Supporting Incorporation of Climate Change into Federal Plan Revisions for Northern California

May 3, 2022

EcoAdapt™
Meeting the challenges of climate change

THE EVENT WILL START SHORTLY!

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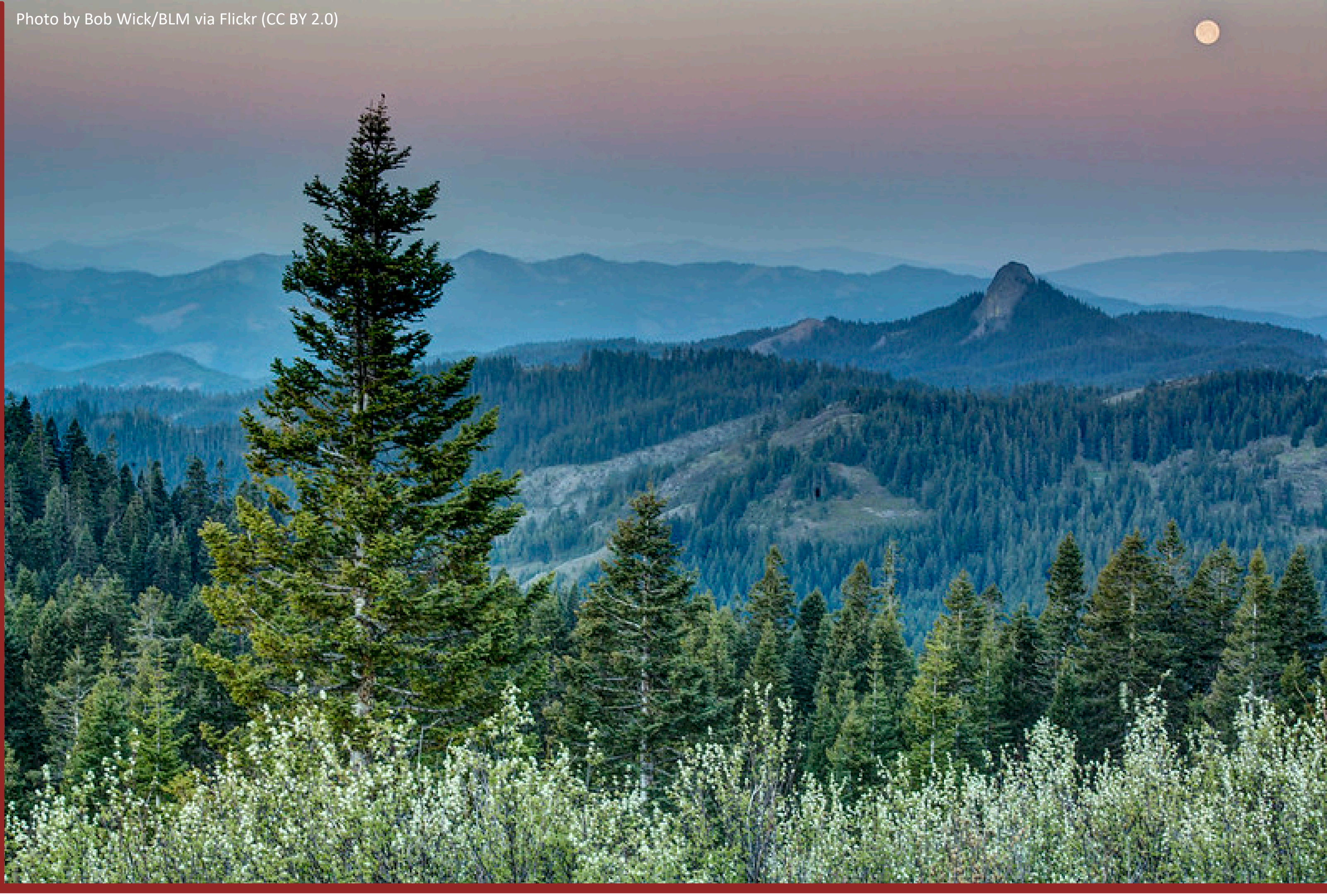
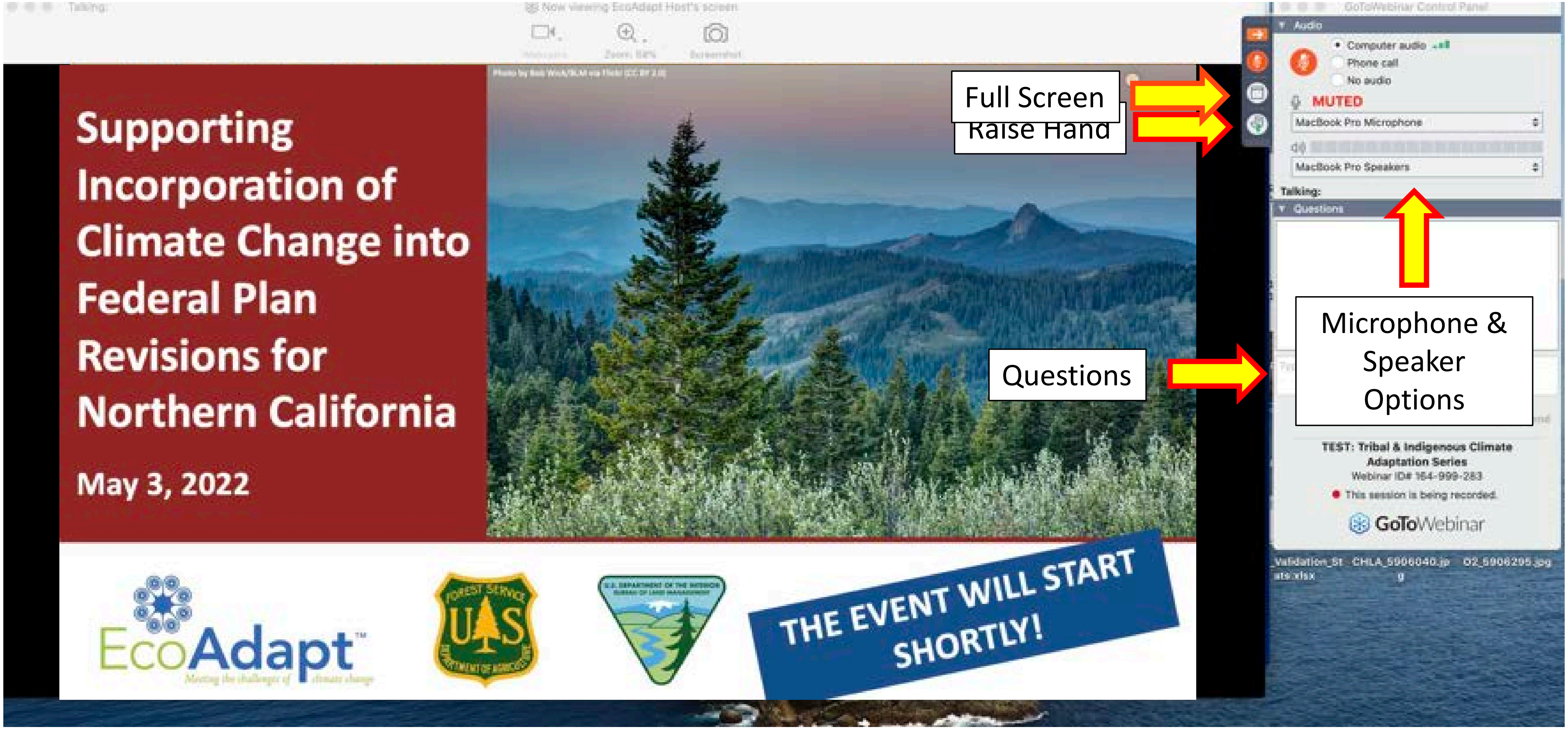


EcoAdapt™ Meeting the challenges of climate change

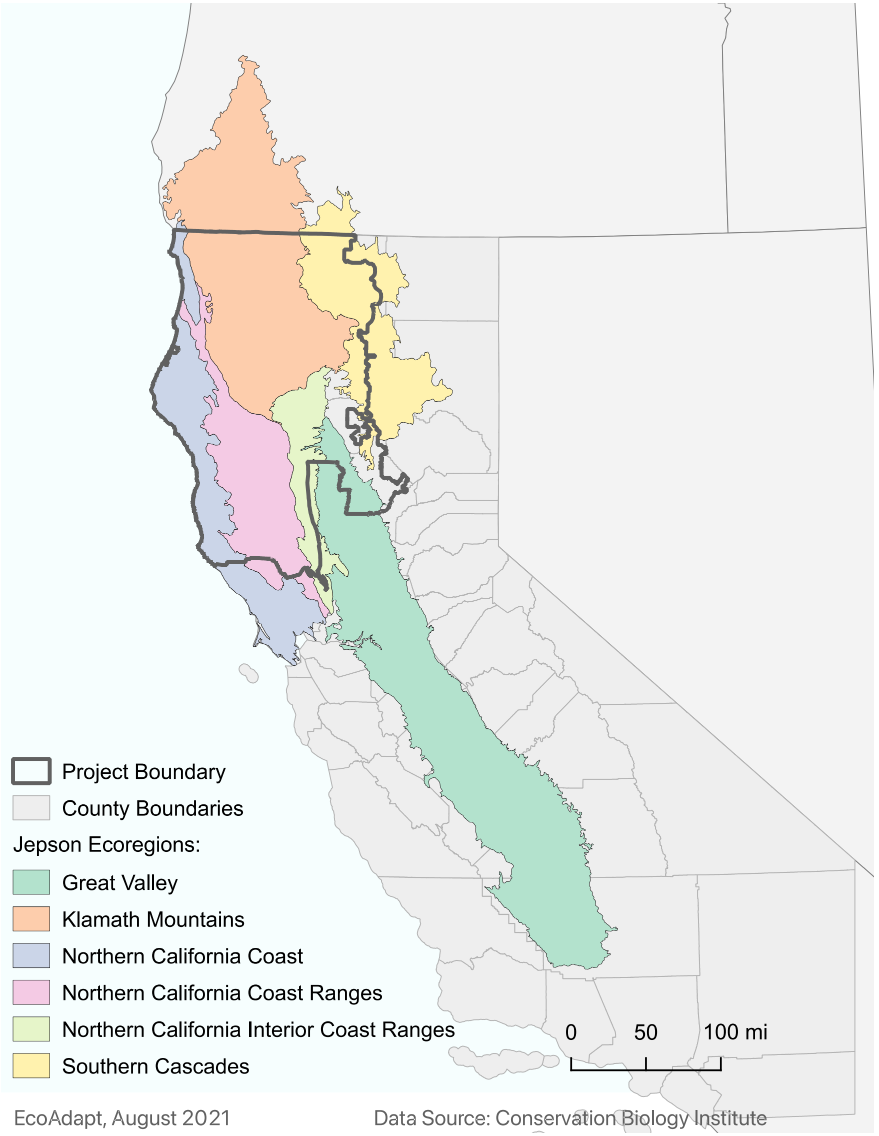
Forest Service U.S. Department of Agriculture

U.S. Department of the Interior Bureau of Land Management

GoToWebinar Orientation



Northern California Climate Adaptation Project



Project Goals

- Improve understanding of how and why important Northern California resources may be vulnerable to changing climate conditions
- Identify adaptation actions that can be implemented to reduce vulnerabilities and/or increase overall resilience

Northern California Climate Adaptation Project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- **Synthesis** of observed and projected future **climatic changes**
- **Vulnerability assessments** for focal habitats and species
- Stakeholder-developed **adaptation strategies and actions**
- **Supporting maps and climate data** on Data Basin
- A **network of practitioners** interested and engaged in adaptation

Webinar Overview

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Welcome and Introduction

Bureau of Land Management

- Climate Change Policy & Context *(Jim Weigand)*
- Application to BLM Planning Processes *(Katie Flahive)*

U.S. Forest Service

- Climate Change Policy & Context *(Lara Buluc & Logan Graham)*
- Application to USFS Planning Processes *(Sarah Sawyer)*

Northern California Climate Adaptation Project

- Project findings and available products


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EcoAdapt™
Meeting the challenges of climate change

Vulnerability Assessments, Mapping, & Adaptation Strategies

FOR NORTHWESTERN CALIFORNIA

Project Timeline

Focal Resources	Vulnerability Assessment	Adaptation Planning	Adaptation Implementation
Step 1	Step 2	Step 3	Step 4
Identify focal ... gather relevant data and info	Assess ... focal resources	Use assessment ... adaptation options	Develop ... plans for on-the ground action
MARCH 2016	MAY 2017	DEC 2017	NOV 2021

Phase 1: Vulnerability Assessment

Phase 2: Adaptation Planning

Project Findings


Photo by Redwood National and State Forests via Flickr (Public Domain)

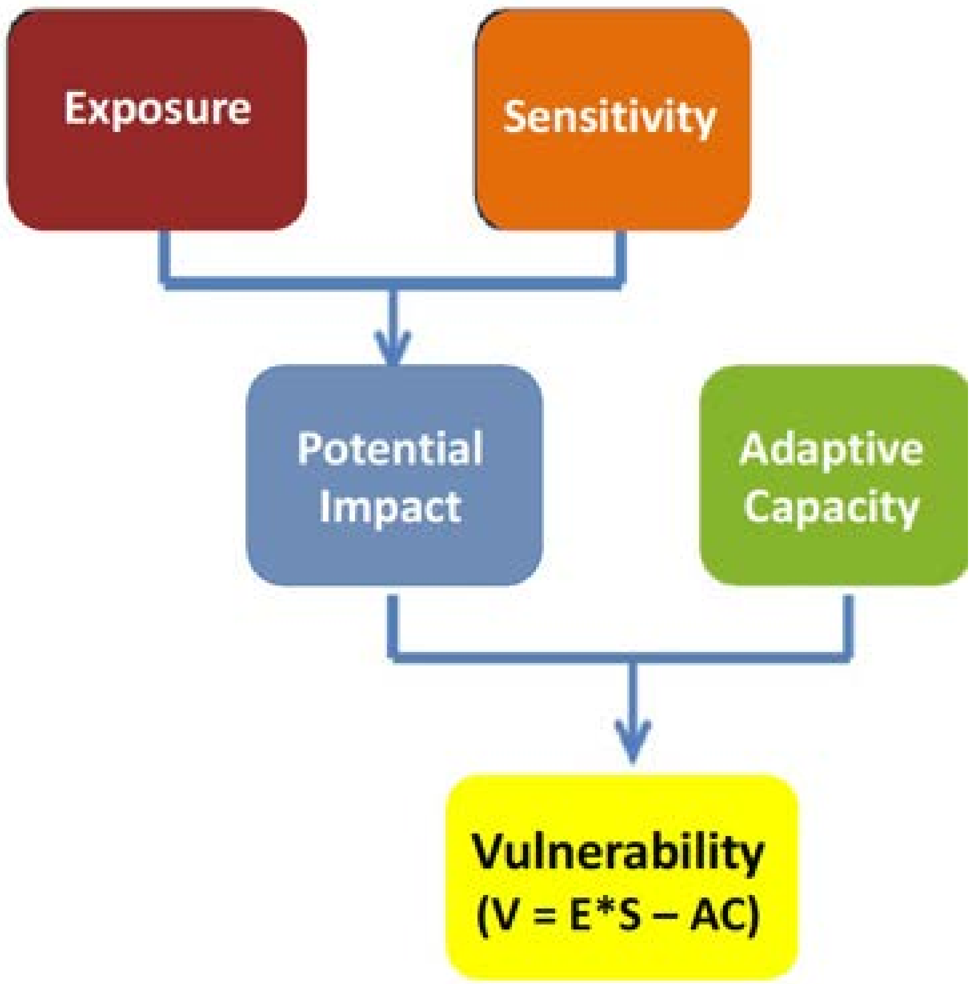
- Vulnerability Assessments
- Regional Climate Impacts
- Climatic Water Deficit Maps
- Adaptation Strategies & Actions
- Adaptation Implementation Plans

Vulnerability Assessment

Purpose of a vulnerability assessment:

Identify ***which*** resources are most vulnerable and ***why***

- **Exposure**
- **Sensitivity**
- **Adaptive Capacity**



Vulnerability Assessment

EXPOSURE is a measure of ***how much change*** in climate that a resource is likely to experience

Factors considered:

- Direction and magnitude of change in climate stressors and disturbance regimes
- Degree of uncertainty associated with projected changes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Vulnerability Assessment


Photo by USFS/Mike McMillan (Public Domain)

SENSITIVITY is a measure of whether and how a resource is likely to be affected by a given change in climate factors

Factors affecting sensitivity:
- Climate drivers
- Disturbance regimes
- Non-climate stressors

Vulnerability Assessment

ADAPTIVE CAPACITY is a measure of a resource's ability to accommodate or cope with climate change impacts with minimal disruption

Factors affecting adaptive capacity:

- Extent & integrity
- Connectivity
- Resistance & recovery
- Diversity
- Public, societal, and cultural value
- Management potential

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Climate Change Vulnerability:
Late-Successional-Dependent Species

Moderate-High Vulnerability
Moderate Confidence

Exposure

Moderate Exposure
Low Confidence

- ⬆ Air temperature
- ⬆ Heat waves
- ⬆⬇ Precipitation amount/timing
- ⬆ Drought
- ⬇ Snowpack
- ⬅ Timing of snowmelt/runoff
- ⬆ Storms
- ⬆ Wildfire

Sensitivity

Moderate-High Sensitivity
High Confidence

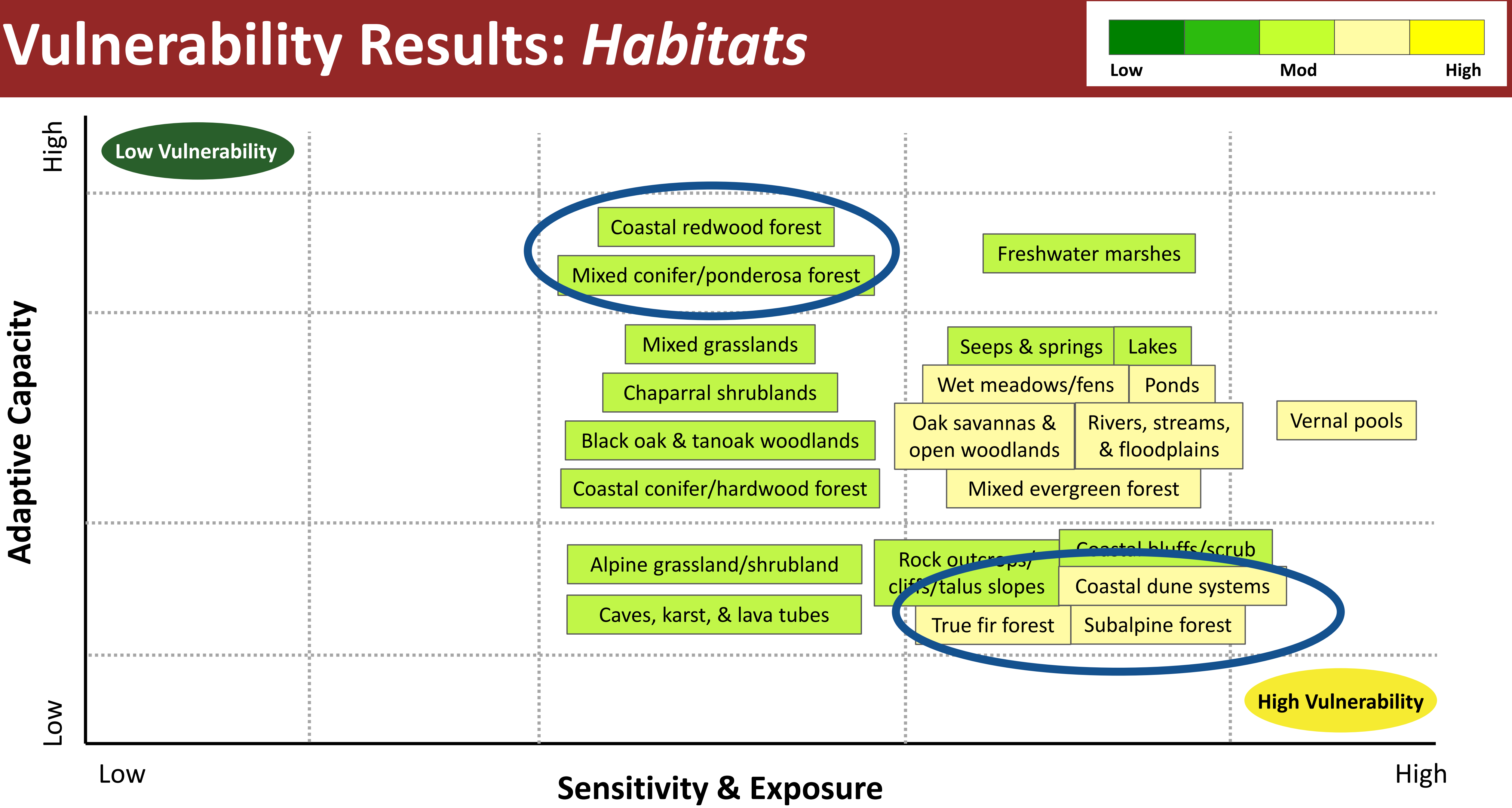
- Decreased survival and recruitment
- Altered prey availability and interspecific competition for food/habitat resources
- Changes in habitat structure and availability of critical habitat features
- Reduced habitat extent and connectivity
- Shifts in species distribution
- *Non-climate stressors:* Fire exclusion, timber harvest, roads, poisons

Adaptive Capacity

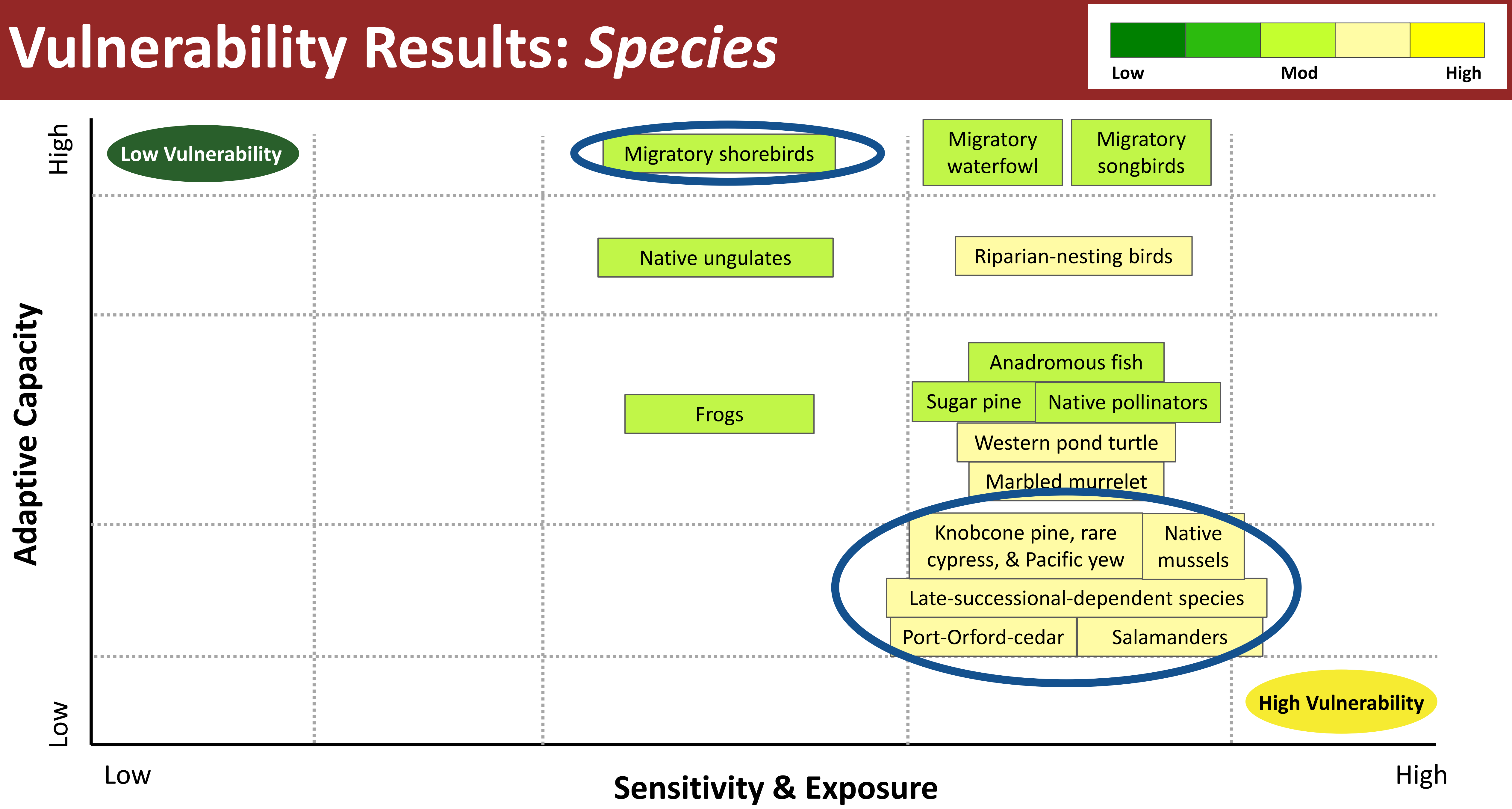
Low-Moderate Adaptive Capacity
High Confidence

- ▲ Behavioral plasticity
- ▲ Some regulatory and legislative support for species management
- ▼ Declining regional populations
- ▼ Small, isolated populations vulnerable to extirpation or genetic bottlenecks
- ▼ Recovery limited by low reproductive potential & reliance on late-seral stand conditions

Vulnerability Results: *Habitats*



Vulnerability Results: *Species*



Vulnerability Assessment Trends

Climate Stressors
- Precip/soil moisture
- Drought

Disturbance Regimes
- Wildfire
- Disease

Non-Climate Stressors
- Fire suppression
- Timber harvest
- Pollutions & poisons
- Dams & water diversions
- Roads, highways, & trails

Photo by BLM/Greg Shine (CC BY 2.0)

Photo by USFWS/Tom Kogutus (CC BY 2.0)

Adaptive Capacity Factors

▲ High physical and topographical diversity

▲ Large areas of undeveloped/roadless land increase connectivity

▼ Many habitats & populations degraded

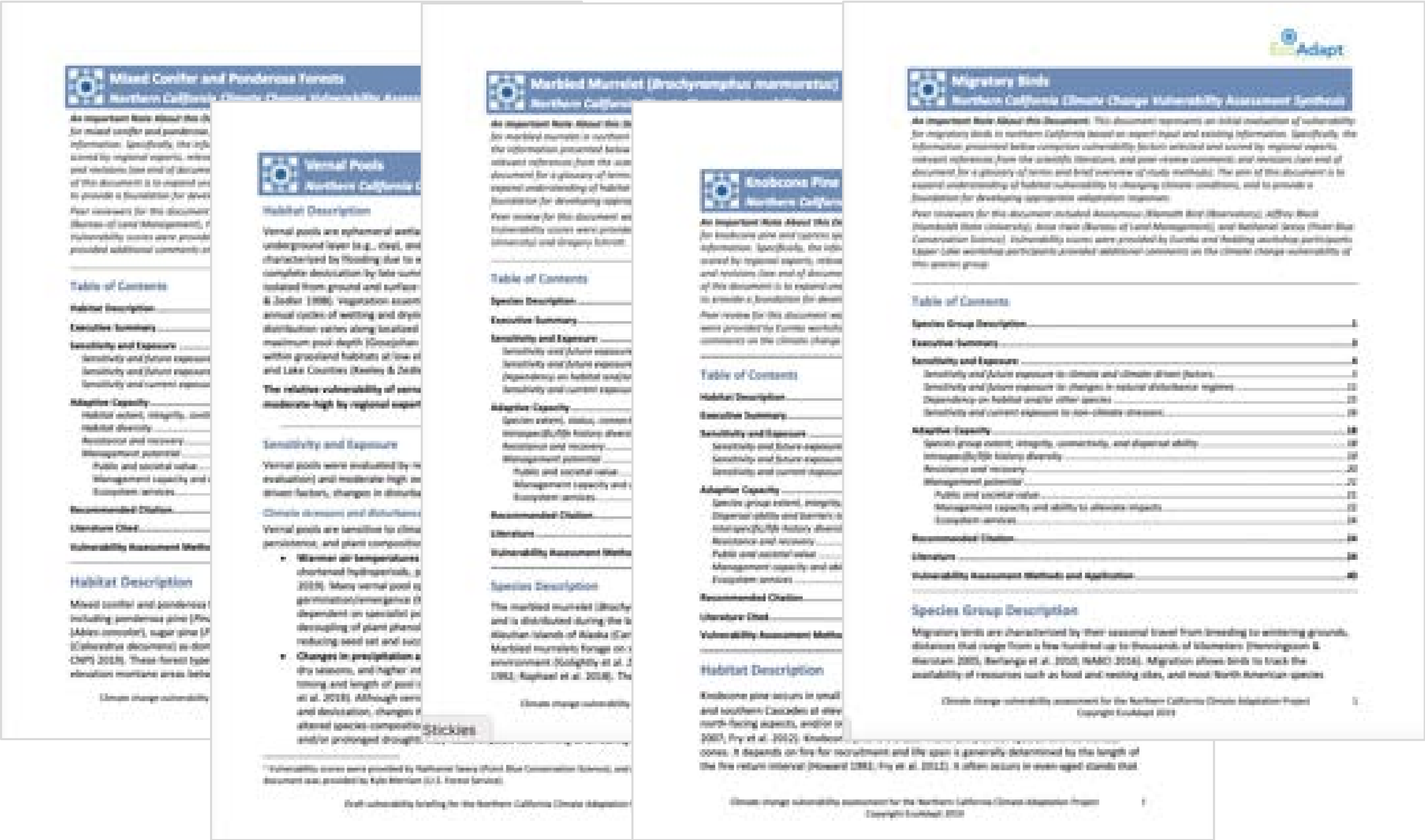
▼ Past management activities

▼ Low to mod management capacity & ability

Vulnerability Assessment Products

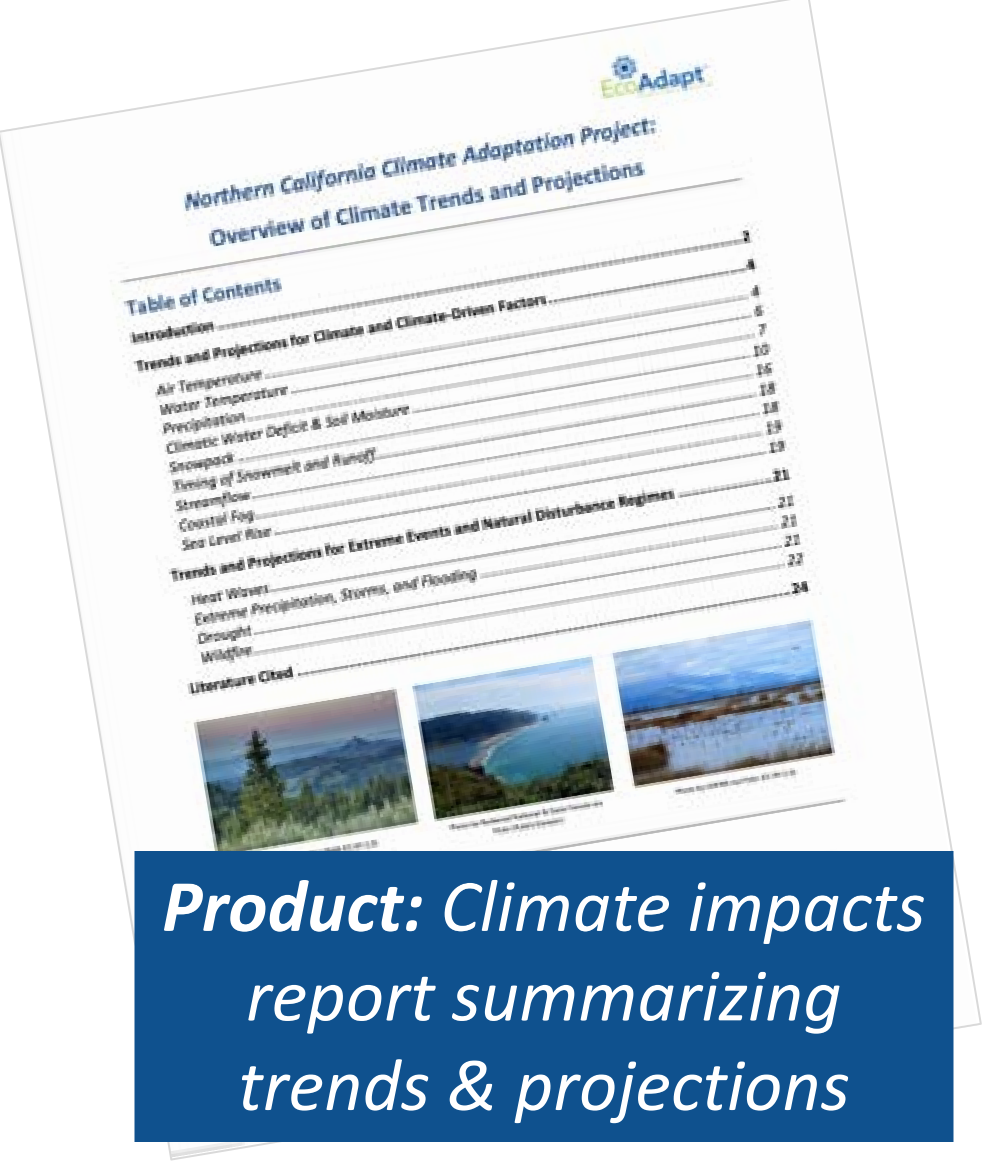

Photo by USFWS via Flickr (Public Domain)

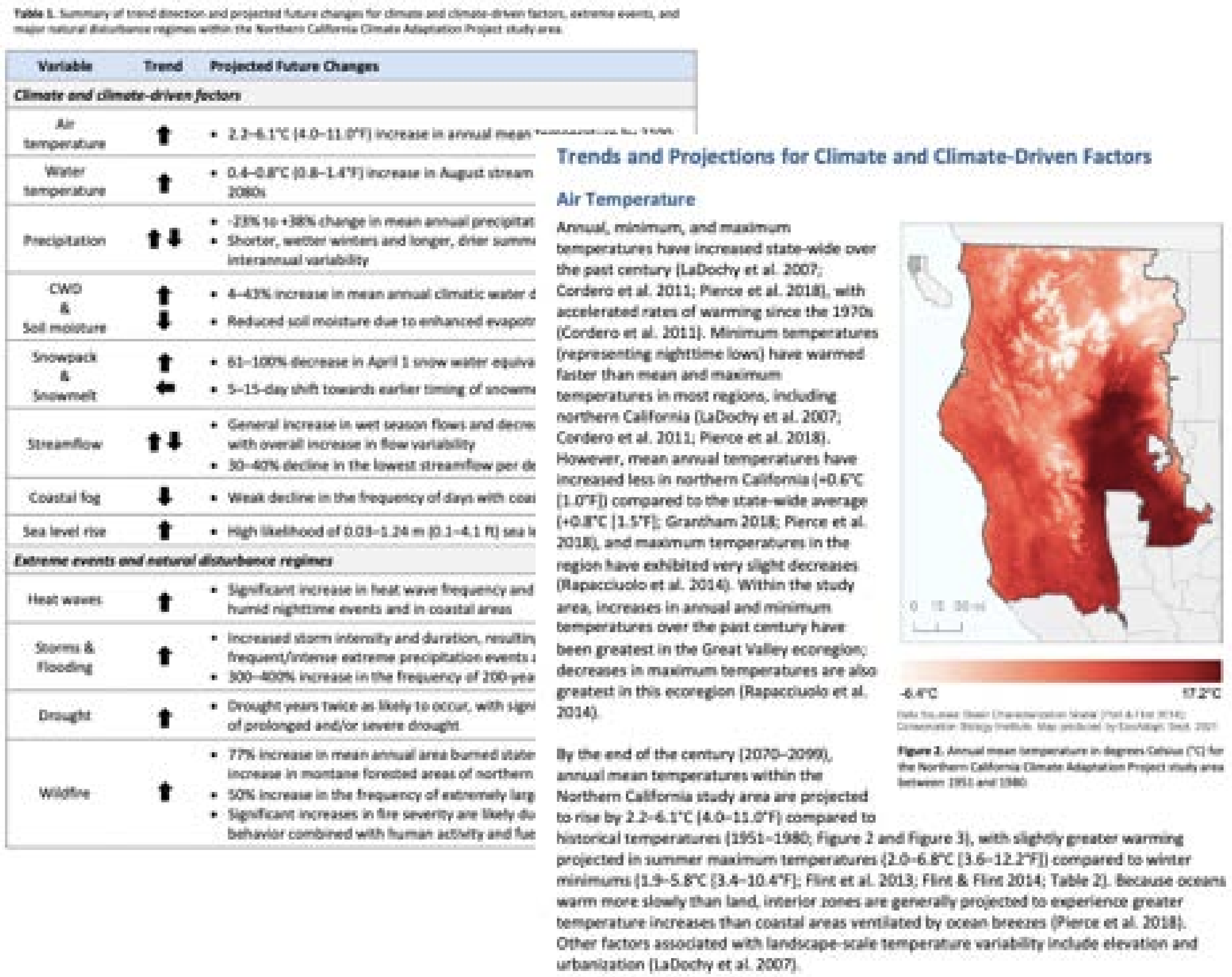
- Expert assessment
- Downscaled climate projections
- Review of scientific literature
- Peer review and evaluation of results



Product: *Vulnerability assessment syntheses for 33 focal resources*

Regional Climate Impacts

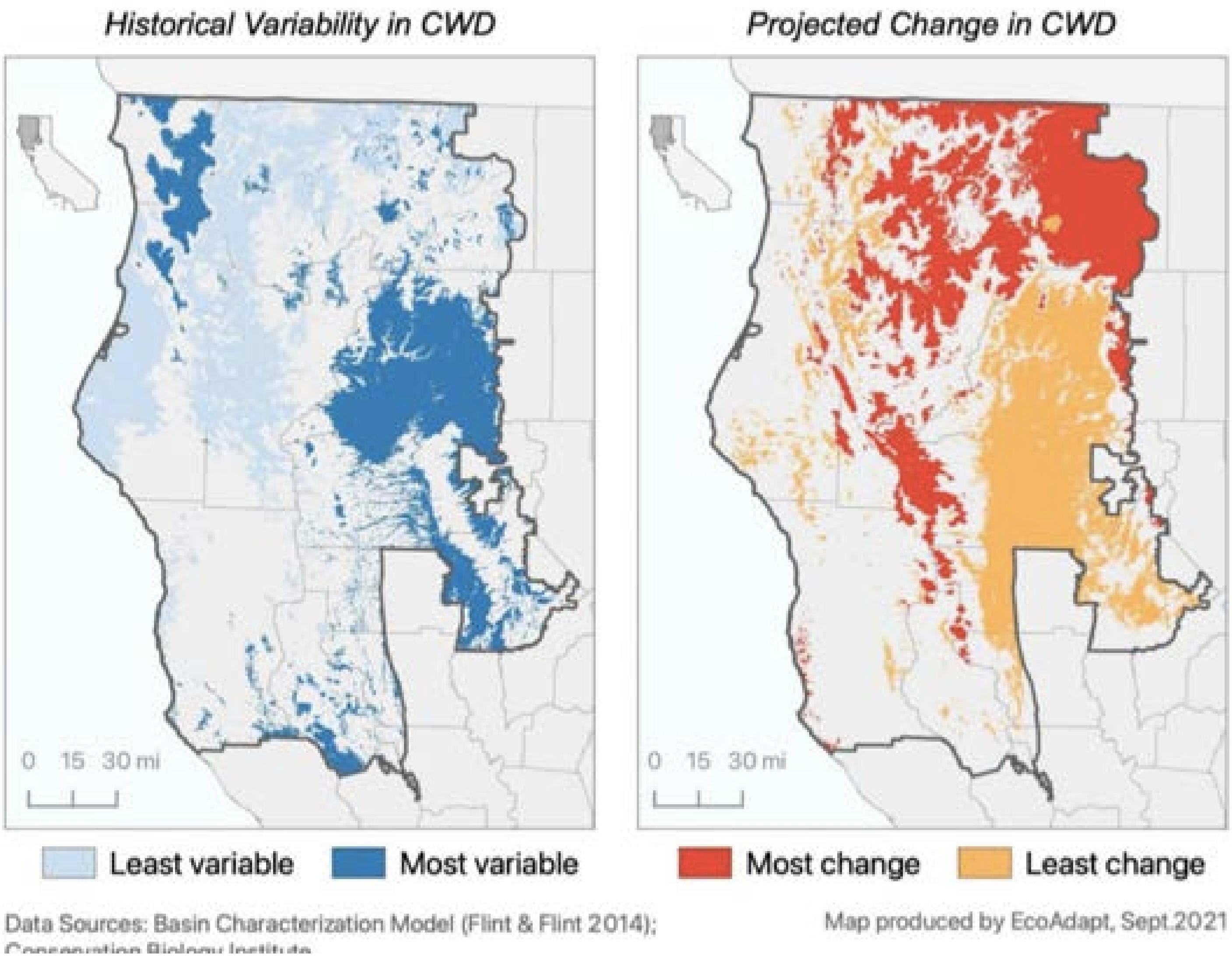




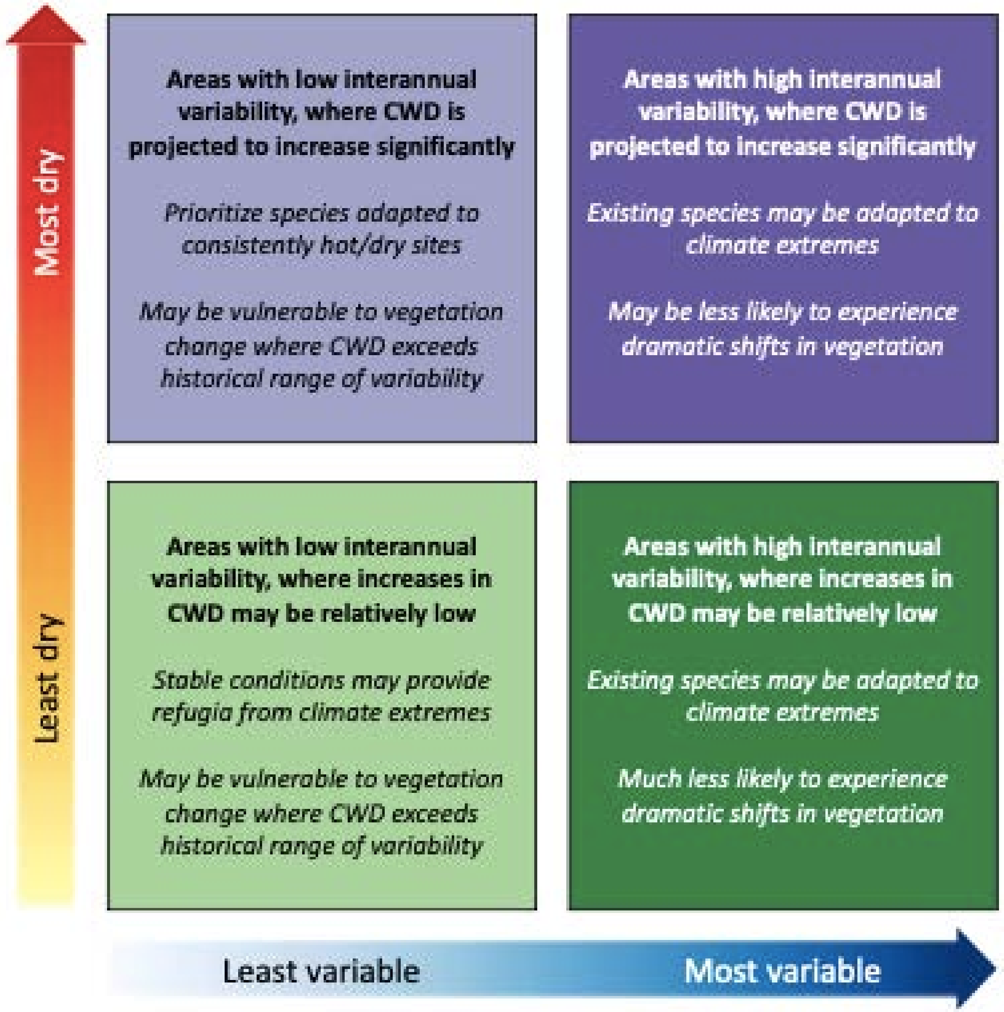
Product: *Climate impacts report summarizing trends & projections*

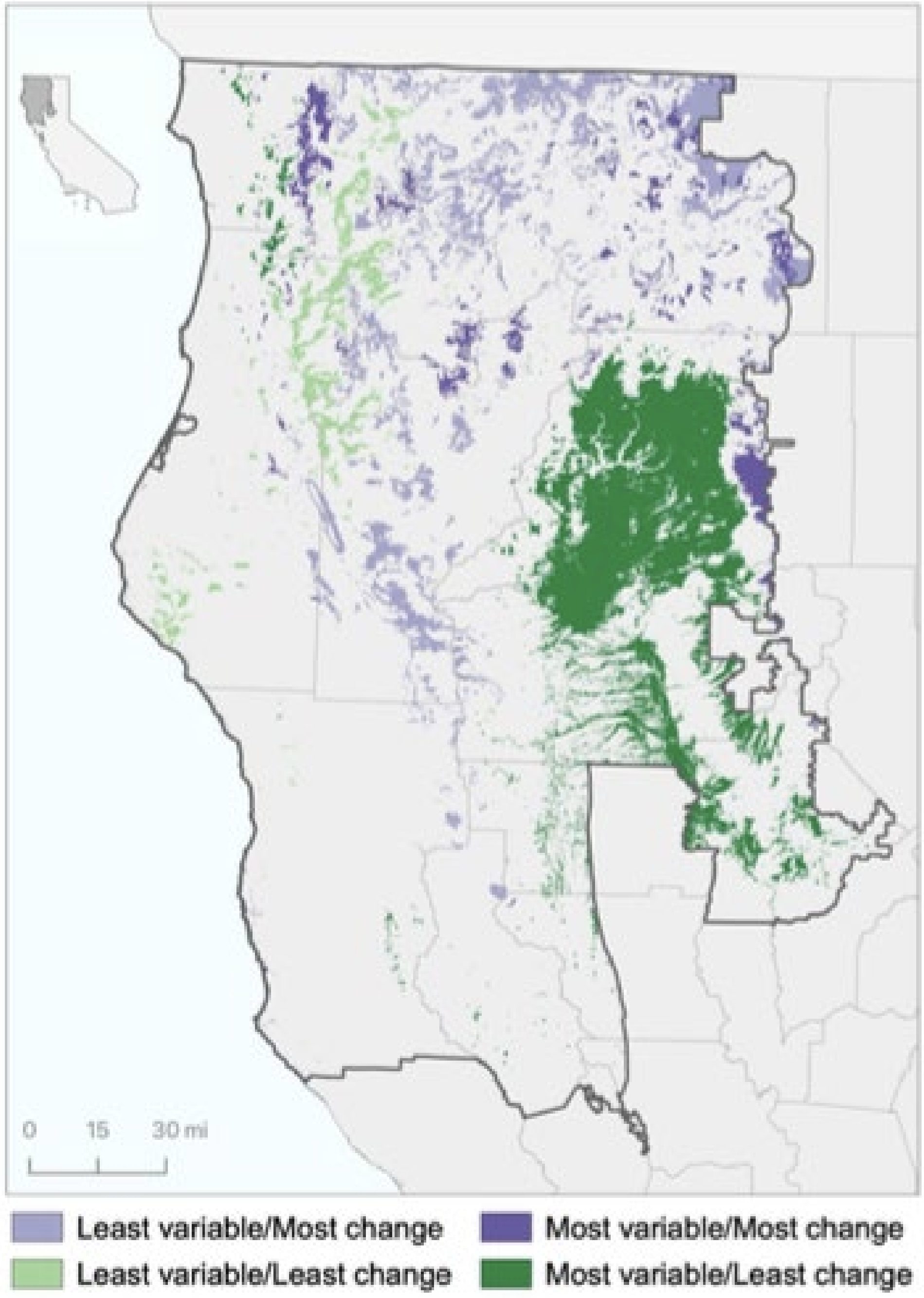
Climatic Water Deficit Maps

Some areas of the landscape may be more vulnerable to significant ecosystem changes



Climatic Water Deficit Maps



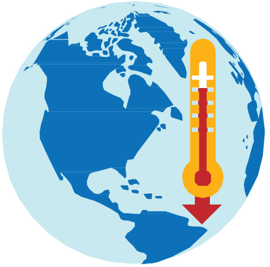


Data Sources: Basin Characterization Model (Flint & Flint 2014); Conservation Biology Institute
Map produced by EcoAdapt, Sept.2021

Climate Change Adaptation

Climate change adaptation refers to adjustments in natural or human systems in response to changing climate conditions

ADAPTATION STRATEGIES:



Reduce climate impacts
(sensitivity & exposure)

Increase climate resilience
(adaptive capacity)

Reduce climate change vulnerability

Adaptation Approaches

Resistance/Resilience

Focused on managing for persistence of existing ecosystems

Example: Use exclusion fencing in upland areas to prevent herbivory of oak seedlings

Acceptance

Focused on accommodating change in response to novel conditions

Example: Identify areas where post-fire type conversion should be allowed to occur without management intervention

Direct/Response

Focused on actively facilitating change/ transformation in response to novel conditions

Example: Experiment with seeds from climate analog zones for restoration projects

Knowledge

Focused on gathering information about climate impacts and/or management effectiveness

Example: Expand research on hardwood silviculture techniques, esp. for drought- and heat-tolerant species

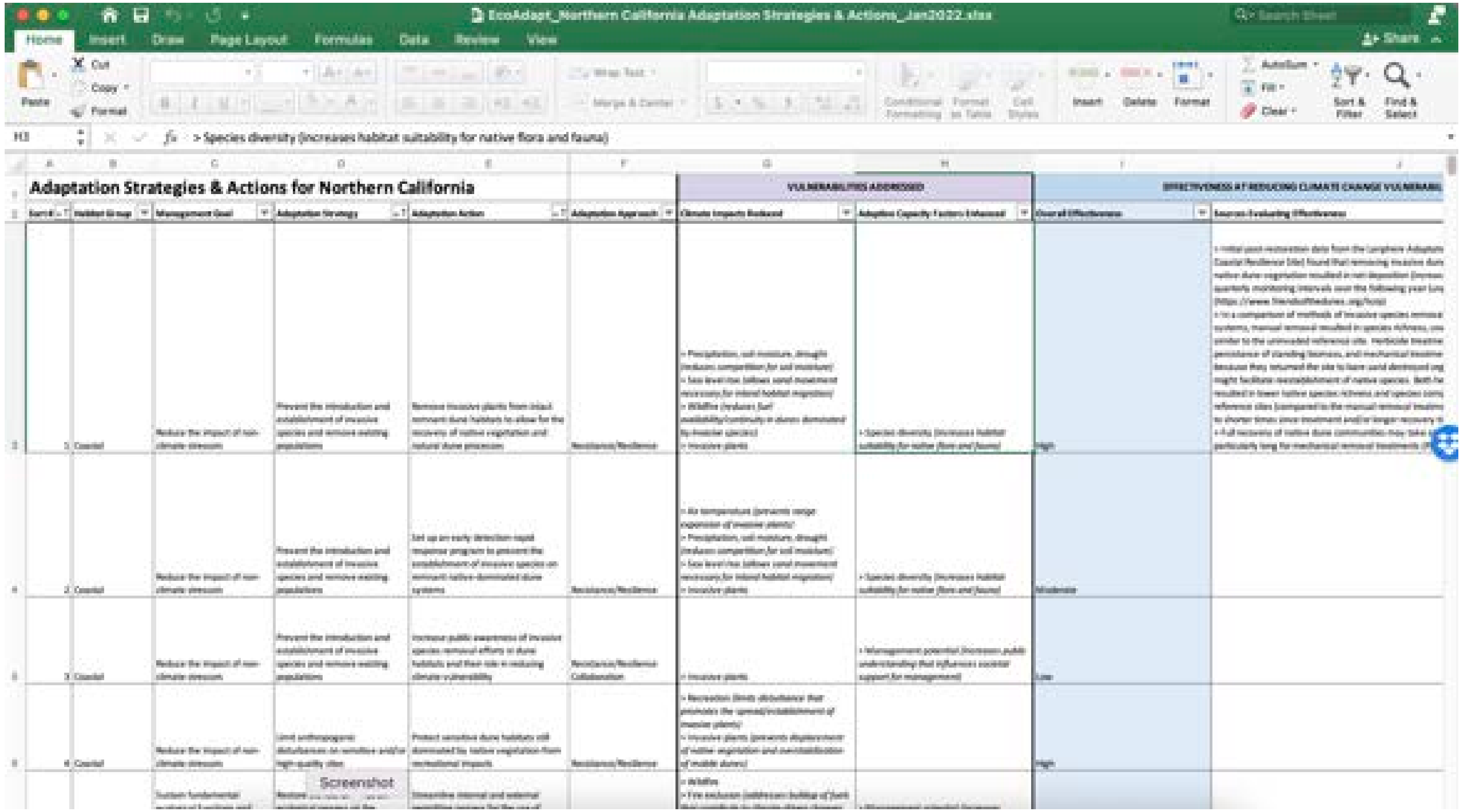
Collaboration

Focused on coordinating management efforts and/or capacity across organizations

Example: Develop and/or strengthen new and existing collaborative networks in order to leverage resources

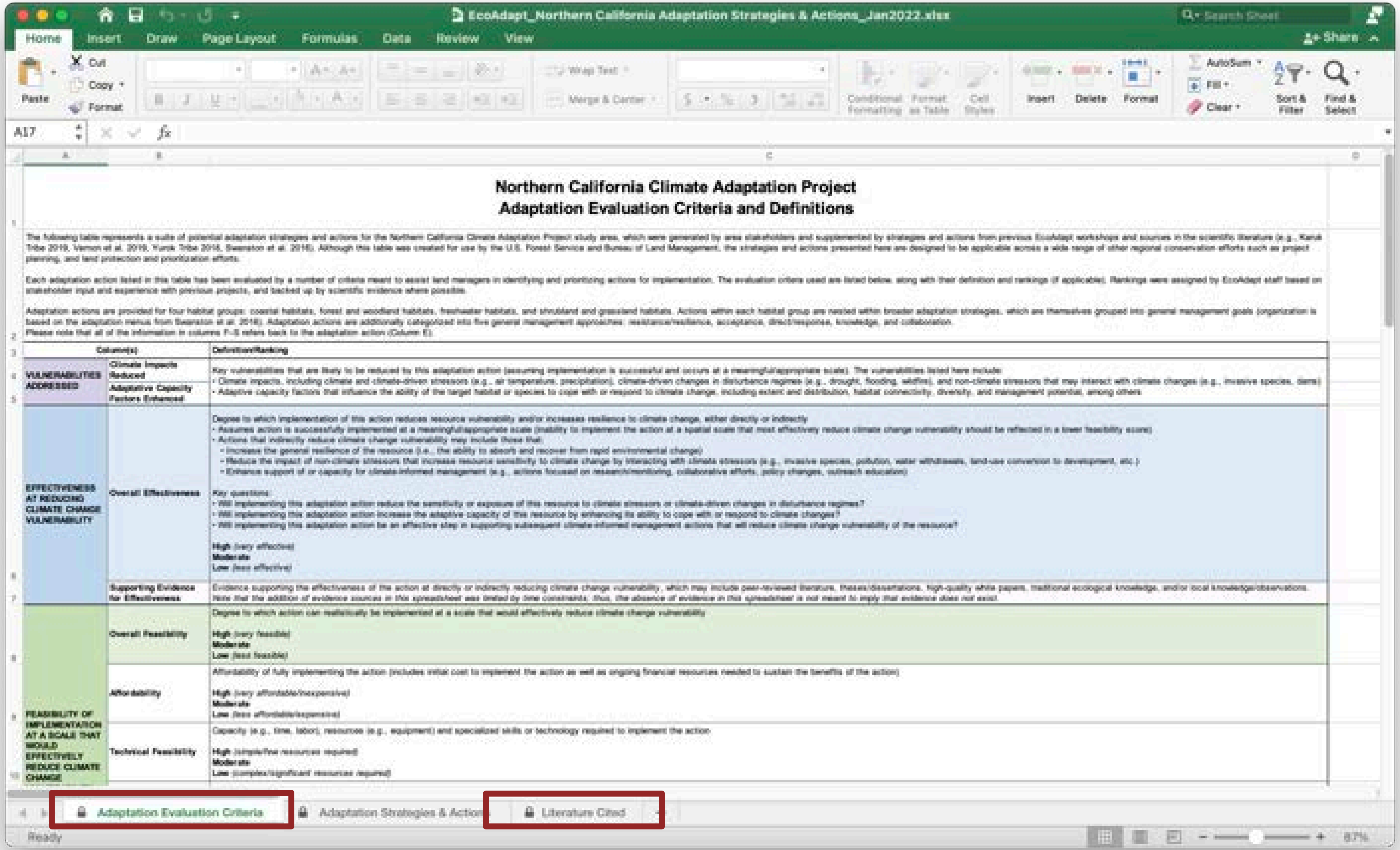
Adaptation Strategies & Actions

Product: *Suite of adaptation strategies and actions evaluated by criteria meant to assist land managers in identifying and prioritizing actions for implementation*

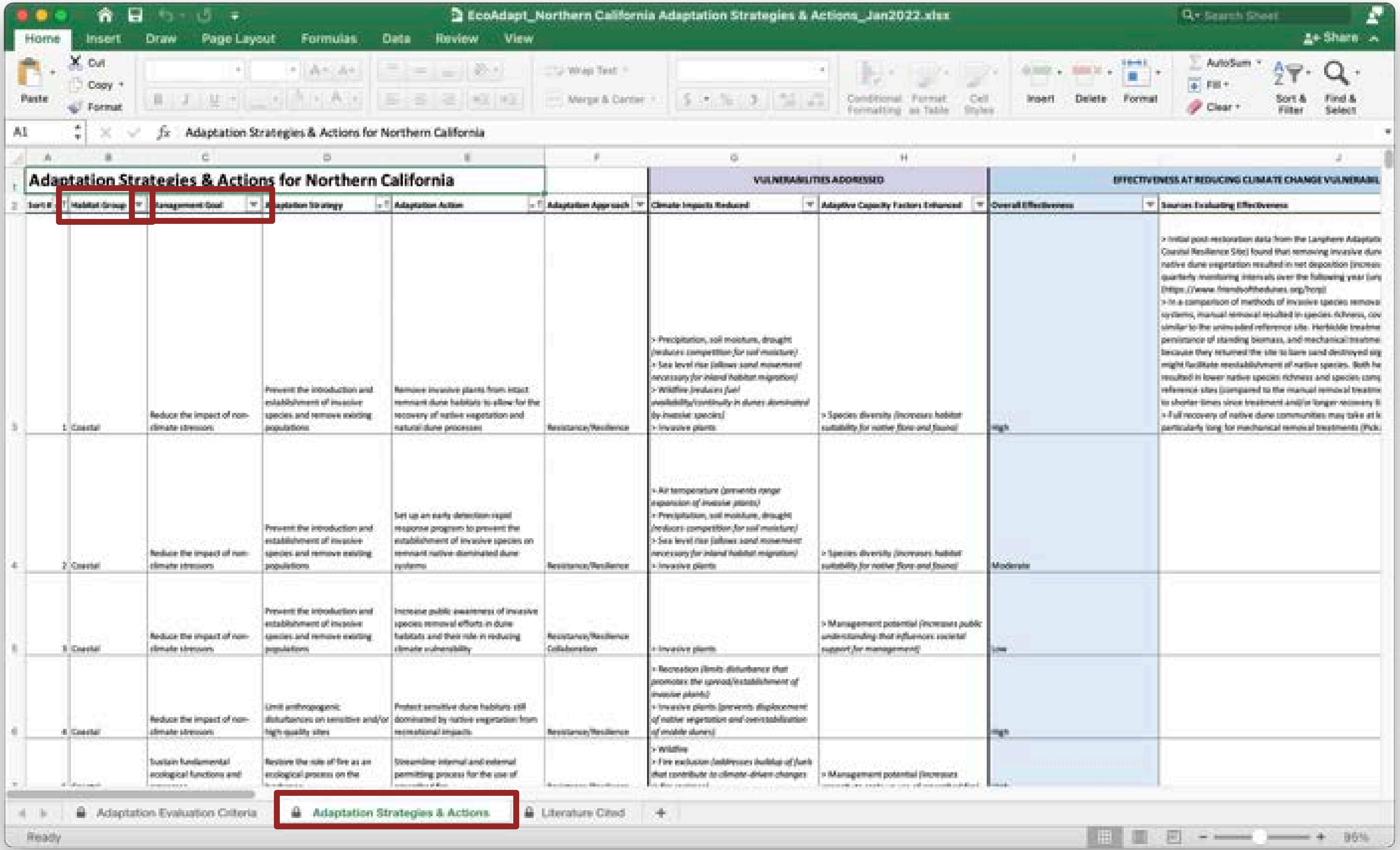


- Effectiveness
- Feasibility
- Co-Benefits & Consequences

Adaptation Strategies & Actions



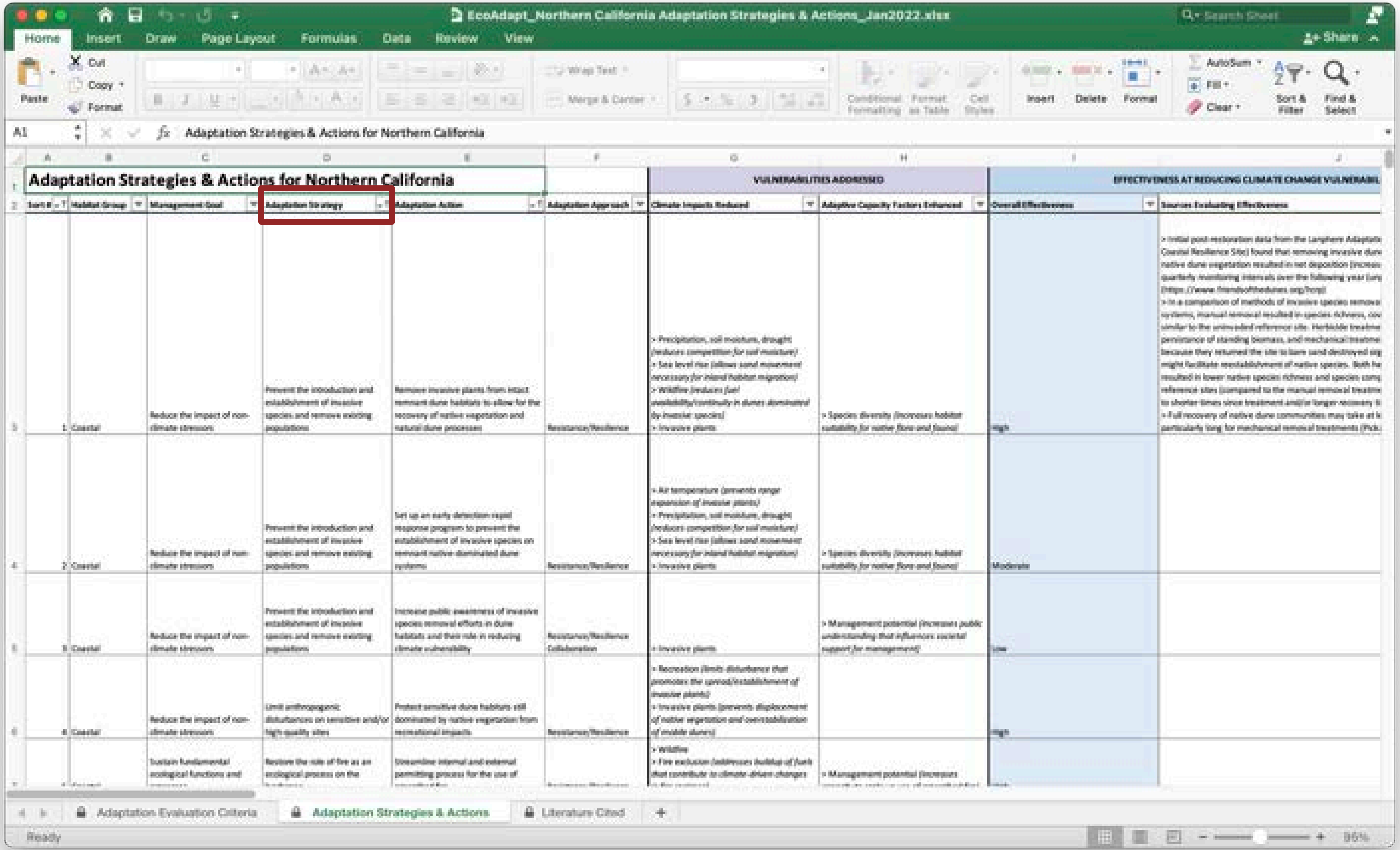
Adaptation Strategies & Actions



Management Goal

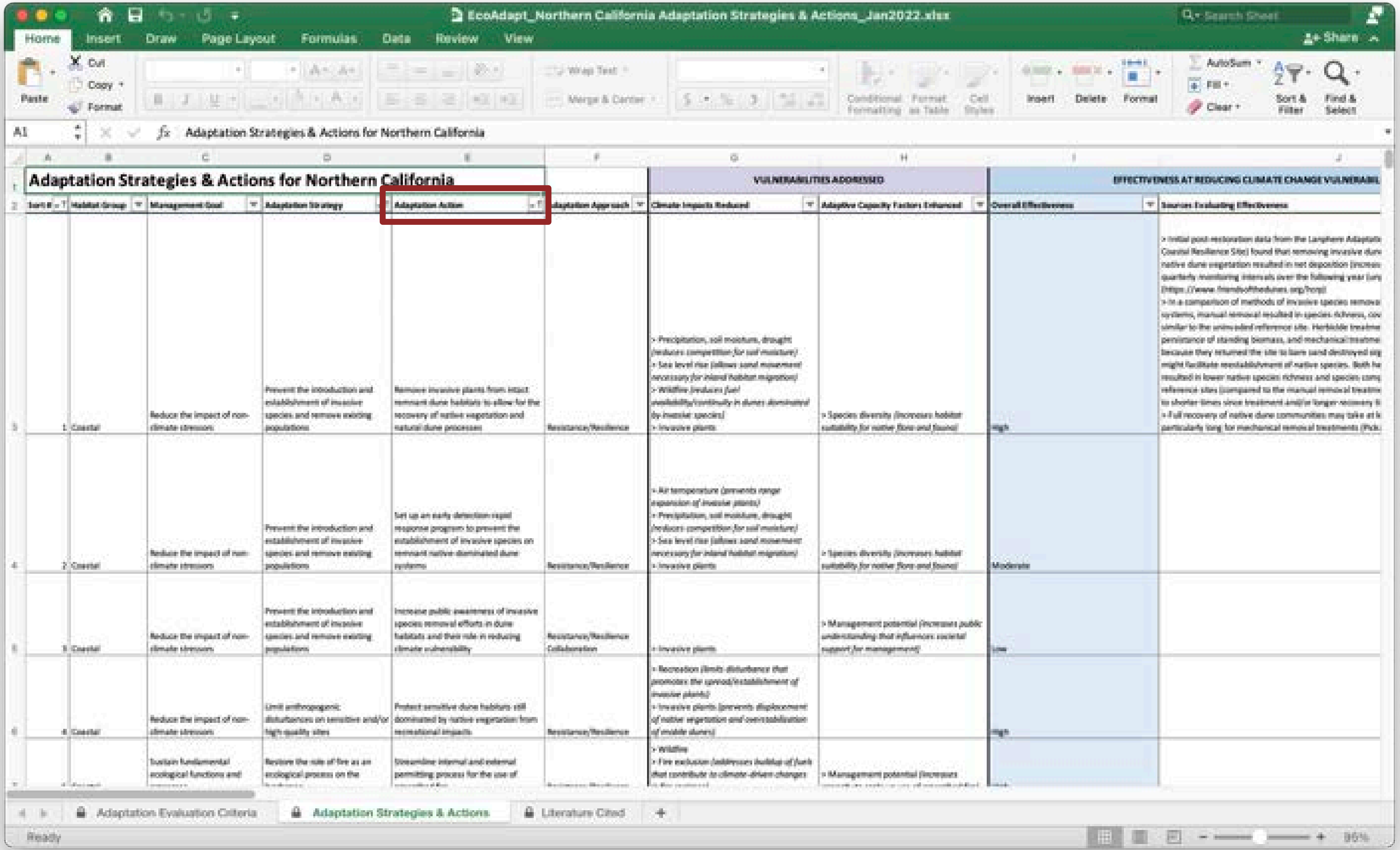
- Reduce the impact of non-climate stressors
- Reduce the risk/impacts of severe disturbances and extreme events
- Sustain ecological functions/processes
- Maintain and protect refugia
- Allow/facilitate habitat and species adjustments to better align with changing climate conditions

Adaptation Strategies & Actions



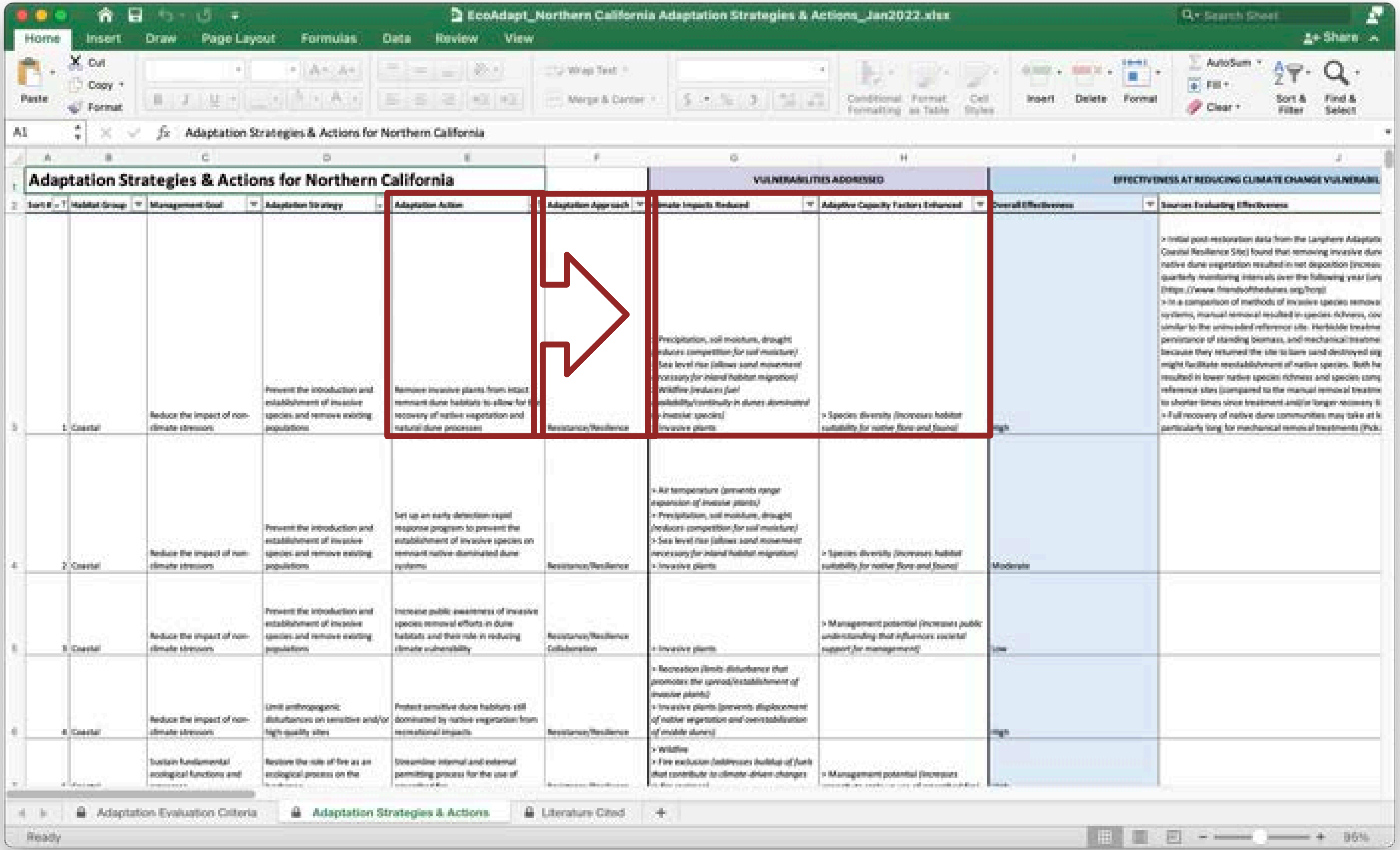
- Prevent the introduction & establishment of invasive species
- Restore the role of fire as an ecological process on the landscape
- Maintain/create migration corridors for native plants/wildlife

Adaptation Strategies & Actions



- Remove invasive plants from intact remnant dune habitats to allow for the recovery of native vegetation and natural dune processes

Adaptation Strategies & Actions



- Remove invasive plants from intact remnant dune habitats to allow for the recovery of native vegetation and natural dune processes

Adaptation Strategies & Actions

E	I	J	K	L
alifornia	EFFECTIVENESS AT REDUCING CLIMATE CHANGE VULNERABILITY			FEASIBILITY OF IMPLEMENTATI
Adaptation Action	Overall Effectiveness	Sources Evaluating Effectiveness	Overall Feasibility	Affordability
Remove invasive plants from intact remnant dune habitats to allow for the recovery of native vegetation and natural dune processes	High	> Initial post-restoration data from the Lanphere Adaptation Site (part of the Humboldt Coastal Resilience Site) found that removing invasive dune grasses followed by planting native dune vegetation resulted in net deposition (increased foredune volume) during all quarterly monitoring intervals over the following year (unpublished, but see progress report (https://www.friendsofthedunes.org/hcrp) > In a comparison of methods of invasive species removal in 3 northern California dune systems, manual removal resulted in species richness, cover, and composition that was most similar to the uninvaded reference site. Herbicide treatments resulted in higher cover to the persistance of standing biomass, and mechanical treatments resulted in lower cover, likely because they returned the site to bare sand destroyed organic matter and soil biota that might facilitate reestablishment of native species. Both herbicide and mechanical treatments resulted in lower native species richness and species composition that was less similar to the reference sites (compared to the manual removal treatments), though this may be partly due to shorter times since treatment and/or longer recovery times necessary (Pickart et al. 2021) > Full recovery of native dune communities may take at least to 20 years, and is likely to be particularly long for mechanical removal treatments (Pickart et al. 2021)	Moderate	Moderate > Eradication requires ongoing inves over multiple years > Cost varies by method of removal manual removal is very expensive, mechanical removal is less so, and herbicide or a combination of burnin herbicide is relatively inexpensive (F et al. 2021)

Will implementing this adaptation action reduce climate change vulnerability?

- Directly reducing impacts of climate stressors or climate-driven changes in disturbance regimes
- Reducing impacts of non-climate stressors that interact with climate changes
- Increasing general resilience of the resource (e.g., ability to absorb/recover from rapid change)
- Enhancing support/capacity for climate-informed management

Adaptation Strategies & Actions

E	K	L	M	N	O
alifornia	FEASIBILITY OF IMPLEMENTATION AT A SCALE THAT WOULD EFFECTIVELY REDUCE CLIMATE CHANGE VULNERABILITY				
Adaptation Action	Overall Feasibility	Affordability	Technical Feasibility	Institutional/Legal Feasibility	Sociopolitical Support
Remove invasive plants from intact remnant dune habitats to allow for the recovery of native vegetation and natural dune processes	Moderate	Moderate > Eradication requires ongoing investment over multiple years > Cost varies by method of removal - manual removal is very expensive, mechanical removal is less so, and herbicide or a combination of burning and herbicide is relatively inexpensive (Pickart et al. 2021)	Moderate > Treatments often must be repeated for full eradication to occur > Manual removal is very labor-intensive and difficult because of the deep rhizome systems of invasive dune grasses; there are also logistical challenges related to the need to repeatedly access remote sites for retreatment (Pickart et al. 2021) > Mechanical removal with bulldozers and excavators is less labor-intensive and less logistically challenging, making it more feasible to treat larger areas (Pickart et al. 2021)	Moderate > Many of the remaining degraded dune areas are owned privately or by local agencies, who generally do not implement large-scale restoration projects	Moderate > Possible conflict if the public (including adjacent landowners) believes that dune stabilization by invasive species is necessary to prevent erosion and reduce flooding risk

How feasible is it to implement this action at a scale that would reduce vulnerability?

- **Affordability** – Initial and ongoing costs associated with implementing the action & maintaining benefits of the action
- **Technical Feasibility** – Time/labor, equipment, specialized technology/skills, other resources needed to implement the action

Adaptation Strategies & Actions

E	K	L	M	N	O
alifornia	FEASIBILITY OF IMPLEMENTATION AT A SCALE THAT WOULD EFFECTIVELY REDUCE CLIMATE CHANGE VULNERABILITY				
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How feasible is it to implement this action at a scale that would reduce vulnerability?

- **Institutional/Legal Feasibility** – Regulatory/administrative requirements, policy conflicts, potential legal challenges that may impact ability to implement the action
- **Sociopolitical Support** – Public and/or political backing for implementation of the action

Adaptation Strategies & Actions

E	P	Q	R	
alifornia		CO-BENEFITS & CONSEQUENCES		
Adaptation Action	Impacts on Non-Target Habitats and Species	Impacts on Human Well-being	Impacts on Climate Mitigation Efforts	Where/When/How
Remove invasive plants from intact remnant dune habitats to allow for the recovery of native vegetation and natural dune processes	(+) Threatened/endangered plant and wildlife species, including migratory shorebirds (+) Pollinators (attracted by increased diversity of native flora) (-) Amphibians (frequently occupy coastal dune drainages in northern California where invasive plants have overstabilized the dunes; Halstead & Kleeman 2017)	(+) Flood protection (if dunes are able to persist by migrating inland) (+) Recreation (+) Aesthetic values/beauty (increased native flora includes colorful wildflowers that attract pollinators such as butterflies) (-) Recreation (recovery of threatened/endangered species might result in reduced availability of land for public use, at least in some areas and/or seasons)	(-) Reduces overall vegetative cover on dunes that were stabilized and become more mobile	> Prioritize higher-elevation areas away fr erosion increases > Depending on site-specific characteristic invasive species > Periodic re-treatment will likely be requi

Are there co-benefits or potential conflicts/unintended consequences of the action?

- **Impacts on non-target habitats, species, and/or ecosystem services**
- **Impacts on human well-being** – Food security, water supplies/quality, air quality, flood control, health/safety, recreation, economic opportunities (e.g., jobs), cultural well-being (e.g., availability of valued species, ability to maintain traditional practices, tribal sovereignty), sense of place, beauty

Adaptation Strategies & Actions

E	P	Q	R	
alifornia	CO-BENEFITS & CONSEQUENCES			
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Are there co-benefits or potential conflicts/unintended consequences of the action?

- **Impacts on climate mitigation efforts** – Greenhouse gas emissions, rate of carbon sequestration, carbon stocks

Adaptation Strategies & Actions

E	S	T	U	V	W	X
:alifornia	IMPLEMENTATION DETAILS					
Adaptation Action	Where/When/How					
Remove invasive plants from intact remnant dune habitats to allow for the recovery of native vegetation and natural dune processes	> Prioritize higher-elevation areas away from bluff edges and other locations more likely to persist as sea levels rise and erosion increases > Depending on site-specific characteristics, use hand-pulling, mechanical removal, or prescribed pile burning to remove invasive species > Periodic re-treatment will likely be required in an ongoing way					

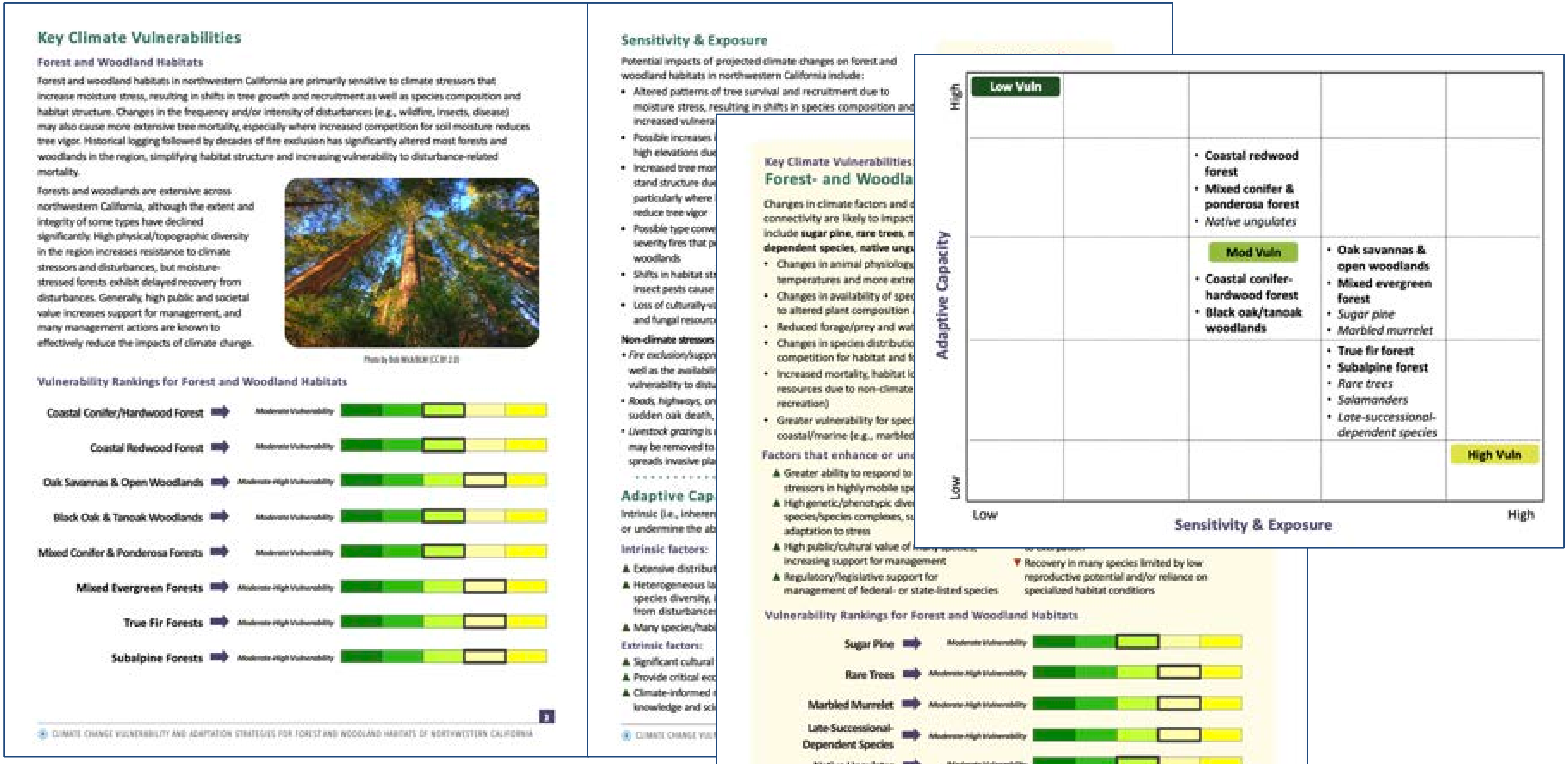
Where, when, and how should this action be implemented?

Vulnerability-Adaptation Summaries

***Product:** Vulnerability-adaptation summaries linking suite of adaptation strategies & actions to identified vulnerabilities*

- Summary of key habitat and species vulnerabilities
- Table linking suite of adaptation strategies & actions to identified vulnerabilities

Vulnerability-Adaptation Summaries



Vulnerability-Adaptation Summaries

GOAL 1. REDUCE THE IMPACT OF NON-CLIMATE STRESSORS

1.1 Prevent the introduction and establishment of invasive species and remove existing populations

1.2 M

1.3 Re

1.4 Re

GOAL

2.1 U

2.2 Er

GOAL

3.1 Re

3.2 Re

3.3 Re

GOAL

4.1 In

GOAL 8. MAINTAIN AND PROTECT REFUGIA

8.1 Prioritize and maintain sites that may be more resistant to changes in climate (e.g., cooler, wetter sites), harbor high biodiversity, and/or provide habitat for rare species

Example adaptation actions:

- Identify forest areas of least/slower change to support the protection and management of potential climate change refugia **(R/K)**
- Protect mature and late-successional forests **(R)**
- Expand reserve boundaries to include mid-seral and complex early-seral forests that have high structural diversity and the potential to develop old-growth characteristics over time **(R)**

Vulnerabilities addressed:

✔ Land-use conversion and human land uses that result in habitat loss and fragmentation

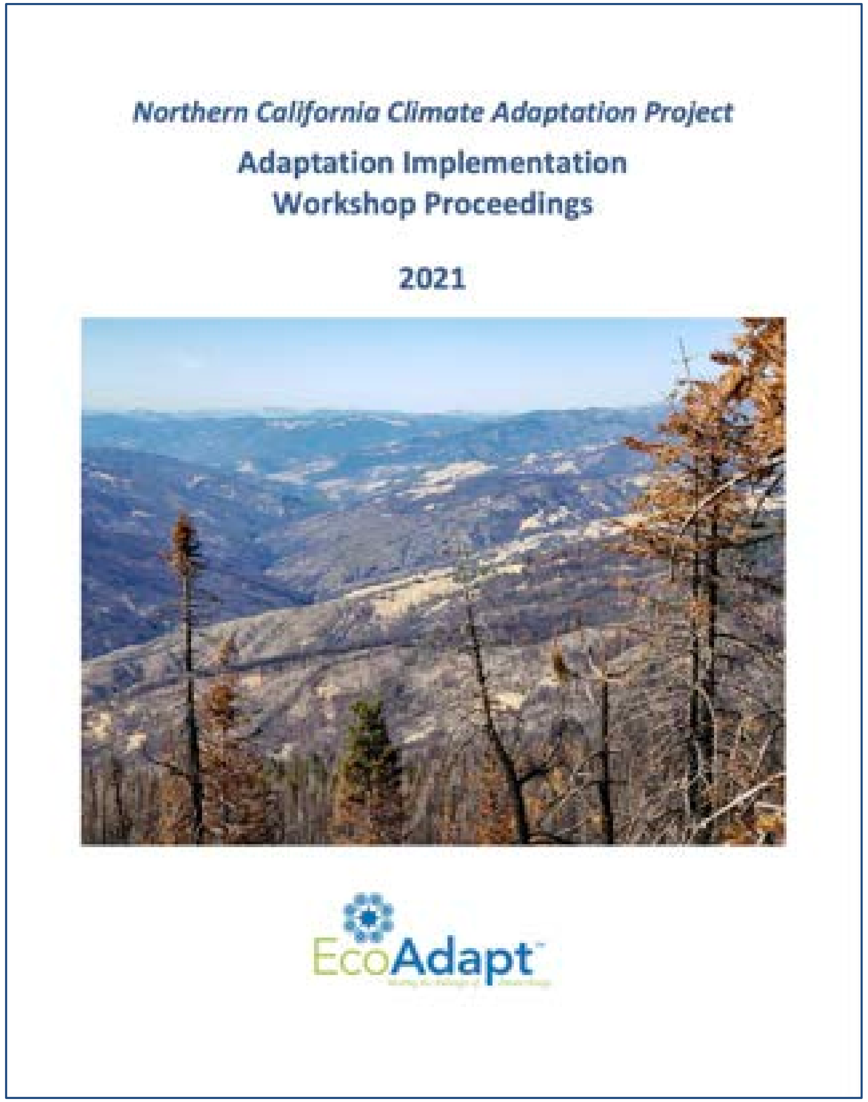
✔ Air temperature, precipitation, soil moisture, drought, wildfire *(loss of cool, moist refugia in mature and late-successional forests)*

✔ Habitat diversity *(loss of structural complexity and range of successional stages)*

Adaptation Implementation Workshop Proceedings

Product: *Proceedings from November 2021 Adaptation Implementation Workshops*

- Overview of climate adaptation planning
- Description of workshop activities
- Review of priority sites selected for implementation planning
- Adaptation implementation plans created by workshop participants for 6 priority sites in the northwestern California study area



Priority Site Selection

Site Name	Value	Condition	Suitability	Adaptation Approach
Rancho Breisgau riparian oak woodland	High	Poor	Suitable	Resistance/Resilience
Plaskett-Keller Post-Fire Restoration Site, Mendocino National Forest	High	Poor	Suitable	Resistance/Resilience
East Fork Scott River meadow/floodplain complex	High	Moderate to Poor	Probably unsuitable	Resistance/Resilience Direct/Respond Acceptance
North Spit Humboldt Bay	High	Moderate	Suitable	Resistance/Resilience
Black oak and tanoak stands on Yurok tribal lands	High	Poor	Suitable	Resistance/Resilience
Indian Creek watershed of the Mid-Klamath	High	Poor	Uncertain	Resistance/Resilience Direct/Respond Acceptance

Adaptation Implementation Plans

Adaptation Implementation Plan for Plaskett-Keller Post-Fire Restoration Site, Mendocino National Forest

SECTION 1. BACKGROUND

PROJECT SITE: Plaskett-Keller Post-Fire Restoration Site, Mendocino National Forest			
Value: High	**Current Condition:** Poor	**Future Suitability:** Suitable	**Potential Approach:** Resistance/Resilience
Overarching management goal: Manage fuels to reduce future wildfire risk in shrublands (and preserve connectivity of shrublands with forest), post-fire restoration, increase shrubland and hydrologic connectivity			
Key climate-related vulnerabilities to be addressed: • Extreme hydrologic events (e.g., atmospheric rivers) • More rain, less snow • Increased temperatures & climatic water deficit → more severe wildfire in the future o Altered watershed response – loss of soil productivity (loss of permeability), water moves offsite quicker • Decreased ability of landscape to support conifers (primarily driven by increased water stress)			
Potential barriers to meeting management goal: • Mixed ownership • Grazing represents a challenge for grassland health (invasive spp.) & fire recovery in general • Lack of resources (personnel, $$) • Potential concern from local tribes about management of the land (unknown at this time) • Conifer dominance in FS (cultural challenge) o Grasslands/Shrublands don't have the monetary/cultural backing that the conifers do			
Potential conflicts or unintended consequences with non-target ecosystems/species, human communities, and/or other management goals: • Potential impacts to the wild and scenic river corridor • Summer homes and camp ground in the project area – public use is a concern • FS likes to manage forest – grassland/shrubland are not a priority (not actively managed at this point			

The Black Butte River Valley in Mendocino National Forest, which was burned in the 2020 August Complex Fire. (Photo © Chad Roberts)

Products

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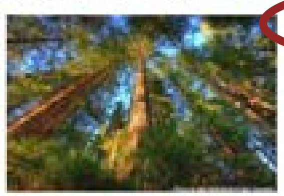
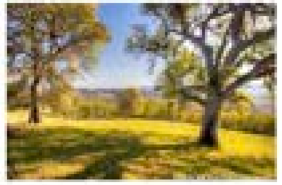




Northern California Climate Adaptation Products

The goal of the Northern California Climate Adaptation Project is to increase the understanding of and capacity to reduce climate-related vulnerabilities of habitats and species of natural and cultural importance in northwestern California. For more information about the project, please visit the project page.

Product Descriptions

The Overview of Climate Trends and Projections summarizes observed changes and expected future conditions for the Northern California Climate Adaptation Project study area.

The **Vulnerability/Adaptation Summaries** *(linked below)* provide a high-level overview of vulnerability for habitats and associated species within the four major habitat groups (coastal habitats, forest and woodland habitats, freshwater habitats, and shrubland and grassland habitats), as well as a table of adaptation strategies and actions linked to those vulnerabilities.

The **Vulnerability Assessment Syntheses** *(linked below)* provide an in-depth review of how habitats and species are likely to be impacted by climate change, and include information gathered from regional experts, the scientific literature, and peer-review comments and revisions. Each synthesis examines the sensitivity of a given habitat, species, or species group to climate change, its exposure to projected changes, and its capacity to adapt. The aim of these syntheses is to expand understanding of habitat and species vulnerability to changing climate conditions, and to provide a foundation for developing appropriate adaptation responses.

The Adaptation Strategies and Actions Table presents a suite of potential adaptation strategies and actions for the northern California study area, which were generated by area stakeholders and supplemented by strategies and actions from previous EcoAdapt workshops and sources in the scientific literature. Adaptation actions are provided for the four major habitat groups, and action listed in the table has been evaluated by a number of criteria meant to assist land managers in identifying and prioritizing actions for implementation (e.g., effectiveness, feasibility, potential co-benefits and consequences).

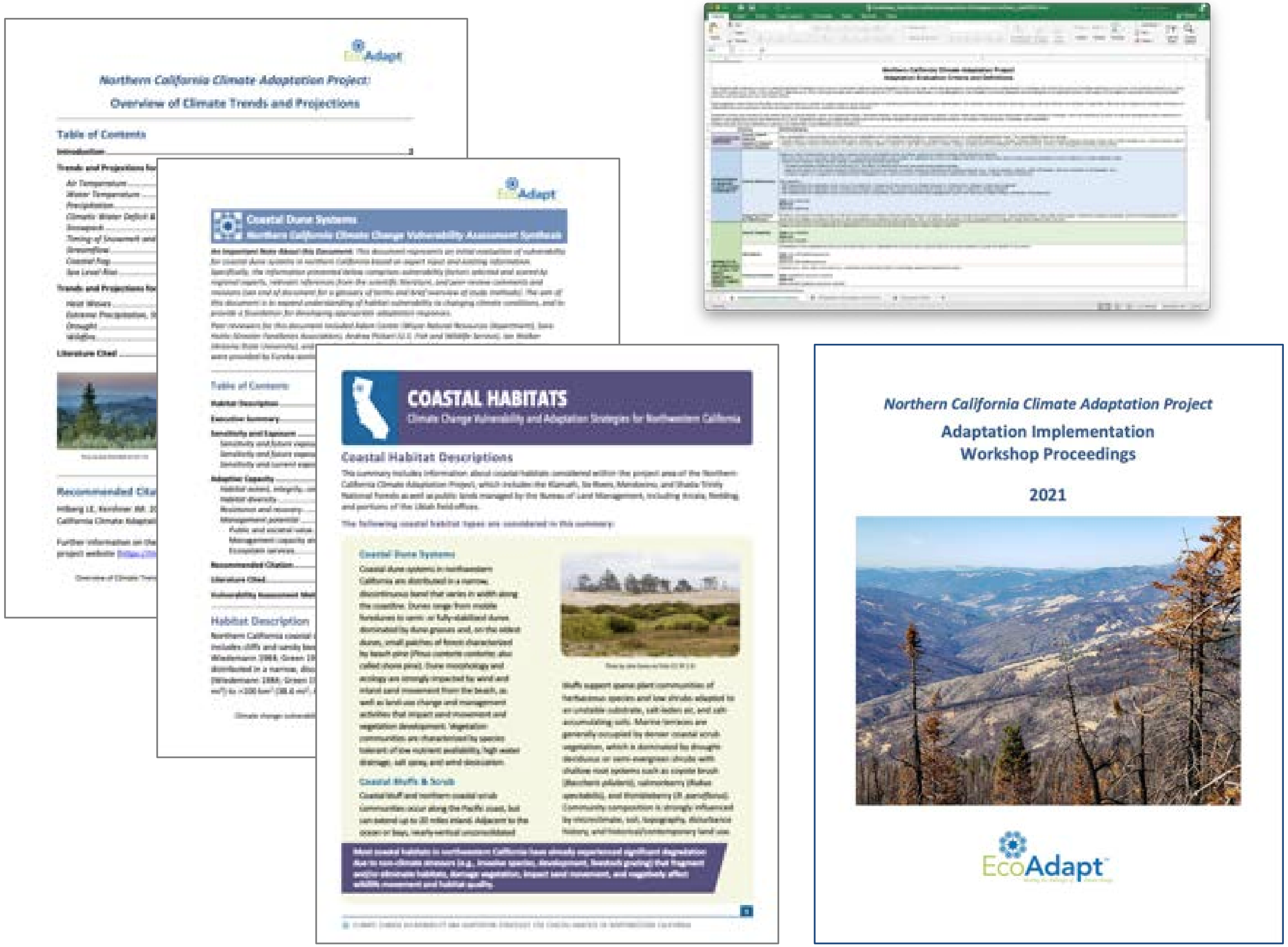
The Adaptation Implementation Workshop Proceedings summarize the activities and outcomes of the Northern California Adaptation Implementation Workshops held for the Redding and Eureka/Arcata regions in November 2021. The report includes an overview of climate adaptation planning and a description of the workshop activities, then presents adaptation implementation plans created by workshop participants for six priority sites within the northwestern California study area.

Coastal Habitats

Vulnerability/Adaptation Summary

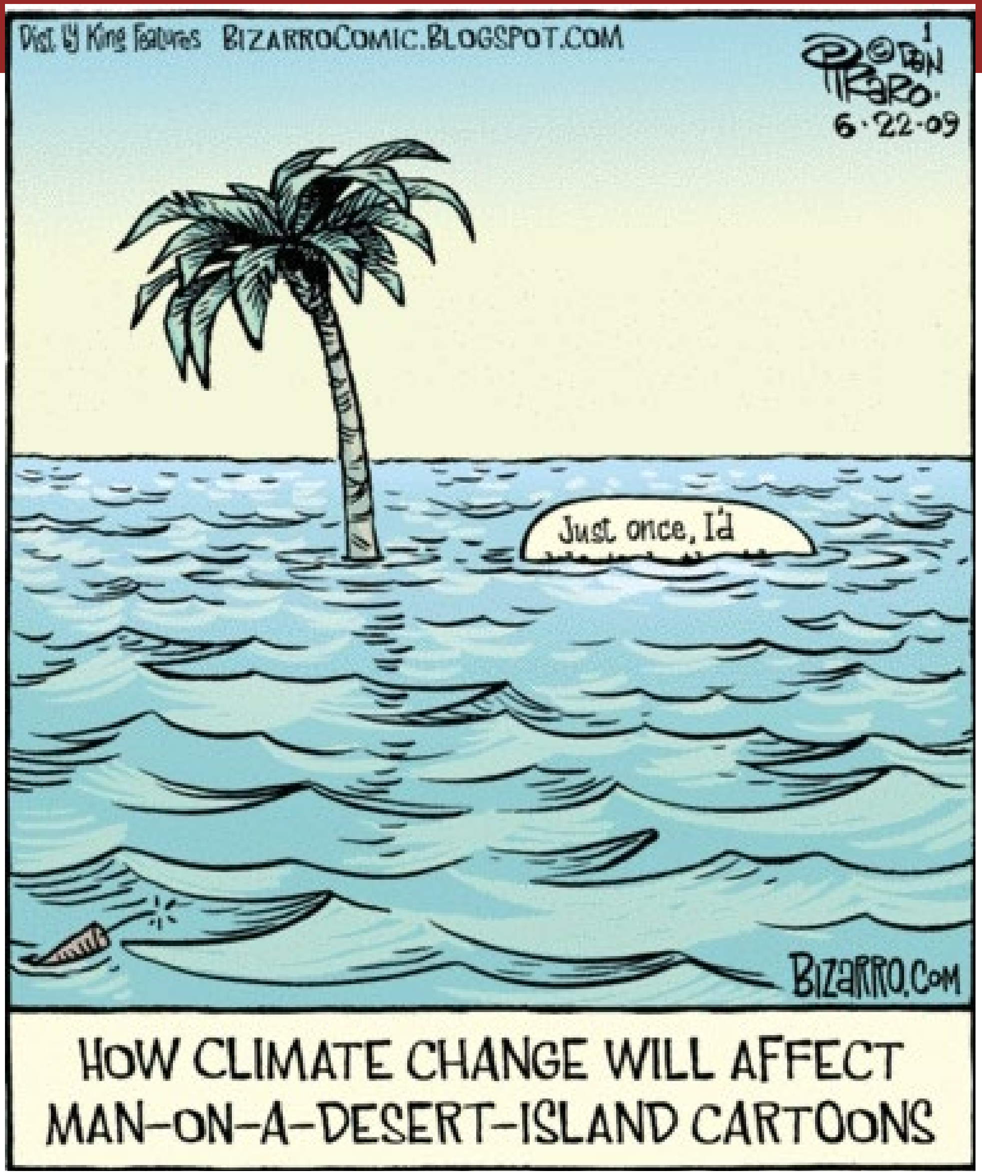
Vulnerability Assessment Syntheses

Habitats: Coastal Dune Systems
Coastal Bluffs & Scrub



https://tinyurl.com/NorCalAdaptationProducts

Questions?



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https://tinyurl.com/NorCalAdaptation


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Thank You!

Webinar recording will be sent to all registrants and posted online with the slides at https://tinyurl.com/NorCalAdaptation