire temperatures exceed 900 degrees. Rural regions will always have smaller populations, and they will have to compete with urban communities applying for the same climate relief grants.

Takeaways from workshops

- In short, the top three concerns for communities within the SNC region are threats to forest health, diminishing air quality, and wildfire.
- Extreme heat events are another significant concern for underserved communities that don't have access to cooling centers or other ways of staying cool. Warmer temperatures have impacted seasonal agriculture on the Modoc Plateau; without consistent hard freezes, plant pests will demolish crops. Warmer temperatures have shifted planting seasons and time frames.
- For now, water shortage is a concern only in specific communities, but this concern will grow throughout the region as snowpack declines, drought continues, and water politics are left unresolved.
- Communities whose economies rely on reservoir recreation have expressed concern regarding dramatically low water levels.
- Niche communities in the Eastern Sierra are concerned about extreme precipitation events including avalanches, ROS events, and debris flows.

Overall, feedback from the communities was fairly consistent: on average, they do not feel prepared for the climate emergency, and they do not have the capacity to adapt to its impacts. Some of the contributing issues include political/community tension, a struggle to evolve, and lack of education/communication. However, workshop attendees consistently expressed eagerness to step up and do what they can to help their communities become more climate resilient.

INTERPRETATIONS

The Sierra Nevada region—consisting of the Southern Cascades, Modoc Plateau, and Basin and Range—is composed of unique ecosystems that are highly vulnerable to minor changes in temperature and precipitation. Climate impacts highlight economic, infrastructure, and community risks to the region’s economic drivers. One of the biggest concerns is the fact that these impacts are not isolated from each other.

Increased temperature is directly correlated with forest health and increased wildfire risk in the region. Wildfire is already impacting the Sierra Nevada region’s economy, infrastructure, and community, and it is anticipated to worsen dramatically throughout the mid century. Wildfire season impacts tourism directly through evacuations or indirectly through poor air quality.

At the time of this report, there is no calculation for the cost of climate impacts to the primary economic drivers in the region. However, losses to the tourism industry due to the pandemic can be used as a proxy for climate change impacts. From 2019 to 2020, travel spending decreased by 42%. The loss was valued at over \$4.1 billion. Tourism-based employment decreased by 18% in the same time frame. Many small and medium businesses in the region did not recover from pandemic and wildfire impacts, and some are still struggling to bounce back (as of spring 2022).³

Fires reaching the magnitude of megafires damage landscapes and impose significant risks, including: landslides during extreme precipitation events; avalanche danger during the winter; and overall destruction to forests to the point where regeneration isn’t possible. These consequences will create a shift in mountain and foothill culture. We can assume that if climate impacts continue (and continue to grow in magnitude every year) communities in the rural Sierra Nevada region will continue to struggle unless adaptation efforts are implemented as soon as possible.

This SNC region is on the precipice of ecological changes due to temperature shifts. Warming temperatures are already impacting the overall welfare of the region. Many communities expressed that capacity is a critical issue. Most workshop participants described funding and capacity as being synonymous with one another, emphasizing the fact that local economic development is critical to climate resilience. The region needs to be prioritized for funding to implement adaptation measures and build capacity.



Common Trends Identified for Community Project Needs within the SNC Region

- Warming and cooling centers for vulnerable populations (during extended power outages and extreme heat events).
- Education on evacuation routes, stable communication during evacuations, and evacuation centers.
- Forest maintenance for wildfire prevention.
 - ▷ Build partnerships with state and federal organizations over jurisdiction conflicts.
- Assistance with private property tree removal for vulnerable populations.
- Fresh water storage for extended periods of drought.
- Alternate routes to direct traffic in emergencies.
- Broadband for communication.
 - ▷ Capacity boosting city and county web pages (trusted communication sources).
- Indoor air filtration infrastructure during wildfire season.

The SNC region makes up nearly a quarter of the land in California, encompassing roughly 25 million acres. Over 85% of the region's land is wilderness open space, mostly consisting of evergreen forests and shrubland. A little over 10% of the SNC region is agricultural land, the vast majority used as pasture or open grassland. Less than 0.5% of the region has been developed.

The region is home to a third of the state's wilderness land, giving it the ability to perform crucial ecosystem services that benefit local and downstream communities. Some of these services include ecosystem products (e.g., timber or fish) that can be sold on the market. But the majority of these services are noncommodities, like carbon storage, water storage and filtration, soil formation and nutrient cycling, erosion mitigation, and more.

Using metrics calculated in *A Changing Climate: Vulnerability in California's Eastern Sierra* (extrapolated over the entire wilderness acreage in the SNC region) it can be roughly estimated that the SNC region provides nearly \$600 billion worth of ecosystem services.⁴

As climate hazards in the region increase, ecosystems will suffer from degradation, a lower capacity to provide services, and a higher risk of damage from wildfires. Catastrophic wildfire/megafire events like the ones seen recently in the Sierra may release carbon emissions that negate the years of carbon sequestration and storage provided by ecosystems. It is of the utmost importance to maintain healthy working and natural landscapes that will continue to provide ecosystem services, lending to a more resilient region and state.

NEXT STEPS

This report is a regional document that can be used as a starting point for future projects and project prioritization. Next steps have been identified at the regional or state level, and at the local level.

Next Steps at the Regional Level

This assessment identified knowledge gaps in the SNC region. Some gaps in regional knowledge worth highlighting for research prioritization are:

- Specific climate/environmental indicator data gaps (eg., air quality)
- Socioeconomic data at the community level
- Statistics for specific vulnerable populations with known presence in the region
- Impacts historically underserved communities in rural regions will face due to climate change (outside general knowledge)

These four essential data gaps must be addressed if decision-making at the regional and state level is to encompass all people living within the SNC region.

Next Steps at the Local Level

Using the risk profiles in chapter 6, local planners and community members can begin prioritizing adaptation measures and mitigation strategies to lessen the impact of climate hazards. Research for this report exposed large gaps in capacity within local governments and public organizations. These gaps were typically due to a shortage of government staff, limited or unusable resources for small businesses, and assorted priorities within government operations. Some of these issues will take systemic change to overcome. Next steps to begin building local capacity and knowledge include:

- Assessing local capacity by holding workshops with large groups of diverse community members representing each community
- Utilizing free technical assistance programs like the Sierra Nevada Energy Watch for energy efficiency projects
- Increasing starting wages for government employees to reduce turnover and attract new talent
- Developing hazard mitigation plans that consider how the most vulnerable populations will be affected by the most likely climate hazards

References

- 1 CA.GOV, Summary of Projected Climate Change Impacts on California, <https://climateresilience.ca.gov/overview/impacts.html> IPCC, Climate Change 2022: Mitigation of Climate Change, <https://www.ipcc.ch/report/ar6/wg3/>
- 2 Due to the COVID-19 pandemic and continuous wildfire evacuations, workshop attendance and diversity were impacted. Therefore a limited scope on the true capacity of the region was determined during these workshops. Deeper analysis into the lived experiences of non-English speakers, POC, seasonal employees, low income earners, and other underrepresented groups is necessary to accurately represent capacity in the Sierra. We would like to expand our community outreach when the pandemic no longer impacts in-person communication.
- 3 Visit California, Economic Impact of Travel in California 2011-2020. Authored by Dean Runyan Associates, Inc.
- 4 This value is estimated using average dollar per acre values for land cover types providing different ecosystem services determined in A Changing Climate: Vulnerability in California's Eastern Sierra. This value represents only four ecosystem services provided by working and natural lands in the SNC region. Those ecosystem services are: air quality, water quality, carbon sequestration, and carbon storage. Due to the inclusion of carbon storage, this value cannot be annualized. This is not an official evaluation of ecosystem services in the SNC region.

APPENDICES

APPENDICES	276
Glossary of Terms	278
Overview of Assessment	278
Ways to Measure Climate Change Effects on Humans/Ecosystems	279
Responses to Climate Change	279
Approach	280
Climate and Environmental Research/Data	280
Primary Technical Advisory Group Members	280
Climate Projection Parameters/Modeled Data	280
Cal-Adapt Team	280
Methodology	280
Framework	281
Best Practices	281
Climate Parameters and Models	282
Data Analytics	285
<p>Since this project serves regional scale and localized county/city purposes—two datasets were clipped to meet both of these purposes. Cal-Adapt being the recommended source by the State of California offers great value of information at the county level. However, the SNC boundary does not include full county boundaries, and at the time of the data collection phase, there wasn’t an option for this on Cal-Adapt. Instead one of the TAG members who works closely with California-Nevada Climate Applications Program at Scripps Institution of Oceanography (Scripps) was able to provide the SBC team with detailed projection datasets for the SNC region. The benefit of mapping these higher resolution datasets from Scripps (instead of county level averages) is that we can see precisely the dramatic changes that occur within a county.</p>	287
Disclosures Regarding the Data and Methodology	287
Raw Data	287
Modeled Data and Climate Parameters	287
Cal-Adapt	287
Socioeconomic and Populations Data	288
County Risk Scores	288
Climate Hazard Risk Score	289

Human Impact Score	290
Community Capacity Assessment Worksheet	292
Adaptation Planning	402
Adaptation Framework	402
Adaptation Strategies for Ecosystems	403
Adaptation Strategies for Industry	404
Adaptation Strategies for Communities	404
Tools	406
Water	406
Drought	407
Water Quality	407
Flood	408
Wildfire	408
Vulnerability Assessments in the Sierra	408
Water	410
Drought	410
Water Quality	411
Flood	412
Ecosystem	412
Other Vulnerability Assessments	413

Glossary of Terms

Overview of Assessment

- **Climate Change** - the change in the state of the climate that can be measured by a change in the average or variability of properties that exist for long periods of time (decades or longer).
- **Sierra Nevada Conservancy** - the largest conservancy in California, and the largest state conservation effort of its kind in the nation. The nonregulatory, nonprofit organization, which functions under the State Resources Agency, funded this vulnerability assessment.
- **Senate Bill SB 379** - requires all cities and counties to include climate adaptation and resiliency strategies in the safety elements of their general plans upon the next revision beginning on or after January 1, 2017, or, if the local jurisdiction has not adopted a local hazard mitigation plan, beginning on or before January 1, 2022. The bill requires the climate adaptation update to include a set of goals, policies, and objectives for their communities based on the vulnerability assessment, as well as implementation measures, including the conservation and implementation of natural infrastructure that may be used in adaptation projects. Specifically, the bill requires that upon the next revision of a general plan or local hazard mitigation plan, the safety element is to be updated as necessary to address climate adaptation and resiliency strategies applicable to the city or county.
- **California Adaptation Planning Guide (APG)** - a resource for local governments engaged in adaptation and resiliency planning developed by the California Governor's Office of Emergency Services.
- **Vulnerability Assessment (VA)** - a tool that can be used to initiate the adaptation planning process. A climate change VA focuses on factors that contribute to climate change, and the direct and indirect impacts of climate change on humans, ecosystems, and infrastructure.
- **Greenhouse Gas** - naturally occurring or anthropogenic gasses in the Earth's atmosphere that absorb and emit radiation, resulting in the greenhouse effect.
- **Environmental Indicators** - climate variables with trackable data like temperature, precipitation amount, snow cover, soil moisture, etc.
- **Socioeconomic Indicators** - social and economic variables with trackable data like demographic populations, median household income, labor force participation, etc.

- **Climate Hazards** - environmental indicators that reach high/dangerous levels, or climate sensitivities (see sensitivity definition below). Examples: extreme heat/heat waves, extreme precipitation, wildfire, debris flow/flooding, avalanches, etc.

Ways to Measure Climate Change Effects on Humans/Ecosystems

- **Vulnerability** - the overall risk of people, ecosystems, or infrastructure to be negatively affected by climate change.
- **Impact** - the effects of climate change hazards and sensitivities on humans, ecosystems, and infrastructure.
- **Sensitivity** - the outcomes of climate change that endanger humans, ecosystems, or community infrastructure/assets. Examples: reduced snowpack, earlier runoff, forest health, wildfire, surface water level, dry wells, unhealthy AQI, etc.

Responses to Climate Change

- **Adaptive Capacity** - the ability of people, ecosystems, or infrastructure to respond to climate change impacts that result in the least amount of harm.
- **Community Capacity** - the adaptive capacity of a community (in the report, communities are generally defined as jurisdictional regions (e.g., census tracts, towns, cities, counties, etc.)).
- **Adaptation** - the process of adjusting to projected or actual changes in climate and its impacts to reduce harm to humans, ecosystems, and infrastructure.
- **Mitigation** - human intervention that reduces the amount of greenhouse gasses emitted, or works to capture and store (enhance natural sinks) of greenhouse gasses.

Approach

Primary Sources That Informed this Vulnerability Assessment.

This report compliments and supports other recently published assessments on different parts of the region, including: NPS, USGS, and USFS (2009); SSP (2010); Koopman et al. (2011); Peterson et al. (2011); Kershner (2014a); Siegel et al. (2014), and the California’s Fourth Climate Change Assessment (2018).

Climate and Environmental Research/Data

The climate and environmental research and data that informed this assessment included collaborating with a team of volunteer specialists (Technical Advisory Group “TAG”), conducting multiple interviews with various state scientists, in-depth research of peer reviewed and government sourced materials, and previous California/Sierra Nevada assessments.

Primary Technical Advisory Group Members

- Christine Albana: GIS Specialist
- Courtney Henderson: Consultant
- Holly Alpert: Mono/Inyo Water Specialist
- Jeff Lauder
- Jose Sanchez: USFS Wildfire Specialist
- Marian Vernon: Sierra Meadows Specialist
- Michael Dettinger: Climate Scientist
- Nathan Bengtsson: PG&E Consultant
- Whitney Brennan: Tahoe Regional Specialist

Climate Projection Parameters/Modeled Data

The primary data that informed the regional assessment is from the California-Nevada Climate Applications Program at Scripps Institution of Oceanography.

Cal-Adapt Team

We have incorporated some climate data from Cal-Adapt, including emissions, extreme heat events (day and night temperature thresholds), acres burned, and streamflow.

Methodology

Contextual framework, best practices, approach, and description of methods.

Framework

The Sierra Nevada Climate Vulnerability Assessment was initiated by the passing of Senate Bill 379 ([SB 379](#)). This bill outlines that,

“The bill would require the update to include a set of goals, policies, and objectives based on a vulnerability assessment, identifying the risks that climate change poses to the local jurisdiction and the geographic areas at risk from climate change impacts, and specified information from federal, state, regional, and local agencies....A vulnerability assessment that identifies the risks that climate change poses to the local jurisdiction and the geographic areas at risk from climate change impacts, including, but not limited to, an assessment of how climate change may affect the risks.”¹

Vulnerability Assessment requirements are including but not limited to,

- (I) Information from the Internet-based Cal-Adapt tool.*
- (II) Information from the most recent version of the California Adaptation Planning Guide.*
- (III) Information from local agencies on the types of assets, resources, and populations that will be sensitive to various climate change exposures.*
- (IV) Information from local agencies on their current ability to deal with the impacts of climate change.*
- (V) Historical data on natural events and hazards, including locally prepared maps of areas subject to previous risk, areas that are vulnerable, and sites that have been repeatedly damaged.*
- (VI) Existing and planned development in identified at-risk areas, including structures, roads, utilities, and essential public facilities.*
- (VII) Federal, state, regional, and local agencies with responsibility for the protection of public health and safety and the environment, including special districts and local offices of emergency services.*²

This project’s framework was influenced and developed around an ethnographic conceptual framework that examines the relationships across diverse environmental indicators and their impacts on socio economic indicators. More specifically, this report applies a cultural and economic lens to the study of how people’s (communities) lives are impacted by climate change using quantitative and qualitative datasets.

Best Practices

Dealing with data (TAG, [Cal-Adapt](#)): Raw data vs. modeled data—the difference between the two and why it matters in the data-collection process.

¹ SB 379, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB379

² See footnote 1

Timeframe: When using climate baseline data or projections, it's been recommended by the science community that a minimum time frame of 30 years (three decades) must be used. *For example, within a 30 yr window, you can calculate average and extreme conditions using annual values as your dataset.*³

Climate Parameters and Models

Representative Concentration Pathway (RCP) is the concentration pathway of greenhouse gasses adopted by the IPCC. These are the parameters that define the assumptions that define the climate models. There are currently roughly seven different RCP scenarios. The two primary RCP scenarios frequently communicated to the public are RCP 4.5 and RCP 8.5. RCP 4.5 is the “intermediate scenario” where emissions peak around 2040, then decline. The RCP 8.5 scenario, however—also known by the [California APG](#) as “the “business as usual” projection—assumes that global GHG emissions will continue to increase through the end of the 21st century.⁴

Earth has experienced many different cycles of climate change over the past ~4.6 billion years, but never at the rapidly changing rate we are experiencing today. The RCP 8.5 projections illustrate that global temperatures could increase up to 2°C (3.6°F) for the mid-century projections (2046–2065), and up to 3.7°C (6.66°F) by the late-century projections (2081–2100).⁵ Climate models from the IPCC Second Assessment in 1995 estimated that the earth's average temperature could rise from 1°C (1.8°F) to 3.5°C (6.3°F) by 2100. However, since 1981 the rate of increase of earth's average surface temperature has more than doubled. According to the IPCC Sixth Assessment, “Since the second assessment in 1995, Global warming of 1.5°C and 2°C (high-confidence range) will be exceeded during the 21st century unless deep reductions in carbon dioxide (CO₂) and other greenhouse gas emissions occur in the coming decades.”⁶

As of today, climate scientists anticipate global temperatures will most likely rise from 2.5°C (3.6°F) to 4°C (9°F), but could increase up to 5.8°C (10.4°F) by 2100. The doubled rate of increase means that extreme events originally predicted for mid century—are occurring now. The earth has already increased 3.6°F since the beginning of the 19th century, 2020.⁷ An average temperature of 1.8°F in the US this year (from January to August) made 2021 one of the top 13 hottest years on record, and

³ Cal-Adapt, <https://cal-adapt.org/help/get-started/best-practices-for-using-climate-projections/>

⁴ State Climate Change Impact Summary, <https://www.caloes.ca.gov/HazardMitigationSite/Documents/CA-Adaptation-Planning-Guide-FINAL-June-2020-Accessible.pdf#page=36>

⁵ IPCC, 6th Assessment Summary for Policy Report, https://web.archive.org/web/20140701131355/http://climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf

⁶ See footnote 4

⁷ See footnote 3

<https://research.noaa.gov/article/ArtMID/587/ArticleID/2759/NOAA-index-tracks-how-greenhouse-gas-pollution-amplified-global-warming-in-2020>

California reported the third warmest temperature year to date.⁸ In California, June to August 2021 was one of the hottest summers on record at 2.6°F above the 20th-century average (warmer than the 1936 Dust Bowl)⁹. Globally, nine of the 10 warmest Augusts have all occurred since 2009.¹⁰ October 2021 was the fourth warmest October on record.¹¹

For the purposes of this assessment, SBC’s team chose to use the RCP 8.5 parameters—though SBC thoroughly analyzed the RCP 4.5 projections as well, and that information is available upon request for stakeholders. SBC’s team consulted with a handful of climate science specialists (the Technical Advisory Team) and decided, for the purposes of this assessment and our audience, that we would use 10 models averaged under the RCP 8.5 parameters to inform this report (unless data was not available). We are aware of the controversies surrounding this choice from the past years. However, in recent years, countless people (in California and in the Sierra Nevada) have been caught off guard by climate related disasters. People have lost homes and family members due to unpreparedness. Since people's lives are at stake, we believe that—in terms of planning—we should be planning for the worst-case scenario. Science has evolved since SB 379 was developed; it evolves and improves daily. However, in the last few years (particularly in 2021), we’ve seen disasters occur that were not anticipated to occur for a number of years, and many of the repercussions are irreversible.¹² We are no longer experiencing climate change; we are experiencing a climate emergency.

⁸ NOAA, *Summer 2021 neck and neck with Dust Bowl summer for hottest on record*, <https://www.noaa.gov/news/summer-2021-neck-and-neck-with-dust-bowl-summer-for-hottest-on-record>

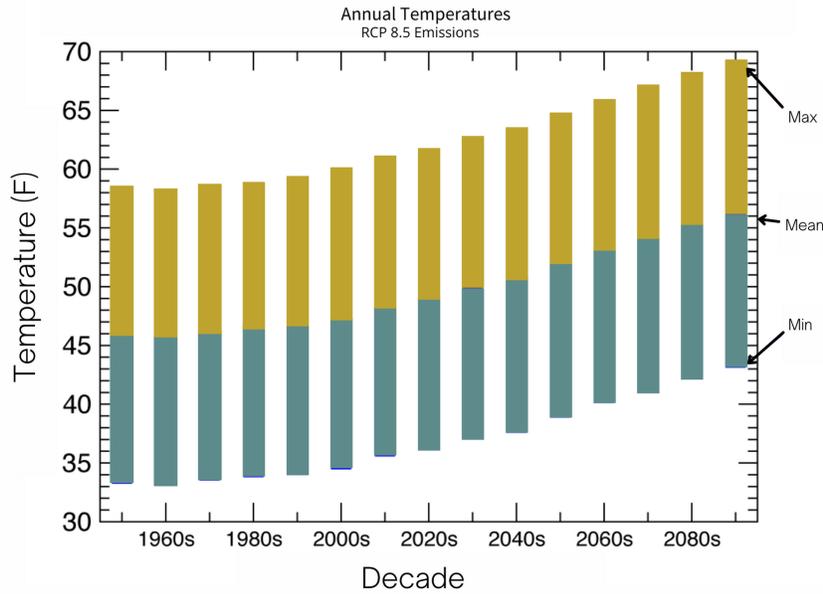
⁹ See footnote 8

¹⁰ NOAA, *August 2021 was Earth’s sixth-warmest August on record*, <https://www.noaa.gov/news/august-2021-was-earths-sixth-warmest-august-on-record>

¹¹ NOAA, *October 2021 was world’s fourth warmest on record*, <https://www.noaa.gov/news/october-2021-was-worlds-fourth-warmest-on-record>

¹² IPCC, *6th Assessment Report*, <https://www.ipcc.ch/assessment-report/ar6/>

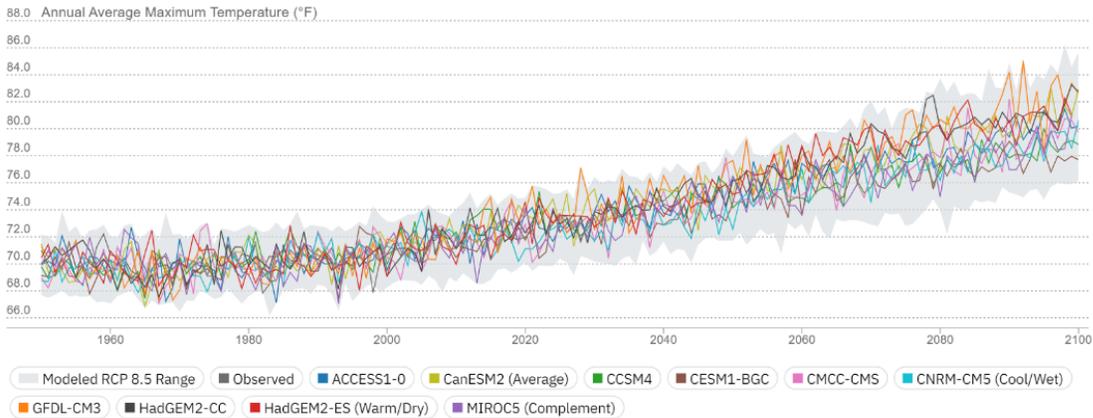
Lake Tahoe



State of California

Projected changes in Annual Average Maximum Temperature under a High Emissions (RCP 8.5) Scenario.

MODELED HISTORICAL 1960-1990		FUTURE PROJECTIONS 2035-2065		FUTURE PROJECTIONS End-Century (2070-2099)	
31 YEAR AVG	31 YEAR RANGE	31 YEAR AVG	31 YEAR RANGE	30 YEAR AVG	30 YEAR RANGE
69.9 °F	66.8–73.0 °F	75.3 °F	71.2–79.7 °F	78.9 °F	74.5–85.0 °F



Source: Cal-Adapt. Data: LOCA Downscaled CMIP5 Climate Projections (Scripps Institution of Oceanography), Gridded Observed Meteorological Data (University of Colorado Boulder), LOCA Derived Products (Geospatial Innovation Facility).

13

¹³ Screenshot from Cal Adapt–In the SNC region, temperatures are expected to continue to increase.
<https://cal-adapt.org/tools/annual-averages/?climvar=tasmax&scenario=rcp45&models=HadGEM2-ES,CNRM-CM5,Ca>

Cal-Adapt and the CalEnviroScreen Fourth Assessment Report estimates that the Sierra Range is anticipated to experience an average increase of 6°F from the historical baseline during the mid-century time frame, and then an additional 4.7°F during the late-century time frame. In total, the Sierra is expecting an average temperature increase of 10.7 degrees in the next 70 years. Minor increases would drastically change the mountainous environment; however, an average 10°F increase would be catastrophic. While the California Fourth Assessment boundaries slightly differ than the SNC regional boundary, the data still matches the projection data we've collaborated on with Michael Dettinger and Scripps, projecting that the average number of extreme heat days will increase throughout the SNC region from a historical baseline of 10 days to a mid-century projection of 25 days and late-century average of 59 extreme heat days.

As a point of reference, 2021 was one of the warmest summers on record for Truckee (SBC's office base and centrally located within the SNC region). Precipitation was almost nonexistent, and heavy smoke for days on end made conditions even more uncomfortable.

Average max temperatures in Truckee summer of 2021 from June to September were 84, 91, 87, and 82, respectively, and monthly max highs were 98, 98, 97, and 95, respectively.¹⁴

	(1961–1990) Average (°F)	2036–2065 Range & Avg (°F)	2070–2099 Range & Avg (°F)
Northeastern Sierra	60	61.2–70.9, 66	65.2–76.3, 70.8
Northern Sierra	61.5	63–71.9, 67.5	66–77.7, 71.9
Southern Sierra	63.6	64.9–74.0, 69.5	68.5–80.7, 74.6
Average Sierra	61.7	67.7	72.4

Data Analytics

Primary Climate Environmental Datasets <u>Historical (observed) County Data</u>	
Ozone and PM _{2.5}	EPA
Snowpack (SWE)	CA.GOV / SNOTEL (NRCS)

nESM2, MIROC5, ACCESS1-0, CCSM4, CESM1-BGC, CMCC-CMS, GFDL-CM3, HadGEM2-CC&lng=-119.2704&lat=37.272&boundary=states

¹⁴ NOAA, Now Data, <https://www.weather.gov/wrh/climate?wfo=rev>

Flood	FloodFactor
Flash Flood and Debris Flows	USGS
Drought	Cal-Adapt / NOAA
Snow Cover	NOAA and Global Snow Lab
Snowmelt Runoff Timing	CA.GOV-OEHHA
Precipitation	Cal-Adapt
Extreme Heat Events	Cal-Adapt
Warm Nights	Cal-Adapt
Fire High Hazard Severity Zones	CalFire
Acres Burned	Cal-Adapt

RCP 8.5 regional climate dataset projections used in CH.2 derived from **California-Nevada Climate Applications Program at Scripps Institution of Oceanography**, and mapping of the datasets was done by SBC. These mid-century and end-century projection datasets include,

- Extreme Heat
- Warm Nights
- Soil Moisture
- Snowpack (SWE)
- Snow Cover
- Runoff
- Precipitation

However the RCP 8.5 datasets used in CH.6 were acquired from **Cal-Adapt**. These datasets were analyzed at county level resolution and complied with county planners in mind. Furthermore, these datasets were processed and normalized for comparing purposes to Socioeconomic indicators. See “County Risk Scores” below for more information.

Since this project serves regional scale and localized county/city purposes—two datasets were clipped to meet both of these purposes. Cal-Adapt being the recommended source by the State of California offers great value of information at the county level. However, the SNC boundary does not include full county boundaries, and at the time of the data collection phase, there wasn't an option for this on Cal-Adapt. Instead one of the TAG members who works closely with California-Nevada Climate Applications Program at Scripps Institution of Oceanography (Scripps) was able to provide the SBC team with detailed projection datasets for the SNC region. The benefit of mapping these higher resolution datasets from Scripps (instead of county level averages) is that we can see precisely the dramatic changes that occur within a county.

Disclosures Regarding the Data and Methodology

Raw Data

- Data collection stations
 - Gaps in when data was collected—missing data. Climate best practices suggest that modeled data over a 30yr time span is used in place of raw data.
 - Data collection points (stations) are few and far between. For example, there are only 1-2 air quality data collection points per county. Doesn't accurately portray historical air quality because counties are geographically large and diverse. Air quality (smoke) is a fluid metric influenced by many variables including but not limited to pressure, temperature, and wind.

Modeled Data and Climate Parameters

- The projection datasets from Scripps are derived from modeled climate data and are therefore science's best estimates of RCP scenarios to date. However, predictions change every year as scientists obtain more data. Interpreting and Getting comfortable with uncertainty.
- Natural variability.
- The more data models gain over the years, the closer we get to what's accurate.
- “Mid-century” is typically defined as 2035–2064 and “End-century” is typically defined as 2070–2099.
- Using model averages vs. a single-model projection. There are many climate models, and they all project different outcomes based on different variables. It's recommended that at least 10 models are averaged under one parameter (e.g., 10 models under the RCP 8.5 are averaged).

Cal-Adapt

- Datasets are county and city averages—these types of datasets don't allow us to see the diversity within the larger counties spread over different types of geography.
- Acreage burned dataset—an estimate based on what we've experienced. Acreage burned doesn't take into account the human factor (i.e., the rate at which humans cause fires); rather, it accounts for how likely a given area will burn based on Very High Hazard Severity Zone statistics.

Socioeconomic and Populations Data

Data for chapter 3 primarily relied on the 2020 US American Community Survey conducted in 2019. While 2020 data was available, SBC decided to use 2019 data in order to eliminate discrepancies in socioeconomic well-being due to the COVID-19 pandemic. Data was accessed via the Economic Profile System by Headwaters Economics.

Data presented in chapter 3 was analyzed at the county subdivision level and aggregated in order to better match the SNC region. Populations discussed in chapter 3 were specifically chosen for three reasons:

1. Their prevalence in the SNC region (e.g., housing-burdened residents)
2. Their history of systemic discrimination (e.g., Indigenous people)
3. Their increased likelihood of facing Sierra-specific hardships (e.g., single-access road residents)

Data presented in chapter 4 primarily relied on 2020 US Department of Labor Statistics, Quarterly Census of Employment and Wages, the US Forest Service, and Visit California. SBC used 2019 data where available, but nonlabor income data was only analyzed for 2020.

Chapter 4 was analyzed at the county level and aggregated across the 22 counties. Whole-county data was used due to the lack of data sources on smaller scales. News articles were cited in the report due to the lack of consistent economic data for the SNC region.

In general, more community-level economic and demographic data needs to be collected within rural regions of California.

Data in chapter 6 uses whole-county data collected from the US American Community Survey to determine the Human Impact Score, as well as whole-county data from Cal-Adapt to determine the Climate Hazard Score. Methodology for score calculations is discussed below.

County Risk Scores

The Overall Risk Score was determined by multiplying the Climate Hazards Risk Score by the Human Impact Score to develop a 1–100 scoring system that weights climate projection data and socioeconomic data equally for each county.

The methodology used to calculate the scores was developed based on the CalEnviroScreen (v. 4.0) Model Indicator Selection and Scoring.¹⁵

¹⁵ CalEnviroScreen 4.0 Report, pg 12 - 29

Climate Hazard Risk Score

To calculate the Climate Hazard Risk Score, we chose four Cal-Adapt climate indicators that will have strong impacts on the SNC Region.

Climate Indicators:

1. Number of Extreme Heat Days
2. Number of Warm Nights
3. Acreage Burned by Wildfire
4. April 1st Snow Water Equivalent (SWE)

Using data provided by Cal-Adapt between December 1–31, 2021, we determined the percentage change in projected values for each indicator from historical modeled data (1961–1990) to mid-century modeled data (2035–2064). It is customary to compare projected modeled data to historical modeled data, even when observed historical data is available.

After calculating percentage change in values for each of the four indicators listed above for each SNC county, we calculated the percent rank for each indicator. In this way, the Climate Hazard Risk Score is a comparative score among the SNC counties. (It should be noted that the percent rank value for April 1st SWE was determined based on the absolute value of the percentage change. Because all SNC counties will experience a decline in water derived from snowpack, it was important to designate the highest magnitude loss of April 1st SWE as the 100 percent rank.)

Using percent rankings for the four indicators, we calculated the average percent rank for each county, assigning each county a 1–100 average percent rank value. To normalize these values, we divided each county's average percent rank value by the maximum average percent rank. The Normalized Average Percent Rank value was then multiplied by 10 to assign a 1–10 Normalized Average Percent Rank—this is the Climate Hazard Risk Score.

Example calculation for Alpine County’s Climate Hazard Risk Score:

Indicator	Percent Change	Percent Rank (among 20 SNC counties)
% Change in April 1 SWE (Absolute Value)	52.66%	31.60%
% change in # of Extreme Heat Days	700%	73.70%
% change in Number of Warm Nights	575.00%	63.20%
% change in Acres Burned	96.7%	100.00%
Average Percent Rank		67.13%
Max Percent Rank in Region		71.05% (Madera County)
Normalized Percent Rank		0.945
Climate Hazard Score		9.45

Human Impact Score

To calculate the Human Impact Score, we chose six social indicators and three economic indicators that represent systemic disadvantages and/or disadvantages exacerbating vulnerability in rural communities.

Social Indicators:

1. Senior Citizen Populations
2. People of Color, including Hispanic/Latinx Populations
3. American Indian and Native Alaskan
4. People Who Don’t Speak English Well
5. Mobility Limited due to Disability
6. People without Broadband

Economic Indicators:

1. Families in Poverty
2. Households without a Car
3. Housing-burdened People

Data for these indicators was collected as a proportion of the county population as published by the US Census Bureau for 2019 and accessed via Headwaters Economics reports titled “Demographics” and “Populations at Risk,” in addition to broadband data published by Microsoft.

We then calculated the percent rank for each social indicator and economic indicator per county. In this way, the Human Impact Score is a comparative score among the SNC regional counties. We found the average percent rank for each county’s social indicators and economic indicators, then determined the mean of the two averages for a combined socioeconomic score. At this point, each county has a 1–100 value. To normalize these values, we found the maximum average percent rank value and divided each county’s average percent rank value by this maximum. The Normalized Average Percent Rank value was then multiplied by 10 to assign a 1–10 Normalized Average Percent Rank—this is the Human Impact Score.

Example calculation for Yuba County’s Human Impact Score:

Social Indicator	Proportion of Population	Percent Rank	Economic Indicator	Proportion of Population	Percent Rank
Senior Citizens	0.12	5.30%	Families in Poverty	0.15	94.70%
POC, including Hispanic/Latinx	0.45	84.20%	No Car	0.07	94.70%
American Indian, Native Alaskan	0.01	26.30%	Housing Burdened	0.42	52.60%
Don’t Speak English Well	0.06	94.70%	Average Economic Percent Rank	80.67	
Mobility Limited	0.16	36.80%	Average Socioeconomic Percent Rank	62.70	
No Access to Broadband	.45	21.10%	Max Percent Rank in Region	75.01 (Tehama County)	
Average Social Percent Rank	44.73		Normalized Percent Rank	0.836	
			Human Impact Score	8.36	

Community Capacity Assessment Worksheet

Community Capacity Assessment

Community Name _____

Please select the number that best reflects your community's level of capital or capacity (on a scale of 1–5, 1 being the lowest level of capital or capacity and 5 being the highest level). Use space beneath each type of capital to provide narrative information. For example, describe the unique or important characteristics of your community that informed your decision. Additional space is provided at the end of this survey.

FINANCIAL CAPITAL

LOW **1** **2** **3** **4** **5** HIGH

(Availability of funds for use on local projects and pressing local needs. These may be public funds or private funds, but private funds are tightly linked to community interests.)

Please describe why you rated this community as you did in the box below.

HUMAN CAPITAL

LOW **1** **2** **3** **4** **5** HIGH

(Individuals with knowledge/ability to address conditions and stressors of concern. Also describes the experience and capabilities of local residents and their willingness to use these locally.)

Please describe why you rated this community as you did in the box below.

SOCIAL CAPITAL

LOW **1** **2** **3** **4** **5** HIGH

(The ability and willingness of local residents to work together toward community ends and purposes.)

Please describe why you rated this community as you did in the box below.

CULTURAL CAPITAL

LOW **1** **2** **3** **4** **5** HIGH

(The prevalence of a strong shared local bond and way of life, and the unique identity it cultivates.)

Please describe why you rated this community as you did in the box below.

PHYSICAL CAPITAL

LOW 1 2 3 4 5 HIGH

(The “hard infrastructure” of a community, such as roads, sewers, schools, etc., including the quality of this infrastructure and its ability to meet local needs.)

Please describe why you rated this community as you did in the box below.

OVERALL CAPACITY RATING

LOW 1 2 3 4 5 HIGH

Please describe why you rated this community as you did in the box below.

Additional Narrative Information:

Community Capacity Narratives

Modoc County

Tulelake/Newell/Canby

Overall Capacity Score: 2

Tulelake/Newell and Canby are very distinct from one another, but limitations of census block group designations resulted in these areas being scored together. Canby itself is not home to very many businesses, and there are not a large number of local landowners. Elements contributing to their capacity include a medical facility, a fire department, and efforts to progress geothermal development in the area. It is also home to the religious community, I'SOT. The Tulelake/Newell area is home to many large ranches, which provide a source of financial resources and shared culture to this community. However, it still faces challenges with poverty, and does not contain very many businesses with which to grow capital. Additionally, there are prominent social disparities present here, including racial and class divides. One participant in the workshop referred to this area as being made up of the “haves and have nots.” Tensions were described between classes of landowners and laborers, without much support and communication between the two. Participants also noted divides between the white and nonwhite populations of the area.

Davis Creek/New Pine Creek

Overall Capacity Score: 2

The Davis Creek/New Pine Creek community was rated a 2 due to a lack of resources and means to bring about improvements in the area. There is a low household income and lack of industry, with one prominent retail business regularly open. Participants noted infrastructure improvements that need to be made to older buildings in the community, including the school, church, and grange hall. There is also a lack of water and sewer infrastructure. However, there are also many strong components of social and cultural capital here. Participants noted a good school and educational opportunities for 4-H students, a successful local RCD, and an organized volunteer fire department. They highlighted a strong sense of shared identity and culture, exemplified through examples such as an annual parade in the community.

Surprise Valley

Overall Capacity Score: 3

Surprise Valley was rated a 3 due to strong social capital and cultural identity present in the community. Participants noted that a lot could be learned from how this community works together. Local residents have joined together in the past around a variety of causes including a local food

movement, developing local internet, fundraising to reorganize the schools, keeping their local fair going without state funding, and maintaining the presence of a medical facility in the community. The area also has a fair level of physical capital, with infrastructure support provided through CalTrans, the county road department, SV Electric, and a volunteer fire department. However, despite the presence of dedicated community members and local government and infrastructure, Surprise Valley has lower capacity in regard to availability of financial and human capital. It is lacking in both stable industry, as well as a strong tax base for improvements. Participants also noted a lack of hard skills and a need for more people.

Alturas/Cal Pines/Likely

Overall Capacity Score: 3

Alturas/Cal Pines/Likely was rated a 3 due to a number of successful programs and dedicated community members and organizations in the area. Funding is not abundant, but local government and agencies such as TEACH (Training, Employment, and Community Help), Inc. and AFWD (Alliance for Workforce Development) seek out grants, partnerships, and other means to obtain funding. The community is fairly reliant on government funding and an increasing number of people in the community need government assistance. Wages are fairly low, and nearly 40% of households in the greater Alturas area report an annual income of less than \$25,000. Participants noted that while there is a strong group of people in the community who want to see it grow, there is concern that there is not a younger group of people coming up behind them. Infrastructure is a major challenge and not good enough to attract a younger or bigger demographic, with difficulties around housing and internet connectivity. There is encouragement to be had on the agricultural side of things, in that there are younger farmers and ranchers, but this is relative (40 years old, compared to 70). Ultimately, one participant noted that there is potential to build greater capacity and for change, but there is some reluctance to do so.

Big Valley

Overall Capacity Score: 2

Big Valley was rated a 2. There is a large lack of financial and human resources due to the demographics and geography of the community. There is not a lot that brings this community together, however strong points of social capital include the RCD and a successfully retained ambulance service. Physical capital includes a sewer system in Adin, water and sewer in Bieber, a community center, veterans hall, and swimming pool. The lack of financial resources and cultural cohesion is more pronounced on the Modoc side of the community, as it is dispersed, and there are not a lot of businesses. The Lassen side has Bieber, which has a bit more physical infrastructure and human capital. There is a general lawlessness in the community as well, (illegal grows, break-ins), as they are not near a county center. Downturn in the area really began with mill closures, as the mill had

been a cornerstone in the community. They are also feeling the burdens of increased regulatory burden around water. Agriculture is really essential to the area, and losing that would be devastating.

Lassen County

Big Valley

Overall Capacity Score: 2

See community narrative under Modoc county.

Doyle

Overall Capacity Score: 2

Doyle is a small rural town, located along highway 395. This community was rated low given the small population, low economic opportunity and financial capital, and a lack of infrastructure. Residents here have to travel for most of their services. However, it was commented that people have a lot of pride in this community, and participants pointed to a local historical society and church as important components of Doyle's cultural and social capital.

This community has also been hit hard by wildfires. 50 homes, of the 450 present in the community, burned down in two separate fires over nine months in the 2020 and 2021 wildfire seasons. Many residents are working to rebuild, but there is a financial barrier in doing so. Additionally, many in the community were unable to afford fire insurance. There is a volunteer fire department here, consisting of roughly 16 volunteers. Their team helped to evacuate people and defend structures during the fires, including the Beckwourth Complex in 2021.

Eagle Lake/Westwood/Clear Creek

Overall Capacity Score: 3

Financially, workshop participants agreed that there is not much money available locally to meet pressing local needs in the Eagle Lake/Westwood/Clear Creek community. There are some residents in Eagle Lake with good incomes, however a majority of Westwood and Clear Creek are low income, so private dollars are limited. Westwood is unincorporated, so availability of Lassen county taxes are limited, as are services. Grants for the area must be submitted by the county.

The group praised the high social capital of each community, noting good attendance at meetings and public events, long established residents, strong community leaders, and resources like the Chimney Fund and Family Resource Center. Westwood Area Chamber of Commerce is also a strong community building organization and has much local support. Culturally, Westwood has a distinct identity as a company town founded by Red River Lumber Co. One participant commented, "Being a former mill

town gives us a unique history, but I believe that we have to focus more on the present and future to make our town work for its citizens.”

Westwood, Clear Creek and Spalding all have CSD's that provide critical infrastructure for their small areas and roads are maintained by the County. The water system in Westwood/Clear Creek is compromised and the sewer system has been identified by SWRCB as a problem, with concerns about runoff from sewer ponds. There is also a community center, but it is reportedly in need of updating. Additionally, the elementary school in Westwood has been closed for several years due to asbestos concerns as well as a general low enrollment of students.

Janesville

Overall Capacity Score: 3

In Janesville, workshop participants noted that there are limited employment and service opportunities, and that residents generally commute for employment and services. The increase in food and gas prices, and inflation in general, has placed an undue hardship on this community as a result of many people having to travel to work and shop. Public funds are also typically used in more remote areas of the county due to access issues. However, human capital and community support is high, with good leadership coming from the community from schools, first responders, government representatives. Activities are often blended into Susanville, but Janesville residents are still able to come together when the community experiences stressors, as workshop participants commented on strong participation in community meetings. However, like in many rural areas, this capacity is still limited given the small nature of the community, and many residents manage stressors with little or no help from others. Calls for service are reportedly generally limited to true times of emergency.

Infrastructure concerns in this community include internet stability, power stability, and fire prevention management. There is also no sewer or water system. Roads are prioritized on need and budget which means some roads will go unpaved, plowed or maintained at times.

Milford/Herlong/Sierra Army Depot

Overall Capacity Score: 2

The Milford/Herlong/Sierra Army Depot community was described as “economically depressed,” however Milford is distinct from Herlong and Sierra Army Depot, and generally contains more capital in terms of financial resource availability. One participant noted that Herlong is a priority community for the public funds that they manage, there are limited job opportunities, and inflation has a major impact on residents’ ability to drive to the Reno or Susanville area for supplies. In regard to human capital, there are many residents who are personally invested in the growth of their community and are willing and able to identify stressors and work toward solutions. However, as one participant commented, “Unfortunately, there are just as many (or more) who are unwilling to do so.” One positive

example is that many people volunteered at the Fort Sage One Stop and Family Resource Center and availed themselves of the services there.

Socially, there are many active social groups, and they do have town halls to discuss problems. Residents are reportedly willing to help, though the community often lacks capacity to meet desired goals. Culturally, there is reportedly a strong sense of shared experience, and “locals are quick to let you know ‘how we do it here.’” For Herlong specifically, there is some nostalgia for when it was a thriving community, and residents will often talk of the “good old days.” As one stakeholder commented, “there is a sense of despair but hope for better things to come.”

Physical infrastructure in this area was described as being in a critical state of decline, with Herlong specifically containing numerous old, dilapidated buildings, and poor roads. This was prior to the 2021 wildfire season, which resulted in further deterioration and destruction of both private and public property.

Ravendale/Termo/Madeline

Overall Capacity Score: 1.5

The Ravendale/Termo/Madeline community is extremely rural and dispersed, without much wealth or industry present in the area, aside from a few large ranch owners. In regard to human capital, there are simply not many people living here. However, those who do were characterized as hearty, with knowledge of how to live in a rural place with extreme conditions. Socially, there are some in this area that gather for church, and seem to be connected in protesting things like marijuana grows, as there have been code enforcement issues with illegal grows out in this area. However, there are reportedly “all sorts of folks in this area, including those who want to be left alone.”

The rural and dispersed nature of the communities here also contribute to lacking infrastructure, and participants noted that there is simply not much here. There are no sewers, and enrollment at the school in Termo is low. However, the presence of natural gas lines, power lines, and power facilities do provide some potential for future growth.

Standish/Litchfield

Overall Capacity Score: 2.5

The Standish/Litchfield community generally has lower income levels than in other parts of the county, with fewer opportunities to spend money here. There are relatively few financial drivers or value-added products beyond agriculture and many residents commute out of the area for employment. There are few examples of community-level work to address limitations and there are little to no community events, or places at which to hold events. Stakeholders did note, however, quite a bit of neighborly activity and a shared culture in considerable overlap of lifestyle and common

values. Residents were also described as very hardworking. Physical infrastructure is limited, without a sewer or water system. There are some dirt roads and many unmaintained private roads. However, workshop participants characterized the schools as being above average compared to others in the county.

Susanville

Overall Capacity Score: 3.5

Susanville was rated as the highest capacity community in the county, with the highest financial capital. That being said, there is reportedly not much money left to spare, with community needs still left unmet due to funding and/or organizational capacity. The city is working in a deficit budget and has very little capital to reinvest back into the community other than police and fire. With CCC prison leaving town this year (2022), the town is going to see a large loss of jobs, and most likely businesses leaving. With little capital to actually put back into the community, it is unlikely that there will be any sort of population growth for some time unless the town and area is able to create new businesses and local area attractions. Multiple participants also noted issues with residents going outside of the area to spend money, with a lack of support for local businesses or money spent locally.

In regard to human capital, there is a lot of institutional knowledge among community members, as well as a large number of volunteers. This community is home to natural resource professionals from all over the country, as well as residents that have lived there their entire lives, including the ranching and farming communities. There are, however, also a lot of people that seem as though they are just getting by, and do not currently have the ability to reinvest in the community at this time. One participant noted that “it seems as though there is a small group of folks that are pushing for change and wanting to use their skills to invest into the community and high levels of push back are received from the county and city governments.” Culturally, stakeholders commented on a divide between pushing for change, and maintaining an old way of life. As one participant put it, “it feels as though there is a struggle between the old ways and new ways that the town/area needs to embrace in order to survive. There is a general consensus for the area of how people feel, act, talk about how and where we live, which creates a sense of community, but we are always actively trying to stay afloat, and now with a major employer in town leaving, I am hopeful that it will bring more people to the table that want to see the area improve.”

Regarding infrastructure, in most of this area, the City covers the infrastructure needs of the community. The County does however provide road service and there are independent school districts throughout. Participants commented that there is enough funding to meet basic needs, though there are still issues to be addressed. Blight was cited as an issue, though lacking fiscal capital has made this difficult to address.

Overall, participants agreed that Susanville has the most overall capacity of any community in the county. There are many individuals and groups that are staunch advocates for the region. Lack of funding, economic opportunities, revitalization, workforce, and complacency were identified as the largest challenges. During difficult times the community will come together, but during normal times there is reportedly a lack of organization and collaboration, and a lacking shared goal for positive change.

Shasta County

Montgomery Creek/Big Bend

Overall Capacity Score: 2.5

The towns of Montgomery Creek and Big Bend each have a post office, school, and small convenience store. Overall the community is very impoverished. Many long-term residents seem content despite low socioeconomic status and there are a few very capable residents and well-educated people who have the desire and knowledge to seek improvement. There are a few small businesses such as logging companies, and a large PG&E presence due to hydropower on the Pit River, and presence of the cannabis industry. However, there is very little opportunity to spend income locally and so it does not go into the community or toward local needs. The cannabis industry pollutes water sources, exacerbates social issues like substance abuse, and creates tension between long-term residents and those who come in just for the growing season.

The population is scattered throughout the area, and most residents have their own septic and water systems. Shared infrastructure includes roads, phone and power lines, and schools. The schools, while under-resourced, have good facilities, including a pool in Big Bend which is sometimes open for community use. There is a local radio station and teen center, and folks tend to come together to help their neighbors. Hill Country Health and Wellness was started by a group of individuals and it is a large local employer and has awakened talent within the community. Big Bend has a unique culture that includes tribal families, forest work, PG&E PSEA camps, and fishing and fly fishing as well as an influx of homesteading families due to the cannabis industry.

Burney/Johnson Park

Overall Capacity Score: 2.5

In Burney there is a mix when it comes to community engagement. There are many civic-minded and engaged people who tend to be involved in many different things and are spread thin. There are good school teachers, engaged families, church groups and other groups that work together, and an influx of educated retirees who stay involved in the community as long as their health allows. However, there is also a lot of apathy and people vocal about a need for community-wide changes but without the capacity to follow through, likely spurred by low socioeconomic status and lack of opportunity. There

are a few large events and some fundraisers but not a lot of opportunity for people to gather outside of that and there isn't a push to maintain or develop new programs. Young people leave the area in search of education and career opportunities but there are very few opportunities for them to return in a professional capacity. The schools are in good shape and there are parks, and efforts around building a community swimming pool and creating a youth soccer league, but there is a lack of community engagement to maintain the existing facilities and programs and develop new ones. Donations to community efforts tend to come from local business owners and are therefore directly linked to the local economy, so economic downturns highly impact contributions to community efforts.

People take pride in the natural beauty and outdoor recreation of the area and love to share their experiences with others. Road infrastructure is good with CalTrans and the county roads department constantly improving. The school district and water and sewer infrastructure have been or are being improved through state revolving fund grants and funds from the nearby windmill project. Burney has a lot of industry, including two mills and Dicalite Minerals Co. However, other infrastructure is lacking, and there are many vacant lots on the main street.

Johnson Park is more of a residential area than a self-sufficient community and relies on the infrastructure and services of Burney. There is a gas station, one restaurant and many small neighborhood streets and mobile home parks. There are a few community organizations and individual citizens that fundraise, access grants, and advocate for the community, and there is a lot of poverty. In the past there have been united efforts against rising water prices and crime, but often people experience stressors and do not know how to address them. Different groups in the area experience shared bonds, such as loggers, Native Americans, and church groups, but the groups do not tend to come together. The roads along 299 are well maintained due to CalTrans. The water system needs improvement and the high cost of water is an issue. Homes, trailer parks, and the few businesses are old and in disrepair. It is a depressed area with not a lot of resources or leadership. There is a collective love of the area but little identity or organization as a community.

Cassel/Hat Creek/Old Station

Overall Capacity Score: 3

Hat Creek and Old Station share many characteristics. There are long-rooted families, monied ranch owners, and wealthy second-home owners (such as Clint Eastwood whose home was previously owned by Bing Crosby) alongside residential areas and pockets of poverty. There is strong community involvement from some, but others are working hard to avoid poverty and do not have time to get involved. There is a small population of mostly elderly people with a lot of local knowledge and common experiences who work together to get things done. There used to be more community assets such as a theater which is now closed, but there are still some large annual events. In some areas residents are well served by the roads, schools, fire departments, and wells and septic tanks. In Old Station there are no schools and the few children are bused to Fall River Mills, and the volunteer fire

department can barely stay open due to lack of volunteers. Residents of Old Station are served by one private and two mutual water companies.

The Hat Creek Valley is beautiful and tourism is a primary driver of the economy. There are several RV parks and cabin rentals, as well as fly fishing on Hat Creek and the only hang gliding place in eastern Shasta County. Overall, people are independent and the area has decent overall capacity, although there is room for improvement in all areas.

Fall River Mills/McArthur

Overall Capacity Score: 3

The Fall River Mills/McArthur has a population that is very dispersed, and in practice includes the area of the Burney block group north of Lake Britton. Despite the geographic spread, it is a tight knit community that shares schools and infrastructure. There are strong ties to ranching families, especially founding families, and related values, and there is a growing community of Hispanic and migrant workers. Overall there is a lot of pride in the community, some wealthier families, and high capacity individuals that contribute to the schools and other religious and social organizations and work to meet the needs of the community. Retirees from out of the area bring in wealth as well. Bringing talented individuals together, bridging cultural boundaries, and communication and follow-through have been challenges, but things still do get done and there are a lot of community events.

The area possesses an elementary and high school, grocery stores, gas stations, hospital, and amenities such as a movie theater and restaurants, as well as infrastructure such as roads. However, much of the infrastructure and buildings are old and in need of updating. The water system is not capable of meeting demand for the communities. There is newer infrastructure where there is more wealth along the Pit River, which draws in tourists for fly fishing and outdoor recreation opportunities.

Millville/Oak Run/Whitmore

Overall Capacity Score: 2.5

The Millville/Oak Run/Whitmore community was rated as relatively lower capacity compared to the rest of Shasta county. Millville, however, was noted to be higher capacity than Oak Run or Whitmore, with fewer low income households and highly rated public schools.

The community as a whole contains many small ranches, with some larger commercial agriculture contributing to financial capital in the area. However, residents tend to commute for employment and other services into Redding or Palo Cedro. There is reportedly not a lot of growth here, however as one stakeholder commented “people generally don’t want it to grow.” Oak Run in particular is very small, with the presence of one store and a post office in town.

In regard to physical capital, stakeholders expressed concern over a lack of fire suppression infrastructure in these areas, though Whitmore does have a volunteer fire department. Water and sewer is all county based, and many residents are on the system of Palo Cedro. There are also no individual sewer systems in this area.

Shingletown

Overall Capacity Score: 3

Shingletown has reportedly recently seen an uptick in financial capacity, however stakeholders commented that this is nowhere near the level of industry that was seen in the 50s and 60s for timber and logging. The economy is still a timber economy, however it is smaller scale private operations. Tourism and recreation also contribute to capital in the area to an extent, as well as a few wineries. There are also a lot of retirees who live here.

Stakeholders pointed to an active town council in this community that contributes to social and human capital, and residents are reportedly able to organize themselves well. As one participant commented, “The work that people do for the community is impressive, but it also tends to come down to just a few people.” An example of this is that the community is working to bring more law enforcement into the area, in part due to the issue of illegal marijuana grows, and have garnered support for this. One stakeholder also noted problems with squatters, however this is reportedly more of a county-wide issue, and not necessarily specific to Shingletown.

Some of the only major infrastructure in this community are the roads (this was also true for Millville/Oak Run/Whitmore). There used to be an airport here, but it was shut down in 2002 due to the decayed condition of the unmaintained runway and surrounding area. Participants also noted a commercial center, medical clinic, school system, and small water system present here. The community is also on a microgrid, which helps in the event of a Public Safety Power Shut Off (PSPS).

Tehama County

Mineral/Mill Creek/Paynes Creek/Ponderosa Sky Ranch

Overall Capacity Score: 2

The Mineral/Mill Creek/Paynes Creek/Ponderosa Sky Ranch community encompasses a large geographic area, and census block group limitations resulted in multiple communities being assessed together. Mineral and Mill Creek are reportedly similar in that they are relatively (for the county) affluent, with tourism-based communities and many retirees as residents. Social capital in these areas was noted to be fairly high, with participants commenting that community residents work together well.

Paynes Creek and Ponderosa Sky Ranch, on the other hand, were noted as having fewer financial resources. Participants commented that people who live there tend to “subsist,” and added that there is not much business or industry present here. Demographically, participants noted that there tends to be a set, older age cohort in this area, without much repopulation of the younger age group. As a result, school populations are contracting. One participant noted that many people in the area have a tendency to “live for the present, without much planning for the future of the community.” In regard to physical capital, infrastructure was described as limited. Most people have individual wells, and in Ponderosa Sky Ranch, water is trucked in.

Tehama East

Overall Capacity Score: 1.5

This area was described by participants as being very sparsely populated and geographically dispersed, without much physical infrastructure. There is a post office for “East Tehama,” no county water districts, and school districts extend into Los Molinos or Red Bluff. Financial resources are low, and industries present here include ranching, logging, and grazing. Socially, one participant noted that residents here don’t tend to engage with those that they don’t know and will often “stick to themselves”. However, another commented that, in their view, there is a fair level of local knowledge in this portion of Tehama county, and people would likely come together in a time of crisis.

Plumas County

Blairsdden/Johnsonville/Whitehawk/Clio

Overall Capacity Score: 3

Responses for social, cultural and physical capital varied. The four subcommunities identified in this region all have operating facilities with increasing demands and financial need. All four subcommunities cited challenges in some form of capital. Generally, communities were characterized as having high social capital within their distinct subcommunities (i.e., Blairsdden/Johnsonville/Whitehawk/Clio) and tended to cooperate across the four subcommunities; however, social capital is limited by the small number of permanent residents. Seasonal residents’ lack of understanding community issues was described by workshop participants, which resulted in lowering the social capital of the region as a whole.

Informants discussed Whitehawk as an upper income community, compared to the other three areas, who may encounter more difficulty in acquiring funds for projects. Whitehawk has a mutual water company and a CSD, Gold Mountain/Clio has a CSD, and Johnsonville has a Public Utilities District.

Blairsdon, Johnsville and Clio need to develop capacity to meet the demand for licensed water/wastewater operators and address their aging infrastructure. According to one informant, dependence on an individual expert to manage services and aging infrastructure in an area creates vulnerability. Institutional knowledge and expertise needs to be maintained through transitions in personnel and community members.

Chester

Overall Capacity Score: 3

Workshop participants described Chester as having an “identity as a community,” maintaining a high level of human capital supported by skilled retirees and community experts. However, several informants indicate that while Chester has high human capital, there is an unwillingness to engage and work together for a common goal, indicative of lower social capital. With some poverty, a predominantly low to middle income population, and a handful of wealthy residents, Chester suffers from a declining population in part due to the few workforce opportunities available in the area. One informant described a dichotomy between the timber/working community versus the retired elite. Others described a seasonal population that has not been bought into the community and the challenges in trying to involve community members.

Physical infrastructure concerns included roads in disrepair due to a limited budget for repairs. Fire protection, ambulance service, and streetlights have also faced budgetary problems. With storm occurrences and aging sewage infrastructure, workshop participants voiced concerns related to the proximity of the septic system to the lake. Participants did also acknowledge the Public Utilities District employees as very knowledgeable (human capital), but lacking financial capital.

Cromburg/Greenhorn

Overall Capacity Score: 2.5

Participants described Cromberg and Greenhorn as two very different areas. Greenhorn is a summer vacation area and Cromberg is a year-round rural community. No specific challenges and strengths were provided for these communities.

East Shore/Lake Almanor West/Prattville

Overall Capacity Score: 2.5

Community experts separated East Shore from Lake Almanor West and Prattville owing to low financial and physical capitals. East Shore's permanent residents have a high average income but capacity on the East Shore is lower than other regions due to poor human and social capital. With the exception of three seasonal RV resorts, the entire six-mile length of East Shore is private

residences with few full-time occupants. For nearly 300 homes, the 2010 census identified only 50 year-round residents. By the time of the workshop, participants estimated that number to be even lower, after deaths and departures without replacements. Because residents are spread out over a six-mile stretch of State Highway 147, interaction between year-round residents is very difficult and extremely limited. Lake Almanor West was considered by workshop participants to have good to excellent infrastructure and an overall higher level of capacity. Prattville was deemed to have marginal infrastructure. The Lake Almanor West area was described as having high levels of human capital among older, retired residents and second-home owners. A small group of educated and experienced retirees work together on issues, but are seldom involved outside of this group. Other informants emphasized how second-home ownership and summer/vacation properties lead to poor community involvement.

Participants cited an “unwillingness to participate” in HB district meetings, which resulted in a failure of the community to support Prattville’s Fire and Police Department.

Graeagle/Plumas Eureka

Overall Capacity Score: 3.5

Graeagle/Plumas Eureka was described as stable, fairly well-off, and comprised of 75% snowbirds who reside less than 6 months of the year in the area. Infrastructure is fairly good in the short term, but Graeagle needs a central sewer system. Large infrastructure projects may need to be financed in the future. The community appears to have high social capital indicated by their ability to work together. Nonetheless, public involvement in decision making remains low.

Greenville

Overall Capacity Score: 2*

**This assessment occurred prior to the impacts of the Dixie fire in 2021*

Greenville received mixed capacity ratings owing to a number of recent factors: the increased effectiveness of the CSD, the 2017 Main Street revitalization project, road improvements and other nonspecified improvements with funding received through Proposition 50. Greenville is a center of many services, including a grocery store, bank, pharmacy, schools, and parks. However, many participants reflected how in the earlier years, Greenville had significantly more services, stores, offices (e.g., Forest Service office), and even an airstrip. Prior to the revitalization project in Greenville, the community struggled with infrastructure with many improvement projects reliant on volunteers due to a lack of county funding.

While physical infrastructure has improved, workshop participants described a transient population, characterized by residents not invested in the area for the long term. Other concerns

include limited public and private financial resources, high levels of welfare, few homeowners, and limited employment opportunities in the town except for businesses that are family owned and family staffed. Some of the exodus is likely due to people having to search outside of Greenville for employment as high levels of unemployment plagues the area.

There is a high degree of place-based pride and cultural capital, even across the divergent perspectives with a high level of volunteerism and community participation of some of the more devoted community members. This dovetails with the high level of human capital, specifically knowledge and interest, noted among the older population. There is concern regarding the younger population and their lack of participation in local groups, interests or projects. Many capable youths leave for university and do not return. Social capital has emerged during problematic times such as when schools and hospitals have closed, but participants noted finding solutions has been difficult owing to the diversity of interests. Social capital is also impacted by racism and tight-knit social circles, according to several workshop participants. There is a perceived difference between people who work in town and those who work out of town, and between those who are retired or unemployed. Other tangible divides in the community are between the public school and charter school, with the public school losing students to the charter school resulting in less funding allotted to the public school. There is a Native American community that is also perceived as separate. However, as previously noted, during times of need, the community is able to come together despite the differences.

Indian and Genesee Valleys

Overall Capacity Score: 2.5

Several families have inhabited the area for a long time and are referred to as “locals”. Many of those local families are ranchers and are the “wealth of the valley.” Largely self-sufficient, many ranchers are considered “land wealthy, but money poor,” with the exception of the Palmaz family, owners of much of Genesee Valley. Community experts wonder if the money will spread throughout the community. The family has renovated the Genesee Store with plans to reopen.

There exists a strong cultural bond to place, but some fragmentation within the broader community among ranchers, Tribes, cannabis growers, and the school divide between charter versus public. There is overlap among the Indian Valley and Genesee Valley, but no common vision. If there is a need to work together, the community has proven able. While the community is distinct from Greenville, both of the valleys are reliant on Greenville for services (groceries, gas, banking, pharmacy, health clinic).

Volunteerism is strong with community fundraisers for the volunteer fire department, churches, and other community-oriented initiatives, especially among the highly involved older

population. The younger generation is thought to lack involvement in local issues.

The CSD has maintained systems, but there is need for improvement and replacement of aging water infrastructure and a struggle to meet that need. Participants cited a high level of unemployment, a limited number of public and private dollars, and a large number of welfare recipients in the area.

Lake Almanor Peninsula/North Shore/Hamilton Branch

Overall Capacity Score: 3.5

Overall the Lake Almanor Peninsula/North Shore/Hamilton Branch was described by community experts as having good infrastructure in terms of water, roads and utility systems and the ability to maintain and improve infrastructure. Some areas, particularly the Lake Almanor Country Club were characterized as having a few multimillionaire residents that are not present nor invested in the community. However, there is a connection between the Country Club and the greater community because the neighborhood does not have services and is dependent on the surrounding area.

Several participants identified a contrast between the extreme wealth seen in Hamilton Branch and some parts of the Peninsula with their high Median Household Income (MHI) and the poorer residents located in the North Shore and other parts of the Peninsula. The lake serves as the common bond shared among all residents of different socioeconomic backgrounds. Overall, there is some variation in cultural and social capital within the community residents, but community experts agree they have an effective CSD and Fire Departments.

Meadow Valley/Bucks Lake

Overall Capacity Score: 3

Community experts characterize Meadow Valley and Bucks Lake areas as distinct communities. Meadow Valley has a solid group of residents expressing interest in and working for the community through the volunteer fire department, Meadow Valley schoolhouse, cemetery, church, and social club that's indicative of the strong social cohesion felt among residents. The two areas have a range of financial capacity and services, many provided by individual homeowners.

There are no permanent residents in Bucks Lake. Seasonal residents consist of primarily PG&E and USFS recreational homeowners and are "voracious about their needs." According to informants, oversight in the area is steady, but uneven with distinct populations of homeowners and visitors. The public works commitment is strong in Bucks Lake and everyone uses a personal septic system and mostly wells.

Northern Sierra Valley

Overall Capacity Score: 2.5

The Northern Sierra Valley is a ranching community that is highly rural and mostly undeveloped. There isn't much infrastructure but residents are largely self-sufficient. The community has a ranching culture that, though not unique in the area, identifies as a group. Ranchers in this area tend to take care of their own needs, but can also organize when necessary and are willing to help on specific projects. There are no public funds and a high degree of poverty, though some pockets of wealth exist (e.g., Chilcoot-Vinton). It was noted that residents are "land rich and money poor."

Portola/Dellecker

Overall Capacity Score: 2

This community has a history tied to the Union Pacific Railroad and logging. Following the decline of those industries, the community has been hit hard economically and socially, losing a shared bond and distinct culture, resulting in many abandoned, brownfields sites and high unemployment. The community has some challenges working together (tension between the haves and the have nots), though one respondent noted a wealth of knowledge and interest in addressing the issues facing the community. Portola is the only incorporated city in Plumas County and as such has some associated institutional capacity but still qualifies for access to public funds allocated to severely disadvantaged communities. Workshop participants described considerable differences between Portola and Dellecker, with the latter having less access to funding and resources combined with limited human capital, emphasizing the low capacity of Dellecker. Both communities are experiencing severe poverty and infrastructure challenges.

Quincy

Overall Capacity Score: 3.5

There was agreement among workshop participants that Quincy is one of the highest capacity communities in the region, and participants also noted that individuals from other communities often experience frustration that Quincy seems to receive more resources than other communities from the county. The county seat is situated in Quincy, enhancing the capacity of the community. There are numerous stores, job opportunities, and a "healthy" art scene. Many educated and younger professionals reside in Quincy, especially compared to the rest of the county. Quincy is a like-minded, tight knit community, but there are also many subgroups with a tendency toward cliques. Participants agreed that the capacity of Quincy is strongest during business hours. The town shuts down after 5:00 when government employees make their way

home.

Taylorsville/Crescent Mills/Feather River Canyon

Overall Capacity Score: 2.5

There is general agreement that the block group forming this community is the most awkward in the region. Taylorsville and Crescent Mills make more sense as a part of the Indian Valley community and have little in common with the canyon. Participants were unable to discuss this community as a whole, instead noting that Taylorsville has a higher capacity and more year-round employment than other communities in the region. Crescent Mills is comprised of low-income but working residents, and the Feather River Canyon has a high transient and unemployed populations. Residents of each subcommunity (i.e., Taylorsville, Crescent Mills, Feather River Canyon) tend to stay within their own community and social groups. Respondents also mentioned enormous social divisions within each subcommunity, particularly relating to schools (public and charter) in Taylorsville. There are pockets of wealth and talent within the community but low capacity overall. Improvements are needed for schools, sewers, and drinking water.

Sierra County

Allegheny/Sattley

Overall Capacity Score: 1.5

Workshop participants differentiated between the communities of Allegheny and Sattley. Situated in the hill about 40 miles west, slightly southwest of Sattley, Allegheny was described as a fiercely independent, remote community. As an area previously committed to mining, Allegheny was said to contribute to historical significance and related business opportunities have emerged in the area. Since the closure of mining, participants told of low financial resources in the Allegheny area, with a dependence on the Forest Service, and some property owners cultivating marijuana for economic gain. Residents were described in two manners, those who do not want the government involved with their lives and others living there because they are unable to move. The school in Allegheny is closed, leaving the residents without a community center, garden, or social space for residents to congregate. What remains is two businesses and a bar. Physical infrastructure is “poor, not the best.” Nonetheless, the water district is successfully maintained by volunteers, yet the reliance on volunteers leaves the community vulnerable if something were to occur. Participants noted the high number of volunteers that help to keep county facilities operating. If communities could be separated, workshop participants would designate Allegheny as a 1 for overall community capacity. “We tried to do a grant in Allegheny years ago, everyone qualified, definitely disadvantaged. Even with money in the pot, they didn’t want people to come into their homes to fix things.”

Sattley is part of Sierra Valley and offers “a totally opposite conclusion with pastoral scenes and strong agricultural values.” Sattley exhibits a tightly knit community devoted to agricultural uses and “is on the coattails of the agricultural community of Sierra Valley.” Both Alleghany and Sattley have low populations and income levels; however, workshop participants noted that ranchers and other private businesses have more resources and a close tie to the land. Sattley has few employment opportunities and low human capital.

The communities try to pull together, but this is not always possible due to the long distance to travel between communities, resulting in two very distinct areas with little communication.

Calpine/Downieville/Sierra City

Overall Capacity Score: 3

Sierra City and Downieville have many residents with historic ties to the area. The residents of the community are heavy into fundraising evidenced by several community supported programs, volunteer fire departments, the school and community members working together to better the community, and everyone’s “willingness to help.” Participants described high levels of volunteerism, with a population small enough to create a fishbowl, it is difficult not to participate or know what is going on. There area has a high percent of motivated professionals or businessman who may work outside the area or have home business. Private funds are quite often offered at fundraisers with above average per capita income in Sierra City and Calpine occupied by vacation and second homes. Downieville has lower overall income levels.

With a unique geography, rich history and active community involvement, workshop participants told of a “love of our rural lifestyle.” Calpine and Sierra City have a large percent of professionals residing in the county. Downieville is the county seat and is the home of governmental activity. Historically, tax values were high in Sierra City and Calpine. Sierra City has a high value recreation area (Lakes Basin) and the Downieville-Sierra City area has a rich “gold country” history with high value resources to access.

Infrastructure is almost nonexistent in some areas, but is very much needed. There is not sufficient funding to meet infrastructure needs. Inadequate infrastructure includes road improvements, challenges with water and sewer, a lack of cell service on the west side, poor cell coverage on the east side, and limited broadband. However, with high social capital noted by participants, “when infrastructure really needs improvement, we manage to find the funds.”

Calpine was more specifically characterized as a ranching and retirement community and incredibly active with volunteers.

As the county seat, Downieville also has many volunteers and is well known for hosting successful events (e.g., Downieville Classic Mountain Bike Race). There has been a loss of business and participants told of gas not always readily available. The Downieville school has decent program, including arts and theater, and increasing enrollment. The school drives a lot of people on the west side (Downieville/ Sierra City), and socially the school gets a lot of people out. We need a bunch of infrastructure. The clock doesn't work on the courthouse in Downieville, which did not surprise workshop participants.

Sierra City has a business community which has become seasonal. Fun volunteer activities are planned throughout the year with volunteer fire and recreation, but like many of the communities in Sierra County, there is a transition toward bedroom communities for Truckee and Reno.

There is a clear divide between the east side and the west side of the county with more transient tourism on the west compared to more agricultural and ranching on the east.

Loyalton/Verdi

Overall Capacity Score: 2.5

The City of Loyalton and Verdi are distinct areas. In describing Loyalton, workshop participants told of a city on the verge of financial bankruptcy and plagued by governance challenges. In need of road repair and water treatment plant maintenance, Loyalton suffers from physical infrastructure issues. Loyalton is an incorporated area that hosts about a third of the county's population, lots of vacant homes, and properties in disrepair. A low-income trailer park was closed with residents displaced, leaving the property in shambles and increasing homelessness. Some residents were moved to Reno, but some assimilated into Loyalton.

A few organizations (e.g., ESVCC and Rotary) actively raise money that is funneled back into the community as donations to the hospital and educational scholarships. Loyalton has some professionals with knowledge and experience who are able to address community problems and are willing to work together to try to improve conditions; however, there are also residents who are unaware or unwilling to address community challenges or be involved. Many residents will get involved in a crisis and contribute their capabilities then.

Loyalton community meetings were said to have limited attendance and of those who attend, many will argue on community issues and will express disagreement with decisions made by city officers and county supervisors. Another workshop participant described resident participation as good, but with many activities for the small community, including an "excellent museum." Workshop participants recognized the value of their rural lifestyle and passing on knowledge of land management to younger generations, though some thought the school system could do better in supporting rural livelihoods through their lessons and activities.

The overall community capacity score for Loyalton was “increased because of Verdi and Verdi and Loyalton are different worlds.”

Verdi was characterized as a bedroom community to Reno. Small ranchettes or high-value properties scatter the terrain of this ranching community. Residential infrastructure is challenged already with respect to sewer and water. Participants described diversity within the community, with a large segment of seniors and another sizable segment commuting to other locations for work and living in Verdi but “not paying attention.” Many commuters take their children to school in Reno or Truckee because Sierra County doesn’t have bus service in the area. Lastly, participants described volunteers, teachers, and social services as the people who show up.

Verdi is populated by capable people, but there is reliance on a portion of the community to help resolve issues with the “same people coming and helping and a lack of community interest by others.”

One workshop participant noted that social capital is often higher in the lower socioeconomic areas, which facilitates stronger support systems. For example, “in the trailer park, if someone has a need, neighbors come together and take care of one another.” There is weariness of outsiders coming in and helping. “Seems that some of the higher socioeconomic areas do not have the same community support,” such as the bedroom communities.

Sierraville

Overall Capacity Score: 3.5

Sierraville is both a community of ranchers and a bedroom community for residents who commute to Truckee for work. Financial capital is higher than other areas in the county given the influx of workers from Truckee; however, “there is more money in bank accounts than invested in the community.” Some contention exists among “newcomers” and old-time residents. Participants told of newcomers not supporting change and pointed toward old-time residents recognizing the need for development and revitalization. “We are on the verge of some very significant changes with bedroom community issues. Some people are not contributing to the community.” There are also limitations on growth as “agricultural properties are very well defined by law. There’s a real limit or where it will grow and how.”

The community dynamics are increasingly commuter oriented. “People moving in live here, take their kids to Truckee where they work, resulting in a lack of contribution to the health of the community.” Schools are declining enrollment. As they retire, they are living here, but not volunteering. “There are mattresses in home, but no contribution to communities. Sitting in this building [old school house] shows what has happened. This used to be a thriving K-12 school,

but slowly the population declined. They closed the mill and the population started to change. When we closed Sierraville school, we had three students remaining.”

Regarding social capital, one participant told of how the “community came together to raise money for a cancer patient (\$50,000). That is a huge scale to help a local community member.” The fire department is all volunteers and has “nice trucks and an annual successful bike tour” in Sierraville. “Newcomers have come together for meetings, such as what to do with the old school house, but then no one wants to be a part of the process. They want someone else to do it.”

Community gatherings include games at the ball fields and a few local events, but no historical society within the immediate area. Longtime residents get very involved in events and any new projects. They hold community meetings and write letters to the editor.

Regarding physical infrastructure, residents have recently repaired old barns downtown and other old buildings. Road work is still needed owing to last year’s flood on the state highway, but most roads are in decent shape.

“Everyone loves where we live and doesn’t want it to change. There is a strong community with capable individuals. This is a small, close-knit community.”

Yuba County

Beale Air Force Base

Final Capacity Measure: 4

Beale Air Force Base (AFB) is considered an “oddity” in an otherwise rural foothill region according to workshop participants. Financial capital rated very high as the base is federally funded and participants felt that the funding would continue regardless of context in the surrounding area. Regardless, community participants discussed the area qualifying as disadvantaged based on low salaries. Human and social capital rated highly given the number of technically savvy people and the military structure that engenders cohesion. Beale attracts families because of the services in Yuba county that focus on treating children’s autism.

Unfortunately, there is frequent turnover without warning that takes personnel and their institutional knowledge elsewhere. As members of the military, their community is strongly bound around durable and deeply shared experience. Community action is mainly focused on emerging crisis-related causes rather than Yuba county specific ones. Residents tend to not interact with people living off base, leaving Beale as a somewhat insular community. But as one participant asserted, “if there’s a flood, they [Air Force personnel] will show up.”

Even though funding was rated as generally strong, it can be inconsistent, leading to mixed success in addressing significant infrastructure issues relating to water. Many in the IRWM are concerned that a groundwater plume of infected water below the base will spread. The sewer system is also “in trouble” according to participants.

Challenge/Brownsville

Final Capacity Measure: 3.5

Similar to Browns Valley/Oregon House, Brownsville’s capacity diverges from its counterpart Challenge. Compared to Brownsville’s high financial capital, Challenge remains economically distressed. Brownsville is the most metropolitan community in the area, housing the volunteer fire department, water service district, businesses, churches, a grocery store and gas stations. The fire department fields a large number of calls and hosts fundraising efforts. The fire chief is very involved in the community and understands community needs.

Water infrastructure is antiquated and serves approximately 800 connections for consumption and fire suppression. “We haven’t been able to fund infrastructure improvement and could never afford costs of drilling wells...if there was a problem with the water infrastructure... it would be a huge blow” warned multiple participants. Challenge has very little infrastructure: “only piece that holds that community together is the Yuba Feather Elementary School, just like all foothill communities.” Residents don’t have a general store or gas station and the Forest Service left. There is a single church. Residents of Brownsville have a shared history, knowledge of community needs, and work together politically.

Challenge residents are less likely to have political involvement. Still, both areas are socially challenged even though “people bond over a rural way of life to get things done.” In both areas, there is not a connection to a sewer system.

Dobbins

Final Capacity Measure: 1.5

Even though Dobbins is physically located in a different block group than Oregon House, the two communities interact frequently and Dobbins leans on Oregon House “to stand up.” The two communities share the grocery store and fire station. In the past, when Dobbins was a logging and mining town, overall community capacity ranked higher. As those industries disappeared, capacity has steadily declined.

Local bonds in this low-income community have not been as strong as in previous years due to divisions from the medical marijuana industry and the influx of part-time residents. There are

knowledgeable residents with the ability to address local concerns, but the community lacks the financial capital to move forward. Some ability to leverage public funds exists in lieu of limited ability to raise private funding. Seemingly “the same five people” do everything in both Oregon House and Dobbins, according to participants. There has been a decline in willingness among the mostly retired and rural residents to maintain services. For example, the local volunteer fire department is not able, or willing, to respond to all 911 calls, mentioned participants. Physical infrastructure was rated low, yet the infrastructure is considered to be more recently updated than places further up the hill. Public school attendance continues to dwindle, threatening closure. Sewer and water infrastructure are nonexistent, but residents receive irrigation. Road conditions are considered “horrible” by workshop participants.

Loma Rica

Final Capacity Measure: 4

Loma Rica is unique in the Yuba IRWM owing to its high economic status. Most residents are ranchers, active business people or retired. Physical infrastructure is “excellent”: active schools, good roads, no sewers but reliable wells, irrigation is delivered and a reservoir is nearby. Residents are well educated and organize without many problems. During a recent fire, people stuck together very closely. The Lions Club and churches are well attended. A tight-knit culture centering around conservative Christian values forms bonds between residents and allows them to work together as a group.

Oregon House/ Browns Valley

Final Capacity Measure: 3

Browns Valley and Oregon House were grouped together as a community because both physically fall within the boundaries of the same block group, yet there are many differences between the two communities, including their capacity. Participants perceived Browns Valley as the wealthiest area in the foothills. Residents are more independent compared to Oregon House’s mostly middle-class community, which possesses a strong identity. Several workshop participants differentiated Browns Valley by its “upscale county gentry” instead of Oregon House’s “country living and religious groups.” There is also an influx of medical marijuana business. “Driving through there are nice homes, some trailer parks, people keeping the simple life, and some funky grow places.” There is a large agro-tourism economy based on wine and olive growers.

Browns Valley, apart from bad roads, has fairly good physical infrastructure and supports larger businesses. Oregon House schools are adequate to good. Roads are bad and getting worse. No drinking water or sewer infrastructure exists although irrigation is delivered. Both communities are filled with knowledgeable people who jump in and try to find solutions. Browns Valley residents seem to work better together than Oregon House, who may have an intractable problem of “too many leaders and not enough workers.” However, Oregon House has a well-managed volunteer fire

department, a charter school and community center. Many self-employed craftsmen and construction types reside in Oregon House, which was beneficial when the community decided to launch a tremendous team effort to negotiate a land deal and build their own community center. Residents fund needed projects fairly well as long as it's not "too expensive."

Robinson Mill/Forbestown

Final Capacity Measure: 2

Robinson Mill/ Forbestown falls predominantly within the low-income bracket. Forbestown is another town that is split geographically and culturally between Butte and Yuba counties, inhibiting residents from collaborating together. Most residents live under restrictive low incomes and do not bond over a shared way of life, with one participant acknowledging "there are still some things to bring the community together but those lessen each year". There's the Butte County Fire Safe Council and the local historical museum that brings outside people wanting to get a glimpse of foothill life. Workshop participants noted that tourism-oriented events like Forbestown Days may start to falter under a shifting culture. Low physical capital stems from lack of schools, bad roads that aren't a high priority for the county, and the need for water infrastructure to be upgraded and expanded. Residents use onsite sewers and wells.

Robinson Mills is a "blink and you'll miss it" town that does not possess infrastructure or resources. Employment historically depended on the timber industry, and ever since timber jobs left, "there is not a whole lot going on." Falling in line with many Sierra communities, there is not a drug treatment clinic to provide support for locals.

Workshop participants reflected on the social capital among Robinson Mill residents and how they still come together as needed; however, with so few residents, they are unlikely to make an impact.

Robinson Mill/ Forbestown falls under a culture of isolation experienced by many rural timber communities. Generational families laid roots here and some have experienced "at least two generations of very low income." A specific cultural identity prevails in the community; however, the community remains reliant on larger county centers to provide major services.

Strawberry Valley/Camptonville/La Porte

Final Capacity Measure: 2

The Strawberry Valley/Camptonville/ La Porte community struggles with many of the same issues that foothill communities face throughout California. A generational conundrum persists where the most active people in the community are older. If someone passes or moves away, the social fabric shifts. For example, there was a death in the community, and subsequently, the water board and school district fell apart along with the entities' ability to galvanize support. Poorly maintained schools and roads as well as private water systems are common. Schools face declining demographics resulting in

losses in funding. Overall, there are low amounts of public dollars available with one exception being money from tourism and campgrounds. Residents can raise small sums privately for local needs, like a new roof. “The area falls financially dependent on what the county can bring to these communities... and Yuba county is notorious for not being able to bring in funds.” Still, differences persist regionally and culturally due to the wide geographic scale of this block group. As a whole, workshop participants noted low levels of cohesive social capital to form due to geographic distance between groups.

Owing to Camptonville’s “approximately 20-year effort to build community capacity,” the area has an advantage in social, human, cultural and physical capitals over the other areas. Participants discussed a small core group of 10–20 people who actively spearhead activities to increase the well-being of children and adults. When asked, others volunteer to contribute their specific talents. Participants agreed that it is “the best organized community in the foothills.” Considered disadvantaged, participants noted that Camptonville manages to raise multiple thousands of dollars for fundraisers each year. Camptonville’s population has diversified from the influx of marijuana growers. All of the kids attend the same school and residents draw strength from commonality. Nonetheless, the culture is not homogenous: “there is a large portion who have common interests and yet there are definitive groups who do not see themselves as participants in Camptonville”.

La Porte and Strawberry Valley were rated as areas with low knowledge bases. Strawberry Valley is home to the Strawberry Maidu, who—for a while—were fairly active but now appear less connected. “A lot of woods and not much infrastructure” commented one participant of Strawberry Valley. La Porte receives some tourist money from lake traffic. Tourism in the area comes with a double-edged sword, though, because the small fire department becomes bombarded with calls from Highway 149.

Note: The majority of attendees for this community were from Comptonville.

Smartsville

Final Capacity Measure: 1.5

Smartsville was one of two communities from Yuba with the lowest overall capacity score, but with an overwhelming ability to raise funds. Participants spoke of Smartsville’s astounding capability to accomplish things for the local Catholic church, even raising hundreds of thousands of dollars to reconstruct the building. Capacity to galvanize community action and volunteerism exists around the religion but has yet to be tested with other topics. “The community clearly knows and thinks itself as a place...locals know one another” commented one participant. This small, isolated and unincorporated community is split between Yuba and Nevada counties which makes resource allocation difficult. Due to the low population and low incomes, there is a small tax base.

Residents remain on a failing septic system that has been placed on a moratorium for expansion. Currently, the county is unable to identify a wastewater solution and there are no funds for residents

to address the problem themselves. Roads are dilapidated. Participants spoke of a new Highway 20 bypass that may negatively affect what little tourist traffic passes through. There is poor access to drinking water, tainted groundwater “semi abandoned by water districts” due to infrastructure challenges. Continued groundwater contamination poses a threat to Smartsville as the community lies directly adjacent to Beale AFB. Old subdivisions like Gold Village have started to collapse into “a mess.”

Butte County

Bangor/Rackerby

Final Capacity Measure: 2

Since Bangor/Rackerby sits on the border between Yuba and Butte counties and according to workshop participants the community has fragmented services with fire and CHP stationed in Yuba county.

Physical infrastructure around water and school districts is also divided between the two governance zones. Residents struggle with low volume wells. Funds are slim, but there are many willing residents who try to help the community. Workshop participants commended the disaster recovery response to fires, especially the role of churches and the school in Bangor. Participants described quality wineries and a great bakery in the community. Bangor/ Rackerby hosts a diverse population with divergent interests who fall into categories of families, retirees and bedroom community members. Participants also noted the presence of marijuana growers who reside in the community.

Berry Creek

Overall Capacity Score: 2

Berry Creek, Feather Falls/ Forbestown and Yankee Hill/ Lower Concow all operate on the historical boom and bust nature of the foothills and as commonly experienced in natural resource dependent communities. One participant told of how people “sign up for the cyclical wild west experience of community growth and atrophy when they move out to rural areas.”

Physical capital is limited by the number of roads and sewers in need of repair. Roads are big challenge in Berry Creek with many unpaved, private roads that the county does not maintain. “Even the main roads don’t get fixed for a long time,” mentioned one workshop participant. There is not a main sewer system, the majority of residents draw their water from wells, and residents have their own propane. Conditions for residents could turn dire if wildfire and climate change affect drawing water from wells. Across all communities in the area, there is a lack of capacity to deal with forest thinning along their own home or roads. Many residents prefer a taste of isolation that a rural setting can provide, but are also willing to work together when there is a shared interest.

The large geographic area causes divisions and only a small handful of people consistently participate in the community. Berry Creek has a seasonal summer population that leaves when the weather turns cold. Residents rally around the local fire department and events like Berry Fest. There is a school and a community park that was recently added. Similar to Feather Falls/ Forbestown and Yankee Hill/ Lower Concow, Berry Creeks' upper foothill community has a "can-do" attitude but struggles with low population and high levels of poverty. Given the location, Berry Creek is often overlooked for public dollars given the location on the edge of Butte County.

Butte Valley/Cherokee

Overall Capacity Score: 3

Butte Valley/ Cherokee exemplifies another instance of dichotomous conditions in a single block group aggregation. The area of Butte Valley was described by workshop participants as the wealthiest of the communities in North Sacramento Valley. There is a broad financial base from land rich farmers who have known the land for hundreds of years, to trailer parks to the middle-class families living on large lots of 5–10 acres. One participant noted however that "it seems that there are often large parcels of land that contain potential community resources but may not be available for meeting local needs." This area was settled in the gold rush and there are a few very old families on ranches. Residents are proud to live in Butte Valley. The neighborhood around Butte College was reviewed as "...a great place to live, there are no houses for sale and residents don't want to change it." The college area is mainly an island unto itself. Each street in Butte Valley seems to be collaborative, with those in immediate proximity talking, but conversation topics only relate to what's going on in relation to their own street neighborhood.

Most residents pull water from a private well and everyone owns a propane tank. Their electrical system is old and during severe wind storms power poles blow over. Since this community has a low population their needs are low on the repair list. Butte Valley has a fairly strong volunteer fire department. In Cherokee, there's more unpaved gravel roads and overall capacity is more akin to Berry Creek or Feather Falls/ Forbestown. Community events aren't common in Cherokee, even the school is more connected to Concow.

Feather Falls/Forbestown

Overall Capacity Score: 1.5

As with Berry Creek and Yankee Hill/ Lower Concow, Feather Fall/ Forbestown is an upper foothill community that has a can-do attitude but struggles with low population and poverty. The community has struggled with overgrown forests and the aftermath of wildfire damage. Residents include fixed income retirees with valuable knowledge as well as low income

families. Workshop participants attributed a “lack of societal cohesion” to subgroups of residents including families, new retirees, pot growers, homesteaders and some troubled families. There are core community groups such as the local grange and community association, but they are unable to attract high levels of participation. Local fire safe councils from each town have cultivated a relationship with the community over the last ten years, allowing residents to identify where capacity needs exist. Very little opportunity for work exists in the community with most residents traveling “down the hill” for employment. Fire burned down half of the Feather Falls homes in 2017, initiating a yearlong recovery process. Some of those affected by the fire are still living in trailers and waiting for electrical hookups. Following the fire, community members came together, but cultural capital faltered as the population dwindled. After the fire in Forbestown, community fundraisers and events sprouted up in support.

Describing physical capital, workshop participants discussed the school in Feather Falls cautioning that “in two years, it’s not going to be there because there are currently about 8 students.” Roads are “okay” but in need of repair and there is not sewer system, residents rely on septic. One participant noted that “Feather falls does not have the water infrastructure... and the age of septic tanks will start causing an issue.” Forbestown does have hydrants, city water from its district and has sufficient escape routes in case of wildfire.

No school exists in Forbestown, instead students are bussed to the nearest town. Road maintenance rarely occurs except for the main road that logging trucks travel. The local general store does not carry all the necessities, so residents travel to Oroville or away on from Butte County on a better road to Marysville for shopping. Participants referred to Forbestown as a bedroom community where the doctors and retirees travel away to spend money and work. Participants concluded that “human capacity is great, but overall capacity is lacking.”

Oroville

Overall Capacity Score: 2.5

Participants felt like Oroville is a “regional rising star” as long as its political, economic and infrastructure challenges can be solved. The community seems splintered for many reasons: 1) a governance split between city and county; and 2) a divide between urban and rural. Oroville exists as an example of an “octopus” style of urban expansion as the city is incorporating neighborhoods that would benefit the tax base and is excluding poorer areas. This results in pockets of lower income residents situated next to wealthy residents, the unincorporated next to incorporated. Social capital rated as middle of the road, but there is some disconnect within subcommunities and church affiliations separating residents. Some participants went even further, saying residents have a “terrible time coordinating and working together, groups have

even changed their names over time...people with common interests can't work together." A small number of volunteers appears to do most of the community-oriented work. Workshop participants cited the spillway as having given the whole community a point to focus on and provide a vehicle for resistance for Tribes and special interest groups.

Workshop participants discussed how many residents live below the poverty line and low levels of home ownership hinder the accumulation of local wealth. "Entrepreneurial pursuits are limited as the entrepreneurial class moves elsewhere for opportunities" noted one participant. Oroville struggles with allocating funds to projects that benefit the entire community and workshop participants attributed this to politically motivated reasons. Participants felt that the city of Oroville, even though it's the county seat, does not have good access to public funds compared to some other communities in the region. The vacuum of leadership, both among the city and city council, was a common theme throughout the Oroville conversation. Residents have limited knowledge of local government. The city is on the verge of bankruptcy while simultaneously experiencing a problem retaining or recruiting staff that severely limits addressing local needs. "The area needs management and realignment towards the overall benefit of citizens" summarized one participant.

Infrastructure in Oroville needs repair as "some parts are over 100 years old," like the antiquated sewer system. Nonetheless, there are three different water purveyors in Oroville, which participants explained is not necessarily beneficial; however, community water needs are generally met. Workshop participants discussed high charges for CalWater service, perceived as "some of the highest rates for water in California," that "no one can afford". Water rates have been a divisive issue, partly from lack of public knowledge of operational costs between agencies. With a few pockets of private septic, residents are less vulnerable to drought than the other foothills area that have more reliance on private systems. Over the years, issues with the Department of Water Resources and their lack of funding continue to nettle residents. Oroville offers a number of activities like hiking, white water rafting, mountain bike trails and triathlons. Oroville Lake is now managed for environmental issues, whereas before, its primary purpose centered around recreation and agriculture. A number of mills closed in the recent past and two superfunds sites were established, which is partially why Oroville is listed as disadvantaged on CalEnviroScreen. Participants listed all of the above as contributors "to how hard it is for this area".

Palermo

Final Capacity Measure: 2

Palermo is a small agricultural community with easy access to Highway 70. Participants mentioned how Palermo's landscape includes larger, well-maintained properties than the nearby Oroville but still has many low-income residents. Lack of funding, both private and public, severely limits any public

use projects from coming to fruition. “It’s more of a community in the sense of the way we think of a community,” said one participant, “...the town has a nice structure of businesses and a school.” The school and grange are locations where many locals bond. Church events are also a bonding force. A community group helps the Feather River Recreation Park with park improvements. However, participants lamented that any discussion beyond park improvements, such as sidewalks, elicits a disinterested response. More community involvement is needed but Palermo “is a poor community and it is difficult to involve a good number of people” outside a handful of established community events.

Palermo was described as a very independent area that finds strength in its human, social and cultural capital; however, its “go-it-alone attitude” may handicap solving infrastructure challenges. Some major water issues exist in Palermo as residents rely on wells and septic. During the rainy season flooding, drainage and backup becomes extremely problematic. Residents rely on wells for drinking water and there is interest in low cost water testing. Certain wells are experiencing low volume flows.

Paradise/Magalia

Overall Capacity Score: 2.5

**This assessment preceded the 2018 Camp Fire by several weeks.*

Paradise/ Magalia struggles with poverty, fire safety and a lack of infrastructure improvements. Many private and county roads are not well maintained and residents worry about navigating road conditions in the event of a wildfire. Participants felt the community is “ripe” for increased involvement and proactive change Individually, as long as it resolves some issues.

Paradise and Magalia have different cultures and experience unique challenges. Paradise, on the other hand, is an incorporated area that “has capacity built into structure as compared to unincorporated communities that rely on volunteers.” The town’s incorporation sets the tone for community ownership of governance. Nonetheless, Paradise does not have a sewer system and has poorly funded public works. Without sewer, commercial enterprises cannot thrive, and the ones that do operate in Paradise, confront failing septic systems. Road conditions are average to poor and the local school is underfunded. A few infrastructure projects happen each year, yet there is still evidence of deferred maintenance. Paradise remains a retirement community with fixed income intermixed with low income households. The older, active citizenry brings plenty of knowledge and spend time involving themselves in churches and civic groups.

Magalia is an unincorporated area that was labeled as somewhat of an urban center in Butte County given its 9,000+ population. Residents have not sustained an organized leadership body like a city council or town hall giving way to active but fractured groups that raise money for roads or traffic light maintenance issues. From its former function as a retiree community,

Magalia now maintains a huge property association of 3,000 homes. Compared to Paradise's urban status, Magalia's smaller population base doesn't capture much wealth.

A shared identity of "the ridge" exists and a culture that is "certainly unique but seemingly critical with no offered solutions." There is a shift occurring in Paradise towards a more diverse populous as new family arrivals create opportunities for change. Some workshop participants believe the demographic changes have undermined the area's cultural capital. The small-town vibe lends itself to more involvements at neighborhood level. No large institutional presence anchors the town beyond the Feather River hospital. Due to its older population, Paradise faces a financial liability from pension funding that's impacting the local water districts. Paradise's remote location on the ridge means curbed sales tax revenues and other revenue raising mechanisms require voter approval. Overall, Paradise wants to attract more federal, state and private funding. Residents can't afford to remove trees, especially trees larger than 10 DBH, increasing already high fire risk. One participant rated physical capacity as a 2 because of the combined fire and septic challenges: "If there is ever a fire up there lots of people will perish." Water issues divided residents in the past few years, even as their water supply is less vulnerable to drought and well unreliability than other communities.

Stirling City/Upper Concow

Overall Capacity Score: 1.5

The Stirling City/ Upper Concow community has its own identity and was described as "most townlike of any community" in the North Sacramento Valley region since it actually has a small downtown street grid. Participants lauded Stirling City Clotilde Merlo Park as a "gem" that attracts visitors. Retirees center themselves around the Stirling Historical Museum. Upper Concow was noted as having a good park and pool facilities.

Fire generates a shared interest across the community. Fires have burned over Stirling City, and particularly Upper Concow multiple times. The area lost at least 60 structures, and participants estimated 80,000 to 120,000 acres burned resulting in a mass exodus of residents. Like all rural areas in the upper foothills of Butte County, this community is "tough" and has a "can do attitude," but deals with a sparse population, lack of resources, and poverty. A group of Chico State students attempted surveying the area to properly assess income, but residents would not answer any questions. Physical capital, especially water systems, needs help. An old septic system in Stirling is failing from root and soil intrusion. Roads, in general, need repair and the school in Stirling closed.

Yankee Hill/ Lower Concow

Overall Capacity Score: 2

The overall community capacity score is lifted by human, social and cultural capitals in Yankee Hill/ Lower Concow, but falters from physical and financial capital challenges. As in many rural, foothill communities with low populations and low incomes, there exists a self-reliant, can-do attitude. Participants rated this community more engaged than others, despite struggling from lack of funding and services. Residents work together over shared interest like fire, even if there is not much money to accomplish projects. Strong residents run the Yankee Hill Fire Safe Council, work on road maintenance, deal with tree mortality and cultivate a culture of preparedness. There is engagement with the historical society and a few other groups but only a select number of community leaders have emerged and younger members are not joining. One participant described resident interrelationships as “retirees, pot growers, low income families...there’s too many social groups to create inclusion.”

Nevada County

Alta Sierra

Overall Capacity Score: 3

According to workshop participants, Alta Sierra’s population is comprised of mainly retirees and wealthy residents, with a small impoverished population. Homeowner rates are high, but slightly declining due to an influx of families and people being priced out of cities. Some participants felt that Alta Sierra had strong community capacity 10 years ago and a greater number of wealthy families. Commuters use Alta Sierra as a base to Auburn and other business centers. Outside of Alta Sierra, property lots become larger, five-acre ranchettes. Social, cultural and human capitals are bolstered by location-based groups but are diminished by a lack of an incorporated city and cohesion. The homeowner’s association is voluntary and very active, having become a fire wise community that focuses on fire mitigation. Regular HOA meetings and a board grant some sense of community. Alta Sierra Country Club draws retiree involvement who feel like they share a culture there. While there isn’t one overall identity, a shared environment and resource constraints brings people together. A sense of community completely disappears outside Alta Sierra proper as the landscape becomes increasingly rural. Participants felt the older age of community members could pose an obstacle in capacity but also enable Alta Sierra where other communities may struggle. Crime, specifically the illicit manufacturing of methamphetamine in local homes, has negatively impacted cultural capacity. Their limited Infrastructure consists of the Alta Sierra School and some businesses near Highway 49. Road conditions are described as “well” but participants emphasized that winding, convoluted roads contribute to a fear of unfeasible egress in the case of fire. “Unless you know your way around, then you can easily get lost or find a dead end,” said one participant. Nevada Irrigation District serves some parts of Alta Sierra proper while the remaining residents use private wells. There is no sewer system and failing septic systems are driving people away from the area.

Banner Mountain/ Airport

Overall Capacity Score: 3

Banner Mountain/Airport has a diverse, highly educated population with various expertise and a willingness to help. If a major external stressor occurred, this community could respond by applying funding and knowledge, but would struggle uniting over its lack of cultural identity. Participants spoke of Banner Mountain leaning on other communities for support. A community group “Friends of Banner Mountain” was able to successfully fundraise for local issues. People associate themselves with different neighborhoods but Banner Mountain itself does not act as a unifying point. A large population of retirees reside here and while enthusiasm is high, their physical ability is limited. The college educated population earning higher incomes and the nearby Loma Rica business park bolster financial capital. Physical capital is strong in the sense that roads are in good shape and there aren’t major problems with water or sewer. Residents are on wells and septic systems. Nevada Irrigation District is well developed in certain areas. There are three designated egress routes, as Banner Mountain was designed to be a fire wise community. An airport is situated here, as reflected in the community name.

Peardale

Overall Capacity Score: 3

Peardale was presented as more of a corridor of rural housing along Highway 174 that participants thought of as an “outer Grass Valley”. Residents are not wealthy, but most own their homes and enjoy a quiet living that is not too far from town. A sense of community stems from the volunteer fire department and good people who live in this community. Cultural and social capitals rank higher on the basis that people care about each other and the community has a clear identity. There’s not really a place to gather in Peardale but in the nearby town of Cedar Ridge, people can visit the small main street. A post office and store are also in Cedar Ridge, important features especially after the Peardale store burned down. Participants noted the opportunity for organizing in Cedar Ridge but residents will need money and assistance. Physical capital is limited in that there is no sewer system, and residents rely on wells and septic. Roads are maintained.

Chicago Park

Overall Capacity Score: 3

This community contains a dichotomous group of residents, some of whom are newer and moved here from urban areas while others are older residents who work or formerly worked in forestry or agriculture. Both big houses and “shacks” dot the rural landscape. “I think of Chicago Park as a rural farm community” said one participant. Changing demographics in this community have riled some residents, like the old agriculture families who feel like the new comers are “infringing upon rights.” Others feel like the mix of long-term residents with cultivated skills and knowledge compliments newer residents bringing in fresh ideas and skills. Cultural capital has suffered therefore from this

divide and from residents' predilection to keep to themselves. But if people feel strongly about an issue, there is action. Folks are self-sufficient to maintain their own roads and clear brush, move earth and raise livestock on their properties. When residents do interact, it is within very specific family groups that live clustered near each other. This Chicago Park store and school also serve as community centers. A recent fire may have contributed to a greater community connection. There are a number of different activities, including a group for Chicago Parks fire-wise community and a local volunteer fire department, both which draw participation. Residents are more likely to have a high school level education. Financially, the participants thought of this community as low to middle income who "keep their money to themselves." Others believed Chicago Park has potential if only this community could receive grant funding. Physical capital is lacking from decrepit roads and subpar Nevada Irrigation District Service. Every home is on septic and wells, which have been known to dry up.

Garden Bar

Overall Capacity Score: 3

Garden Bar is a homogenous, sparsely populated community of large farms, ranches, and land trust property set in a rural landscape. Situated alongside the Bear River, the area was a candidate for a dam site in the recent past. Ranching culture seems to be the only unifying tie here, especially since some are historic ranches. Participants explained that this area doesn't feel like a community or have much happening.

Grass Valley

Overall Capacity Score: 4

In comparison to other communities in Nevada County, Grass Valley is the most developed area, owing to its popular downtown and surrounding higher density housing. Residents find Grass Valley to be a culturally engaging place. Support for the arts and a variety of community events led some participants to say they believed this community is better than the Bay Area. Financially, Grass Valley believes itself to be a disadvantaged community. Social capital is strongly focused in institutions such as church and hunting clubs. The number of groups with distinct allegiances and various identities implies cohesion between smaller groups of friends. But, there seems to be a sense of responsibility and care for others within these groups that extends to the larger community. A small group of active citizens contributes to the area's development and care about solving community issues. Because Grass Valley is incorporated infrastructure already exists for social capital to flourish. Residents feel a strong loyalty to the area, its historic roots and forested environment. Cultural bonds in Grass Valley seem to stem from a pride for the working class, maintaining a high standard in work performed and support for the reduction of homelessness. The Hospitality House provides short-term housing for 75 people in need. However, these bonds may not be shared amongst everyone, especially new arrivals. A high degree of polarization exists that can separate the community into "us" versus "them" and is sometimes reflected politically. Often, the rift is between the older, wealthier, highly educated and

typically retired “outsiders” and the younger, poorly educated, longtime residents with little economic opportunity. Longtime residents who struggle to survive economically tend to resent the retirees that can afford to live in Grass Valley comfortably. New retirees to the area may be less integrated into the resilience mechanisms, like support systems, that long-term residents from multigenerational families have in place from dealing with unemployment and response to disasters.

There is a demographic hole in the 25–45 age range that participants blame on a lack of primary industry and the pull of cheaper housing in the valley. After mining and logging disappeared the entire county of Nevada started hurting economically. This community now relies on retirees and tourism in downtown for an influx of money. One participant argued that some youth are returning as they are priced out of the Bay Area for homes, but not many. While there are a small number of wealthy individuals, the majority are low income residents who don’t own their home and live paycheck to paycheck. Low income housing is prevalent. Businesses in the downtown matrix bring in money, there’s a new brewery attracting attention and participants complimented the chamber of commerce’s efforts. This City of Grass Valley recently passed a measure to increase local sales tax to provide additional funding for police, fire, streets and parks. The new measure was supported by the community and represented the biggest change for taxes in a decade. Through other taxing measures the city is able to spend money on projects and develop community resources in spite of large pockets of poverty. But if Grass Valley were to receive more grant funding as well, participants said the community could leverage the opportunity. For example, in the past Grass Valley received a grant that distributed an iPad to every child based on socioeconomic status. Participants stressed the influence of nonprofits in the area due to the substantial amount of money that retirees donate for various causes. Physical capital is adequate, as county supports services in this municipality like libraries. In the urbanized parts of Grass Valley roads, water delivery and flood control are well provided. Further out, the more “natural” areas find themselves vulnerable to egress issues, flood and wildfires. If a fire occurred, participants believed strong mutual aid agreements and the local airport would benefit the response. City workers actively solicit money to upgrade infrastructure and, again, use taxes for physical needs like updating the sewers. The City of Grass Valley provides water for downtown and the rest of the area receives water from Nevada Irrigation District. Private improvements are lacking in certain neighborhoods. Schools rate well but are hurting due to the lack of younger families.

Lake of the Pines/Higgins

Overall Capacity Score: 3

Lakes of the Pines/Higgins encompasses the gated community of Lake of the Pines (LOP) and the surrounding areas referred to as Higgins and Dark Horse. Most of the population in this community does not live in Lake of the Pines, but the ones who do benefit from a strong HOA and a tight knit community with common interests. Lake of the Pines residents fall into a higher socioeconomic bracket but tend to be reluctant to embrace taxation. Participants told of changing demographics in the community as more renters offset the seniors and retirees. There is a sense of community, but it’s

insular. Water features in LOP have filled up with mercury and require regular dredging. The surrounding area of Higgins and Dark Horse has an overall lower capacity when compared to Lake of the Pines. Higgins Fire District closed one fire station due to funding issues after a ballot measure failed that would have required each property owner to pay \$35 per year. Now, fire protection costs increased by \$2,000 per year and there's no full-time staff. Roads have potholes, schools are in adequate condition and there's no sewer system outside of LOP. A proposed centennial dam has the community worried and has already lowered local home prices. Higgins Marketplace also expects new development in the form of a shopping center project. The Dark Horse area is home to a large Hispanic population but participants say these residents are "invisible" to the greater community. Outside of LOP, cultural and social capital decrease. Population is scattered and there's no central meeting place available. Law enforcement doesn't patrol the area and participants complained of repeated mail theft problems.

Lake Wildwood

Overall Capacity Score: 3.5

Lake Wildwood is another gated community where the majority of residents are still seniors and retirees; however, shifting demographics favor more renters. Lake Wildwood has an identity as a neighborhood and gated community, but that identity is more imposed than created. While social events are available for residents, they don't necessarily always translate to high cultural capital. Regardless, residents stay involved through Lake Wildwood's own television station, newspaper, theater company and numerous subcommittees. Residents are highly educated with diverse job backgrounds. Homes are fairly high-end and spread out around the lake, which can detract from cohesion. Participants mentioned that while a good number of residents identify as affluent, a diverse spread of socioeconomic status does exist. The HOA, which collects fees, assumes responsibility for maintaining roads, culverts, and common-use areas. An extremely unique water problem of E.coli pollution has afflicted Lake Wildwood's lake. Swimming is no longer allowed, and experts continue to struggle with resolving how and why this problem started. Because the response to the ongoing issues with water and a united front when McCourtney experienced a fire, participants thought Lake Wildwoods capacity to deal with threats as strong.

McCourtney

Overall Capacity Score: 2

McCourtney displays its financial dichotomy when viewing thousand-acre horse ranches with mansions next door to a single wide trailer on an acre of land. Generally, high income households prevail that are self-sufficient. The population consists of older agricultural families while more recent residents originate from a variety of backgrounds. Residents possess phenomenal technical capabilities and knowledge that just isn't shared between one another. Most residents are interested in isolation and rarely talk to each other to cultivate a sense of community. Private road associations

serve as the best example of social capital. A common lifestyle of land use, agriculture and livestock cements what little cultural capital they share. This area is very susceptible to fire, flooding and drought. Most properties are on private roads, draw water from wells, and use septic.

Nevada City

Overall Capacity Score: 4

Nevada City is a mix of socioeconomic levels and yet there is considerable wealth that may not be evident from the low-key lifestyle residents espouse. Nevada City has become a magnet for well-heeled retirees. At the same time, many residents, especially long term, live on a shoestring budget. Nevada City is a community with a high level of involvement and participation, despite being economically challenged. Nevada City's discretionary funding is quite limited as evidenced by their estimated \$3 million city budget that's roughly three times smaller than Grass Valley's. The 2,500-person population means the city doesn't have a big staff and means the suite of full services offered can sometimes feel on the cusp of being overwhelmed. Usually one person has multiple jobs, but there's a cohesiveness because of the small geographic area being served. Despite the budget, residents feel Nevada City services are adequate and private dollars are actively invested here. Nonprofits serve the community and rely on donations from residents. The city relies on volunteers and homegrown fundraising, efforts which help span socioeconomic differences. Some participants felt the city relies too heavily on raising funds by donations for city projects. Causes often raise funds successfully, like the recent "Goat Fund Me" campaign that raised money for goat herds to graze greenbelts in Nevada City in an attempt to reduce wildfire risk. Residents gather every week to work on city gardens.

Participants felt wary about burnout, since the same group of progressives spearheads new projects, which can feel like moving from one emergency to the next. One participant who moved to Nevada City from Fresno related that "...the difference in who shows up to volunteer is dramatic. Many people offer their abilities to community projects and bring talents, skills and intelligence." Nevada City, more than any place else in the county, is a center for the weed business. A cohesive group of growers have formed in the community but the topic has also created a fair amount of tumults in the past few years. There is a very strong sense of community and a high regard for place-based activities that support art, music and entrepreneurship. Participants were impressed by the number of gatherings "almost every two weeks" like parades, fire wise community, Wild and Scenic Film Festival and concerts that present a sense of belonging to a community where people enjoy each other. Residents strive to preserve the health and safety of the area and often advocate for higher priced solutions. Nevada City receives a high level of civil engagement, in great part due to loyalty to the area and high retiree population with time on their hands. The local radio station KVMR and the online site YubaNet are well regarded as community engagement hubs. KVMR radio dates back to the 1960s and still manages to engage the "hippy, crunchy granola, nature lover culture of the area that drags people out from all over California." Cultural capital grows from shared bonds and values but the population can diverge into

three communities that don't work together a lot: retirees, cannabis, nature locals. The overall education level in Nevada city is high for a rural community in the mountains, in part due to the retiree population. However, many young people leave the area for education and employment, draining the potential work experience and skills base. Many people previously lived in other cities and there is a strong regard for ideas from the outside. "I notice a lot of respect for educators, social activists and community participation. These are contributors that could lead to resilience and problem solving in stressful or disaster conditions" said one participant. Physical capital in the urban area is high but less so in rural areas, which are particularly vulnerable to fire, flood, drought, egress issues and lack of internet access. Participants mentioned the fact that this community includes rural and forested areas that bring down overall capacity. If a major fire occurred the results could be disastrous based on the minimal egress routes and spread out nature of the population. However, residents would rally in the case of a disaster. Roads and sewer systems have aged out and it is well known that vegetation management for wildfire is not sufficient.

San Juan Ridge/ Newtown

Overall Capacity Score: 3

San Juan Ridge is referred to as "The Ridge" by locals. Ridge culture is strong although the community is changing as time passes and new residents have less connection to the cultural heritage of the area. Residents lack structure and funding to build on their shared sense of community. "If they had funding, these people could mobilize and do something great," said one participant. People have organized large-scale projects like the Inimin Forest and Colombia Cultural Center. The Ridge has one of the most diverse sets of residents in terms of creativity and skills that they generously contribute to the community. San Juan Ridge itself is very cohesive culturally but only amounts to a third of this community's area, whereas Newtown is less cohesive overall and associates more with Nevada City. Education and income levels are mixed. Cannabis grows could contribute substantial financial capital in the future yet many grows still aren't registered as of yet. Due to lack of public transportation, pockets of low incomes, limited access to children's education and egress, the people of this community are extremely vulnerable. Financially, extremes at both ends of the socioeconomic spectrum live here, but the wealthy are willing to contribute resources. Capital is tied up in large land parcels. Public resources include a medical center, fire stations and nonprofits. Egress presents a particularly neglected issue. A number of neighborhoods only have one road in and out, potentially trapping people attempting to escape in a fire. Residents rely on private infrastructure like roads and wells and the condition of physical capital varies greatly based on neighborhood. Public infrastructure is neglected and in need of fire suppression resources. Participants explained many people of this community may be opposed to change, improvement and development in order to maintain privacy and rights. Infrastructure gaps, specifically for sewer and fire suppression, limit future commercial development. Physical capital is driven down by mining and mercury leaching from industry.

Penn Valley

Overall Capacity Score: 3.5

Penn Valley residents embrace the area's moniker of "Penntucky," that references their down to earth agricultural identity, and "Penn Valley formal," referencing the casual dress code of the blue-collar workers. Participants believed that this community has the overall capacity to respond well to external and internal stressors, even with pockets of poverty. Residents, who include marijuana growers and horse ranchers, have a high amount of knowledge of agriculture, land, technical expertise and business. The community comes together through events like the Penn Valley Rodeo, Easter egg hunt and through community groups such as the Penn Valley Park District, Chamber of Commerce and Municipal Advisory Council. During the 2015 Nevada County housing element update, regular town hall meetings drew crowds of 200 to 300 people. Penn Valley recently received a new sewer pipeline, greatly increasing its physical capital. Penn Valley performed their own survey on disadvantaged communities and used the results to justify a block grant to pay for the new sewer pipeline. The Western Gateway Park is considered a "jewel" that receives regular upkeep. Roads were just refurbished and a downtown area draws people inwards.

Red Dog/You Bet

Overall Capacity Score: 2

Red Dog/You Bet includes a significant area of BLM and national forest land, which contributes to the feel of an extremely rural lifestyle. Residents live on large parcels and typically stay to themselves. A number of illegal cannabis grows exist here. Neighbors on the same road may know each other to coordinate things like road repaving or borrowing a tractor. This is not an impoverished community, and skilled people live in the area who can maintain their properties and fix their own cars but that human capital is offset by little to no sharing of services. Their independence is exemplified by an ability to self-assess their own problems; residents own trucks and earth movers that can grade, cut fire breaks and clear snow. The main road is well maintained but somewhat narrow and contains many curves. A well-kept bridge over Greenhorn Creek was replaced within the last 20 years. As with the rest of rural Nevada County, this community relies on wells and septic.

Rough and Ready

Overall Capacity Score: 2.5

Rough and Ready unites over their strong community identity of independence. Residents are limited by low incomes, that aren't typically shared for community projects, and low education levels. In a pinch however, participants expected these folks to work together if needed. An annual festival celebrating their secession from the Union draws large crowds. Wildfire poses a threat here but residents try to clear property. Physical capacity includes the use of wells, septic tanks and intricate road systems.

Spenceville

Overall Capacity Score: 2

Spenceville is another community where residents value an independent lifestyle and prefer to be left alone. Incomes vary widely, there's a number of pockets of low income, and the higher income areas somewhat work together. Drug crime plagues neighborhoods. Overall, participants implied a number of infrastructure challenges. A knowledge and skill base does exist and contributes to a loose sense of community. Cultural capacity is low. Wells are susceptible to groundwater contamination and drought. A few roads provide egress and ingress routes.

Squirrel Creek

Overall Capacity Score: 3

To many participants, Squirrel Creek represented a nondescript, independent, rural area that nonetheless has a community-oriented culture. Residents want to be left alone unless there's an imposing need. Participants related an example where a house manufacturing methamphetamine was repeatedly reported to the Sheriff's office in an organized fashion until the offenders were taken care of, upon which everyone "went back to ignoring each other." Financial capital is highly diverse. These independent residents don't expect outside help or funds. Many highly educated, capable people with a variety of skills live in Squirrel Hill. In terms of human and social capital, there's little motive to work together but with identified need and leadership, the community has resources to self-assess in some situations. Residents strongly associate Grass Valley as an economic and cultural hub. Almost everyone uses septic systems and wells and participants referred to physical infrastructure as fragmentary.

Tahoe National Forest

Overall Capacity Score: 2.5

This sparsely populated community overlaps with Tahoe National Forest Land, which receives funding from the federal government for upkeep. Other than the few private residents who participants described as a mix of "miners, growers and well-off individuals," public agencies, private corporations and recreationalists are the main human influence. Most decisions are made by nonresidents and special interest groups. Human capital increases by the presence of scientists in diverse fields involved in public and private projects. If there is a need, people commute for groceries, schooling and jobs. Recreationalists statewide recognize this national forest as a destination and would lend support for the area if needed. Participants noted however that recreationalists generally have little knowledge of how to care for the land and resources. Participants noted that collaboration and financial capital were higher during the 1970s to 1980s, but some of the knowledge base is still somewhat in place. Private land is isolated, has low economic value except for occasional revenue from timber. The main land owners have a history of caring for the land but decisions are generally out of their hands. A lack of law

enforcement from the county and Tahoe National Forest transfers responsibility to residents. Illegal cannabis grows have been a problem. Roads are the main infrastructure usually fixed rather quickly. Participants told of aging PG&E water infrastructure that's now in limbo after the company declared bankruptcy. Defensible space issues also pose a threat as residents lack incentive to invest in the land long term. People in this area are very spread out and live as individuals that are self-sufficient and desire privacy.

Truckee

Overall Capacity Score: 4.5

Truckee was rated as one of the highest capacity communities in the region. While the town boundary of Truckee is located in Nevada county, participants extended community boundaries for this assessment into a portion of Placer county as well.

Ultimately, stakeholders rated the area very highly across all capitals of capacity. Financially, the community was described as having a very robust response to fundraising, with generous community members providing a high level of financial capital for community initiatives. However, one participant commented that for those in the community with moderate levels of income, there is difficulty in finding adequate housing.

There are also many active community organizations and local government bodies in Truckee, including the Truckee Tahoe Community Foundation, the Truckee River Watershed Council, the Truckee Donner Land Trust, the Sierra Business Council, a town council, and many more. These groups bring a high level of human capital, with participants noting the presence of many talented and knowledgeable people. Socially, though, stakeholders commented that groups can often operate within their own spheres, without optimal buy-in or engagement of other community groups, specifically the LatinX community. One participant noted that there have been some great efforts made in this realm, but there is still often a lack of follow through when it comes to enabling long-term partnerships and collaboration. Ultimately, there is great capacity for collaboration, but this tends to exist within subsets, and there are significant portions of the community that should be engaged in future efforts and projects.

Physical infrastructure was also rated highly, with participants commenting on a generally swift response to infrastructure improvement needs. However, this infrastructure is not nimble, and still faces its own challenges in adapting to stressors. One stakeholder noted that, in particular, the community has faced challenges in addressing lacking snow storage capacity for stormwater management. Awareness of evacuation infrastructure has also evolved, with residents becoming more knowledgeable in recent years of ingress and egress routes. The community is fortunate to have a freeway, which accelerates evacuation processes in the event of an emergency. There is a challenge with second-home owners in the area, and as one participant noted that it is easier for officials to educate and train year-round residents behaviorally in terms of evacuation preparedness.

Placer County

Loomis/Penryn

Overall Capacity Score: 5

The residents of Loomis like to be called a town, not a city, keeping in line with their preference for limiting growth. On the whole, Loomis is less disadvantaged than other communities in Placer due to the number of wealthy people residing in this community. “When there is a code enforcement issue...they call the board of supervisors” said one participant in reference to the wealthier residents’ ability to self-assess and utilize political channels to solve their problems. “They’re fine without everybody else and don’t need anyone” summarized another participant. However, participants noted stratification along socioeconomic lines since there are some pockets of lower income residents. Community members will go out and support their community, particularly through the various social events like the Mandarin Festival. Infrastructure rated well, with schools thought to be in very good shape.

South Auburn

Overall Capacity Score: 4.5

South Auburn is in a better financial position compared to the City of Auburn. Portions of this community are unincorporated while others are incorporated into the city. There are some large, wealthy subdivisions. Physical infrastructure, in terms of roads, sewer, water and a regional park, is strong and doesn’t require much work. Culturally, residents socialize at fairground events. The Auburn Indian community also has an office located in South Auburn. Residents of South Auburn are not very good at working together as a group. There is no Municipal Advisory Council for the area, which are groups that communicate constituent concerns directly with their Board of Supervisors representative.

Auburn

Overall Capacity Score: 3.5

Auburn is experiencing a growing community base from the influx of people moving from high density population areas. However, the newcomers haven’t yet connected socially to the rest of the community. Although, some of the “old Auburn” groups have been influenced by new members with different values. Auburn has a strong sense of community with many involved citizens and residents of the incorporated portion of Auburn are very willing to use their capabilities to address the town’s needs. Still, participants indicated that residents cannot solve problems together very well. On an individual basis, there are a number of high-income residents who have the financial capability to deal with potential problems. Auburn promotes its cultural events well and is known as the “endurance

capital of the world.” Generating funds and improving the city is a major problem for Auburn. Participants noted the number of large houses in the unincorporated region of Auburn, exacerbating the drain of funding from the city center. The property tax base is in North Auburn, and income isn’t shared equally in unincorporated area. Locals consider the process of incorporating the surrounding regions of Auburn together and want to keep North Auburn rural. More infrastructure is needed to handle the recent population influx, which has the potential to overwhelm Auburn’s capacity. Even though the City of Auburn needs to improve water and sewer infrastructure, the city lacks staff, has difficulties uniting people behind projects and takes a long time to organize grant funding. “The City of Auburn does not have a robust fund to serve residents” said one participant, for example, local roads are constantly in need of repairs. Auburn has a well-equipped emergency structure but some residents are hard to access in the more rural areas.

Auburn/Bowman

Overall Capacity Score: 3

Auburn/Bowman functions more as a commercial center than a residential area. There is almost no sense of community or shared culture in Bowman. Some well-connected residents get together to advocate on shared issues like the Bowman Charter School and road widening. The community is unincorporated and relies on county funding, but compared to other unincorporated areas Auburn/Bowman has a higher capacity to provide for residents. Development in the area is stymied by their sewer system reaching capacity, steep hillsides and proximity to BLM and protected lands. Water is also hard to come by.

Clipper Gap

Overall Capacity Score: 2

The majority of Clipper Gap residents are elderly or retired without much financial capital. Participants labeled this as a bedroom community that has no strong social hub like a town center. Clipper Gap has a limited supply of treated water for fire and domestic use. Some areas require updated sewer infrastructure. Human and social capital are mixed. Placer County Water Agency attempted to get the community to work together but found that the residents weren’t willing to do so. Other participants said that the community is willing to meet together for a common purpose.

Applegate

Overall Capacity Score: 2

Applegate is a smaller, rural community of mostly elderly on a fixed income. Incomes are low to middling though some newer developments have been marketed towards higher income individuals. A number of private projects, like the expansion of the Applegate grange, were recently approved and constructed, demonstrating the availability of private funding. Living a rural lifestyle underpins the

main shared bond between residents. Some people in the community are willing to work together, but a loose sense of community pervades with no community organizations and a lack of local advocates. There are no central areas like a downtown to gather in other than churches. For a rural area, Applegate residents are generally well served in terms of roads, water, sewer and access to infrastructure but certain problems still persist for constricted residents. Most of the neighborhoods that have water issues reach out to Placer County Water Agency (PCWA), but they serve such a small portion of the population that “PCWA can only support the ratepayers they have.” One participant mentioned the area of Meadow Glen, which has wells 500 to 750 feet deep and would require tens of thousands of dollars to fix. Heather Glen, an elderly home in Applegate, has clientele on fixed incomes and doesn’t have sewer or a water connection and “brings down the capacity in this region.” Residents experience wells drying up during drought periods. Participants also warned that if a forest fire occurred in Applegate, the results would be devastating. Meadow Vista is close by and PCWA is talking about having a water tie-in between Meadow Vista and Applegate, which would help during a fire.

Foresthill

Overall Capacity Score: 1.5

Consistent with the title of this community, quite a bit of land in the community belongs to the USFS and state park property. The timber and mining industry used to sustain this community but now those industries are gone. Foresthill ranges from retirees to working people who travel off the mountain to work. Participants labeled Foresthill an “interesting little town” that has a number of old families. Job opportunities are limited to Placer Water Agency, public utility or the Forest Service, pushing young people off the hill to find work. More affluent residents tend to not associate with locals and spend more time in the Auburn area than they do in Foresthill. A significant number of people live paycheck to paycheck or receive government assistance. “This is a depressed area with pockets of financial resources not available for community use” said one participant. The community is divided between those people with historic roots in the community and those who have lived there for 10 years or less. Newcomers are influential in community decisions and often at odds with larger local member ideas. The community works together on issues concerning fire and water. For other issues, working together takes a great deal of communication and pre-event planning. A movement that addresses wildlife concerns for the community is bringing local agencies and community members together. Foresthill’s history that dates back to the Gold Rush and mining knits together local culture. Participants noted a definite divergence in population priorities based on the immediate living area. Roads are in constant need of repair and upkeep. There are two schools in this community, one of them is a high school managed through Auburn School District, and both have a high number of disadvantaged students.

Placer East

Overall Capacity Score: 1.5

Placer East's small population is dispersed across a large area that is primarily owned by the United States Forest Service, Bureau of Land Management or wildlands. There are pockets of financial prosperity where the most county resources are focused. A Native American population exerts significant influence in this community. The Cedars is a wealthy enclave of seasonal residents that has historical ties to the Central Pacific Railroad Company. People retain an independent nature and ties to their neighbors, as opposed to relying on county resources.

Cape Horn/Moody Ridge

Overall Capacity Score: 2

Participants relayed the history of the Cape Horn/Moody Ridge as originating in the 1960s, when squatters moved onto the land. Part of the community is now made up of many people living on one large piece of property. Properties are still not accumulating taxes because participants said the county doesn't know those people still squatting. All of Moody Ridge still has dirt roads and relies on wells. Participants noted that roadways are one of the biggest problems Cape Horn/Moody Ridge has in terms of infrastructure and fire danger. Within the last 30 years, Cape Horn has built out in the last 30 years, but there is still limited infrastructure. Roads are one lane, there are no hydrants, and residents rely on wells. Railroad tracks run across the one-lane road into the community, and participants warned that if a train breaks down while a fire happens, no one will be able to escape. Egress is limited regardless. The area has a history of fire damage (e.g., when the 2004 Stevens Fire destroyed several homes).

Alta/Dutch Flat

Overall Capacity Score: 3

Alta/Dutch Flat has been the largest community in this area for a long time. Although there is a limited local tax base from both businesses and residents, most revenues from this area are absorbed by the county. There is no economic structure or town center, however, residents were said to have wealth. Infrastructure is maintained by Placer County and the water system is fine, but there are issues with roads. A number of resident's volunteer for the fire department but more fire protection is needed. There is a community center. This community is very close knit and people will do things for free. Members work together to make up for project shortcomings and to keep the community maintained where the county does or cannot. A monthly community potluck brings large crowds of up to 100. Elderly people work well together and stay involved in the community.

Colfax/ Iowa Hill

Overall Capacity Score: 2

This community includes two very different areas of Colfax, which is one of the most populated areas in the county, and Iowa Hill, which is extremely rural. Both areas feel connected to each other due to

their proximity to the American River, sharing the same zip code and sending their children to the same elementary school. Culture capital benefits from generations of families who love their isolated lifestyle, share family values, support local sports and the high number of community events, like fourth of July celebrations. The community will pull together when needed, as one participant said, “when the fire comes everybody gets out and helps.” Colfax has a small-town center with many rural, satellite residents who still identify as a part of the Colfax community. The city relies on grants for financial assistance. For years Colfax has had strong human, cultural and social capital but still struggles with financial issues, most of the funding originating from sales tax. Infrastructure in Colfax has been difficult to maintain due to its population and boundaries. Even with Highway 80 running through the middle of Colfax, there isn’t much development. Iowa Hill is extremely rural and community members have had to learn how to survive in this area, as well as work together. Local Iowa Hill residents are willing to share knowledge. Practically no infrastructure exists. Residents just recently received phone service but still lack integrated systems for water, sewer, and power. Everyone relies on generators, wells and septic systems. Roads in Iowa Hill are maintained by the county and the school recently closed due to a lack of students.

Weimar

Overall Capacity Score: 2.5

Weimar’s history started around the inception of the Weimar Institute in 1978 given there was little record of logging in the area. This bedroom community is all rural country but it is located off of the Highway 80 corridor, “perfect for commutes to jobs in Sacramento.” Much of this community is unincorporated. Residents must travel outside of the area for attractions since there is no economic hub other than service stations, the Weimar Institute and schools. Regardless, residents feel pulled to live here given its location outside of high-density areas. Several large developments with HOAs have recently brought more financially well-off residents. Community identity is very individualistic per household with people mostly wanting to be left alone.

Meadow Vista

Overall Capacity Score: 4

Meadow Vista is a community that has the ability to support itself relative to others in Placer. The majority of residents are affluent and highly educated. Residents remain well connected to the community and active in issues. Meadow Vista has its own Municipal Advisory Committee, which is a group that communicates constituent concerns directly to their Board of Supervisors representative. Winchester golf course is a location of note that residents use. Physical capital is not all there and hydrant capacity is unclear.

North Auburn

Overall Capacity Score: 4

North Auburn is an unincorporated area in Placer County that has a large, educated population. Property values are moderately high to very high and the community is a mix between residential and industrial. Funds come from county tax dollars and while the county does fund projects in North Auburn, there are no core community groups advocating for funds. Traffic fees imposed on development are used to make road improvements, many roads in North Auburn are county maintained. “It is not a distinct community, more rural and small housing development that has a growing population base” said one participant. Neighborhoods are stratified with poor, higher-density development generally flanking Highway 49, and large-lot rural farms in the outlying area. Furthermore, compared to the rest of Auburn, North Auburn has higher crime and poverty rates. Nobody wants to incorporate surrounding places together, the process is considered too difficult and North Auburn likes being more rural. Despite being in an unincorporated area, North Auburn does meet its residents’ needs. Public services are centrally located and most of the county officers are located in North Auburn. Further away from the highway, groups like “Protect Rural Placer” opposed expansion of a park and can join together to self-assess. Rural North Auburn has a strong sense of local bonds and ways of living (i.e., farming) but the less affluent residents do not appear to have the same sense of community. North Auburn also came together to raise awareness of homelessness and to oppose development of big box stores. Wineries and agriculture tend to bond the community together. Infrastructure is often not well maintained in areas around Highway 49 and 80. Public sewer and water are available. Wells and leach fields are used for water and sewer but aren’t major infrastructure problems because North Auburn can always find funding. Some areas struggle with water issues. Constructed conveyance customers are using canal water, a lower-quality water, for domestic purposes. Others cannot drill wells because lots are too small and need treated water infrastructure. Participants were worried about water quality due to a history of mining in the area.

Newcastle/Ophir

Overall Capacity Score: 3.5

Newcastle/Ophir is very diverse financially. Residents range from rural farms to high-end HOAs in large, wealthy subdivisions. Generations of family members from old farming and ranching communities share cultural bonds. The community has its own Municipal Advisory Committee, which is a group that communicates constituents’ concerns directly to their Board of Supervisors representative. Newcastle has a very tight community that is learning to work on a variety of issues, including fire, water, and community structure. Because the town of Newcastle is a small area, there are issues with funding for the fire department. Participants also qualified Newcastle as an affluent bedroom community.

Rural Lincoln

Overall Capacity Score: 3

Rural Lincoln is a stratified community with a mix of wealthy residents who are more independent and very socioeconomically disadvantaged residents who have tight-knit community ties. The Sheridan area rates especially low socioeconomically and can't grow because the sewer system capacity isn't sufficient. Sheridan falls within the Western Placer School District, which participants characterized as "forgotten." Most of the children in Rural Lincoln attend a Title 1 school and receive free and reduced lunches. Because of the deep stratification, the more economically disadvantaged communities tend to be underserved and underrepresented. Rural Lincoln used to be a poorer community but in more recent years residents with wealth have moved into the area. One participant explained that the socioeconomic matrix has been changing so much over the past 5-8 years that, even though there's still a fair bit of impoverishment, they can't decide if the current situation reflects "pockets of wealth or pockets of impoverishment." The community is challenged to come together as a whole, partially because people are so spread out. Culturally, residents associate themselves with Lincoln but can't interact as much because there is no community center. In terms of social and human capital, the less wealthy residents generally have more of a willingness to work toward community projects. Wealthier residents, who participants referred to as living in "mansions," don't work together much on overall community needs and are able to use their wealth to self-assess any problems. Agriculture and wineries on the "Placer Wine Trail" bring some of the community together. Ability to meet infrastructure needs hasn't been an issue yet, but there is no sewer treatment system and the community uses wells and leach fields.

El Dorado County

American River Canyon

Overall Capacity Score: 1

Workshop participants described the American River Canyon as a very low capacity community. With declines in infrastructure, development, and a sense of community, the overall rating was determined to be a "1" out of 5. Resources are extremely constrained and the area is vulnerable to natural disasters with unstable slopes in a mountainous region. Previously, a neighborhood known as Little Norway was a vibrant area with a scattering of houses. A fire swept through and there was no financial capacity to rebuild.

Today there are many vacation and recreational homes occupied during summer months. These part-time residents are said to have human capital, but do not use their skills to invest in the community. The few year-round residents have low incomes and "virtually no community."

Challenges exist with septic systems. There are areas that are unable to support septic systems and several commercial establishments (e.g., Whitehall) that lack private sewer capacity to sustain growth.

The American River Canyon is an important watershed for water supply and fish habitat. Participants noted some sense of community in Kyburz and Strawberry, but an overall decline as Highway 50 travelers now only pass through the area.

Auburn Lake Trails

Overall Capacity Score: 4

Auburn Lakes Trails is a forested community with some residents from the Bay Area. Traditionally the community consisted of ranchers and with the influx of retirees from the Bay, but there is a divide between the “ranchers” and the “golf community.” Human capital is present among the community with both those who have retired in Auburn Lake Trails and those that are currently working. There are many organizations and communities that work well together, including the horse community, golf community, and other recreational groups.

There is a gated community with higher socioeconomic status that has decent funding from the homeowner’s association. The gated community has a wastewater system with 200 lots shared, but owing to the design and merging of some of the lots, the wastewater system is becoming problematic. However, with more financial capacity to address challenges when they arise, this community is more resilient and may be able to maintain and repair septic issues. Auburn Lake Trails has wells and water from the Georgetown Divide Public Utilities District and is treated at the Auburn Lakes Trails treatment plant. Other physical infrastructure noted by workshop participants include buses for schools, access to broadband, and decent cellular service. A local fire station and a CalFire Station are nearby, but fire evacuation is difficult.

Camino

Overall Capacity Score: 4.5

The community of Camino was described by workshop participants as having a very strong community action committee with a large agricultural presence and an apple hill growers’ association. The community is well organized; however, farms do not make much money. The human, social, and cultural capitals were rated very high and the community is very politically active. Residents have strong cultural bonds. Despite lower financial capital, workshop participants felt that Camino had more access to money than other communities in the region because of their industries.

Camino has some economic dependence on tourism as one of the larger tourist destinations in the area because of their wineries and farms.

Camino is rural with the exception of a small downtown that was based around a lumber mill that has since closed. Residents are older with mostly blue collared workers and retired agriculturalists relying on lower incomes.

Cedar Grove

Overall Capacity Score: 2

Workshop participants felt that Cedar Grove is very similar to Camino based on a shared farm culture and agricultural lifestyle. However, workshop participants described many mobile home parks and a prevalence of drugs in Cedar Grove.

Cedar grove is considered economically depressed with lower social capital than Camino. While some agricultural community fundraisers do exist, the low financial capital and threat of wildfire with overgrown roads and limited evacuation routes make this community extremely vulnerable.

Cameron Park

Overall Capacity Score: 4

Overall workshop participants determined that Cameron Park had a relatively high overall community capacity with a “4” out of 5. Cameron Park has medium to high income housing with some low income and multifamily apartment options. The older parts of Cameron Park were developed before modern county design standards were implemented. Workshop participants noted drainage maintenance issues without much funding outside of the community services district and zones of benefit. There are many drainage complaints from residents due to the flooding and property damage. Property owners need to perform some of the maintenance but many do not have the knowledge to address the challenges.

Participants discussed how there are some passionate residents who speak for the community and work together. One example was the collaboration on the Cameron Park design standards. The community has a fire district, but the fire station has very few volunteers. Cameron Park has strong community spirit where local residents work together to solve problems within the community and residents have a strong sense of community and way of life consisting of suburban residents and businesses. There are also many who commute for work outside of the community, but participants noted there is “some level of culture throughout community groups.”

With its own community services district with tax based funding, there is some public funding for projects in the community. Also, owing to the population size, there is a range of technical expertise to solve local issues. There is a school, a water treatment plant and public water in the Cameron Park community, and “good infrastructure and financial capacity” overall with the “majority of infrastructure that is newer.”

Coloma/Lotus

Overall Capacity Score: 4

Coloma is known for the “Marshall Gold Discovery State Park,” and an important part of history during the gold rush. With class three sections of the American River, recreationalist and others moved here to appreciate this resource. Lotus Valley is very unique geographically and lends to a strong rafting and recreational tourist industry (e.g., biking, hiking, riding horses) with an estimated 400,000 visitors to the river and historic park annually. There is a strong “river community” identity and historic community sense of place with resident who actively participate in planning efforts and projects.

The Coloma/Lotus community was established in 1850 with a more recent wave of immigrants seeking out the river community and collectively fighting for river access. The American River Conservancy emerged in Coloma/Lotus, and “I can’t think of any other community that has such strong organizations for an area of 750 houses.”

While the sense of place reveals high cultural capital, the community is considered underserved and is unincorporated. A small retail commercial base exists with boater recreational fees from outfitter. There are high levels of education and strong base of volunteers. Local organizations that host volunteers include the American River Conservancy, the Coloma/Lotus Business Council, the Coloma/Lotus Fire Safe Council, the Gold Trail Grange, and Marshall Gold Discovery State Park among others.

Physical infrastructure includes some El Dorado Irrigation District service areas, some Georgetown Divide Public Utilities District service areas, and much of the community on wells and septic. Schools and roads are good, but there is a low maintenance budget. A new Murphy bridge is needed, but there is a sentiment to keep Coloma/Lotus rural. They do not “need the same level of capital as Placerville or El Dorado Hills.” Coloma/Lotus is lacking a 24/7 fire station and there is not a community service district. The community depends on the County for some of their needs.

Cool/Pilot Hill

Overall Capacity Score: 3

Workshop participants underscored the differences between Cool and Pilot Hill. The areas are distinct and isolated from one another and “the cultures do not bleed over from one to the other.” In the more rural areas, Pilot Hill, there is a lot of disparity and rural isolation. There are also wineries and land ownership of wealthy residents from the Bay Area in Cool.

In regard to physical infrastructure, there is a fire station and CalFire. There is a single road in and out creating a fire hazard with a lack of egress. Although the road, water, and schools are reliable, the water pressure is lower leading to fire insurance issues. Lack of reliable cellular service and lack of reliable broadband internet are challenges. The major roads in the area are 49 and 193.

The wealthier segment of the community has private dollars that are used for community purposes and many projects use fundraising. Members throughout the community share their education, knowledge, and experience and fulfill community leadership roles. Community members tend to work

together and convene throughout the year to attend fairs, parades, family markets, and community hall educational and outreach events. Local business owners work together and support one another.

The culture is rural with a lot of agriculture, farms, ranches, a horse community, pastures, and vineyards. The cultural, human and social capitals are considered high, but infrastructure challenges exist.

Pilot Hill is mostly underserved, unincorporated communities that are dependent on State Highway 49. Residents have lower incomes and “are not like Cool or Auburn Lake Trails.” There is a small retail commercial base.

Diamond Springs

Overall Capacity Score: 3.5

Diamond Springs received an above average community capacity score overall, but was characterized as a financially depressed area with relatively low median household incomes. El Dorado County focuses some projects in this area, such as the Diamond Springs Parkway, which is about to break ground. This project will divert some of the traffic from downtown, relieving congestion. The community has a grocery store, fire department, and access to internet. There is a robust business area and “Financial Highway 49,” a major traffic corridor. The Highway 49 corridor has sewer and water infrastructure funded by larger organizations such as CalTrans, El Dorado County and the El Dorado Irrigation District.

The community maintains a good level of local expertise to solve local problems and the Diamond Springs Fire Department and the Union Mine High School rally community action when needed. The Diamond Springs Fire Department is a local leader and actively fundraises for their needs, as well as other community needs. Diamond Springs has some local culture but is also somewhat of a “bedroom” community according to workshop participants.

El Dorado Hills

Overall Capacity Score: 5

El Dorado Hills received the highest community capacity rating in El Dorado county. With the highest financial capital of the communities in the county, the community of El Dorado Hills is collects valuable tax dollars and has a CSD. The community is fairly new as compared to others that were built during the Gold Rush years; therefore, roads and infrastructure are new. The community was characterized by workshop participants as “a 21st century community, and the rest of El Dorado is in the 1800’s.”

In addition to the CSD, El Dorado Hills has El Dorado Irrigation District, land developers, a library, senior citizen’s center, recreational center, and a “really nice fire station.”

Owing to the young nature of the community, there is not a long-term culture established, but residents are moderately engaged with social organizations in the community and real estate brochures cast “El Dorado Hills as the Marin of the Sierra.” There is a very affluent community that has the ability to raise money fairly easily and a highly educated population that is engaged in the community.

El Dorado/Nashville

Overall Capacity Score: 2.5

Overall community capacity was rated as below average. Struggling with poor physical infrastructure, workshop participants pointed to a mobile home park situated on the river in Nashville, which has waste water transported over the river and presents E. coli challenges when there are water overflows. Gold Beach, the aforementioned mobile home park, is located on the river’s shore and “is a code enforcement nightmare.” It is “swirling with issues and there will never be a CSD at Gold Beach.” Participants noted the challenge residents face in securing housing elsewhere. Nashville used to have a commercial core, a café with music, but now it’s on the decline. “Even the highway sign has been stolen,” noted a workshop participant. “The score for Nashville is pulling down the score for El Dorado.”

El Dorado was described as a historic town with small mining houses. While there are not many residents, neighborhoods do exist. With private investment, county attention, an “up-and-coming” brewery, niche shops, and artists moving into the area, El Dorado was viewed in a positive light overall even with a very low median household income. Residents were described as “wanting to live there and very proud to live there.”

The western edge has ranches and a small, nice subdivision. China Hill is another neighborhood that includes large lots and higher income houses. The area includes Christmas tree farms and ranches.

There are no nonprofits in the area who are able to apply for resources on the community’s behalf, according to workshop participants. The community has pockets of poverty, challenges with drugs, and septic issues.

Fair Play

Overall Capacity Score: 3.5

Fair Play has some affluent areas, large vineyards, and was described as being similar to Shenandoah Valley. The area with the wineries is higher capacity and considered very successful with a winery association and a strong sense of community. Participants mentioned a few pockets of less well-off residents.

Fair Play was described as almost identical to Somerset both culturally and economically. Some environmental issues exist with homeless encampments on the Cosumnes River. Dumping, vandalism, erosion of county maintained roads, all contribute to the extreme fire risk in this steep, massive canyon. The impact on water quality and fisheries from ORV use and non-maintained roads is a major problem. Independent wells and septic are found throughout the community.

Georgetown

Overall Capacity Score: 3

The workshop discussion about Georgetown started with the topic of a local school district study that revealed two distinct socioeconomic groups in the community, as opposed to a distribution of a normal bell curve. One group of residents is well-educated with decent incomes and fills supervisory roles, and the other group is considered low income with lower levels of education and some association with the timber industry. Few residents were found with average income and education levels demonstrative of the divide in the community, according to workshop participants. Workshop participants also described Hispanic immigrants that may not be reflected in the census and were characterized by lower economic status.

On the other hand, workshop participants discussed strong cultural bonds in Georgetown and a proud community: “it’s awesome and has social, cultural, and human aspects as a group.” Georgetown is considered a gateway to the national forest with trails that go across the Sierra.

Participants expressed concern regarding Georgetown Divide Public Utilities District water systems and the lack of financial capacity to deal with aging infrastructure and ongoing maintenance needs. There are many old parcels with old septic systems. The need for fire/fuels reduction work is much greater than the financial capacity as there are many overgrown forests creating fire hazards.

Other physical infrastructure concerns include the roads with the abundance of pot holes. One participant referred to the roads as the “Gold Rush road system,” as much investment in the community was made during the Gold Rush Era.

In terms of social capital, participants stated that residents are reasonably involved in the community with lots of retired residents with different expertise. The community is rural with a relatively homogenous population in terms of ethnicity, mostly conservative, and many retired residents.

Many local service offices are located in Georgetown and provide services to a larger area, including water purveyors and school district offices.

Gold Hill

Overall Capacity Score: 3

Gold Hill was characterized by participants as rural, like much of the county, but with low levels of social or cultural capital. Nonetheless, originally, Gold Hill was a Japanese colony and that cultural heritage is described as strong.

There is the Gold Trail School District in Gold Hill, but the fire station is vacant, the CSD nonexistent, no public transit, and there are no bike or pedestrian lanes. Private roads create small communities, but there is not a sense of overall community. The culture is one of farming and there is a lot of open space as opposed to a town center. Some residents commute to jobs in more populated areas and there is a high number of retirees.

Garden Valley/Greenwood

Overall Capacity Score: 3.5

Garden Valley/Greenwood was compared to Georgetown and Cool at the onset by workshop participants and rated as slightly higher in overall community capacity. With a relatively sparse population, a mix of low income and high-income residents, large parcels of land, and lots of seniors, Garden Valley has an active community association with high levels of participation and many residents with high levels of expertise in diverse arenas.

The community is active in other realms, residents get involved in regular farmers meet-ups at the park and other events at the Garden Valley Park, one of the community's gathering places. Participants described high social capital.

Physical infrastructure such as roads and schools are considered "good" by workshop participants. Garden Valley has both a middle school and a high school. The central park is a community gathering space. However, internet access is suboptimal.

Financial capital is low with some residents commuting for higher pay, which also gives the area a bedroom community flavor, but participants also stressed how residents maintain a high value for rural life. Commuters were designated as the residents most able and most likely to respond to community stressors. Therefore, while there are some characteristics of a bedroom community, commuters still seem to invest in the local community.

Grizzly Flats/Omo

Overall Capacity Score: 2

The Grizzly Flat/Omo community received an overall community capacity rating of "2" out of 5. In terms of human, social, and cultural capital, workshop participants noted a strong fire safe council and community service district. The fire safe council tends to pull the community together and can sometimes address larger issues, such as school and water issues. Omo is starting their own fire safe council and pulling a number of residents together to participate. Overall, the community was

described as having shared local bonds, able to work together, and capable of securing and executing grant funding, i.e., grants through the El Dorado Water Agency.

Grizzly Flats community was built in the 1850s. According to participants, the county does not have funds to redo roads. Omo needs road work as well. Problems with water supply systems were noted. Older physical infrastructure is problematic to finance, with lower socioeconomics across the community, and taxing the community would be challenging.

Participants described how developers thought they were developing summer homes rather than year-round housing and therefore, the roads were not originally designed for winter travel. Paved over roads with no subbase, lending to major road maintenance needed and typically repaired with “just Band-Aids.”

Both Grizzly Flats and Omo have elementary schools and need buses for transporting the middle and high school students. Grizzly Flats has a water system and a few wells. Omo has parcels on wells and no fire hydrants. Water sources for residences during drought years can be challenging for firefighting as there is limited water storage and low flows. This also reveals vulnerability in terms of responding to climate change. There are needed conservation upgrades and hazards with trees. The community is rated as lower capacity overall because of physical capital and high-risk fire.

In this region, workshop participants were concerned with an observed increase in homeless encampments, dumping, and drug use along the river corridor. These activities pose a hazard to upstream communities because of fire and downstream due to sediment and contaminants that reach the river.

Kelsey

Overall Capacity Score: 3

Overall, Kelsey was rated about the same as Garden Valley with socioeconomic diversity across the community. Kelsey does have a fire station, but is also vulnerable to wildland fire. Other challenges relate to transportation, the quality of roads, the poor cell service and poor broadband.

There are many community residents with diverse expertise and knowledge, indicating high human capital. Social capital in Kelsey is demonstrated by the community coming together to meet at various community events, such as the Kelsey school breakfast program and the collaboration that occurs to host the community farmers’ market. The community has a shared rural agricultural lifestyle and small, local business owners. Participants noted that “similar to many rural communities in the area, there is very good human, cultural, and social capital, but there are challenges with physical and financial capital.”

For physical infrastructure, participants noted a single major road thoroughfare (CA 193), a high school, and the Georgetown Divide Public Utilities District servicing the area with water. The

wastewater is mostly septic tanks and many residents are on wells. The community is also serviced by the Walton treatment plant.

Latrobe

Overall Capacity Score: 2.5

Participants characterized Latrobe as a big rangeland area without infrastructure or roads. The area has faced problems with wells running dry as private wells service most of this region. The local school is serviced by a well and there have been high levels of arsenic. Latrobe residents value the region for its open, non-urban nature as the community is full of large lots and they do not want to subdivide those properties.

Latrobe was described as having low capacity in terms of fire flow issues with long, strung out systems with inadequate flow at the end of the line. This creates vulnerability during fire season.

A Tribe bought an expanse of land in Latrobe and workshop participants are unsure how this will impact the current community.

Mosquito/Swansboro

Overall Capacity Score: 1.5

On the lower end of the community capacity range, Mosquito/Swansboro was described as a community with very few paved roads, and those roads that are paved are ridden with potholes. Many dirt roads signage connect the community, so unless you are familiar with the area, it is very easy to get lost. Much of the community is an extension of USFS land with almost impassable roads.

There are some residents in Swansboro with higher personal financial capital, but many are retired and money isn't going directly into the community. Some of the well-off residents built an airport, but other residents do not approve of the airport.

Participants mentioned concerns with the number of fire hydrants in the area estimating there are probably between 8 and 12 fire hydrants in the whole area. The fire management technique implemented was described as "pumping water out of a pond" to fight fire. There is also a need for water tanks as PG&E shuts off power in the region in the summer, so well water is shut off.

Moving into the Mosquito area, it is more forested and there are fire breaks being burned to protect from fire. The community does express social capital in how they rally around the fire station and firefighters: "the community wants to help out."

For grants, some residents want to come together and support applying for grants. Residents also come together over a popular pancake breakfast and can gather nearly 500 people.

Newtown/Sly Park

Overall Capacity Score: 3

Newtown consists of large, rural parcels. Sly Park is rather different with tract living and more social, cultural and physical capacity than Newtown. Participants emphasized the modality between the two communities.

“Newtown is right on Newtown road, is only residential, and there really is nothing else there.”

Placerville

Overall Capacity Score: 4

Placerville was considered “doing well, thanks to voters passing two measures to increase taxes on the ballot to revamp the water and sewer system.” Forty-five million has been spent on the wastewater treatment plant in 2009. There is a health department and a social services office in Placerville. Many lower income people are drawn to the resource center in Placerville and there is a good stock of low-income housing. While workshop participants think Placerville “still has a long way to go,” Placerville received a “4” rating for their ability to take care of their residents and has improved over the past 20 years with help from an active community.

Workshop participants felt that tax money stays in Placerville rather than dispersing out into the greater county. In addition to county dollars, workshop participants discussed how there are other funding sources available in Placerville, but did not cite specifics. As the county seat, Placerville attracts substantial capital for various county services. One workshop participant mentioned a tax that was just passed to tax tourists, which would help pay for infrastructure.

Physical infrastructure overall was described as good, but roads need repair outside of the main road. Workshop participants noted that roads have reached their maximum capacity. The “old city” was built around the Gold Rush road system and not planned like a modern city.

Highway 50 and traffic through to Tahoe has had a positive effect on local businesses. Participants discussed how businesses attract more engaged people, an entrepreneurial spirit. There also appears to be substantial support for arts in the community with funding for music and art.

Pleasant Valley

Overall Capacity Score: 4

Community capacity in Pleasant Valley was described as very high overall owing to high financial capital and well-maintained county roads. Most residents are on septic systems and wells, with some residents served by El Dorado Irrigation District. The community has a mix of residents with high financial resources and very low financial resources. Many roads are private, requiring local

cooperation among residents to fund repairs and maintenance. The community has large acre lots, lot of ranches, agriculture and winery activities.

Participants described a diverse range of residents and businesses that could provide expertise locally to solve local issues such as roadside litter and fire prevention. Local businesses were cited as a common link between area residents. Area residents, which include multiple wineries, have a sense of pride and belonging, "I think the residents would rally if there is a need. However, most residents are self-reliant and tend to keep to themselves."

"This is an area where folks have no problem protecting their property assets and own the materials and equipment to assist themselves and neighbors to connect a situation."

Pleasant Valley Road is a major arterial road and requires lots of maintenance and snow removal and occasionally there are challenges due to flooding. Two schools are located in Pleasant Valley and families seem to participate with schools.

Pollock Pines

Overall Capacity Score: 2

Pollock Pines was described as having lower overall community capacity, but culturally very high capital. There is a good community center that people rally around and that provides hot meals for elderly with limited incomes. Other community services include Meals on Wheels. Financially, the area has extremely low capital as the community was a mining and timber dependent community and those industries are no longer present, including many small family-owned mills.

Physical infrastructure is somewhat limited as roads were built during the gold rush and, according to workshop participants, while the county maintains the roads, conditions are not great. With narrow, winding roads, originally developed for horse and carriage, access to emergency services is difficult. Roads need immediate egress fuels reduction.

There are many mobile home parks and other temporary housing that turned permanent and major challenges to housing that need attention.

Two El Dorado Irrigation District (EID) reservoirs are located in the area and EID does a good job according to participants, but much of the infrastructure is aging and needs more than simple maintenance. The water infrastructure developed originally for mining and agriculture, according to participants. Open ditches were described as being used in the community's "outdated water delivery system."

Due to the geography and flumes, the community is very vulnerable to wildfire and mudslides. Communities popped up along the main routes between Pollock Pines and Placerville. The roads are very overgrown with large private sections without the county to support maintenance.

Events such as the wagon from that overnights in Pollock Pines, bring the community together. There are also free Christmas and Thanksgiving community meals provided each year.

Rescue

Overall Capacity Score: 3.5

Rescue was characterized by participants as having pockets of big homes, small homes, rich people and poor people with most residents on wells, many dirt roads, but most of those roads are privately maintained. As previously mentioned, Rescue has a mixed demographic of older fixed income and newer high earners and lots of agriculture.

Physical infrastructure includes a fire station, community hall, and small post office. Green Valley Road is a major arterial road, but the Rescue area doesn't receive a lot of outside traffic. Homes have been there since the Gold Rush, but workshop participants discussed how residents have decreased their land base owing to El Dorado Irrigation District taxes. There was an old story core of Rescue, which is now closed, but new commercial developments and subdivisions on the border of Cameron Park.

There is not a strong community network as many residents are very independent, but there is a shared rural lifestyle with older roads, wells, septic and a newer school.

Strong financial capital and human capital are found scattered throughout the area. Neighbors seem to work together and are very proud of where they live and their lifestyle. Rescue is a destination area, so there is not a lot of tourist activity.

Shingle Springs

Overall Capacity Score: 3.5

Over the last ten years, there have been many wealthy individuals and families building multimillion dollar estates in Shingle Springs. Prior to this, there were many manufactured homes. The community is split between longtime, retired residents and newer higher income private dollars.

Residents have strong social ties to the land in Shingle Springs and the overall community capacity is believed to be little above Cool and other more rural areas. Participants described the community as engaged in local issues with strong voices on certain issues, but there is no formal group. While participants noted some diversity, most "rally around a rural lifestyle and privacy."

There is access to water, a fire station, community services district, community resources and better infrastructure and roads than other areas. However, workshop participants described how physical infrastructure is mixed owing to many private roads in poor condition and a limited plan for fire emergency. Many residents also rely on wells and septic.

Volcanoville/Quintette

Overall Capacity Score: 2

Volcanoville/Quintette was relativized by the group as being “the flipside of the American River Canyon with nothing going through it.” One workshop participant noted that this area is “the best example of a rural, underserved area.” There were vibrant businesses in the past, but the community has lost many and people are isolated with severe fire risk and hazards in part due to the single fire evacuation route and lack of good cellular and broadband internet service.

The area does not receive significant dollars, but there is a local CSD, a small water district in Quintette, fire groups and a few organizations, but no community center. Several informal, active individuals volunteer in the community and community organizations help with shared local bonds among residents and a “willingness to try to help out one another in times of need.”

Volcanoville is a rural area that includes the “Bear State” community and is mostly comprised of large residential lots that are mostly forested. The commercial core of Volcanoville is a hotel, storefronts, and other businesses that were burned down several years prior and no longer exists. Participants noted a limited tax base for area improvements, with the exception of road maintenance. There is minimal infrastructure with homes on private wells and a single elementary school noted by participants.

Overall community capacity is low as the area is not suited to increased population density, and geographically, the Bear State is an important forest land and watershed area.

Outingdale/Somerset

Overall Capacity Score: 1.5

Outingdale was considered to be a very densely populated community within Somerset by workshop participants. Participants described a unique culture and how there used to be a circus with elephants of which the community took great pride.

Currently, there are many retired residents on restricted budgets and the residents that live and work in the area are working class or farmers. Several overall community challenges result in an overall community capacity rating of “1.5.” From dumping and drug issues to septic tank issues and drainage problems that both affect the river through contamination and increased sediment, the community has not been able to address these challenges. Somerset was described as having homeless encampments impacting the river. Additionally, participants mentioned the large fire risk, with limited egress routes and overgrown invasive species.

Workshop participants described low social capital in this community as it “does not seem gelled as a whole.” Nonetheless, there are subgroups that do work together like the wineries and farms. There are also some properties that are second homes owned by wealthy people from the Bay Area and are not involved locally. This community has a stratum of people with different interests. Agriculture and

wineries would be ranked higher in capacity, like a “4” out of 5, however there are more people who are struggling socioeconomically in the community. “Data in the area could be skewed by the wealthy, out of town second-home owners, but they are not interested in the prosperity of the community.” “There is a large presence of people who just want to live out there and be left alone and don’t participate socially.” There is a winery and agricultural association, but workshop participants stated that it has not quite brought people together.

Regarding infrastructure, El Dorado Irrigation District provides water services “which people say they do competently.” Water delivery for agriculture is a pressing issue with climate change and there is pressure from residential wells on the water table. Roads were described as being in poor condition, but schools were said to be good.

Amador County

Camanche

Final Capacity Measure: 2

Participants indicated that physical capital in Camanche demands attention. All the homes in the community fall within the Lake Camanche Village Association consisting of 1,104 lots. Sixty-eight of the property owners cannot continue to build their homes due to a sewer moratorium that’s lasted 15 years from a lack of treatment capacity. Part of the association does not have sewer, rather, they have installed an “expensive alternative system themselves.” No schools exist in Camanche, there’s one very small store with gas, but otherwise, the town has nothing to aggregate people together. Roads and internet both rate as poor.

The population is a mix of retirees, large horse ranches, young families and second home owners, all of which travel outside of the area for work or activities because “there’s nothing there.” A shared culture has not emerged since people frequently move in and out of the area. Camanche was described as a low-income community where “people are just trying to live paycheck to paycheck and want to be left alone.” Volunteer support is limited in the community for community problem-solving. Churches and community organizations report low attendance and workshop participants discussed the lack of structure to enable diverse groups to work together. “I believe we have great potential at this time, but with little money and very few volunteers we are going backwards instead of forwards,” lamented a participant.

Ione/Jackson Valley

Final Capacity Measure: 3

“Big changes are coming to the [Ione/ Jackson] community.” The Jackson Valley Irrigation District (JVID) received grant funding for physical capacity improvement, a new water system, and there’s a casino in Buena Vista being built. Bad roads that have burdened emergency response time in the past

are under construction. Additional housing growth has the potential to increase assessed values within the city. Participants quickly noted that Lone/ Jackson faces these development plans without any clear sense of “what the town wants to be when it grows up.” Residents are particularly interested in what impacts the casino will have on the local economy. Lone/ Jackson is mostly a bedroom community that hosts areas of lower income residents. The community at large attempts to balance human and social capacity against a lack of economic base. However, there is an “OK” amount of financial investment pouring into the city. A state prison acts as the major employer and has a willingness to invest in the area.

Social and human capital remain strong given the community stays active with residential “street meetups.” The Jackson Valley Fire Protection District (JVFPD) is a leader in the community and one workshop participant lamented “other than the fire district, it is unclear if stuff gets done.” Nevertheless, JVFPD has a few challenges with a part-time chief working with a limited staff budget. Lone endures serious issues regarding lack of a sense of community, challenges with their waste water system and transportation (a planned bypass currently has no funding). Lone’s leaders are “hard, inflexible... and resistant to change.”

Pine Grove/ Volcano East

Final Capacity Measure: 3

Volcano is a minor development that is tight knit and organized as a community. The rest of the area is disjointed creating challenges with community cohesion. For example, Pine Grove attempted to make a town center, but there has not been progress. “There will be less cohesiveness in rural communities unless people travel into the center and interact” explained a participant. In response, there’s a push to make Pine Grove walkable. Financial capital varies greatly as well, with the town of Volcano home to wealthier residents while other areas tend to be poorer. One half of Volcano, Volcano East, maintains a lower capacity than the town centers of Volcano and Pine Grove with one participant quoted as saying it has “little community identity and fewer engaged citizens.” Good community affiliations abound with people involved in the Rotary Club and/or churches. Residents love their rural way of life and depend on connections with their neighbors. Many residents have valuable skills or knowledge that they’re willing to share. Some divisiveness has whipped up in recent years between old and new residents over national culture wars. The Pine Grove and Volcano township people have a long history of working together to benefit their communities. Someone noted that they “did not see a willingness to spend private money and public funds are limited.” Amador County promotes tourism in Pine Grove/Volcano East. Some strong businesses persist, but economic growth potential is limited. Housing stocks have large lots but the assessed value is low and participants felt there wasn’t much affordable housing near Volcano East.

In areas outside of Volcano to the northeast, the only community effort recognized by workshop participants was establishing and staffing a volunteer fire department. In the last two years that

department has suffered an exodus of personnel and its survival is in serious question. In unincorporated areas, participants noted that fire departments might soon break down. Physical capital requires improvements. Volcano needs a new sewer system; the water system is aging out and schools demand a long-term funding commitment from the community. No schools exist near Volcano East, requiring students to sit for long bus rides. All workshop participants agreed the roads are in poor condition.

Pioneer/ Buckhorn

Final Capacity Measure: 2.5

A noticeable widening of the financial disparity in Pioneer/ Buckhorn occurs as more wealthy Bay Area transplants moved into town. In terms of social capital there is a “somebody else’s problem mentality for helping each other day-to-day.” Workshop participants discussed financial capital limited to pockets of wealth but those rarely translate into spending on the most pressing local community needs. Pioneer/ Buckhorn is thought to house the largest percentage of retirees in the county. Many retirees come from a higher socioeconomic stratum and have significant transfer income from pensions, but very low levels of that wealth are reinvested in the community. On the other side of the socioeconomic spectrum are fixed income retirees and younger, low-income residents.

Human and cultural capital were rated low given the elderly age of the populous and the divide that the community feels. A few individuals are involved in improvement work while the majority prefer not to be involved in community affairs, even if they have skills to share. One collaborative event is a convening to discuss community issues at a monthly meeting of a loose knit group known as Upcountry Community Council. Regional leaders include churches, fraternal organizations, Amador Water Agency and the Amador Fire Department. Workshop participants cited poor community cohesion as a common challenge; however, the community did band together to save its local grocery store in 2013–2014. Since then, the community has been torn surrounding the election which has led to conflict. With a large population of retirees, participants cited a divide in what residents value. The deficit of local school involvement was cited as an example.

County funds dedicated to road repairs, fire protection and hazardous tree removal have strengthened the housing market. Most other infrastructure improvement funding flows from federal channels. Participants credited good elected officials for the consistency of quality improvements they’ve seen in their town. Private roads, however, were said not to be up to standard and there is not a wastewater treatment plant in Buckhorn. Most of the upcountry water system is inadequate in supporting fire protection, with one participant drawing attention to how water mains are too small to serve standard fire hydrants.

Plymouth

Final Capacity Measure: 3

Participants agreed that feuding factions in Plymouth have kept the town from building cohesion. New arrivals and the recent emergence of winery tourism has strengthened the economy. The old ranching approach of “hell no, we’re not going to change” remains and there is a rift in the community exacerbated by national political discussion. However, even with divides, people individually volunteer or find groups like the Rotary Club to support the area, especially financially. Participants rated human capital high and described the community as having a large talent pool from which to draw. There are a number of long-time families that remain committed to the community and when there is a dire crisis, residents come together.

Plymouth hosts the county fair and receives significant revenue for this. Other positive financial changes include short-term increases in assessed home value, new development funds, exploding commercial funding and changes in tax revenues. While Plymouth benefits from high levels of financial capital with a well-funded town, the community experiences a lack of cohesiveness and cultural capital. Commuters may leave Plymouth following the work day, but wine tourism is infusing the community owing to their location as the gateway to Shenandoah wine country. New money related to the wine industry and a recently built tract of million-dollar homes places more tension on the existing identity of “old country living.”

“Political leadership gets played off one another with a result of not much achieved for the community.” Building a wastewater treatment plant has posed a challenge and there are commitment issues about assigning bonds for schools or general improvement.

However, workshop participants ended the discussion of Plymouth on a positive note, “these places are fine to live and experience rural life and raise a family.”

River Pines

Final Capacity Measure: 3

Workshop participants presented River Pines as one of the most polarized communities in the region. The divisiveness pervades the community, unfolding into a “Hatfield versus McCoy” like standoff that prevents the community from working together. One participant related the story of residents arguing over rates at the water department and subsequently firing shots into the windows of an empty building to demonstrate their discontent.

Participants also noted that within the last 6 years the environment has improved with some residents coming together to raise the collective bar in town for living and economic conditions. As an example of recent collaboration, the community received a \$5 million grant for their water utility to renovate the entire system. Still, residents were described as somewhat “anti-social and cliquy.” Severe deficiencies were identified including the poor state of roads, disrepair of housing stock and the high fire danger. A large renter population limits local government fundraising. According to workshop

participants, the county receives the most residential code violations from River Pines. Participants emphasized that River Pines is a beautiful area that needs proper investment from the government to help overcome issues of high crime, extreme poverty and drug use. Residents struggle with basic needs, the grocery store is limited in selection (e.g., only carries candy and eggs).

Sutter Creek/ Amador City/ Volcano West

Final Capacity Measure: 4

In the city centers of Sutter Creek and Amador City participants noted the high level of financial, social, human and cultural capitals. Many affluent residents donate to local causes, the populace collaborates well together to solve civic problems and there are many skilled residents who generously share their expertise. Sutter Creek is known as a thriving tourist destination that is a “happening place” with a flourishing sales tax revenue. “People want to be in these towns rather than have to be,” said one participant. There is a shared sense of place between people of the communities and a clear idea of what they love and what they want to protect from outside influence. Even with the concentration of wealth in Sutter Creek, the schools need improvements, but there is a lack of commitment from the community as described by workshop participants. This may be in part due to the high proportion of retirees in the area, who on the contrary, were described as very active and involved.

Water and wastewater systems require upgrades. Outside of city centers, rural areas tend to be more isolated and lack a sense of community. Trails for biking and running were suggested as improvements. Volcano West falls into this description with less community engagement and significant work toward improved fire protection.

Alpine County

Alpine Village/ Kirkwood/ Mesa Vista

Final Capacity Measure: 3.5

Participants stressed the high financial capital of Kirkwood. Workshop participants characterized Kirkwood residents as wealthy weekenders and second-home owners who are “good at using money for community assistance,” and are willing to work together and share skills and expertise to meet areas of critical community need.

Depending on the season, Kirkwood becomes desolate and one of the largest regional cities with almost no human support. Workshop participants expressed complaints regarding infrastructure including the limited number of schools, the lack of water and wastewater systems and little affordable housing. Part of Kirkwood’s administration, like emergency services, depends on Alpine County. There is a great deal of engaged and skilled human capital in Hope Valley whose residents

experience similar problems with water systems. Once outside of Kirkwood, problems multiply with one participant stating “Kirkwood is really good and everywhere else is pretty bad, so it’s hard to rate an area like that.”

Markleeville/ Bear Valley

Final Capacity Measure: 3

The Markleeville/ Bear Valley’s population is small and scattered across a rural landscape, such that reaching critical mass for political decisions or maintaining organizations presents a challenge. Communities feel the influence of federal land covering 90% of the county. Participants agreed “[It’s]... more difficult to get things done because they don’t have the bodies to do the work.” There is some tension between the “new” and the “old” [residents], but folks generate a strong sense of place and like their town. There are “good people abound with skills gained from other places,” said one participant. Health and Human Services, the Watershed Council and county schools were all mentioned multiple times as being well run. Markleeville appears well off in financial capital. Large scale projects are mostly funded through grants, but the community struggles somewhat because “of the tale of two cities” between Markleeville and Bear Valley. Participants didn’t classify Bear Valley as a town so much as a winter sports commercial enterprise with a daytime population of mainly nonresidents who drive up from Arnold for work. A low tax base in Markleeville necessitates stretching resources. The Washoe Tribe in Woodfords is well led; however, they experience extreme unemployment and poverty. The Tribe receives a separate, small mutual water connection. Markleeville has a problematic surface water system with approximately 200 connections.

Calaveras County

Angels Camp

Final Capacity Measure: 3.5

Angels Camp has several local groups who work to improve the community, such as hosting events like the notorious frog jump. Community members work together for their collective benefit, including fundraising for community projects. Volunteerism isn’t as good as it should be and residents see potential in recruiting millennials to get more done. Physical capital is in disrepair; public water and sewer systems continue to degrade and upgrades are estimated to be multimillion dollar investments. Major roads and schools are in decent shape with one workshop participant mentioning the “beautiful high school balancing out other infrastructure issues.” Angels Camp was described as having a strong identity, but part of the community withered when the new bypass was installed. There is a mix of wealthier golf course residents contrasted with poor trailer parks and rural poverty. Ranching culture remains evident in the area. Gold rush, mining and outdoor tourism leaves a big mark on community identity but it was noted there are still very few extra dollars for development.

Arnold/ Avery/ Dorrington

Final Capacity Measure: 3.5

Arnold/ Avery/ Dorrington hosts largely second homes owned by vacationers from the Bay Area. The full-time residents are predominantly retirees who like to volunteer for very active groups like the library, Moose Lodge, Calaveras Big Tree State Park and Arnold Rim Trail. Low income areas, such as Dorrington, share the landscape with pockets of wealth throughout the area. Workshop participants rated Avery and Arnold as having a higher financial capital evidenced by high levels of contributions to the local library and fire department. While workshop participants noted that property taxes are higher than other areas, but other expenses are comparable or more inexpensive than other areas.

Physical capital is maintained by the community “they care for themselves.” Participants described road conditions as good, water as great, and noted the high number of schools, parks, trails. The community has a “wonderful paid fire department” that holds the area together. Some sewer and water issues have concerned residents, but the community is able to lobby for limited funds to make needed repairs.

In a different perspective, one workshop participant mentioned that “although the resources seem to be there, there is not much investment in downtown... many people want the area to stay the same and not become Murphy.” In past years the business economy in Arnold/ Avery/ Dorrington took a huge hit and now passersby look through empty storefronts in some areas. Another workshop participant noted that residents lack different skills and knowledge sets indicating some limitations with human capital.

Overall, the community works well together and has a strong sense of place.

Blue Mountain Communities

Final Capacity Measure: 3

A spirited discussion emerged with the Blue Mountain Communities (BMC) financial capital. Medium income for a family of four hovers around \$24,000 and regional businesses are highly stressed. Large disparities exist in the community but “there’s never been a fundraiser that didn’t make it”—a testament to the community’s ability to leverage human capital with a small population. High income residents are known to engage considerably in fundraisers; however, many needs are still unmet. Some participants rated financial capital as higher owing to the severely disadvantaged communities’ “remarkable ability to obtain big grants and bring in state and federal money (possibly reflecting high levels of human capital).

According to workshop discussions, Calaveras County invested \$14 million into the community already and has another \$4 million ready to infuse. Blue Mountain Communities (BMC) played a key role in securing CFLR monies. The grants enabled BMC to meet some local infrastructure needs; although, roads and buildings have degraded since the infusion of prior monies. The Butte Fire transformed the area for the worse, especially for the Native American population, some of whom were described as still living in 40-year-old trailers without roofs. As with other communities who experienced devastating fire, the BMC had better physical capital prefire. “The housing stock was already a mess before the fire...many folks are still uninsured living in trailers and we are losing young people due to the threat of school closures.”

Human and social capital complement each other well here. Residents highly regard caring for each other - “no matter what happens in the community, people step up.” If a house burns down, by the next day, those residents have a new place to live. A number of community organizations exist in BMC, such as the veterans’ clubs, a forest restoration collaborative, service clubs, a community radio station and a newspaper. There is a “very bright and talented core group of individuals that make a difference.” Nevertheless, postfire, a small human exodus occurred that affected the local human capital. BMC was labeled a microcosm of a significantly disadvantaged community where people are more concerned about “putting food on the table and paying their water bill than having potlucks.” As one workshop participant described, “this is a community that gets to a point where their water gets shut off and they have to choose between food and water service.” Lack of employment stands as a major issue. More changes are on the way for BMC as cannabis regulation controversies escalate.

Copperopolis/ Copper Cove

Final Capacity Measure: 3.5

“Copperopolis has the greatest potential for growth in the county, they have all the ingredients, but can’t finish the recipe” explained one participant. Copperopolis/ Copper Cove is a divided community with an “us” versus “them” mentality lacking a sense of collective identity. Participants loosely defined these groups as lake/gated versus old timers/blue collar. Groups are not homogeneous with some “identifying with the lake, golf course, agriculture and others with town square.” Million-dollar homes speckle the Lake Tulloch shore and low-income trailer parks scatter throughout the greater area. While there are factions in the community, many residents find ways to give back, “big time.” Rarely do the distinct groups combine in an effort unless there is involvement of a local organization such as the Lion’s Club or there is a cause raising money to give back to schools and fire departments. As in other communities, the fire department really brings people together. Involvement of the HomeOwners Association garners lots of volunteers in the affluent portions of town. The physical infrastructure needs work, but is in better condition than other communities in the region. Public water and sewer are distributed over most of the area and there are decent roads and schools. Nine separate developers built individual neighborhood projects that aren’t connected by roads or business orientation, further dividing residents from each other.

Mokelumne Hill/ Paloma

Final Capacity Measure: 4

In Mokelumne Hill/ Paloma, the old timers and newcomers socialize and everyone knows each other. “There has always been a sense of community in the area...with old family ties...and they generally take care of themselves” mentioned one workshop participant. The population consists of a mix of college educated professionals who migrated to the area and local residents who grew up there and stayed, both knowledgeable populations with a wide range of skills and willing to work collectively on community projects.

Residents with high incomes in Mokelumne Hill/ Paloma increase the overall socioeconomics compared to other parts of the area. Regarding social capital, locals develop projects, but work in separate groups. School activities, even with a newly built school, lack human capital. Most shopping is in Jackson or Valley Springs, but the local economy does support a few businesses. Residents financially “rally” behind the library, park, town hall and school. In many locations, unpaved roads are only maintained by property owners. Calaveras Public Utility District (CPUD) has an aging infrastructure, especially the wastewater treatment plant which needs improvement. The majority of residents operate on a septic system. As in other regional communities, the Butte Fire and issues with cannabis regulation have caused challenges.

Mountain Ranch/ Sheep Ranch/ Calaveritas

Final Capacity Measure: 3

Ever since the Butte Fire, the Mountain Ranch/ Sheep Ranch/ Calaveritas community has struggled with recovery. Financial disparities were made worse postfire, especially for the agricultural community. Population displacement was widespread, that included a diaspora of local leadership. Many homes are still not rebuilt and approximately fifteen fire firefighters lost homes while battling flames. Cultural, social, human and physical capitals were all rated much higher pre-fire. One participant described the community as having “a deep sense of place, pride and connection to others.” The rich history of volunteerism and civic engagement leadership is described as “missing” by workshop participants. Generally, lots of community engagement occurs around business, sports, schools, youth community clubs and cultural events. A small core group of individuals are responsible for pulling the community together when there is a high priority; however, participants noted their less than average historical ability to secure grants. Forests, water, roads and streams fell into “a mess” after the burn and schools have closed. Poor prefire water and road infrastructure are blamed for exacerbating the resulting damage. There’s additional concern about the flux of marijuana business and money coming into the region.

Calaveritas and Sheep Ranch have a legacy of generational families with a deep sense of community who rally around each other in times of need. Sheep Ranch, in particular, was described as adverse to outside influence, especially the government. The community utilizes a general community plan to defend their open range lifestyle. One workshop participant referred to the Sheep Ranch community's "uncompromising mindset" to change because "I've got my forty acres and I don't want anything smaller." Sheep Ranch's financial situation was categorized as "dire" but appears difficult to assess due to resident's refusal to answer questions about their incomes for an income survey. As a "poster child" for a fire ravaged community, Mountain Ranch/ Sheep Ranch/Calaveritas "burned but is still kicking."

Murphys/ Douglas Flats

Final Capacity Measure: 4

Murphys and Douglas weave a "tale of two cities." On one side rests Murphys, a vibrant town with lots of businesses, a good real estate market, high home values, a strong tourism economy and "the best social and financial capital of the county." On the other side is Douglas, a town that has much less financial or social capital than Murphys, but benefits from its neighbor's success. Residents live in trailer parks with high income ranches scattered throughout. The community as a whole has high physical capital demonstrated by public water and sewer and a well-maintained highway and road system. "Somebody knows how to do this" mentioned one participant in regards to the well-managed tourism in Murphys. Wineries leverage significant marketing and agricultural knowledge to bring in revenues. Murphys' doesn't have any chain stores and the entrepreneurial, independent businesses are continuing to grow. Although residents like to stay within their preformed groups when engaging in volunteerism, participants noted a strong community identity that can overcome most problems. A participant complemented the community's ability as "very good at going after grants." There is active support for the arts such as the community theater; local concerts and cultural events are linked to the area's history.

San Andreas

Final Capacity Measure: 2

As the county seat, the economy of San Andreas is stimulated by hosting government buildings, the hospital, newspaper, courthouse, jail, library and historical society museum. Participants commented on the beauty of the community hall. Even with the several aforementioned facilities, participants described San Andreas as a "dead town" that's "not a fun place to be" and only acts as a drive-through town in which people come to work but not to live. This is especially true following the closure of the cement plant.

Social and human capital were rated as low. The area has experienced a loss of residents and a subdued sense of community, the latter has resulted in a severe underrepresentation of local interests

in government. A large proportion of remaining residents rent homes and are classified as financially challenged. It was noted that there are many “broken home” situations.

Infrastructure poses a significant challenge to success. The elementary school is one of the worst in the county, the public water and sewer systems are in need of repair, the fire department is experiencing financial issues and, in an attempt to cover costs, the water department is voting to raise rates by 84%.

Tamarack

Overall Capacity Score: 2.5

Tamarack is a very small and high mountain community. Residents, dispersed throughout, tend to identify with Bear Valley in Alpine County. Although they rate low on overall capital, there is also very little need. Residents take care of themselves.

Valley Springs/ Rancho Calaveras/ La Contenta/ Jenny Lind

Final Capacity Measure: 2.5

These four communities “don’t play well together” owing to the distinctiveness of each area's economic, cultural and demographic makeup. The groups live together in relative isolation and are defined by economic subdivisions; Valley Springs is classified as low income, Rancho Calaveras as middle class and La Contenta as affluent. Poor subdivision planning further exacerbates the lack of cohesion. A participant used the descriptor “Mostly middle class and retirees in a quasi-suburban setting masquerading as rural living.” While some other communities are known to struggle with “new versus the old”, tensions here are “new versus new.” Families moved here to escape urban crowds each evening but still commute to work and shop far away in the valley, leading to their distinction as a bedroom community with little accompanying sense of place. There’s fairly low civic engagement with some significant exceptions like baseball games, children’s issues, schools and the board of supervisors. However, a trend of recalling supervisors indicates struggles with leadership. Though described as low on organizational connectivity, residents will collaborate to fundraise and write grants when necessary. Physical capacity is high in terms of good roads and above average housing. Water system problems are significant with some wells running dry.

Tuolumne County

Cedar Ridge/Big Hill/Jupiter

Overall Capacity Score: 2.5

Cedar Ridge, Big Hill, and Jupiter are considered separate areas according to workshop participants. There is no connectivity or organizational relationships among these communities. Cedar Ridge supports the bulk of the population and one respondent noted that people live in Cedar Ridge “for the

way of life.” Financial and physical capital are considered lacking, with some assistance needed for road and water systems.

Jupiter is off the grid with extreme poverty and a lack of organized structure. Big Hill is similar, but slightly less remote.

Overall, Cedar Ridge residents have an ability and willingness to collaborate but tend to be involved in larger surrounding communities like Twain Harte and Sonora.

Leadership specific to each area was cited as lacking according to workshop participants.

Columbia

Overall Capacity Score: 3.5

Columbia is a fairly low-income community with some off the grid households. Much of the community rents or resides in mobile home parks. Physical infrastructure is mixed with some areas confronting very poor/gravel roads and other subdivisions in decent condition. Improvements have been made recently. The elementary school, Columbia State Park, and wealthier subdivisions help boost the overall capacity of this area. Many residents are active in the community volunteering in the park and turning out to community meetings to protect the heritage of the area. Columbia is also home to Blue Mountain Minerals, a Limestone mine, which has an impact on the roads in Columbia and Sonora.

Crystal Falls

Overall Capacity Score: 3

Crystal Falls is characterized by high homeownership and moderate involvement in recreational activities around the lake and horse stables. It is a popular area for first time buyers and starter homes, but also harbors many long-term local families with local knowledge. There is a lot of diversity in this area and the community tends to be active, work well together, and has a homeowner’s association. Tuolumne County is able to provide some local dollars and infrastructure. There are no major infrastructure problems; although, the roads can be difficult to use in winter. Issues with the septic system do exist.

Pine Mountain Lake

Overall Capacity Score: 4

Pine Mountain Lake is a community with a high population of retirees and second-home owners. The majority of properties have year-round water consumption. The community has cultivated a strong sense of identity with Pine Mountain Lake, the golf course, and mountain recreation. There are a high number of septic systems where a sewer system is within a feasible distance for eventual hookups. Pine Mountain Lake makes up a large part of the Groveland Community Services District service area.

East Sonora

Overall Capacity Score: 4

East Sonora is a moderate-income area with some poverty. Small businesses have begun expanding. There are families, retirees, mobile homes and blue-collar jobs, with community circles gathering around churches and school activities. Physical capital is average with some green areas and new development as well as mobile home parks. Engagement tends to be moderate and dependent on the issue. East Sonora is home to Sierra Pacific Industry's (SPI) Standard Mill.

Jamestown

Overall Capacity Score: 2

Jamestown's population struggles with low incomes, homelessness, crime, and many rely on public assistance. Few residents volunteer or contribute to the community and leadership is lacking, although a few are involved in local politics. Jamestown's Railtown State Historic Park attracts tourists. The ranching community in Jamestown shares a sense of culture. Access to services is lacking and the school is good, water, sewer, and roads are present, but some are not in good condition. Estimates place Jamestown as an area with one of the highest percentages of students on public assistance, free and reduced lunch and one of the lowest socioeconomic bases in the county. A vast majority of residents rent homes or have other low-income rentals.

Groveland/Big Oak Flat

Overall Capacity Score: 3.5

Income in this area is mixed with some low and pockets of higher income. Demographically, young families blend with retirees. Social capital is very strong with a high interest in local issues and good ability to come together around youth and senior issues and disaster recovery. There is a divide between Groveland, which has a downtown, and Big Oak Flat, which has been more affected by a lack of infrastructure and is primarily residential. However, the geographic isolation of the area contributes to a strong sense of community.

Quartz/Stent

Overall Capacity Score: 2.5

This community is very rural and remote, with an older population, some poverty and aging infrastructure. Water is a huge issue here. The community was highly impacted by the drought; many wells went dry which brought residents to local meetings. TUD extended a water line to this area through grant funding during the drought. The farms and ranches in the area have a shared sense of history and culture and help each other. There is a lack of capacity to apply for grants and address local needs.

Soulsbyville

Overall Capacity Score: 3.5

Income in Soulsbyville is mixed between some property owners, a number of business interests, and other lower income renters. Young families act as the base pooling resources for the school. Physical infrastructure is decent. The geographic boundaries and the shared history of timber industry unite the area, and assets like the school and community park help draw people together.

Twain Harte

Overall Capacity Score: 4

Twain Harte has a high population of retirees and second home owners. Restaurants and businesses are doing well, but the shopping center and office spaces have many units that have been vacant for decades. A strong volunteer base shares pride in the community and residents make a point to support the local economy. However, the area faces the same challenges as any area with a high proportion of seasonal residents. In addition, things are shifting as the group of highly engaged residents ages and new retirees are less inclined to get involved. The downtown area is served by water and sewer, but the infrastructure is aging and outlying areas are on septic and wells.

Tuttletown/Rawhide

Overall Capacity Score: 2.5

This area is predominantly low income, with fairly low levels of formal education but a good deal of historical knowledge. Rawhide and Tuttletown have a sense of community identity, but residents do not tend to come together. There is no water system and many wells suffered during the drought. Maintenance of physical infrastructure is lacking and little capital is available for improvements. Rawhide is home to Sierra Waldrof School and has access to some services.

Tuolumne

Overall Capacity Score: 3.5

The residential area in Tuolumne has poverty, low education levels, and crime that contribute to the isolation of the town. Tuolumne has a fire district, an excellent school, and aging infrastructure. The community comes together around activities like the farmers' market, Strawberry music festival, and church. Good things are happening in Tuolumne but the community also struggles over issues of extreme poverty and homelessness. The town of Tuolumne depends, to a certain extent, upon voluntary contributions from the Tribe which contributes to the challenges of the town.

Tuolumne Band of Me-Wuk Indians is considered its own place as it has its own census designation, and it is a Rancheria. The Tuolumne Band of Me-Wuk Indians has a large amount of financial and cultural capital. The casino puts money back into the local economy and the Tribe influences the surrounding area's culture. Tribal leaders are effective community voices.

Groveland/Yosemite

Overall Capacity Score: 3.5

Almost no one lives in this community, but there are a number of core high-end lodges that provide economic benefit. The few, scattered residents are associated with the high-end tourism and recreation in Yosemite National Park. Capacity is low, but there is not substantial community need either. No services in this area, growth is unlikely to be possible without some infrastructure.

Chinese Camp/Keystone/Red Hills

Overall Capacity Score: 2.5

This isolated community tends toward lower socioeconomic status, especially in Chinese Camp. Generational families that have operated businesses for a long time and have a wealth of historical knowledge lack an ability to access outside resources. Businesses in the area include SPI's Chinese Camp Lumber Mill, Pacific Ultra Power Biomass facility, California Wood Shavings, Diestel Turkey Ranch, and George Reed Inc. aggregates plant. The aggregates plant has an impact on the local roads including HWY 108 and J59. The area is served by the Jamestown School District which utilizes the Chinese Camp School as a Science Academy for third through sixth grade. Although there is no official community forum, the ranching families come together and there is a definite ranch culture.

Lake Don Pedro

Overall Capacity Score: 2.5

Lake Don Pedro's population includes middle-income residents interspersed with vacation homes and a population of retirees. Due to the dispersed nature of homes and many people working outside of the area, a strong sense of community has not developed. Nevertheless, some leadership and ability to come together to address issues prevails. The county helped when many wells in the area went dry but otherwise physical capital is adequate. The community is more connected to Merced and elsewhere than Tuolumne County. This community is bisected by county lines (Tuolumne and Merced) creating issues in providing services.

Long Barn/Pine Crest/Strawberry

Overall Capacity Score: 3

The Long Barn/Pinecrest/Strawberry community is a mix of full-time residents and second-home owners. Recreation industries (lake activities and skiing) support the community and provide seasonal employment, although revenues depend on the weather. Physical infrastructure is okay and there is a high school, but the elementary school has closed due to budget cuts. A strong sense of culture brings people together, especially in Pinecrest, and select business interests and the permittee association provide some leadership. Full time residents are willing to help each other out.

Mi Wuk/Confidence

Overall Capacity Score: 3

A wide range of incomes exists in the Mi Wuk Confidence community ranging from low income renters to fixed income retirees to wealthy second home owners. Very little financial capital makes its way back to the community. Physical capital is present but not well maintained and the nearest school is in Twain Harte. Community members take pride in their shared way of life, many joining together around the church. There is a decent amount of knowledge and some willingness to work together on local issues but little leadership to bring people together.

Old Wards Ferry/Algerine Wards Ferry

Overall Capacity Score: 2

This community is very rural with a mix of ranches and new arrivals who chose a rural lifestyle. Roads are in poor condition and are not often repaired, and there is no public water, sewer, or schools. Residents tend to be independent but come together when needed. The county does not have a large presence either in infrastructure repair or in enforcing codes.

Phoenix Lake

Overall Capacity Score: 3.5

Workshop participants characterized Phoenix Lake as a moderate income community with high rates of home ownership. Phoenix Lake is a popular place for residents from the Bay Area to retire. Community members gather for events related to the homeowners' associations, as well as the golf and tennis court associations. This community, with mainly small subdivision size lots, is entirely on individual septic systems and located above a water source for several communities in the same watershed. Physical infrastructure was described as aging with roads being a primary area of concern; however, Phoenix Lake has access to the financial resources to address these needs.

Sonora

Overall Capacity Score: 4

Sonora is the largest and most connected city in the area with banks, fast food, a radio station, etc. While Sonora was described as maintaining good schools, it has aging physical infrastructure, including roads that are heavily impacted by commercial traffic and a water system that is over 150 years old in some places. There is a mix of high- and low-income residents as well as homelessness. Residential participation in local issues is moderately high and there is a sense of pride for the area and strong local leadership. Sonora shares many of the same issues as other communities in this area, but is more central and connected to the county government as the county seat of Tuolumne County. Sonora is home to the county library, theaters and art communities, and Columbia College. Additionally, Sonora has a regional hospital and medical offices.

Mono County

Antelope Valley (Walker, Coleville, Topaz)

Overall Capacity Score: 2

This area was described by participants as one of the poorest in the county. Recent impacts from the 2020 Mountain View have been devastating for many residents. Due to poverty in the area, many residents who lost their homes in the fire are choosing not to rebuild, or cannot afford to rebuild, and are relocating from the area. Many had insurance issues being underinsured, or not insured altogether. There is some outside money coming in, however, as these properties are flipped outside of community ownership, mainly to LA or bay-area residents.

Socially, participants rated the community higher, given that, according to them, this area came together really well after the Mountain View fire. There is also reportedly a dedicated set of community activists who are involved in addressing issues, but this tends to be the same set of a few people. One participant noted worry about burnout, or filling in gaps as the demographic ages out, or long time residents move away.

Regarding physical capital, participants noted a good school system and community center, however there were some impacts to local infrastructure due to the fire. However, some recent grants are helping to provide some new influx.

Overall, this community was rated a 2 given that while there are some skilled and hard working community focused individuals and residents, there are also many challenges for this community, and a lot of change as long time residents move out or are faced with homelessness due to the fire and few housing options. There have been several waves of investments in the community and some recent grants for community infrastructure, so participants noted that it will be interesting to see how things change as new money and ownership come into play after some long time residents leave.

Bridgeport/Twin Lakes/Swauger

Overall capacity score: 2.5

Workshop participants characterized residents of the Bridgeport/Twin Lakes/Swauger community as very capable people with rural social capital in terms of being able to take care of themselves. Financially, there are economic challenges, but it is also the county seat, meaning that there are some financial resources available from the county and the agencies based there. The presence of county departments, as well as the USFS, also contributes to human capital in the area through knowledge and skill sets to address issues. There is a business community that experiences active seasonal highs from tourism, however, recently, there have been some serious challenges and impacts to business from COVID closures.

Regarding social capital, stakeholders rated this area fairly low due to some reported infighting and tension which were exacerbated in the midst of the COVID-19 pandemic. As one participant noted, there were “different perspectives on COVID and how to handle closures vs business owners wanting to be open,” resulting in some big feuds and friction. Like in many rural areas, there are reportedly still a handful of individuals that keep working hard on many groups and community projects to better the area, but there was a noted concern of burnout and exhaustion of the limited volunteer base.

Culturally, participants noted a high level of capital stemming from long term residents and community perspectives, however this is lowered to a degree from new residents and second-home owners, especially in the Twin Lakes area, as there is reportedly some tension between long term and new residents.

Regarding physical capital, participants noted the lack of a high school, expensive PUD, vacant downtown buildings, and economic collapse over the past 30 years. There is again some benefit to physical capital as a result of being the county seat and presence of USFS agencies. The RPAC (Regional Planning Advisory Committee) has done work to take on community projects like a new banner and redevelopment in the downtown Mainstreet areas. There have also been some challenges with water quality that the community is working to address.

Lee Vining/Mono Basin

Overall capacity score: 4

Participants noted that this community has been called the “Berkeley” of Mono Basin, and is reportedly very organized with residents representing a unified front in terms of cultural and social bonds. There is a high level of intelligence in the area, as well as physical capital, particularly in regard to their water systems. Financially, stakeholders noted a perception of average wealth in the community (relative to the rest of Mono county).

Regarding capacity weaknesses, workshop participants cited divisive local politics as being problematic. Specifically, there are serious divisions about supporting vs. objecting to the work of the Mono Lake Committee. However, residents reportedly come together well to support schools and fire departments in the area.

June Lake

Overall capacity score: 3.5

June Lake is unincorporated and to an extent relies upon county funding financially. However, there is a significant second homeowner financial base and strong real estate values. Participants reported that the community is seeing some good growth, with a lot of young people moving in, which they

hope will prove to be beneficial. Socially, there is a bit of a young v. old dynamic, or new v. old in terms of how long residents have lived there, and this can be quite contentious.

Stakeholders also reported solid infrastructure capital in the community, however one noted concern was a lack of egress routes. In the event of an emergency, like a blizzard, there is only one way out of the community, so there is a heavy risk from highway closures.

Mammoth Lakes/Long Valley

Overall capacity score: 4

The Town of Mammoth Lakes has access to large amounts of financial capital through high-income residents, high-income visitors (and second-home owners), community foundations, and other organizations. Long Valley is not part of the Town, but consists mostly of full-time residents, most of whom have financial stability and capability. Mammoth Mountain is also a pretty big economic driver. Considering the interests of hispanic communities in the area makes the financial score a little lower.

In regard to human capital, stakeholders commented that there are a lot of really smart and knowledgeable people in Mammoth Lakes/Long Valley who can solve many of the area's problems. There is a rich history of locals who step up to help wherever they can, and there are also many volunteer organizations that contribute to the community. One participant noted that, in their view, “people don't last long in the region unless they are hardy individuals,” and that “there is a sense of responsibility that individuals have to our communities.” However, this is still a rural region, so outside help is needed at times.

The sense of responsibility to community in this area also extends to social capital. One participant commented, “[t]he community of full-time residents often coalesce around a shared purpose. We are isolated and realize that we must rely upon one another to get things done.” On the other hand, another participant expressed that there can be infighting and stasis, which really keep these communities from moving forward.

Culturally, Mammoth Lakes and Long Valley are considered mountain towns, with mountain culture. This is why most people live, play, and recreate there. However, the high expense of living and recreating there also limits the inclusion of all people. Participants commented that the entire region lacks in racial diversity and more focus needs to be placed on the integration and inclusion of their Hispanic community.

The relatively high level of financial capital of these communities translates to fairly well-maintained physical capital, with participants noting respectable response times to repair damages. There is one fire district with full time firefighters here, and one incorporated district. However, they also commented that there is still certainly outdated infrastructure that needs upgrading or replacing. One

expert commented that while the region's hard infrastructure is relatively solid, they “have more concern about the complimentary capacity, e.g., snow removal, emergency services, childcare, workforce education and, of course, housing.”

Swall Meadows/Paradise

Overall capacity score: 4

The perception of wealth in this community among workshop participants was that it is well above average for Mono county. Residents are typically wealthier than average and very concerned and protective of their neighborhoods. For example, fundraising efforts for the fire departments generally fare well. In addition, the Round Fire of 2015 generated a tremendous outpouring of financial support for those that lost their homes. One of the only factors detracting from financial capital here, according to stakeholders, is the presence of second-home owners who are not very involved in the community.

The population reportedly contains many well-educated folks, successful business owners, retired professionals and people with contracting skills and natural resource agency experience. Stakeholders noted that in their experience, the community is very engaged and willing to contribute time and effort to community interests. Newcomers in the last year or so have seemed especially outgoing in their efforts to learn about the neighborhood, and residents come together for the two volunteer fire depts, the fire safe council, Eastern Sierra Land Trust, and more. Culturally, experiencing the Round Fire in 2015 created a common bond. Additionally, participants commented that the love of natural beauty, open space, peace & quiet and individual freedoms are strong among residents, even those who differ politically.

Physical capacity here is a bit lower, as there is no second egress route for emergencies and there is also aging water infrastructure in the area. Regarding the egress route, however, there are back roads and most community residents know their way around them. Roads were also noted to be well maintained, snow removal generally good, and electrical infrastructure getting major overhauls.

Tri-Valley/Oasis

Overall capacity score: 2.5

Tri-Valley/Oasis rated low relative to the rest of Mono county. It is a very rural, sparsely populated region, with few to no major community-based organizations or other ways to attract dollars. There are lower incomes and real estate values and many individuals are focused elsewhere for work.

This community also has a very distinct culture from the rest of the county. It is more rural and remote, and heavily influenced by agriculture. Residents here tend to be wary of outsiders, which can make it difficult to provide assistance. Participants described them as “fiercely independent spirits that want

to look out for themselves and their acreage,” but also “incredibly knowledgeable about and seemingly in tune with their communities and their economies.”

This community is also dependent on the county to provide resources for physical capital, and while the county does do this, there are still infrastructure needs here. Residents are on septic and their own wells, and groundwater levels are declining. There are concerns of wells being in danger with the water table dropping yearly, and the schools are not as well funded as workshop participants would like.

Inyo County

Bishop

Overall Capacity Score: 3.5

Bishop has been called the hub of the Eastern Sierra, and was described by the participants as being the strongest in the county in terms of resource availability and resilience. It is a regional center for State and Federal offices, and participants noted that the City is able to provide services and remain financially balanced. It is the only incorporated city in Inyo county, and has had a static population for the better part of a century. However, participants noted a lack of capacity to expand services or commit capital to nonessential projects, such as downtown revitalization, tourism amenities, etc. There were also reported struggles in accessing State and Federal resources. While there is some private capital in the community, there is a lack of vehicles for philanthropists to invest in the area, specifically in regard to a lack of infrastructure to support awareness of planned giving and estate donations. There is also a fair level of human capital, with well-qualified individuals in the community to address concerns, with a wide breadth of abilities. One participant noted that it is a popular destination for enthusiastic and educated individuals, but the realities of living there makes it hard to maintain people, with housing being a notable challenge. In regard to other infrastructure, it was noted that Bishop is generally able to provide adequate water, sewer, and roads for its residents and that the school system serves the community well. Participants commented, however, that the community could benefit enormously from being able to address several neglected community development needs, but LADWP land ownership in the area somewhat limits their ability to do so.

In terms of cultural cohesiveness, participants noted that this area is not as strong as it could be. There are very segmented communities, including tribal/nontribal and latinx divides, and also a sense of cliqueness between communities like climbers, retirees, and people new to the area (people from the Bay in particular). Whether or not people in this area pull together can really depend on the issue- there are polarizing and nonpolarizing issues. It was discussed that there is a lack of communication, and increasing this is needed to elevate understanding between people. One participant noted that despite disagreements, there is still a sense of family in the area and a commonality of knowing each other, which has contributed to a sense of security during a polarizing time. Another participant commented that Bishop runs on volunteerism, and being a tight knit community is a big asset.

Big Pine/Independence

Overall Capacity Score: 3

Census block group limitations make it so that Big Pine and Independence are one community, but participants felt that it needed to be noted in the narrative that these are distinct from one another. Overall, though, these areas were both noted as having high social capital. There is still a disconnect between the tribal community and the rest of the community. However, largely, there is a sense that commonalities of being from these areas can help to bridge differences. These areas are independent in the sense that they are self-sufficient in terms of roads, infrastructure, and schools. Socially, there is also a sense of independence, and for some who try to hold meetings, there is pushback for holding meetings in Bishop. Financially, it is a tourist economy, with a contained job market, and much of the human capital in the area comes from outside the community. In terms of an availability of funds to meet needs, they have to rely on county funds which have to be shared with other communities. Both areas are unincorporated, with sparse populations, which contributes to this scarcity of resources.

Greater Lone Pine

Overall Capacity Score: 3

For Lone Pine, participants commented that there is an endearing and productive element to the area's human and social capital, that there are good people around, and that the community takes advantage of capital that does exist. One example of this was the development of a healthcare service delivery system, which took advantage of an almost defunct hospital and skilled nursing community. One participant noted that there might be more capacity here than what is obvious from an outside perspective. There is strong community spirit and good community pride, but it was also noted that there can be entrenched opinions and strong personalities in the area. One participant noted that there is not as much coming together as other communities on certain issues, that there is a lack of communication and working with other groups, and that there are segments that could be brought together.

The capacity is lower on the financial side given that it has a low density population center. Financial capital here is often spent in other communities on services that this community cannot provide. However, there is a strong tourism economy, due to visitors to Mt. Whitney, Alabama Hills, Manzanar National Park, and more. A subset of the population includes long standing residents and retirees with a good level of financial stability, but there are pockets of poverty as well.

Overall physical capital was noted to be relatively lower than other areas in the Eastern Sierra. They do, however, have a volunteer fire department that responds to basic emergencies, and Southern Inyo Hospital which provides urgent care. All critical patients, however, are flown out to a facility that would

be appropriate for the circumstance. It also has a well-attended school district. The water and sewer systems are reportedly mixed in capacity.

Olancha/Cartago/Kennedy Meadows

Overall Capacity Score: 2

This community is very isolated, with low levels of infrastructure capital and availability of financial dollars for public use. Financially, it was noted that a lot of the capital is invested onto private lands for private purposes. Given the low number of residents, there is a reliance on very few and specific services and assets to bring in revenue. Tax dollars are often directed at the county level, and are not necessarily locally driven.

Residents here are more spread out, making it difficult to maintain regular and routine contact. However, community residents are committed to volunteerism through the local fire department, which helps to bring people together during crisis or emergency response situations. Culturally, there is a strong sense of individuality, particularly pertaining to the ranching history and way of life.

In terms of physical capital, there is no longer a local school. A decrease in the youth population resulted in the school closing many years ago, and access to basic services is in Lone Pine. The infrastructure as it relates to roads is primarily the main highway, and there is a major 395 reroute in the works for this area.

Death Valley

Overall Capacity Score: 1.5

This community is largely Death Valley National Park. Visitation to the park during the peak season is significant, however this means that there is an ebb and flow of the population base with the tourist season. There is a range of financial capital in this area. The Furnace Creek area has substantial financial capacity due to the high volume of tourism and presence of large corporations, such as Xanterra Parks and Resorts. There is also a substantial mining presence, many companies of which have mixed financial resources. However, several communities like Darwin, Tecopa, Shoshone, and Death Valley Junction do not appear to have much in terms of financial capital.

Participants noted that residents in these communities live there for many of the same reasons, including the privacy and rural atmosphere. This can bring communities together, but the desire for privacy can also inhibit cooperation, particularly when it comes to government agencies. Large multi-community gatherings are not regularly organized, and specific groups in the area include National Park Service residents, the Timbisha Tribe, the Shoshone Community, and the Tecopa Community.

The Southern Inyo Fire Protection District (staffed by volunteers), provides basic emergency and fire services. The nearest hospital would be in Lone Pine or Pahrump, NV. There is a very small school in the area, but the enrollment varies with the tourism season. Water is a concern, as many areas do not have potable water and must get their drinking water from a water distribution center located at the SIFPD. The quality of road infrastructure can vary depending on location within or outside of the national park boundaries, and varying jurisdictions.

Mariposa County

Bear Valley/ Hornitos/ Mount Bullion

Final Capacity Measure: 2.5

The Bear Valley region includes several dispersed communities. There is a strong cultural identity and shared values that bring people together, especially during emergencies. The area is underserved and receives little county support. There are some pockets of wealth; however, it is a highly impoverished area with many residents living in rentals or on public assistance. Other challenges include drug use, internet and phone connectivity, poorly maintained roads (except the roads that are the responsibility of CalTrans), poor conditions of water and sewer systems, and there are no schools or post offices in the area. The communities are in a fire prone area also subject to flooding that can wash out roads.

Ben Hur

Final Capacity Measure: 3

Ben Hur is a rural community with a strong cultural identity and high social capital among residents. The area is known for rolling hills and large ranches that are home to established families who retain a strong knowledge of regional history. Respondents mentioned various indicators of high social capital, including neighbors looking out for each other during fire evacuations, community members watching for escaped livestock, established families with strong local knowledge of community history, and community supported events through the Long Ranch such as hikes, classes and civil war reenactment. There are many knowledgeable and skilled locals in the area. The main challenges in the community are with infrastructure (roads need repair, no school or sewer) and limited availability of private funding.

Bootjack

Final Capacity Measure: 3.5

Bootjack has a strong sense of community, but its identity is difficult to disentangle from the nearby town of Mariposa. Bootjack has a feed store, gas station, veterinarian, a small community center, and a strong community fire department. The community has many retirees from the Bay Area, as well as residents who live in Bootjack and commute to work in Mariposa, spending much of their time and money in Mariposa. The community has the ability to come together (social capital) and there are many skilled residents in the community (human capital), but much of that knowledge and energy is

invested in Mariposa. There is a dichotomy between long-term residents and more recent transplants, as well as disparities in income. The roads are good, but there are some issues with the school's septic system and a need for a small water/wastewater treatment system. Other valuable infrastructure has fallen by the wayside; the school closed and their park is also currently closed due to tree mortality.

Cathey's Valley

Final Capacity Measure: 3.5

Cathey's Valley is an area that has been changing. With an influx from the valley, large ranches are being subdivided and the community is becoming more diverse. However, according to workshop participants, this has not affected social capital, the community still comes together when there is a need (e.g., recent floods). There remains a strong sense of community identity and pride. The community benefits from high levels of human and social capital with many long-term residents willing and able to help newer residents and provide technical expertise when needed. Financially, lower income residents struggle to find work and affordable places to live. Cathey's Valley also has some concentrated pockets of wealth.

The community was involved in a recent transition from a public school to a charter school. The Mariposa County Unified School District (MCUSD) closed the public school. Residents with a range of expertise banded together to write a charter to reopen a school, the Sierra Foothill Charter.

There is no community sewer system and several bridges and roads are in disrepair following flooding, demonstrating some of the struggles with poor infrastructure. Some housing challenges exist with minimal low-income housing for rent. City Hall and the school still do not have potable water. The community is vulnerable to wildfire with minimal county support for weed abatement, defensive space, and road/erosion control.

Ponderosa Basin (formerly Chowchilla)

Final Capacity Measure: 3

The Ponderosa Basin is a small area with limited resources to devote to physical infrastructure maintenance (e.g., roads) and to address challenges with high levels of tree mortality. The area was hit hard by tree mortality with one participant mentioning, "you could take the ponderosa out of [the name]." Public and private dollars are limited (financial capital). There is not a cultural/social community center nor a sense of community — much of the area consists of vacation rentals.

Some participants noted a willingness of the community to work together; however, the community is aging and housing is transitioning toward more vacation rentals. Local residents support the volunteer fire department and water district, although this is a requirement for homeowners. Vacation homes and second-home owners have some financial capital, but this is not frequently invested toward community projects.

Human capital does exist with the community winning grants for seniors and low-income residents through fire safe council grant efforts. Nonetheless, unmet needs remain with much needed water system upgrades, road maintenance and repair, and there is not a school in the area. Improvements in cultural and physical capital are also needed.

Coulterville

Final Capacity Measure: 3

Coulterville is the heart of the northern region of the county, serving as the center of activities, commerce, and tourism. It is located at the intersection of highways 49 and 132, the two main arteries that tie the county's northern communities together. Perceptions about Coulterville capacity differ. Some identified high levels of human and social capital due to a core group of residents who are active in the community, as evidenced by the revamping of a 25-year-old annual event into a vibrant festival, and a car show and other features that attract tourists to the area. Community breakfasts are held twice each month, and the town hosts a community dinner each week. A community food giveaway takes place monthly. A campaign was launched to improve the image of the area that included filming a movie in Coulterville, building a hotel, and promoting the local museum and history center. Tourism is the primary industry, providing highly seasonal revenue to the area. Some participants noted that the hotel was not in use, reflecting more limited overall community capacity due to limited jobs and a depressed economy. While residents retain a strong sense of identity, the town was identified as having numerous “nonjoiners.” There is a dichotomy between long-term residents and more recent transplants, and disparities in income. For those not of retirement age, there are few job opportunities that do not require long commutes. There are also major challenges with physical infrastructure, including telephone and internet access. Considerable investment is also needed for improvements to water and sewer systems, and roads.

Greeley Hill

Final Capacity Measure: 3

While participants noted a slightly higher capacity in Greeley Hill than Coulterville, Greeley Hill experiences some financial hardship. There is a sense of community in Coulterville and people are “willing to give.” The human and social capital is high, demonstrated by a core group of residents who organizes and were able to open a school after one was closed. However, due to financial constraints, the community struggles to keep the school open. Experienced local trades people share their talents locally. The Fire Safe Council received a recent grant for tree removal.

Greeley Hill has a health clinic, an “above average” grocery store, pizza place, community center, fire department, decent roads and a library. This area has infrastructure and water needs. Greeley Hill is far removed from the county center resulting in limited access to health and social services. While there are residents with fiscal struggles, there are also higher income residents that infuse some money into the community, supporting the local economy. High levels of economic disparity were noted among participants.

Indian Peak

Final Capacity Measure: 3

The Indian Peak community was described by workshop participants as largely consisting of residents from Yosemite Mountain Ranch. Several workshop participants characterized the area as bimodal with some large, well-to-do property owners disjointed from other residents who occupy rental properties. While several families have been rooted in the area for many generations, there has been a transition in residents with low interactions among older and newer community members resulting in a low sense of community. One participant suggested that individual neighborhoods have stronger social capital than the community at large. Physical infrastructure is limited in the area with large private properties with many privately maintained dirt and gravel roads. Overall, the infrastructure meets local needs.

Lake Don Pedro

Final Capacity Measure: 3.5

Lake Don Pedro has some differing perspectives on overall capacity, but there is general consensus that the area is at least a 3, and workshop participants suggested Lake Don Pedro to be considered a 3.5 overall. An ample supply of young families with children supports the school and the school connects the community. The church also brings the community together. When the community faced challenges with dry wells and water issues, the community was able to secure monies to improve wells and replace leaking water lines. Additionally, by charging for water service, water purveyors can generate funds to maintain and upgrade the system when needed.

The community lacks a town center and many residents commute elsewhere for work; workshop participants consider the community a “bedroom community” with few local businesses. However, participants described Lake Don Pedro as “functional” with nicely paved roads, school, and water system improvements underway. Even with a lower financial capacity, the community seems to be able to come together and work toward solving problems when they emerge (e.g., fundraiser for local flood victims that raised \$12,000 to be dispersed among victims). The community has access to grants and there is a community services district to coordinate services, but the capital available is not adequate to meet all needs.

Mariposa

Final Capacity Measure: 4

As the “Gateway to Yosemite,” participants viewed the Mariposa community as a high capacity area with an unwavering sense of identity. Human capital runs high with many skilled residents, “if you need something done, you can find someone.” The population is varied with diverse knowledge, skills, and abilities. During daylight hours, Mariposa thrives as a cultural and social center of the county with many employees commuting to the community from surrounding areas. There is a blend of working professionals, business owners, and lower income residents. At night, Mariposa is more subdued.

Social capital is strong as demonstrated by the community coming together during the fire and floods of recent years (e.g., Detwiler Fire). There is strong community participation in volunteer groups and associations, the community fair, and the butterfly festival. Many residents live in or around town in order to stay actively engaged. Mariposa is an economic center of the county with a number of successful businesses. Roads are in good condition; however, the water/wastewater treatment system is aging and needs replacement. Transportation infrastructure remains in disrepair for an extended period of time following natural disaster events.

Midpines/ Jerseydale/ Mariposa Pines

Final Capacity Measure: 3

This group of communities is bimodal with pronounced disparities in wealth with some disagreement among workshop participants in regards to overall community capacity. Some services are present such as a post office, a community center, and limited-use playground in Midpines, but the area is lacking a sense of community according to workshop participants. Jerseydale is a high capacity area with a sewer and water system. The Mariposa Pines subdivision is also considered high capacity compared to Midpines.

The sense of community across the area is characterized as limited with an “every individual for themselves” mentality focused on “self-interested purposes” with “nothing pulling residents together to address issues,” demonstrative of lower levels of social capital. Large rural land parcels and an influx of absentee landlords reduce the contributions and commitments to invest in the community. On the other hand, human capital is high with lots of experience and talent, but lacking the social capital to pull together resources and community members to and collectively work for the good of the community.

The lack of infrastructure, centralized water and wastewater (Midpines), and reliance on external funds for infrastructure lend to a lower physical capital rating. Tree mortality is a problem and fire safety concerns are an emerging issue.

Triangle

Final Capacity Measure: 3

The community of Triangle has been devastated by pine beetles, drastically altering the community’s visual image from the lush landscape they were previously known for. There are many unmet infrastructure needs (e.g., roads, fire safety, school, water systems, etc.) due in part to a limited county budget. Several workshop participants discussed the diverse mix of residents consisting of landowners, ranchers, professional, and lower income households and the lack of a sense of community among them. Furthermore, workshop participants describe the area as a “drive-thru” community that lacks a strong cultural identity. On the other hand, a few workshop participants disagreed with this characterization, citing the local winery and community sustained agriculture as indicators of an innovative community. Some of the subregions seem to work together such as roads associations and neighborhoods, but these groups do not necessarily operate as one. Nonetheless,

there is a buildup of biofuels in the forest due to three years of pine beetle attacks.

Wawona

Final Capacity Measure: 3.5

Wawona has parks, schools, libraries, and support from the National Park Service. It's a community where residents settle for extended periods and identify strongly as a single unit. There is a charming old hotel and golf course. Wawona families have typically passed down property through generations. However, the community is transitioning, losing some families and a higher level of rentals than before, changes in school attendances, and a large absentee population with vacation rentals. Participants mentioned a few highlights including a strong homeowner association, excellent school principal and successful tourist lodging business supported by the Wawona Hotel. Human and social capital falter from lack of interest. There are a number of needs including school, roads, and water systems that are in high need of replacement, with limited funds from federal, county, and private projects.

Yosemite/ El Portal

Final Capacity Measure: 4

From workshop participants' perspectives, Yosemite has access to, and relies heavily on, federal budget allocations. Private funds are also accessible in the community. Residents and government employees maintain good relations and share common interests. The majority of residents are connected to Yosemite National Park (YNP), but do not remain in the area long term; therefore, continued investment in the community is challenging.

From a Park Ranger's perspective, there is a huge unmet need in terms of dollars to hire staff to improve and protect YNP. Community members identify with the Park on some level and people tend to come "out of the woodwork" when things need to be done. Even without the government/park, a high level of social, cultural, and human capital would still exist. People feel Yosemite is a special place to be and work; however, there is not great integration into the greater county. There is high quality programming and funding for youth engagement, outdoor education programming, and tourism. The isolated nature of the Yosemite/El Portal community fosters positive reliance and strong values.

Access to housing, health care, infrastructure, and other issues make the Yosemite/El Portal area a difficult place to live long term. Physical capital is lower because of housing issues. Water and wastewater infrastructure are prevalent, but strained. Schools and daycare facilities are often ill equipped. Throughout the community, there remain many infrastructure needs for roads, fire protection, and water that remain unmet.

Yosemite and El Portal are also very different, with distinct identities. El Portal is disadvantaged with a lower financial capital, but has a sense of culture, a strong identity, and a community hall. There is low financial capital population in Yosemite, for example, seasonal employees such as concession stand workers who are "just scraping by." Other parts of the community consist of federal park employees

and are more well-off, creating a variable, bimodal wealth distribution.

Madera County

Ahwahnee

Overall Capacity Score: 3

Community experts characterized Ahwahnee as “suffering from rural foothill challenges,” including low financial capital and inadequate infrastructure (physical capital). Participants noted that while general skills and abilities are present (human capital), there are minimal shared bonds among residents and minimal motivation to work collectively. This resulted in low social capital ratings in Ahwahnee; however, residents strongly identify with the Ahwahnee community (cultural capital), even without the presence of large community events that take place in surrounding areas (e.g., Coarsegold Rodeo, Raymond Fair).

In recent years, the community has demonstrated an ability to manage and participate in funding opportunities. Led by a couple of the neighborhoods with higher human capital, Ahwahnee successfully completed several development projects, including Ahwahnee Park.

Workshops participants relativized Ahwahnee to other communities across Madera county and described how Ahwahnee has some challenges, but residents tend to have nicer, newer homes than other locations.

Mammoth Pool

Overall Capacity Score: 3

“If you can find ways to tap into the knowledge of those who don’t live here full time, you will have a goldmine.” The Mammoth Pool community is described as a lake community lifestyle with many rentals, a transient population, and a smaller full-time resident population that “carries the load.” A number of higher-end second homes and vacation homes are also located in the area, providing a strong tax base to maintain physical infrastructure. The private funds exceed access to public funding, according to one workshop participant, owing to the prevalence of second homes in the community.

With predominantly part-time residents, residents working for the community are limited (social capital) and lack commonality; however, businesses in the Mammoth Pool area tend to do very well financially. PG&E is also seen as a beneficial resource in the area by workshop participants. The combination of the presence of PG&E and a state recreation area designation directs the County’s attention toward the Mammoth Pool community.

Coarsegold

Overall Capacity Score: 3.5

Coarsegold, similar to other rural areas across the Sierra, has a limited tax base due to its small, dispersed population and is financially constrained, with the exception of the casino and grant assistance. The community is diverse with some residents knowledgeable of community needs and others with little knowledge. Social capital is low as there are some “extreme groups in the area,” but residents do tend to take pride in identifying as a “rural” community, maintaining a “good community spirit” and a high degree of cultural capital. There is a town center that helps to maintain the local culture, and an important community event in town is the Rodeo. There is a veteran’s memorial, peddlers fair, and a farmer’s market. Nonetheless, large parcels of privately owned land and county living values lend to more independent living with difficult communication and limited access and social and cultural exchanges between neighbors.

Maintenance of physical infrastructure, such as roads, is poor and many private roads lack funds for improvements and repairs. The schools, fire department, and police department are all experiencing funding shortages.

Relative to other Madera communities, Coarsegold is located en route to Yosemite National Park, presenting access to tourist dollars and less isolation than other communities in the county, such as North Fork or Raymond.

Indian Lakes/Quartz Mountain/Picayune Rancheria

Overall Capacity Score: 2.5

Workshop participants noted that determining human capital is challenging owing to the low levels of social capital in the area, for example, people “stay to themselves making it difficult to know what they have to offer.” There is a limited number of people who actively commit to problem-solving in the community. Active community members do also exist, however, they are “scraping the bottom of the barrel to find volunteers to work around the community, but those who do volunteer are wonderful.” For those volunteers who regularly help with community needs, they have received a few grants and may be able to secure future grants or grant assistance.

Culturally there is “not much happening” in Indian Lakes. Characterized as an old housing subdivision, the area is similar to typical subdivisions across the US. There are a limited number of community activities outside of a few women’s groups.

Workshop participants perceived financial capital to be “not very high” in the area with a lower than average household income in Indian Lakes, estimated at \$36,000 annually. Many residents are pensioners with fixed income, unemployed or underemployed. There is financial need to secure safe and plentiful water, resources for the schools, investment in the fire and police department, and

support for social activities. A high number of renters reside in the community and some residents struggled with an increase in water usage rate following a water main break due to an antiquated water system on the 4th of July in 2018. Other physical infrastructure needs include road repair and fire hydrants.

North Fork/Mono Rancheria (Teaford Meadows, Leisure Acres)

Overall Capacity Score: 2.5

The North Fork and Mono Rancheria communities, including Teaford Meadows and Leisure Acres, are by and large considered disadvantaged by workshop participants. There are “an average number” of community members who are actively involved and more become involved when needs arise; however, workshop participants discussed how younger generations are not as actively involved. There are several areas of physical infrastructure that need maintenance, including aged roads, bridges and water systems. Some community members volunteer their time and knowledge to address needs by fixing their own roads and wells. Access in some areas in the community is limited and/or difficult. While there is not a significant amount of economic growth in the community in recent years, there are a number of small business owners and nonprofits which are “a great asset to the community.” Over the years, the population and services have declined, but there is a hardworking group that remains.

North Fork has demonstrated how the community can work together to seek grants, fundraise, and problem solve. With an extensive range of strengths in the area, North Fork has a vast native community that works well with the logging industry and the Forest Service. There are a lot of residents who strongly identify with being from North Fork and there is a good deal of investment in the community.

The North Fork Community Development Council has been sharing resources with the community and also has land for sale.

Across the region, there is a proven track record of Tribes working with resource conservation districts and other volunteer groups. Participants mentioned an ongoing process to try to create a consortium between agencies and nonprofits to improve overall capacity. However, in the smaller communities, there is some history of fighting and difficulty in coming together.

Oakhurst

Overall Capacity Score: 4

Oakhurst has experienced plenty of investment area businesses. Many of the business pursuits are commercial, but smaller businesses and unique activities are finding their niche, according to workshop participants. The area is more citylike than other rural parts of the county; however, there is

a reliance on volunteer services and organizations with a sense of “we do it ourselves.” Oakhurst has a potential business opportunity to build up the section of town that runs along the river with shops and restaurants. “There is a river running through our town and buildings are backed up to the river instead of taking advantage of the possibility of a riverfront commercial area and parkway along the river,” said one participant.

Workshop participants described Oakhurst as having infrastructure that is well developed, owing to an abundance of resources and the overall ability of the community. Other workshop participants presented a different narrative with physical infrastructure that is aging and poor water quality.

Oakhurst is perceived as being able to leverage resources from other communities, possessing knowledgeable, educated residents to address local issues, and unified neighborhoods with several social groups that meet and share knowledge (e.g., Rotary Club). While Oakhurst has many opportunities, challenges remain as there are also a number of subcommunities with needs and limited funding. Oakhurst is situated in the mountains, though it is more urban than other surrounding communities. Workshop participants discussed how the County does not address many issues in the mountains, rather, the county tends to focus efforts in the valley. Owing to their mountain-valley location, workshop participants mentioned driving long distances to a supervisor’s meeting to voice needs and concerns. Many services are not available in Oakhurst and many needs remain unmet. For instance, residents desire to have a recreation district that offers activities for children.

O’Neals

Overall Capacity Score: 2.5

O’Neals is a very small area; however, there are high income landowners and the Ponderosa Telephone Phone Company situated in the community. Other than the phone company, there is not a lot of economic opportunity. The population is small and dispersed with mostly ranchers and farmers. Many nice homes and ranches are seen in the community, but financial capital is on an individual level—there is not a lot of joint investment. Nonetheless, the community is close-knit and North Fork is a nearby neighbor.

The community is open and willing to share knowledge with neighboring communities. Being so rural and small in size, O’Neals benefits from the assistance of neighboring communities. There is minimal infrastructure, and it is also not well maintained. In order to repair roads and address challenges with wells, individuals from the community invest their money, time, and knowledge. Risk of fire is relatively high.

Raymond/Knowles

Overall Capacity Score: 2

Workshop participants characterized the area as “disadvantaged” owing to limited capacity, “low social enthusiasm to improve,” inadequate infrastructure, and a community that is deteriorating. One participant described residents as “capable,” yet not willing to step up. Concerns were expressed regarding the low population and how that affects the community’s competitiveness for funding opportunities.

According to one workshop participant, there are over 100 community “champions” or leaders that are actively involved and prioritize information sharing with all. Impressive for the size of the community, but this was also seen as unsustainable and still crippled by low population numbers.

Historically in the community, there were long-standing family feuds which left a social scar for generations and can affect projects. However, in more recent years, there is a lot of comradery among neighbors as values are similar. Raymond is unique in eastern Madera County and has the lowest population. Raymond residents appreciate the rural/cowboy lifestyle, a specific way of life that is actively chosen. Nonetheless, the aging infrastructure and low population make infrastructure repairs expensive with limited opportunities for collaboration or consolidation due to the remote location.

Yosemite Forks/Cedar Valley/Sugar Pine

Overall Capacity Score: 3

In general, the communities were described as having a high percentage of retired residents with set incomes from a broad range of work experiences. Many residents in the community have known each other for a long period of time and lookout for each other. Aging sewer and water systems were mentioned as a challenge.

Sugar Pine has eight full-time residents with a very active volunteer network that works on weekends bringing in around 25–30 participants from surrounding areas. Sugar Pine has shared interests in historic mountain mills history, flumes, trains and expresses a high level of cultural capital. Sugar Pine residents have their own wells, roads, garage, sewer and field with no debts and an annual budget of \$65,000 to maintain the water system, sewer system, and community roads. Since Sugar Pine is not a county district and does not receive outside funds. While the infrastructure is old, there is a high level of human capital to help balance that challenge.

Yosemite Lakes

Overall Capacity Score: 3.5

Yosemite Lakes, relative to some of the other communities in the region, was characterized as having a population that lives in expensive housing within the Yosemite Lakes Park (YLP). The neighborhood in YLP was described as a bedroom community for commuters working in Fresno. Social capital was deemed high as there are high levels of participation in community events. Workshop participants

commended the community's organizational skills and accomplishments. The community is not only viewed as highly capable, but the residents are seen as knowledgeable. While social capital is characterized as high with people working together, cultural capital is seen as degrading overtime. Yosemite Lakes Park manages its own infrastructure and this budget is supplemented by large homeowners' fees according to workshop participants. In general, infrastructure is adequate.

Fresno County

Auberry/ Big Sandy Rancheria

Final Capacity Measure: 3

Of all the communities, participants placed Auberry/ Big Sandy Rancheria as the social, human and cultural center of the region because of PG&E's hydroelectric headquarters, the various churches and the Mountain Press newspaper headquarters in Auberry. There are greater disparities in wealth closer to the Cold Springs Rancheria and Big Sandy Rancheria, even though there is the presence and economic stimulus of a casino. Capacity to secure financial capital is on an upswing; however, long-term stability of financial resources is not secure. Ever since Auberry's mill and school closed, their financial capacity feels like it is decreasing and there seems to be a gravitational pull towards the growing town of Prather.

Auberry/Big Sandy Rancheria has very few high paying jobs. There are wealthy pockets in this community, but they do not integrate. Many residents who work in Clovis or Fresno do not lend their skills to the community. With that being said, participants applauded the other half of the community that heartily embraces volunteerism. Involved groups have a good understanding of the conditions and stressors that impact the greater community and show great willingness to engage. One participant expanded on this further by saying education needs to happen at all levels of the community in order to rethink community approaches to relieving stressors.

Reaching out to community members to garner attention on specific issues has had limited success. Poverty plays a significant barrier to buy in for community engagement since residents already struggle to deal with everyday life. There is a small population with a ranching and cowboy culture that will often combat stressors by collaborating and sharing equipment and knowledge.

Water and wastewater issues exist, especially in "new Auberry." There has been some improvement, but more work is needed. Schools have closed due to the 2008–2009 economic downturn; secondary roads are mostly dirt and poorly maintained. Participants thought that if Auberry/Big Sandy Rancheria took advantage of their human/social capitals then challenges surrounding financial and physical capitals could be resolved.

Friant

Final Capacity Measure: 3.5

Friant has experienced massive development in recent years and residents are preparing for more. Pockets of wealth scatter the area, but the community was described as poor with “needs from 25 years ago that are still not met.” Tribal involvement in this community is described as strong. Table Mountain Casino, which possesses a high level of financial capital, looks to expand operation by building a hotel. The area around the casino of Greater Friant is becoming a bedroom community for northern Fresno. A cultural clash between the foothill way of life and the recent development has emerged. A housing development that’s designed with track housing is “radically different from most of the other foot hill areas.” Residents feel as if their traditional way of life is being consumed by these changes. People who have migrated to Friant “changed the feel of the community... and don’t contribute to the cultural aspects.” Friant reaps capacity from the variety of different government organizations, like the Bureau of Recreation, that spend money in the area. Therefore, physical infrastructure is generally strong but areas with smaller populations require infrastructure upgrades. Recently installed infrastructure is directed towards the new development area around Table Mountain. There’s interest in dealing with local socioeconomic challenges and a willingness to work towards community projects, but capacity is limited by participation. People tend to subdivide themselves into groups, making community gatherings more difficult.

Prather/ Tollhouse/ Cold Springs Rancheria

Final Capacity Measure: 2.5

The community is split into areas of high capacity in Prather, middle capacity in Tollhouse, and low capacity in Cold Springs Rancheria. Prather encompasses a small geographic area that has found itself as an “up and coming” town, home to a shopping center and many businesses. A roundabout built by Caltrans will aid business development. Tollhouse is an outlying area that has very few businesses. Cold Springs Rancheria is located in a remote area and is economically impoverished. In line with overall community capacity ratings, physical capital is ranked highest in Prather and lowest in Cold Springs Rancheria. Most roads and schools are located in or around Prather and Tollhouse. Participants noted a fairly high level of engagement through schools, the volunteer fire department and churches. This foothill community represents a proud cowboy culture distinct from their valley and mountainous counterparts. With few high paying job opportunities, many working-class residents drive to the valley for jobs. One participant noted the number of low-income residents and problems with drugs and alcohol.

Shaver Lake/ Huntington Lake

Final Capacity Measure: 3

There is a solid recreational industry that engages enthusiasts through winter and summer in the Shaver Lake/ Huntington Lake community. In the wintertime, China Peak Ski resort brings repeat customers while in the warmer months, wealthier residents spend time at the restaurants, docks and

marinas. Unfortunately, recreation is volatile. People empty out of the area during the shoulder season before snow and as a result, businesses struggle to keep open and pay employees. Adequate snowfall and snowpack also play a large role in attracting tourists. However, a good snow season for China Peak doesn't equate to a good season for Shaver Lake, as cars tend to pass through without stopping. Resource extraction is the other main industry. About 75% of the parcels are year-round residents and participants noted the permanent residents have to assume more responsibility to care for the community.

Human, cultural and social capital are impacted by a seasonally absentee population which is reliant on tourism. In Shaver Lake, there are many multimillion dollar second households that were described as possessing the ability to self-assess and greater financial assets than the community at large. Workshop participants noted how money from the wealthier residents does not remain in the community. Cabins built on leased USFS land dot the area around Huntington Lake. The community may appear to have high financial capital; however, there is also an income divide between local people who earn lower wage jobs. Another large subset of the population, retirees, have useful knowledge and donate money to different community entities such as the historical society. A select group of tight knit locals drive many of the local programs and projects, but "these locals are aging out and not being back filled with younger members." Professionals with expertise from Southern California Edison and USFS have been community members for many years and many retire in the area. Over the years, community members demonstrated the ability to come together and galvanize around certain issues like public access, recreation, forestry, water quality, groundwater fire and invasive species. The community at one time shared a logging and utility-based industry comradery. This culture still exists but workshop participants described part of the community as "weekenders who stay isolated and are not interested in [interacting with] their neighbors."

Physical infrastructure is strong along the Highway 168 corridor, but very little hard infrastructure is found in the community-maintained areas, beyond the major highway. Overall infrastructure monies are obtained via county funding or homeowners associations. Water availability is an annual concern with mandatory rationing being enforced by many subdivisions. Schools and sewer are well managed.

Sierra National Forest

Final Capacity Measure: 3

The vast majority of the Sierra National Forest community is USFS personnel living temporarily in a "mostly wildland, remote setting." Human capital was rated high and very dependent on USFS. Some "old timers" remain who know the area well and how to live remotely. One participant described locals as "... a unique breed of people. They pull together when there's an emergency but also want to be alone. The environment attracts these tough individuals... that are extremely unique to the mountains. None of these folks are extremely wealthy and some are on the poverty line." Forest land

was rated as inherent capital, given its impact on forest recreation business. Still, the area is highly dependent on outside funding from USFS, forest health and public participation. The staff of the SNF have demonstrated a willingness and capability to engage in collaboration beyond its boards but capacity is limited by staffing and funding challenges. Massive tree death and wildfire poses significant challenges. Fire suppression activities bring in millions of dollars from state and federal government to the SNF with residents describing efforts as only disaster oriented and reactionary.

When a fire occurs, residents see mass devastation and are concerned about a “patch and fix approach” where infrastructure is neglected until it’s damaged by fire. Appropriations to the SNF vary each year and if an environmental disaster occurs, appropriations will not cover all of the originally planned projects. Community resiliency and capacity were said to partially rely on stable budgets and USFS personnel living in the area. Other residents are concerned about the clean-up of dead and fallen trees on roads since county and USFS road maintenance don’t necessarily overlap. USFS and locals have a tenuous connection but nevertheless share a culture dependent on the forest. There is an understanding among locals attributed to a shared environment that influences their way of life. Increased internet access was recommended as a service to broaden connections between small enclaves in the area.

Watts Valley/Foothills

Overall Capacity Score: 2

This is another very small and sparsely populated area. It is home to a few parks and campgrounds, and a few unincorporated communities, including Piedra and Trimmer. Piedra is located on the south bank of the Kings River, has a post office, and students here are a part of the Sanger Unified School District. Trimmer has a campground located on Pine Flat Lake and is home to a fire station. Per capita income in this region is low, with limited resources and infrastructure.

Pinehurst/Dunlap/Hume Lake

Overall Capacity Score: 2.5

Hume Lake was characterized by stakeholders as being an outlier in this community. Previously a logging town, Hume Lake was purchased by the US Forest Service in the 1930s, and has since become a popular tourist destination with numerous recreational opportunities. It houses a mixture of nice homes and is a well traveled tourist area. As a result, financial capital is relatively higher, as is infrastructure quality. Hume Lake Christian Camps is also housed here and is one of the largest facilities in the community. As a result, the economy is fairly seasonal and tourist based and there are not many full-time residents.

Pinehurst/Dunlap were characterized as more rural, and lower in capacity. However, Dunlap houses a K-8 school and is home to St. Nicholas Ranch, which is reportedly a major attraction run by the Greek

Orthodox Church, providing some financial revenue to the area. There are pockets of poverty in these communities, as well as lack in services and infrastructure, particularly medical facilities.

Wonder Valley/Squaw Valley/Miramonte

Overall Capacity Score: 2.5

In discussing Wonder Valley/Squaw Valley/Miramonte, stakeholders noted the capacity differences between southern and northern Fresno communities in the SNC Region generally. According to them, the populations are smaller, contributing to a lack of human capital in terms of having enough people to accomplish all that needs to be done. In this community, there are a few committed residents that have a passion to make these areas better, but this is a limited number, leading to concerns of burnout and lack of capacity. This area is also very isolated, and one participant commented that Miramonte is hard to get to, with rough roads. It was also noted that, socially, Miramonte would better be considered together with Pinehurst, however census block group limitations resulted in the two being considered separately

Tulare County

California Hot Springs/Posey/Johnsondale/Kennedy Meadows

Overall capacity score: 2.5

California Hot Springs, Posey, Johnsondale, and Kennedy Meadows are all included together in a single block group. This area is home to a lot of second-home owners, and is lacking in year-round, permanent residents. Aside from USFS and Calfire personnel, the population is mostly low income, with very few dollars available and few businesses.

There is, however, a strong ranching culture and community. Culturally, workshop participants noted that residents embrace culture as a special ranching community, and are protective of their community and shared way of life. In regard to human capital, ranch families reportedly bring expertise in day to day requirements, with significant knowledge and ability to address conditions. However, one participant commented that this population is older, so physical condition often limits their ability to do so. Distance from the valley work pool is also a challenge for human capital in this area.

Socially, community organizations and churches sponsor community events and give support. There is a senior center and active church. Residents reportedly come together when the community feels passionately about an issue, but one workshop participant noted that, generally, this is a very rural area and people choose to live here to be away from others, which can limit collaboration.

Physical capital is also limited, with few roads, some water systems, and no sewer system. California Hot Springs contains a one room schoolhouse, which often faces financial challenges due to its size. There is also a lack of cell phone and internet availability in these areas.

Lemon Cove

Overall Capacity Score: 2

Lemon Cove was characterized by workshop participants as a small community that does not appear to be as tight or cohesive as other communities contemplated in this assessment, with a large portion of socioeconomically disadvantaged residents, little economic opportunities, limited infrastructure, and few services available. There are rural residential properties here, with subsets of farming communities. It is not an incorporated or defined township and also falls into the corridor that goes up to the national parks. In regard to physical capital, there is a small elementary school and sanitary district.

Springville/Camp Nelson/Ponderosa

Overall capacity score: 3

The community of Springville/Camp Nelson/Ponderosa was rated as having medium capacity. Springville has a high tax base and has recently seen an increase in new local businesses that contribute to the local economy. However, the majority of residents are still average to low income. Springville was also noted as being distinct from Camp Nelson and Ponderosa in that it is more of a year-round foothill community, but Camp Nelson and Ponderosa have a much smaller amount of residents that live in those areas full time. These areas have a large percentage of their population as vacation property owners, with a lot of cabins and recreational areas that are used for seasonal recreational and residential use.

Springville was also characterized by participants as having higher social and human capital, in part due to the higher percentage of year-round residents. Respondents commented that this community comes together well in regard to emergency preparedness during natural disasters such as fires and help each other out. There are many residents here with both the knowledge and experience to address conditions as they arise. These local residents are not only capable, but willingly volunteer their services as needed and there are many active community organizations. Participants reported that there are relatively fewer connections and capacity in the high country of this area, given the prevalence of seasonal residences and resulting seasonal flow of capital.. Ultimately, though, this area contains history linked to the railroad, agriculture, livestock, and forestry.

Physically, participants commented that this community is lacking in infrastructure, including bike lanes, well paved roads, and cell towers. Aging infrastructure is reportedly difficult to address and for this area to benefit from available funding opportunities given current funding requirements. Sewer

and water systems are at or near capacity, which is very limiting to any future growth in the area. Finally, stakeholders commented that Camp Nelson has fire infrastructure needs, however it is costly to do this work given that it is so far from the main population.

Tule River Indian Reservation

Overall capacity score: 1.5

The Tule River Indian Reservation was rated as having low capacity relative to the rest of Tulare county, with reportedly limited revenue and economic opportunity. However, participants pointed to planned relocation of the casino to a more central location, as well as receipt of government grants and health aid, as positive indicators of financial capital.

In regard to human capital, there tends to be high turnover in offices and elected officials, and, more generally, difficulty in attracting additional qualified individuals to live and work on the reservation. Culturally and socially, this area was rated highly, given a strong sense of community, especially around supporting children and elders. Tribal members here have a strong appreciation for and promotion of their culture. However, historical trauma and racism against the tribe have undermined external relationships and opportunities.

There are also challenges in regard to physical capital, including lack of access to reliable, sustainable water sources. The tribe relies on groundwater for more than half of its domestic water, however groundwater has been scarce for the past ~8 years due to drought, new wells have come up dry, and many locations on the reservation are not or cannot be connected to a centralized water system. Additional challenges exist around roads, communications infrastructure, transportation, and access to services.

Three Rivers

Overall capacity score: 4

Three Rivers was rated fairly high and has a large availability of public money because Sequoia National Park is a major source of funding for land management, as well as a source of jobs. There is also a lot of private funding in terms of tourism and vacation homes, which is in some ways linked to community purposes, such as supporting local artists, restaurants, and businesses, but not necessarily intentionally invested in the community. However, one participant commented on a pervasive community feeling that, although Three Rivers generates a lot of income for the county, and is a significant source of recreation and tourism, both in town and on the way to the park, the county does not invest accordingly in infrastructure, such as public bathrooms, public river access, the town center, and more. Residents have unsuccessfully tried to advocate for more county investment in the community for years.

In regard to human capital, there are a lot of long-term residents in Three Rivers and technically skilled people who work for the park and in the community. One stakeholder commented, however, that in their view, most efforts are aimed at natural resource conservation rather than social goals. There are also a lot of seasonal residents who only live in the town temporarily. Socially, participants characterized people in Three Rivers as being very community oriented, where everyone seems to look out for one another. An example of a prominent community group here is the Three Rivers Fire Safe Council, which has been applying for grants for fuel reduction, and community education. Culturally, there is definitely a prevalent culture in Three Rivers of people who feel very connected to the mountains and like to spend time outdoors, who are passionate about natural resource management and come together over that shared passion. However, stakeholders also noted a prominent divide in the community, one that has come out strongly during the COVID-19 pandemic and 2020 election. According to one participant, “People who ‘are from Three Rivers’ trend toward lower education levels & income, stronger conservative identity, and people who have moved there recently, or who are affiliated with the Park, trend toward higher education levels & income, and stronger liberal identity. This dynamic has always been there, but has been more visible in the past couple of years, which has impacted the shared identity and bonds of 3R residents.”

Regarding physical infrastructure, stakeholders felt that, during peak tourism seasons, the town can feel overrun and like there is not enough infrastructure to meet demand. According to one, “Traffic on the main road in town can be a little hectic and local restaurants can be maxed to capacity. It is also very challenging for seasonal employees to find affordable housing, and just generally difficult to find housing (especially for renters). In order to meet the need of 3R tourism (which is Tulare County tourism), the town needs more infrastructure, such as public bathrooms, public river access, town center, and greater walkability, especially along Sierra Dr (hwy 198).” Many residents also rely on private septic tanks and individual domestic wells. Overall, there was sentiment that the potential capacity of Three Rivers greatly exceeds its actual capacity, and its unincorporated status makes it difficult for community members to leverage human, social, and cultural capacity and really meet the needs of community members.

Woodlake/Badger

Overall capacity score: 3

Woodlake and Badger are distinct from one another, but were grouped together as a result of census block group limitations. However, both together were given a rating of 3, which equates to a “medium” capacity to respond to stressors. Financially, this area has many disadvantaged and severely disadvantaged communities. Even Woodlake, as an incorporated city, is a designated SDAC with an MHI of \$34,583. The area has some economic development, but due to the overall socioeconomic status the money is not necessarily reinvested in the community.

The education, skills, and abilities of residents is also varied across this region. The communities of Cutler and Orosi are home to low income families, while the mountain community of Badger has seen a recent influx of retired folks. There is little capacity for folks to engage in community development when they struggle to make ends meet. Woodlake was characterized by participants as a tight knit community with a lot to offer for its citizens. They have various community organizations that come together for the benefit of the town, with an example being that they have a community garden to help disadvantaged youth gain useful life skills. They also host different community activities around the holidays where churches, the fire department, police department, community organizations, and local volunteers come together to host events free of charge for the community.

Physical capital is also varied, and many communities have a water system and sewer system. The mountain communities have some water systems, but no sewer systems. Roads are available in most of the area, but there are some very rural residences throughout the region. One participant noted that there seems to be more affordable housing in Woodlake than in neighboring Three Rivers.

Overall, due to the socioeconomic status of this community, their capacity score was lowered, however, they have strong social capacity which improves their ability to address challenges.

Kern County

Breckenridge Mountain/Walker Basin

Overall capacity score: 3

The Breckenridge Mountain/Walker Basin community is sparsely populated, with low income. Breckenridge Mountain in particular has a very low population, and one workshop participant commented that it is “more of a place than a community.” Walker Basin functions as more of a community, with like-mindedness of residents contributing to social capital. It was characterized as a ranch community, with few available resources. Culturally, participants commented that residents in this area generally seem to want to be left alone, however neighbors come together to solve their property stressors. Residents are like minded, with common goals, and the community has a deep knowledge of their neighbors needs and living environments. In regard to physical capital, there are mostly dirt roads in this community, which the population maintains on their own. The county paved roads could use some attention, and overall, the quality of roads prevents high traffic entry for outside travel/commuters and illegal dumping.

Canebrake/Weldon

Overall capacity score: 2

Canebrake/Weldon is another sparsely populated area. The main road is kept up by CalTrans, otherwise there is very little funding for resources or infrastructure that goes to this area. People in these communities access resources in Lake Isabella or Ridgecrest, are often living on very limited incomes, and are in need of social services that they do not have easy access to. Weldon in particular has issues with persistent generational poverty and drug use. Though, it was noted that most who live here tend to enjoy the isolation and self sufficiency aspect of the community. Culturally, there is a tribal presence here (the Tübatulabal tribe), but otherwise there is minimal instance of the community coming together to better the area as a whole. Most people are reportedly struggling to take care of themselves and cannot put more into their community. In regard to physical capital, there are schools, which are not highly rated, and little other physical infrastructure. Most of the roads are dirt and residents are on wells and septic tanks.

Glennville/Alta Sierra

Overall capacity score: 4

Glennville/Alta Sierra was rated as the highest-capacity community in the Kern portion of the SNC Region. The community was characterized as being tight knit and like-minded, with a combination of permanent residents and vacation homes. People in this community reportedly tend to come together to meet community needs and cannot rely on social services or other resources. The sense of community was clear when they worked together with the fire department to save their community during the French Fire in 2021. Specifically in Alta Sierra, there is a community group that works together to meet many of their own infrastructure needs, e.g., water, internet, snow plowing, etc. Culturally, many people here like living in a more rural area, and are hard working citizens with a mindset to get stuff done. Physically, there is minimal infrastructure and the community is part of the resources in Lake Isabella and Kernville. There are a lot of dirt roads, well water access, and septic tanks rather than public systems.

Kernville/Wofford Heights

Overall capacity score: 3

Kernville and Wofford Heights have many distinctions from one another. Wofford Heights is more impoverished, with higher crime rates, less access to services, and a fair amount of blight. There are also a significant number of senior citizens and pensioners who live here. Kernville, while not really upscale, has citizens with significantly more resources, and lower crime rates. The Kern River Valley is generally a depressed area socioeconomically, however Kernville was characterized as the least so of the communities there. Ultimately, this is an area of mixed capital. There are huge income gaps here, with students of different means attending school together and living within a few miles of each other.

Culturally, in Kernville, residents are very proud of their community and have an overall love of what makes that town great. It is an “everyone knows everyone” type of place, and because it is a tourist

destination, the community understands that it needs to be inviting to visitors and residents share a common goal in that. There are a couple of fairly strong volunteer groups associated with visitor management, however they are overwhelmed by the amount of need and have difficulty in moving past all-volunteer organizations. NGOs in the area are also typically volunteer based, and there was concern that many of the volunteer organizations in the community lack the organizational structure needed for continuity after the volunteers leave. In regard to physical capital, there was also noted concern that Kernville lacks the infrastructure to meet visitor demands during tourist season.

Lake Isabella Complex/Bodfish

Overall capacity score: 2

The communities of Lake Isabella and Bodfish are primarily low income families (the elementary school identifies that 85% of students live in socially/economically disadvantaged homes), and access to private dollars for community needs is minimal. The county provides infrastructure and funding, but participants commented that they do not have a solid understanding of the needs of the community in the areas of infrastructure and social needs. This was exemplified by the construction of a bike path, which frustrated community residents given that there is still no sidewalk to the school. This, along with other instances of unnecessary public infrastructure projects, have culminated in a feeling among community stakeholders of public resources being wasted.

Stakeholders identified that people in this community do not come together to take care of the needs of the community, which, according to one participant, is “because so many people are struggling just to take care of themselves and their families.” Illicit drug use is prevalent and generational poverty is common in the area. Many families rely on public assistance and have difficulty accessing necessary medical and mental health services. Some community activities are well attended, but most are not, unless there are free services provided. Parent participation in education and educational activities is also low. However, one promising example of social capital here was that the community really came together during a spike in teen suicide. Residents reportedly really supported each other, as well as those leading the investigation.

In regard to physical capital, community experts noted that there is a lack of sidewalks for kids to walk or ride their bikes around town safely. There is not a sewer system and each home has a septic tank. Utilities and other services were also reported to be fairly expensive, including a high cost of water and trash service, gas, groceries, and housing. Housing costs have been rising where it used to be much cheaper compared to surrounding areas.

Sand Canyon/Paiute Mountain

Overall capacity score: 2

This community has a very low population base. However, people who do live in this area are “definitely self-sufficient and know how to live in very remote areas with no services.” Most people reportedly know their neighbors and would likely bond together if needed. But again, stakeholders commented that people who choose the solitary lifestyle tend to do so because they don’t necessarily like to be around other people. There is also a lack of physical infrastructure, and there are numerous dirt roads. As one participant commented, “I would guess this community wouldn’t want any services other than the basic major roadway maintenance, fire protection and law enforcement. I think most folks who live here do have public electricity like PG&E or Edison. There are definitely off-grid types here though.” Ultimately, this community was rated relatively low due to sparse population and lack of infrastructure, however the score was bolstered by the reported hardiness and self-sufficiency of residents.

Adaptation Planning

Adaptation Framework

California Adaptation Planning Guide	https://resilientca.org/apg/
Governor's Office of Planning and Research	Office of Planning and Research
The Integrated Climate Adaptation and Resiliency Program is designed to develop a cohesive and coordinated response to the impacts of climate change across the state. Through its activities, the program will develop holistic strategies to coordinate climate activities at the state, regional, and local levels, while advancing social equity.	Integrated Climate Adaptation and Resiliency Program - Office of Planning and Research
The Adaptation Clearinghouse is the state of California's consolidated searchable database of resources for local, regional, and statewide climate adaptation planning and decision making. Search and explore resources for adaptation and resiliency efforts in California.	Adaptation Clearinghouse
Explore case studies and examples in the Adaptation Clearinghouse Database	Adaptation Clearinghouse
In addition to case studies developed by the California Office of Planning and Research (OPR), the Clearinghouse includes case studies from the Ocean Protection Council, the Local Government Commission's CivicSpark program, CalTrans' SB1 Adaptation Planning grantees, and more.	https://resilientca.org/case-studies/?region=7&q ≡
Safeguarding California and Climate Change Adaptation Policy	Safeguarding California
General Plan Guidelines and Technical Advisories	General Plan Guidelines and Technical Advisories
State Hazard Mitigation Plan	State Hazard Mitigation Plan
FEMA Hazard Mitigation Planning	Hazard Mitigation Planning FEMA.gov

Climate Ready Communities is a program designed to bring Whole Community Resilience to local governments with an assisted “Do-It-Yourself” approach. The goal is to ensure that communities of all sizes in the US and Canada have effective climate resilience strategies to protect their people, natural resources, economy, infrastructure, and culture. Whole Community Resilience is a proven framework developed by the Geos Institute’s ClimateWise team. It is a cross-sector, multi-stakeholder approach. It can be adjusted over time and creates multiple benefits across the community.	Climate Ready Communities
Cal-Adapt	Cal-Adapt
Adaptation Capability Advancement Toolkit (Adapt-CA): The Adaptation Capability Advancement Toolkit (Adapt-CA) is intended to assist California local governments with overcoming common institutional barriers and improving agency capabilities. By using Adapt-CA, local governments will be able to rapidly identify opportunities to improve existing capabilities in order to pursue climate change adaptation initiatives more effectively and holistically.	Adaptation Capability Advancement Toolkit – ARCCA California
ICLEI	ICLEI
California Air Resources Board AB 32 Climate Change Scoping Plan	AB 32 Climate Change Scoping Plan California Air Resources Board
California’s Fourth Climate Change Assessment	California's Fourth Climate Change Assessment
Sierra Nevada Region summary report for the California Fourth Climate Change Assessment	Sierra Nevada Region Report

Adaptation Strategies for Ecosystems

Point Blue - Final Climate Smart Meadow Restoration Handbook	A guide to climate-smart meadow restoration in the Sierra Nevada and southern Cascades
Little Hoover Commission - <i>Fire on the Mountain: Rethinking Forest Management in the Sierra Nevada</i>	Fire on the Mountain: Rethinking Forest Management in the Sierra Nevada
Sierra Business Council - <i>Wildfire Strategy</i>	Wildfire Strategy
Tree removal -	
Invasive species -	
Nature-Based Climate Solutions: California's Climate Smart Lands Strategy - <i>Natural and Working Lands Climate Smart Strategy</i>	Natural and Working Lands Climate Smart Strategy Draft for Public Comment

Adaptation Strategies for Industry

Sierra Business Council - <i>Biomass in the Sierra Nevada</i>	https://sierrabusiness.org/wp-content/uploads/2019/12/Biomass in the Sierra Nevada Sierra Business Council November 2019.pdf
Timber/Forestry	Yale Framework
Sustainable Tourism	Global Sustainable Tourism Council
Trail building w/ fuel breaks/access for fire fighters	
Outdoor workers - (???)	
Workforce housing	
Dam assessment, removal/upgrade	

Adaptation Strategies for Communities

EPA - <i>Community-Based Adaptation to a Changing Climate</i>	Community-Based Adaptation to a Changing Climate
NWF - <i>Green Works for Climate Resilience</i>	Green Works for Climate Resilience
Climate Adaptation Knowledge Exchange (CAKE)	Climate Adaptation Knowledge Exchange
Adaptation Library for the Western United States	Climate Change Adaptation Library for the Western United States
Water Utility Climate Alliance (WUCA)	Engineering case studies
Greenlining Institute - <i>Making Equity Real in Climate Adaptation and Community Resilience Policies and Programs: A Guidebook</i>	Making Equity Real in Climate Adaptation and Community Resilience Policies and Programs: A Guidebook - The Greenlining Institute
Northern Arizona University - <i>Tribal Climate Change Adaptation Planning Template</i>	Adaptation - Tribes & Climate Change
Alliance of Regional Collaboratives for Climate Adaptation (ARCCA) - <i>From Mountains to Cities: Exploring California's Urban Connections to Sierra Nevada Ecosystems</i>	From Mountains to Cities
NAACP's <i>Our Communities, Our Power: Advancing Resistance and Resilience in Climate Change Adaptation Action Toolkit</i>	https://live-naacpsite.pantheonsite.io/wp-content/uploads/2019/04/Our-Communities-OurPower-TOOLKIT-FINAL.pdf
Local and Regional Government Alliance on Race & Equity's Racial Equity	https://www.racialequityalliance.org/wp-content/
Getting To Results	uploads/2017/09/GARE_GettingtoEquity_July2017_PUBLISH.pdf
Mountain Housing Council - <i>A Regional Housing Implementation Plan</i>	Regional Housing Implementation Plan
Legislative Analyst's Office (LOA) - <i>Climate Change Impacts Across California: Housing</i>	Climate Change Impacts Across California - Housing
Center for Climate and Energy - <i>Using Digitalization to Achieve Decarbonization Goals (broadband plan)</i>	Using Digitalization to Achieve Decarbonization Goals

Tools

Water

<p>Groundwater Ambient Monitoring Tools (GAMA) - The State Water Board GAMA Program and the US Geological Survey have created tools to help users understand groundwater quality in California. The following online tools allow users to access data through web maps and data querying tools.</p>	<p>GAMA - OnLine Tools California State Water Resources Control Board</p>
<p>Geotracker - the Water Boards' data management system for sites that impact, or have the potential to impact, water quality in California, with emphasis on groundwater.</p>	<p>GeoTracker https://geotracker.waterboards.ca.gov/site_type_definitions https://geotracker.waterboards.ca.gov/map/?myaddress=California&from=header&cqid=9554609000#</p>
<p>Water Resilience Assessment Framework</p>	<p>Water Resilience Assessment Framework Water Utility Business Risk and Opportunity Framework</p>
<p>SGMA California - Impacts of California's Sustainable Groundwater Management Act</p>	<p>https://aquaoso.com/resources/sgma-california/?utm_term=sgma&utm_campaign=California&utm_source=adwords&utm_medium=ppc&hsa_acc=3448002798&hsa_cam=11003487528&hsa_grp=113658253181&hsa_ad=492863222319&hsa_src=g&hsa_tgt=kwd-339446574635&hsa_kw=sgma&hsa_mt=b&hsa_net=adwords&hsa_ver=3&gclid=CjwKCAjwn8SLBhAyEiwAHNTJbX-3yZ71CP1yqX3TXldtmyGicsl8VQM5UyL61h0aSZpBsfNp77XELBoCN-8QAvD_BwE</p>
<p>California Environmental Protection Agency - Office of Environmental Health Hazard Assessment Groundwater Threat Map</p>	<p>Groundwater Threats OEHHA</p>

Drought

National Oceanic and Atmospheric Association - National Integrated Drought Information System Drought Monitor	California Drought.gov
Drought.CA.GOV - includes data sources that illustrate reservoir conditions, precipitation, groundwater, snowpack, river flows, dry wells, and other hydrologic sources	Current drought conditions
Self-Supplied Communities - supports drought resilience planning among rural communities. Users can select a region of interest to see the risks of drought and water shortage in that area.	https://tableau.cnra.ca.gov/t/DWR_IntegratedDataAnalysisBranch/views/DWRDroughtRiskExplorer-RuralCommunititesMarch2021/Dashboard?:isGuestRedirectFromVizportal=y&:embed=y
Historical Water Watcher - This tool displays past and real-time information for different types of drought (e.g., meteorological, hydrological, agricultural, ecological, snow) in the contiguous US.	https://climatetoolbox.org/tool/Historical-Water-Watcher
American Geosciences Institute - Live Water Levels for Major Reservoirs in CA	Interactive map of water levels for major reservoirs in California American Geosciences Institute

Water Quality

Surface Water Quality Modeling Training	Surface Water Quality Modeling Training US EPA
How's My Waterway	How's My Waterway US EPA https://mywaterway.epa.gov/state/CA/water-quality-overview
Drinking Water Mapping Application to Protect Source Waters (DWMAPS)	US EPA DWMAPS
CA State Geoportal - Aquifer Risk Map and Methodology (CA)	https://gis.data.ca.gov/maps/b25cf272c7c7448f89dd4e41d86948fa/explore

CA Water Boards' Combined Risk Map	https://gis.data.ca.gov/datasets/waterboards::combined-risk/about
------------------------------------	---

Flood

First Street Foundation - Flood Factor makes it easy for Americans to find their property's risk of flooding and understand how flood risks are changing because of a changing environment.	About Risk Factor
National Flood Hazard Layer (NFHL) - a geospatial database that contains current effective flood hazard data. FEMA provides the flood hazard data to support the National Flood Insurance Program. Users can consult the information to better understand levels of flood risk and types of flooding.	National Flood Hazard Layer FEMA.gov

Wildfire

Risk Factor - Wildfire Risk	Environmental Changes Impacting Wildfire Risk Factor
Sierra Nevada Conservancy, Fire Web App - provides a number of layers from external fire agencies and organizations that deliver consistently updated map layers regarding the location and status of active and past wildfires.	https://snc.maps.arcgis.com/apps/ImpactSummary/index.html?appid=e827999b8d094937b4f358530595799c
Northern California Geographic Area Coordination Center (GACC) - focal point for coordinating the mobilization of resources for wildland fire and other incidents throughout the Geographic Area	Northern California Geographic Area Coordination Center

Vulnerability Assessments in the Sierra

Mammoth Lakes – Climate Adaptation and Resilience Assessment, May 12, 2021	Climate Adaptation and Resilience Assessment
--	--

<p>USFS – Sierra Nevada Recreation and Infrastructure, Vulnerability Assessment and Adaptation Strategy Partnership</p>	<p>https://adaptationpartners.org/sierrarecinfra/Climate Change Vulnerability and Adaptation for Infrastructure and Recreation in the Sierra Nevada https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=8e405de85b964f7592d83b53303cd82a</p>

Resilient CA

- <https://resilientca.org/search/?q=®ion=7&geography=>
- Resilientca.org offers tools, resources, and case studies regarding adaptation planning in the Sierra Nevada region.

Environmental Protection Agency

Climate Scenario and Adaptation Tool

- Locating and Selecting Scenarios Online
 - <https://lasso.epa.gov/>
 - The LASSO tool guides users step-by-step through the process of identifying and downloading climate change scenarios—or projections—that are relevant to a user’s interest or research question.
- Climate Adaptation Search
 - <https://www.epa.gov/arc-x/your-climate-adaptation-search>
 - This tool allows users to search climate adaptation strategies and resources by region and area of interest.

CA Office of Emergency Services

- MyHazards
 - <https://myhazards.caloes.ca.gov/>
 - MyHazards is a tool for the general public to discover hazards in their area (including earthquake, flood, fire, and tsunami) and learn steps to reduce personal risk. Using the MyHazards tool, users may enter an address, city, or zip code, or they may select a location from a map.

WUCA Climate Adaptation

- <https://www.wucaonline.org/adaptation-in-practice/leading-practices/index.html>

Desert Research Institute/United States Forest Service

- Climate Engine Applications for USFS Monitoring and Assessment
 - https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd910603.pdf

- This is a Google Earth Engine tool for showing data-driven insights to support climate resilience and sustainability. It helps users quickly process and visualize spatial climate, satellite, and land surface model data, including custom time periods and local-to-global scales.

Water

Drought

CA Department of Water Resources Drought and Water Shortage Risk Explorer

- Self-Supplied Communities
 - https://tableau.cnra.ca.gov/t/DWR_IntegratedDataAnalysisBranch/views/DWRDroughtRiskExplorer-RuralCommunitesModuleMarch2021/Dashboard?isGuestRedirectFromVizportal=y&embed=y
 - This site supports drought resilience planning among rural communities. Users can select a region of interest to see the risks of drought and water shortage in that area.
- Small Water Suppliers
 - https://tableau.cnra.ca.gov/t/DWR_IntegratedDataAnalysisBranch/views/SmallWaterSystemRisk-March2021/Dashboard?%3AshowAppBanner=false&%3Adisplay_count=n&%3AshowVizHome=n&%3Aorigin=viz_share_link&%3AisGuestRedirectFromVizportal=y&%3Aembed=y
 - This site supports drought resilience planning among small water suppliers. The map shows combined risk scores for water suppliers from a combination of 29 environmental indicators.
- Small Water Suppliers Metadata
 - https://tableau.cnra.ca.gov/t/DWR_IntegratedDataAnalysisBranch/views/SmallWaterSystemRisk-March2021/urlCNRAOpenData?%3AshowAppBanner=false&%3Adisplay_count=n&%3AshowVizHome=n&%3Aorigin=viz_share_link&%3AisGuestRedirectFromVizportal=y&%3Aembed=y
 - This is the metadata that supports the above Small Water Suppliers tool, available for download and tabular format.

Climate Tool Box

- Historical Water Watcher
 - <https://climatetoolbox.org/tool/Historical-Water-Watcher>

- This tool provides users with a way to look at different types of water surpluses and deficits in near real time. This tool displays past and real-time information for different types of drought (e.g., meteorological, hydrological, agricultural, ecological, snow) in the contiguous US. Maps of different types of drought can be used for comparison side-by-side or against the US Drought Monitor assessment, or for analysis of a specific location.

American Geosciences Institute

- Live Water Levels for Major Reservoirs in CA
 - <https://www.americangeosciences.org/critical-issues/maps/interactive-map-water-levels-major-reservoirs-california>
 - This site links to the California Department of Water Resources' interactive map of water levels for 12 major reservoirs in California. For each reservoir, the current water level (updated daily) is shown along with the historical average and the total reservoir capacity.

Water Quality

Environmental Protection Agency

- Surface Water Quality Modeling Training
 - <https://www.epa.gov/waterdata/surface-water-quality-modeling-training>
 - This is an ongoing series of two-hour webinars to help water quality professionals better understand surface water quality models and how they can be used to address water quality problems.
- How's My Waterway
 - <https://www.epa.gov/waterdata/how-s-my-waterway>
 - This tool was designed to provide the general public with information about the condition of their local waters based on data that states, federal, tribal, local agencies, and others have provided to the EPA.
 - <https://mywaterway.epa.gov/state/CA/water-quality-overview>
 - How's My Waterway: California
- Drinking Water Mapping Application to Protect Source Waters (DWMAPS)
 - <https://geopub.epa.gov/DWWidgetApp/>
 - This is an online mapping tool to help you find information critical to protecting sources of drinking water.

Small Water Systems (CA)

- https://gis.data.ca.gov/datasets/d22302abb66d47e89ad9aaf7dcb4fcd9_0/explore?location=37.313969%2C-119.163600%2C6.78

CA State Geoportal

- Aquifer Risk Map and Methodology (CA)

- <https://gis.data.ca.gov/maps/b25cf272c7c7448f89dd4e41d86948fa/explore>
 - The aquifer risk map is being developed to fulfill requirements of SB 200 and is intended to help prioritize areas where domestic wells and state small water systems may be accessing groundwater that does not meet primary drinking water standards (i.e., maximum contaminant level or MCL).
 - <https://gispublic.waterboards.ca.gov/portal/home/item.html?id=6a50a6cd22a144e9ac621e9070e01c44>
 - This is a methodology note for the draft aquifer risk map created in support of SB 200 to help prioritize SAFER funding for domestic wells and state small water systems at risk for water quality issues.
- CA Water Boards' Combined Risk Map
 - <https://gis.data.ca.gov/datasets/waterboards::combined-risk/about>
 - This map displays combined risk for water quality and domestic well/state small users by census block group, prepared in support of the Aquifer Risk Map.

Flood

Sierra Nevada Conservancy

Wildfire Hazard Potential (CA)

- <https://gis.data.ca.gov/maps/e5eda230cf7c43d9944ef66be1dad7ef/explore?location=38.666829%2C-121.546200%2C6.30>

Ecosystem

Point Blue

- Climate-smart meadow restoration in the Sierra Nevada and southern Cascades
 - https://rdjzr2agvvkijm6n3b66365n-wpengine.netdna-ssl.com/wp-content/uploads/2019/12/Final_Climate_Smart_Meadow_Restoration_Handbook.pdf
 - This handbook provides restoration practitioners with guidance to incorporate climate change considerations into the planning and design of Sierra Nevada meadow restoration projects. Implementation of the recommended approaches and best management practices in this handbook can help practitioners increase the probability that restored meadows are resilient to the consequences of climate change.

Environmental Protection Agency

- EnviroAtlas
 - <https://enviroatlas.epa.gov/enviroatlas/interactivemap/>
 - EnviroAtlas is an interactive, web-based tool that decision-makers can use to inform policy and planning in the places where people live, learn, work, and play. It provides geospatial data, easy-to-use tools, and other resources related to ecosystem services, their chemical and nonchemical stressors, and human health.

USFS Forest Health

- <https://www.arcgis.com/apps/webappviewer/index.html?id=3a2dab80192741808d635461b05a2216>

Black bears in CA (except I'm not totally sure it's a tool as much as a map that can't be changed)

<https://storymaps.arcgis.com/stories/c2c85d5169b844d49c7f661d5f2b0e10>

Other Vulnerability Assessments

Mammoth Lakes – Climate Adaptation and Resilience Assessment, May 12, 2021

- https://mltpa.org/images/downloads/703_02_5-12-21_presentation_draft_V4_FINAL.pdf

USFS – Sierra Nevada Recreation and Infrastructure, Vulnerability Assessment and Adaptation Strategy Partnership

- <https://adaptationpartners.org/sierrarecinfra/>
- https://www.fs.fed.us/psw/publications/documents/psw_gtr272/psw_gtr272.pdf
- <https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=8e405de85b964f7592d83b53303cd82a>

Truckee – Climate Change Vulnerability Assessment for the Town of Truckee, California

- <https://climatewise.org/wp-content/uploads/projects/truckee/truckee-vulnerability-assessment-final.pdf>