FRAMEWORK FOR RESILIENCE TAHOE-CENTRAL SIERRA INITIATIVE

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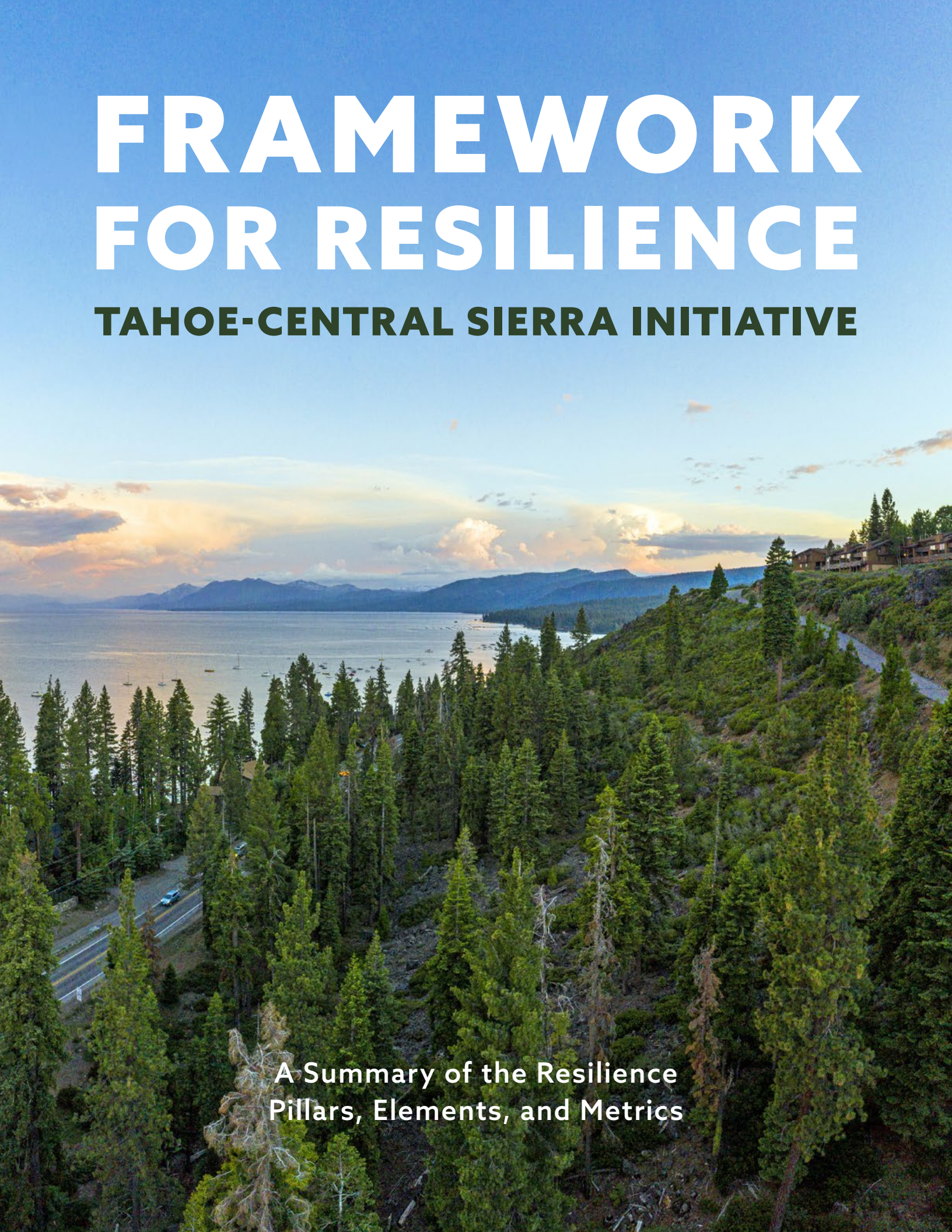
FRAMEWORK FOR RESILIENCE

TAHOE-CENTRAL SIERRA INITIATIVE



A Summary of the Resilience Pillars, Elements, and Metrics


SOCIAL & CULTURAL WELL-BEING
AIR QUALITY
ECONOMIC DIVERSITY
WATER SECURITY
FIRE ADAPTED COMMUNITIES
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ABOUT THE TAHOE-CENTRAL SIERRA INITIATIVE

The Tahoe-Central Sierra Initiative (TCSI) is a partnership among the USDA Forest Service, California Tahoe Conservancy, Sierra Nevada Conservancy, The Nature Conservancy, National Forest Foundation, California Forestry Association, and University of California Sagehen Creek Field Station, and eight forest collaboratives. TCSI partners are accelerating the restoration of forest and watershed resilience through innovative planning, investment, and management across the 2.4-million-acre landscape.

This document was adapted from a product developed in 2020 for the Sierra Nevada Conservancy for the TCSI and funded by the California Climate Investments:

Manley, P., K. Wilson, and N. Povak. 2020. **Framework for Promoting Socio-ecological Resilience across Forested Landscapes in the Sierra Nevada**, Final Report.

Funding for this project was provided by the California Department of Forestry and Fire Protection as part of the California Climate Investments Program.

TAHOE-CENTRAL SIERRA INITIATIVE AREA

The forested watersheds of the Sierra Nevada sustain communities, provide wildlife habitat, ensure a reliable water supply for California, and combat climate change by storing carbon. However, climate change and fire suppression are amplifying wildfires, increasing droughts, and expanding tree mortality with devastating impacts to these natural and working landscapes.

TO TACKLE THESE THREATS the TCSI is accelerating the restoration of forests and watersheds and improving resilience to disturbances across 2.4 million acres. The TCSI landscape encompasses some of California's most beloved terrain, from the blue waters of Lake Tahoe through the verdant foothill communities and rivers that lead to Sacramento.

The TCSI's ***Framework for Promoting Socio-ecological Resilience across Forested Landscapes in the Sierra Nevada*** (Framework) provides a structure for assessing landscape conditions, setting objectives, designing projects, and measuring progress towards social-ecological resilience. The Framework offers a shared vision for landscape-scale resilience that recognizes the interdependent nature of social and ecological values. These values are described by ten pillars that represent the desired outcomes of landscape resilience. Each of the pillars provide metrics for assessing landscape conditions and verifying that actions meet resilience objectives. The Framework helps agencies, landowners, tribes, businesses, and other stakeholders to plan and implement restoration projects that align with shared values at an accelerated pace and scale, and to clearly document progress toward local, regional, and statewide goals.

An interdisciplinary team of scientists, land managers, and policymakers developed the Framework through a science-based, consensus-building process. TCSI partners then used the Framework and its pillars, along with the best-available science, to assess current conditions and model future conditions under climate change across the TCSI landscape. As a next step, TCSI partners will use the Framework and the assessment to develop measurable and achievable target conditions that promote resilience, and to identify project-level opportunities for restoration that will have the greatest benefit.

FRAMEWORK FOR RESILIENCE: PILLARS, ELEMENTS, & METRICS

The Framework comprises three main components for describing and measuring resilience:

1 PILLARS

Pillars are the desired long-term, landscape-scale outcomes of restoring resilience. They include ecological values, such as biodiversity, as well as societal benefits to communities, such as water security.

2 ELEMENTS

Elements represent the primary processes and functions that altogether make up a pillar, such as focal species, water quality, or economic health.

3 METRICS

Metrics describe the characteristics of elements in quantitative or qualitative terms. Users can use metrics to assess, plan for, measure, and monitor progress towards desired outcomes and greater resilience. While pillars and elements are consistent across the Sierra Nevada, the metrics that a group uses may vary from region to region based on ecological and social differences (for example forest types, economy), available data, and user preferences.

WHY SOCIAL-ECOLOGICAL RESILIENCE?

People are part of nature, and the threats facing forested watersheds also threaten California's communities and economies. The Framework therefore employs the concept of social-ecological resilience, which refers to the capacity of systems to cope with and adapt to stress and disturbance while retaining the functions and benefits that people value. The TCSI's strategies thus target not only ecological but also social outcomes such as air quality, recreation, and industry.

THE PILLARS OF RESILIENCE

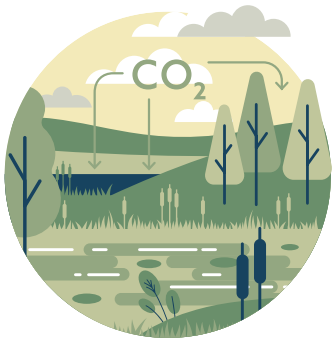
This section describes the ten pillars of resilience, along with their associated elements and metrics. For each, there is also a short outcome statement that characterizes desired conditions.

FOREST RESILIENCE

RESILIENT FORESTS PROVIDE many ecosystem services, including wildlife habitat, clean water, stable soils, recreational opportunities, biodiversity, wood products, and carbon sequestration. They also play an important role in both mitigating and adapting to climate change. Across the landscape, management activities and natural disturbances should maintain desired forest conditions, including forest heterogeneity and wildlife habitat.

OUTCOME: Vegetation composition and structure align with topography, desired disturbance dynamics, and landscape conditions, and are adapted to climate change.

ELEMENT	METRICS
Structure	Tree density Basal area Large/tall tree density Clump/gap structure Individual, clumps, and openings composite index Seral stage (early, mid, late) Large snag density
Composition	Vegetation community type Tree species diversity
Disturbance	Loss of forest cover Time since disturbance Recent disturbance return interval Drought vulnerability

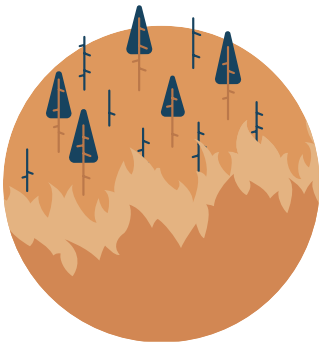


CARBON SEQUESTRATION

CARBON SEQUESTRATION IS THE PROCESS by which carbon dioxide is taken up by trees, grasses, and other plants and stored as carbon in biomass and soils. Resilient forests and wetlands can be net sinks of carbon and can play an important role in reducing greenhouse gas emissions into the atmosphere, thereby mitigating climate change. Forest products also play a role in storing carbon for decades in building materials, thereby delaying emissions.

OUTCOME: Carbon sequestration is enhanced in a stable and sustainable manner that yields multiple ecological and social benefits.

ELEMENT	METRICS
Storage	Mass
Stability	Persistence



FIRE DYNAMICS

FIRE IS AN INTEGRAL PART of Sierra Nevada forest ecosystems, which are evolutionarily adapted to fire. Ideally prescribed fires and managed wildfires would be allowed to burn across the landscape periodically. They would burn primarily at low to moderate severity in a mosaic pattern that covers large areas, which would provide substantial ecological benefits. Because climate change generally increases the severity of fire dynamics, managing such dynamics will continue to grow in importance.

OUTCOME: Fire burns in an ecologically beneficial and socially acceptable way that perpetuates landscape heterogeneity and rarely threatens human safety or infrastructure.

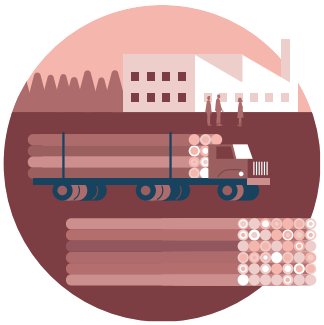
ELEMENT	METRICS
Severity	Risk of high-severity fire High-intensity patch size
Functional fire	Time since fire and frequency Proportion of fire as high severity

FIRE ADAPTED COMMUNITIES

DUE TO CLIMATE CHANGE and other drivers, wildfires increasingly threaten homes and communities, especially in the wildland-urban interface. Fire adapted communities are knowledgeable and engaged. They accept fire as part of the surrounding landscape, take action to reduce their vulnerability to fire, and adapt to live safely with fire.

OUTCOME: Communities have adapted to live safely in forested landscapes and understand the significance of fire to maintaining healthy forests. They have sufficient capacity to manage desired fire and suppress unwanted fire.

ELEMENT	METRICS
Hazard	Risk of high- and moderate-severity fire Threat to infrastructure
Preparedness	Community Wildfire Protection Plans Egress/ingress plans Fire management plans



ECONOMIC DIVERSITY

ECONOMIC DIVERSITY INCREASES business opportunities that provide regional economic vitality and additional benefits to rural and vulnerable populations. Resilient forests provide ecosystem services and forest products that in turn provide a foundation for many local and regional economic activities and employment opportunities, including recreation, tourism, and natural resource management industries.

OUTCOME: Forest management and outdoor activities support a sustainable, natural-resource-based economy, particularly in rural communities.

ELEMENT	METRICS
Wood product industry	Sawtimber supply and demand Biomass supply and demand Small-diameter tree supply and demand Processing capacity
Recreation industry	Recreation diversity Recreational use
Water industry	Water management infrastructure
Economic health	Job market in natural resources Employment resilience Income diversity

SOCIAL & CULTURAL WELL-BEING

A GROWING BODY OF EVIDENCE indicates that greater exposure to nature is associated with better health and well-being. Sierra Nevada forests allow people to build and maintain active cultural and social connections to a place. Resilient landscapes offer opportunities for people to connect with the natural environment through recreation experiences, culturally valued resources, and engagement in natural resource management and conservation.

OUTCOME: The landscape provides a place for people to connect with nature, to recreate, to maintain and improve their overall health, and to contribute to environmental stewardship, and is a critical component of their identity.

ELEMENT	METRICS
Public health	Smoke-induced illness Public health susceptibility
Public engagement	Natural resource knowledge
Recreation quality	Costs and benefits to recreation
Equitable opportunity	Environmental justice

WETLAND INTEGRITY

WETLANDS PROVIDE critical habitat, filter and retain nutrient pollution, store carbon, enhance water quality, control erosion, and provide spaces for recreation. They are local and regional centers of biodiversity, and support species found nowhere else across western landscapes. Functional wetland ecosystems will serve increasingly important roles in buffering impacts from extreme climate events, and upland disturbances such as flooding and erosion.

OUTCOME: Meadow and riparian ecosystems provide multiple ecosystem services and are key linkages between upland and aquatic systems in forested landscapes.

ELEMENT	METRICS
Structure	Stream channel morphology Alluvium storage capacity
Composition	Carbon content Benthic invertebrates
Hydrologic function	Surface water flow Stream channel discharge

BIODIVERSITY CONSERVATION

BIODIVERSITY PLAYS A MAJOR ROLE in our ecosystems and society. Native plants and animals help forests recover after a fire, control flooding and soil erosion, and cycle nutrients. Biodiversity also holds cultural value, including Native American uses, and provides recreational benefits like birdwatching. Greater species diversity promotes adaptability and helps ecosystems withstand and recover from disturbances, including those caused by a changing climate.

OUTCOME: The network of native species and ecological communities is sufficiently abundant and distributed across the landscape to support and sustain their full suite of ecological and cultural roles.

ELEMENT	METRICS
Focal species	Suitable habitat for focal species Critical habitat for listed species
Species diversity	Species diversity Non-native species distribution
Community integrity	Functional group diversity Community diversity

WATER SECURITY

RESILIENT FORESTED WATERSHEDS are key for regional and statewide water security. The economic value of California's water far exceeds that of any other forest product. Water flows from forests into rivers that provide critical aquatic and wetland habitat, and that supply agricultural and drinking water for tens of millions of people. Forests serve as natural water collection, storage, filtration, and delivery systems. These functions will become more important as climate change intensifies.

OUTCOME: Watersheds provide a reliable supply of clean water despite wide swings in annual precipitation, droughts, flooding, and wildfire.

ELEMENT	METRICS
Quantity	Ground water Water yield Snow accumulation
Storage and timing	Stream flow volume Reservoir storage Snow water content Snow melt
Quality	Nitrogen Phosphorus Sediment Pollution

AIR QUALITY

CLEAN AIR IS IMPORTANT to human health and wellness, clean water, biodiversity, and ecosystems. Catastrophic wildfires degrade air quality and cause respiratory illnesses that affect millions of people, especially children and people who work outdoors. Furthermore, people prefer to enjoy the outdoors when it is safe to breathe and the skies are clear. Smoke from wildfires discourages recreation and disrupts businesses and local economies. Land managers seek to improve forest health and resilience by using prescribed fire to reduce the risk of uncharacteristic fire and smoke.

OUTCOME: Emissions from fires are limited to primarily low- and moderate-severity fires in wildland ecosystems. Forests improve air quality by capturing pollutants.

ELEMENT	METRICS
Particulate matter	Wildfire emissions Prescribed fire emissions
Visibility	Visual quality
Greenhouse gases	Ozone

TAILORING THE FRAMEWORK TO SPECIFIC REGIONS AND MANAGEMENT SCALES

While the Framework's components apply throughout the Sierra Nevada, land managers, stakeholders, and tribes can tailor applications of pillars, elements, and metrics to their unique geography. Users who want to emphasize the role of commercial wood products in local economies will focus their planning on different elements and metrics than stakeholders focusing on forest-based recreation. Each user group would be able to select relevant elements from the Framework to meet their management objectives.

The Framework is also scalable. Land managers can use it to evaluate single 5,000-acre projects just as easily as they can to evaluate 500,000-acre landscapes with dozens of projects. This lets partners match the scale of management to the scale of the ecological and biological processes, such as wildfire or migration, that shape and maintain landscapes.

For questions about the science or how to use the Framework in your area, or to share stories about your experiences with it, contact us by visiting sierranevada.ca.gov/tcsi.