

Climate Change Vulnerability Assessment for the Sierra Nevada

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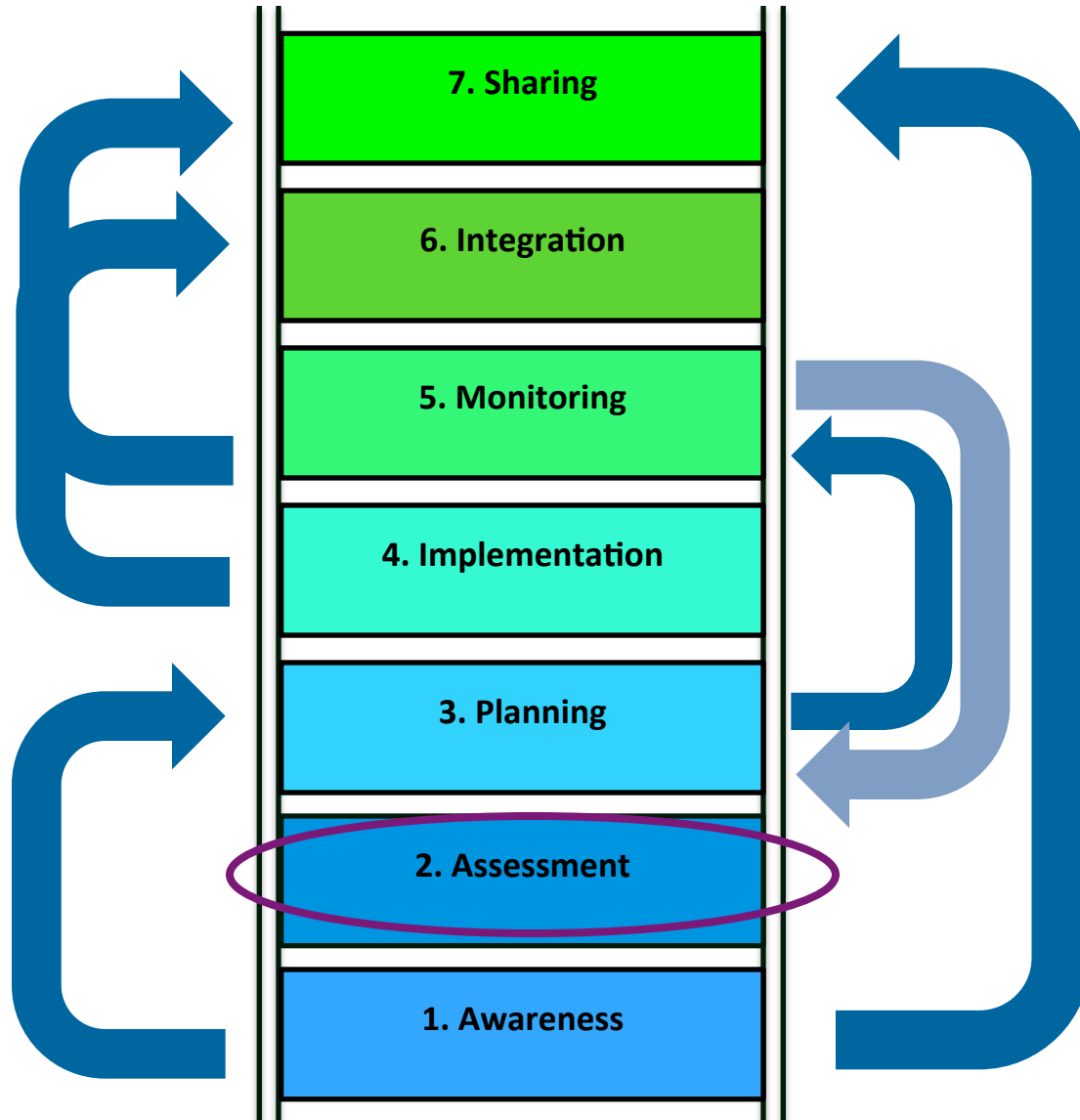


EcoAdapt

- 1. State of Adaptation Program**
finding out how people are fishing
- 2. Climate Adaptation Knowledge Exchange**
(CAKE; www.cakex.org)
connecting fishermen
- 3. Awareness to Action**
teaching others to fish
- 4. Adaptation Consultation**
fishing for you



Adaptation Ladder of Engagement



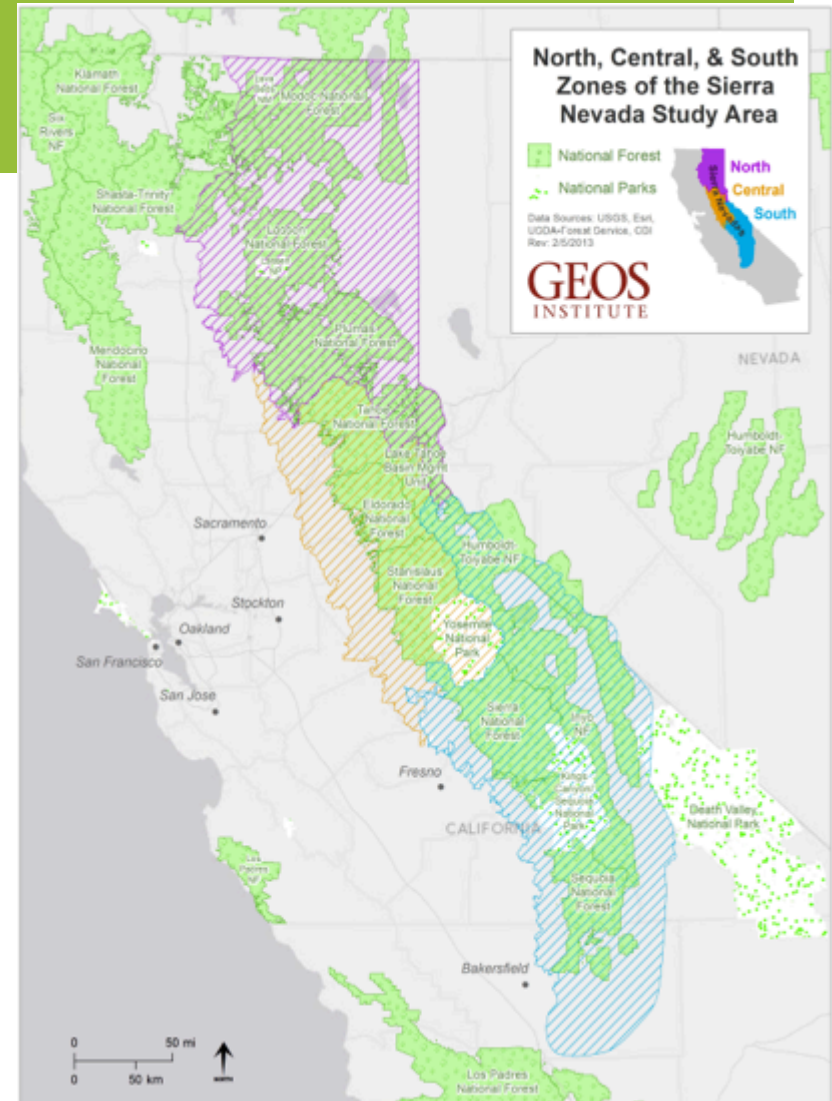
Outline

- A. Background and Need
- B. Components and Process
- C. Results
- D. Broader Impacts



Background

- “Early adopter” national forests in the Sierra Nevada
 - First to revise their land management plans



Project Need – USFS

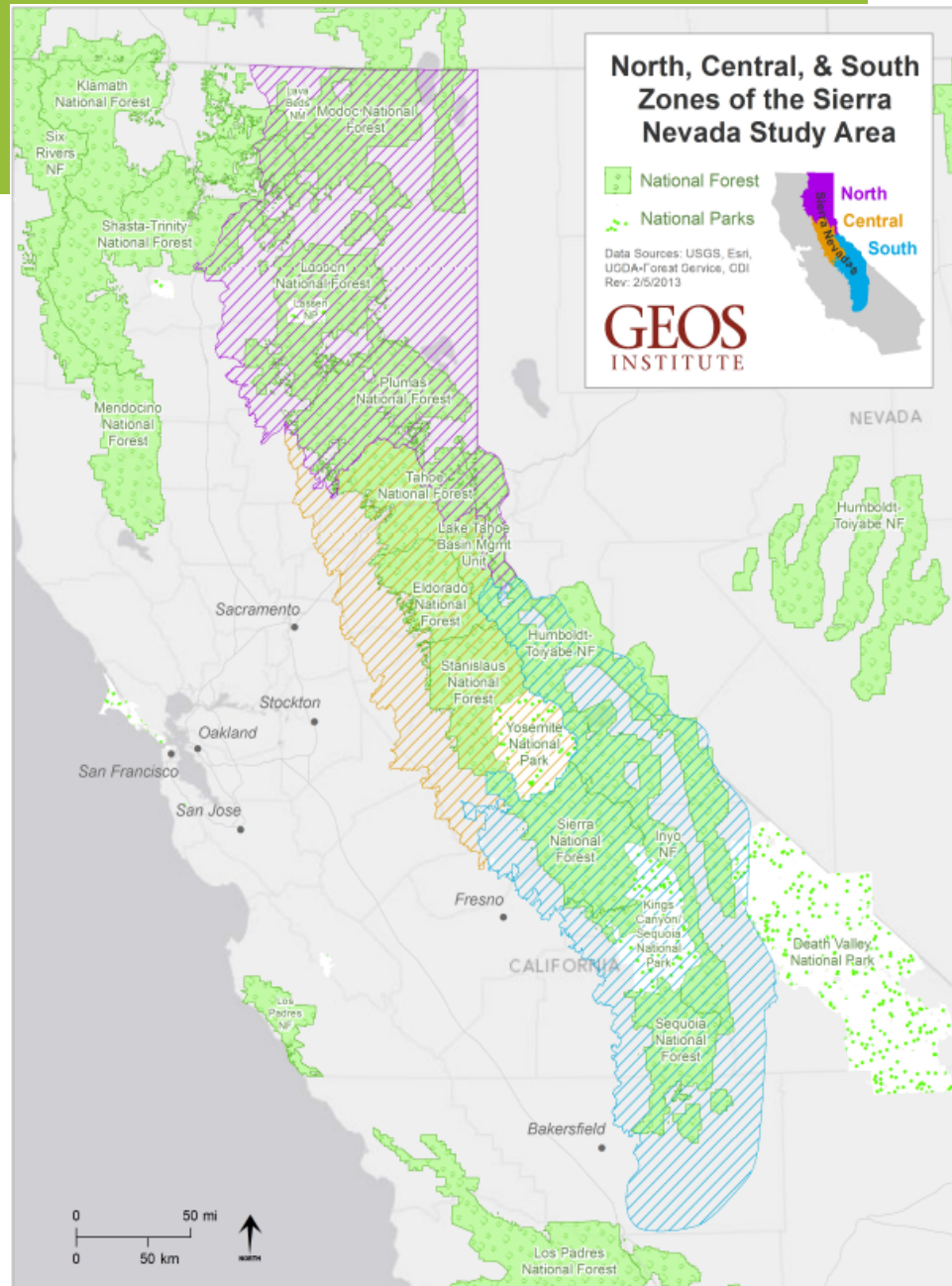
- Climate Change Performance Scorecard
- Forest Plan revision
- Monitoring strategy
- Resource guidance documents
- Project level (i.e. NEPA)

The Forest Service Climate Change Performance Scorecard, 2011 (version 1.3) To be completed annually by each National Forest or Grassland (Unit).		
Scorecard Element	Unit Name	Yes/No
Organizational Capacity		
1. Employee Education	Are all employees provided with training on the basics of climate change, impacts on forests and grasslands, and the Forest Service response? Are resource specialists made aware of the potential contribution of their own work to climate change response?	
2. Designated Climate Change Coordinators	Is at least one employee assigned to coordinate climate change activities and be a resource for climate change questions and issues? Is this employee provided with the training, time, and resources to make his/her assignment successful?	
3. Program Guidance	Does the Unit have written guidance for progressively integrating climate change considerations and activities into Unit-level operations?	
Engagement		
4. Science and Management Partnerships	Does the Unit actively engage with scientists and scientific organizations to improve its ability to respond to climate change?	
5. Other Partnerships	Have climate change related considerations and activities been incorporated into existing or new partnerships (other than science partnerships)?	
Adaptation		
6. Assessing Vulnerability	Has the Unit engaged in developing relevant information about the vulnerability of key resources, such as human communities and ecosystem elements, to the impacts of climate change?	
7. Adaptation Actions	Does the Unit conduct management actions that reduce the vulnerability of resources and places to climate change?	
8. Monitoring	Is monitoring being conducted to track climate change impacts and the effectiveness of adaptation activities?	
Mitigation and Sustainable Consumption		
9. Carbon Assessment and Stewardship	Does the Unit have a baseline assessment of carbon stocks and an assessment of the influence of disturbance and management activities on these stocks? Is the Unit integrating carbon stewardship with the management of other benefits being provided by the Unit?	
10. Sustainable Operations	Is progress being made toward achieving sustainable operations requirements to reduce the environmental footprint of the Agency?	

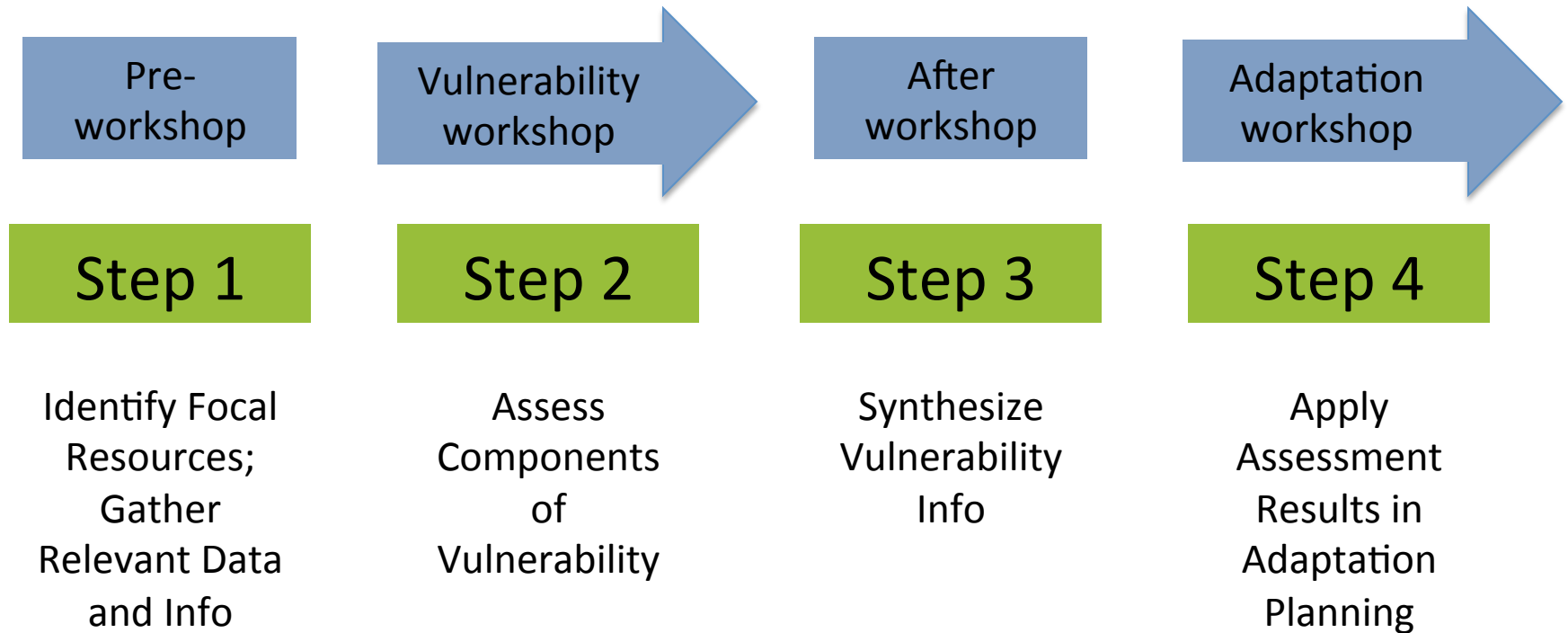


Project Overview

- **Audience:** land managers
- **Scope:** Sierra Nevada
- **Scale:** north, central, south ecoregions
- **Vulnerability of:**
 - Ecosystems
 - Species
 - Ecosystem services
- **Adaptation strategies for:**
 - Ecosystems
 - Species



Sierra Nevada Process



Selecting Priority Resources

- Considered coarse versus fine filter approach in selecting a list
- Species (fine filter) were associated with ecosystems (coarse filter)
- Ultimately groups selected fine filter species given their expertise and whether the species was captured by coarse filter evaluation

Photos: J. Armstrong

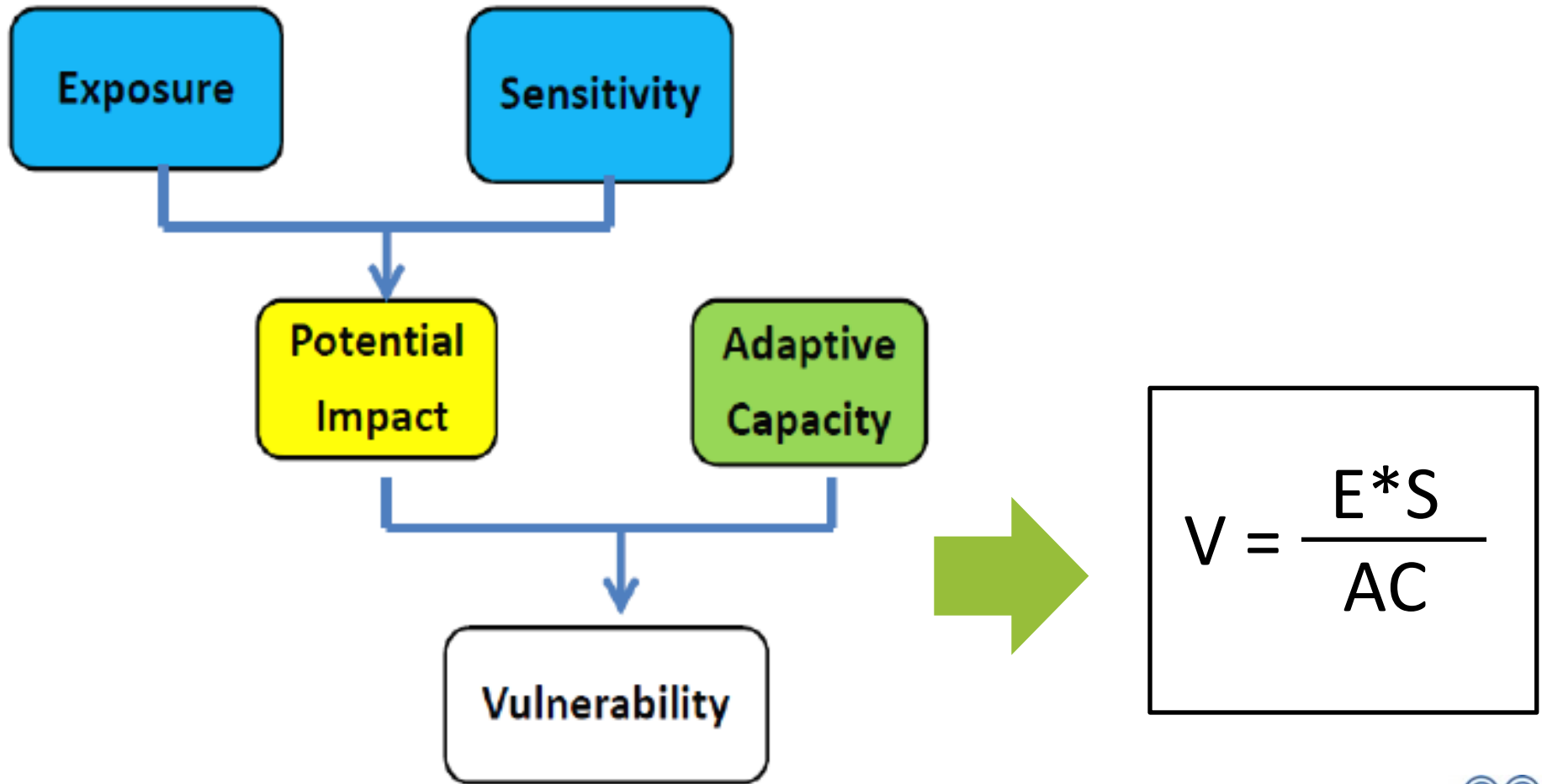


Focal Resources: Final List

Coarse Filter (Ecosystem)	Fine Filter (Species)	Ecosystem Services
Alpine/Subalpine	Bristlecone pine Whitebark pine Bighorn sheep	Fire
Yellow Pine/Mixed Conifer	Fisher	Carbon storage
Wet Meadows	Willow flycatcher Aspen	Recreation
Red Fir	Red fir Marten	Timber/Forest products
Oak Woodlands	Blue oak Black oak	
Chaparral	Wood rat Mountain quail	
Sagebrush	Sage grouse	
Aquatic	Sierra Nevada yellow-legged frog Mountain yellow-legged frog	



Vulnerability Assessment



Goal: Assess vulnerability of selected resources to climate and non-climate stressors using literature review, spatial climate info, and expert input



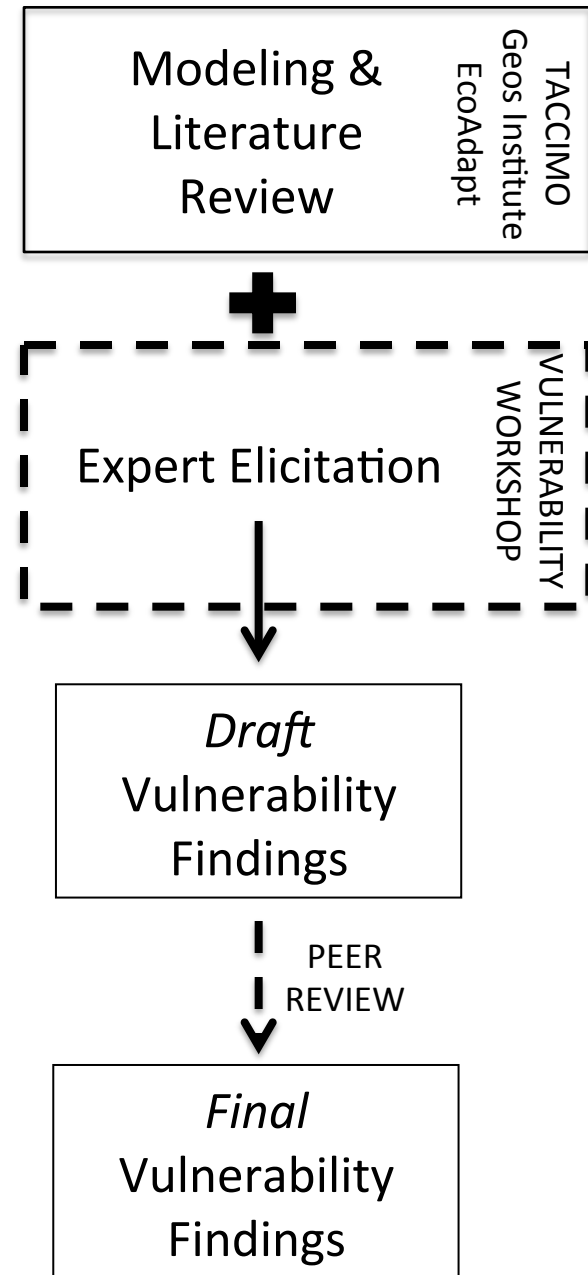
Vulnerability Assessment

- **Process Overview**

1. Collect background info
2. Conduct workshop
3. Assemble & synthesize info
4. Review & revise

- **Vulnerability findings**

- Expert elicitation + Literature
- Peer-reviewed by topic experts



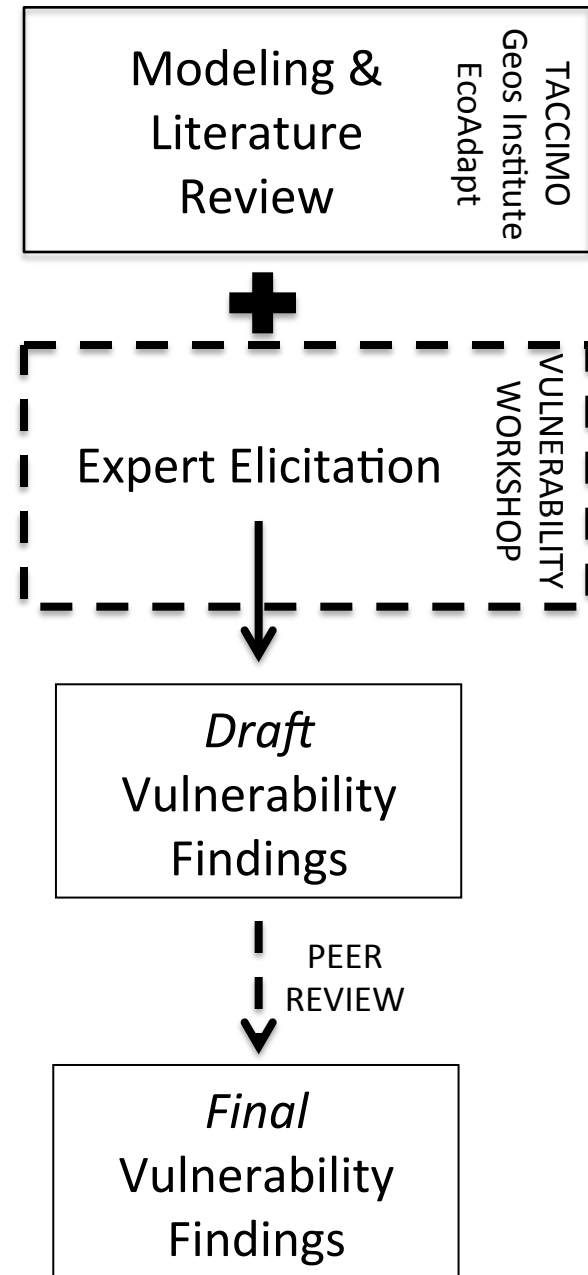
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What Happens at a Vulnerability Assessment Workshop?





Species Sensitivity Assessment

Please pay close attention to the gray boxes in each section. If time is limiting the project team can populate the non-gray fields although we may ask for participants to review answers later.

1. Taxonomy

Scientific Name:

Genus and species

Common Name:

All that apply

Realm

Put an X next to one or more:

Freshwater
Terrestrial

Geography

For what geographic extent is this sensitivity information relevant? You may list its entire range in the Sierra Nevada, or regions, such as North, Central, South, or East.

2. Generalist/Specialist

Generalist: species that use multiple habitats, have multiple prey or forage species, or have multiple host plants (= less sensitive to climate change)
Specialist: species with very narrow habitat needs, single forage or prey species, or single host-plant species (= more sensitive)

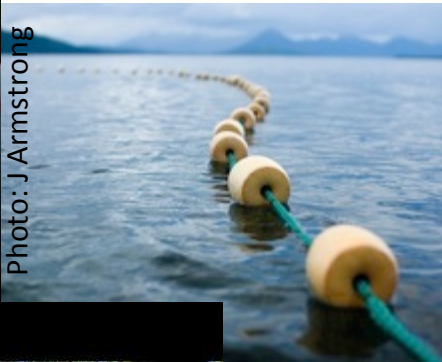
Broadly, where does this species fall on the spectrum of generalist to specialist? Please circle.			Confidence in your assessment of the degree to which the species is a generalist or specialist? Please circle.		
Generalist	Neither/in-between	Specialist	Low	Moderate	High
Please specify which factors make the species more of a specialist: <i>Please circle the relevant relationship(s) that apply. If none apply, do not circle any.</i>					
Predator/prey relationship Foraging dependency Seed dispersal dependency Host plant dependency					Phenology dependency Pollinator dependency Symbiont/Mutualist/Parasite Other dependencies (please describe)
Comments and Citations: Please further describe the relationships that make the species more of a specialist. List all relevant relationships and component species. For example, if the species being assessed is dependent on one host plant, please describe that relationship (e.g., food resource) and list the host plant.					

Worksheets for the Climate Adaptation Project for the Sierra Nevada; EcoAdapt (2013). Questions and guidance from Scanning the Conservation Horizon (2011) and the Pacific Northwest Climate Change Vulnerability Assessment (2010).

Assessing Sensitivity



Photo: J. Armstrong



Measure of whether and how a species or habitat is likely to be affected by a given change in climate.



Factors affecting sensitivity of habitats or species:

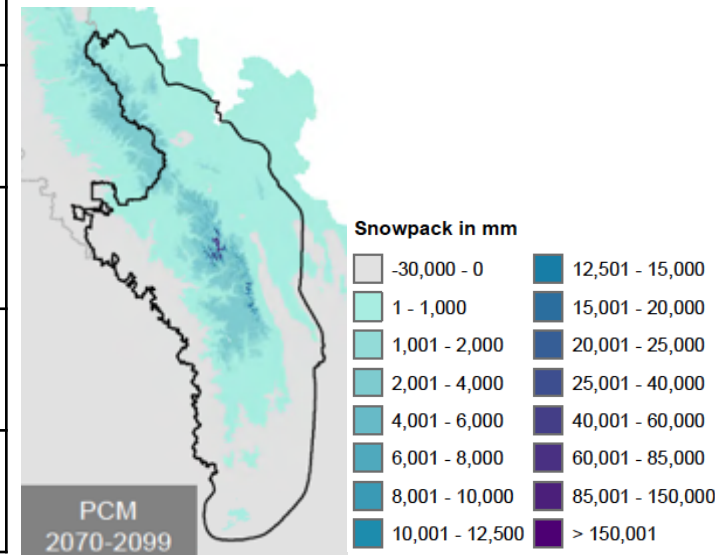
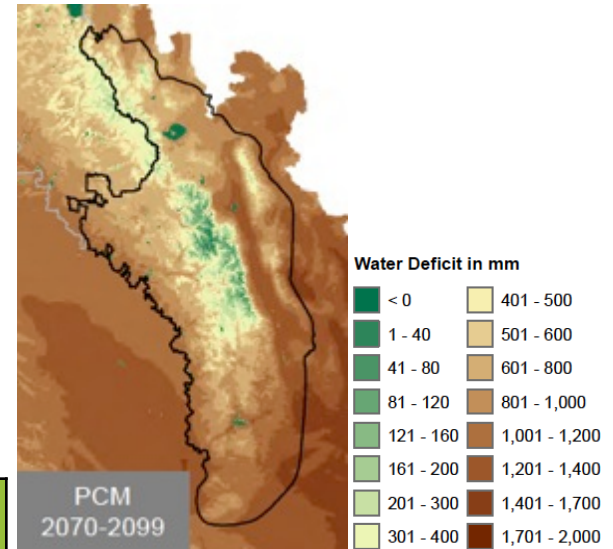
- Climate factors
- Disturbance regimes
- Non-climate stressors
- Dependencies
- Life history





Assessing Exposure

Measure of how much of a change in climate or other environmental factor a species or habitat is likely to experience.



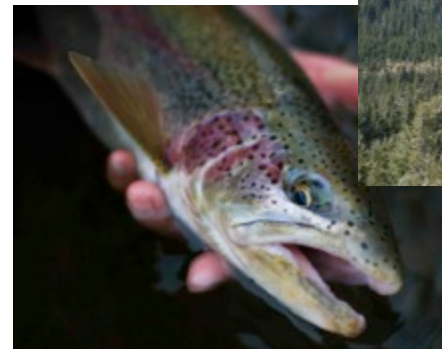
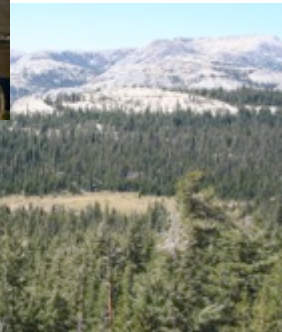
Climate Variable	Projected Future Trends (2080)
Annual Temperature	+2.7 to +3.4°C
Precipitation	↓ summer/fall ↑ winter
Snowpack	-64% to -87%
Climatic Moisture Deficit	+19% to +44%
Wildfire – area burned	+35% to +169%

Assessing Adaptive Capacity

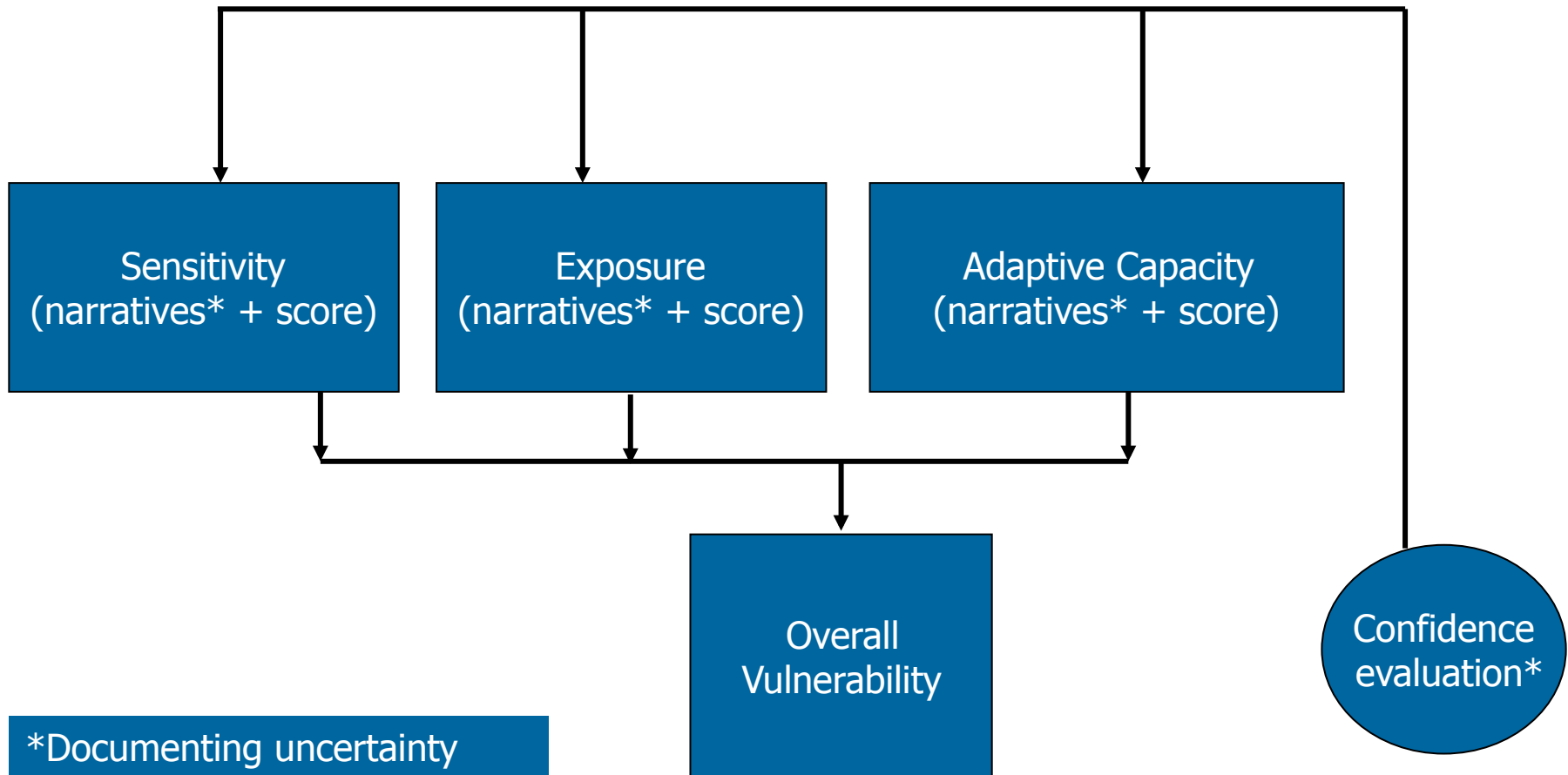
Ability to accommodate or cope with climate change impacts with minimal disruption.

Factors affecting adaptive capacity of habitats or species:

- Extent, status, dispersal ability
- Dispersal barriers/landscape permeability
- Life history or habitat diversity
- Management potential



Vulnerability Assessment Workshop



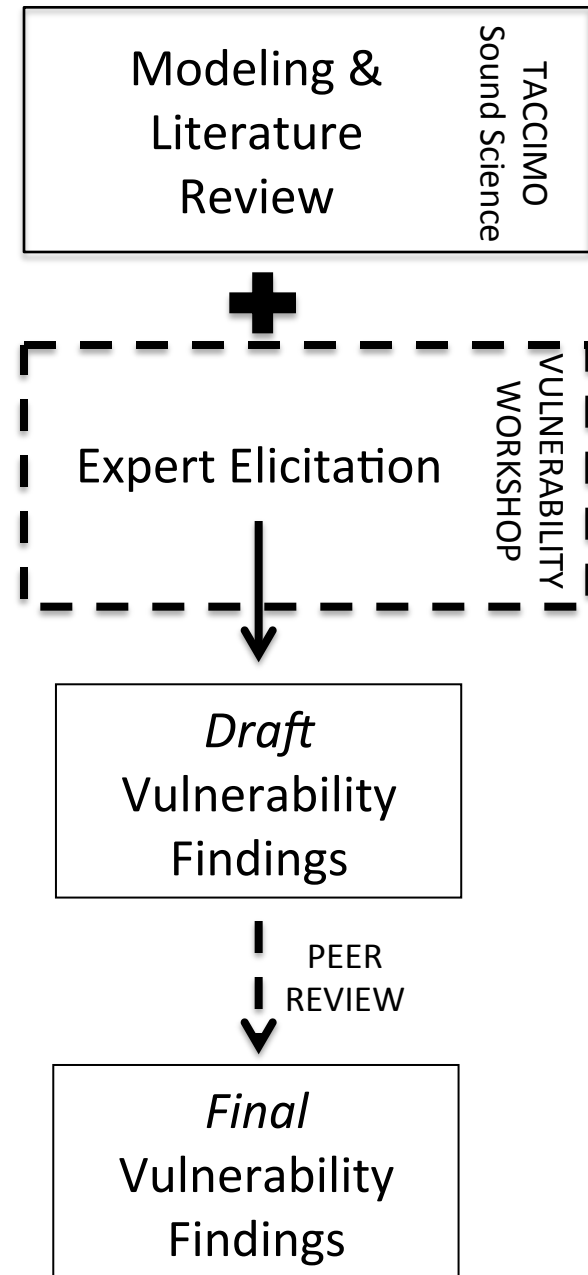
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Vulnerability Assessment Findings: Wet Meadows

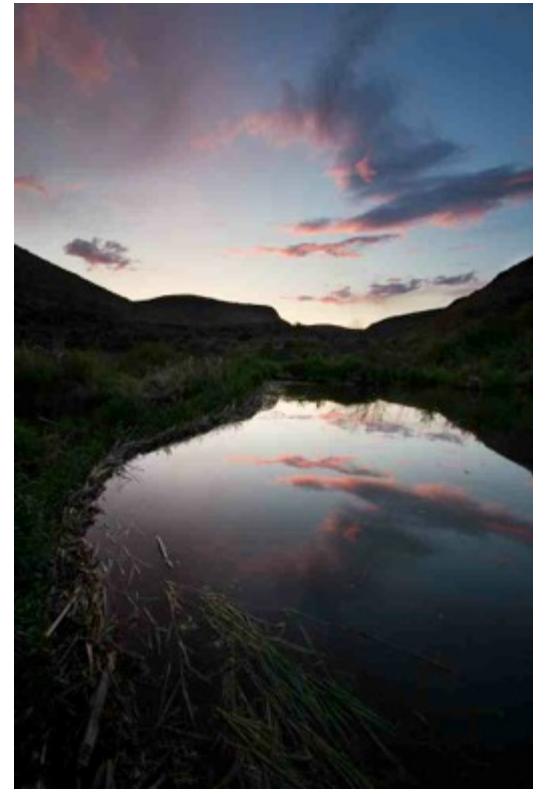
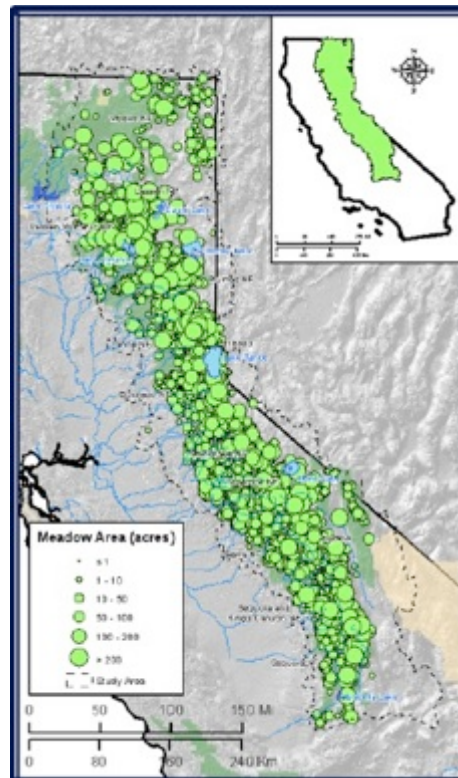
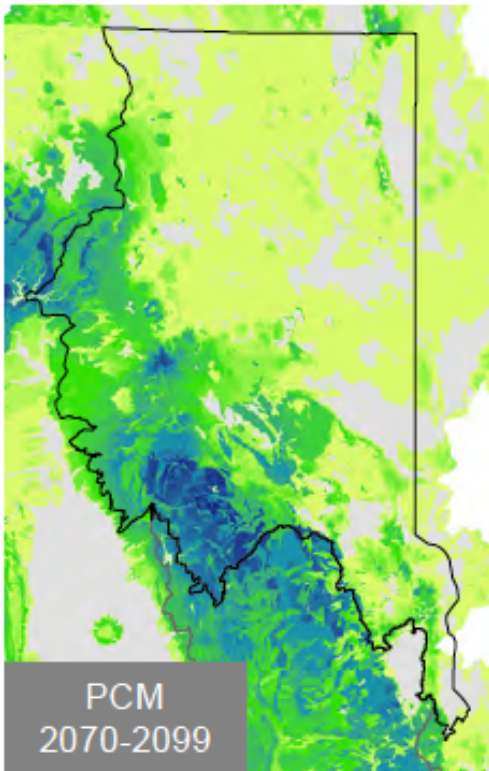


- **Sensitivities to climate and climate-driven changes (mod-high):**
 - Altered precipitation
 - Decreased snowpack
 - Altered hydrology
- **Sensitivities to non-climate stressors (high):**
 - Water diversions
 - Grazing
 - Recreational activities

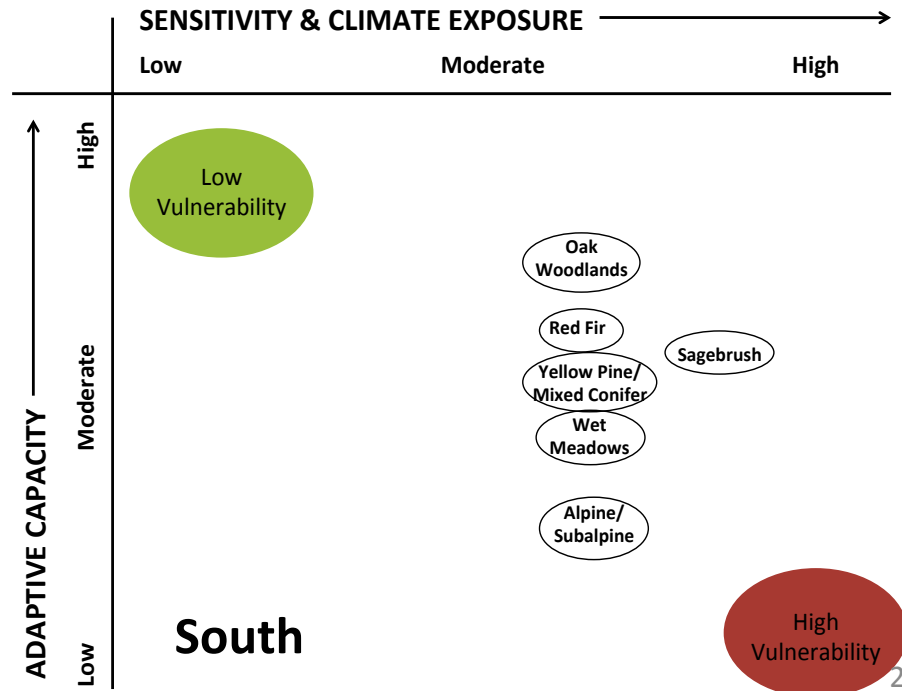
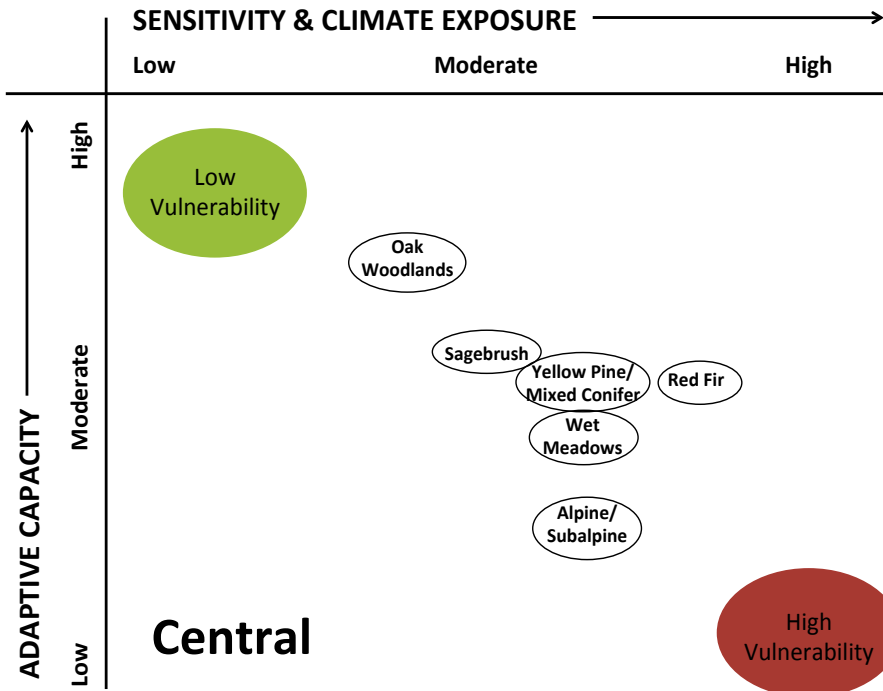
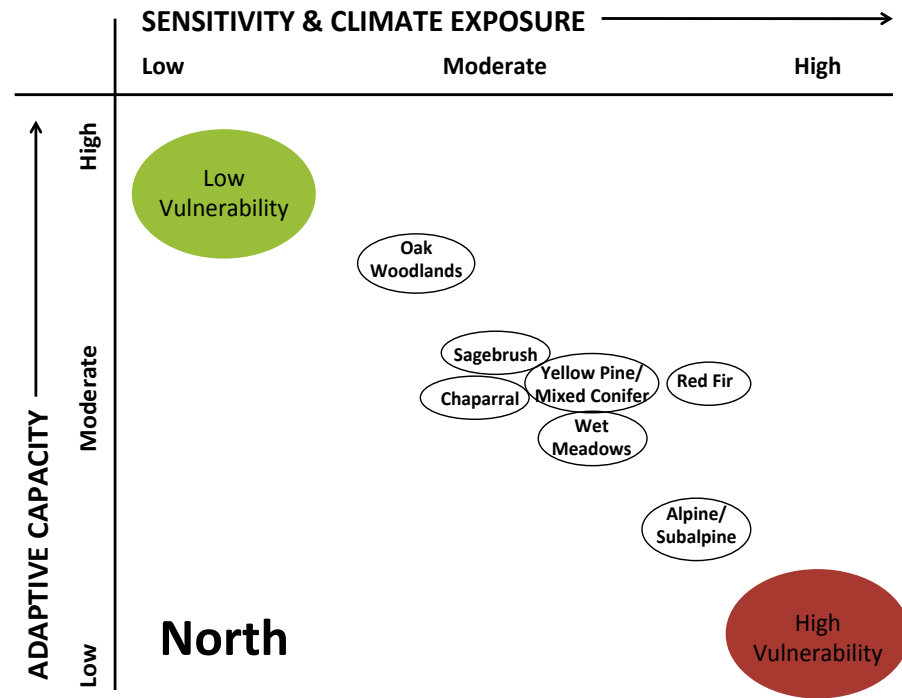


Vulnerability Assessment Findings: Wet Meadows

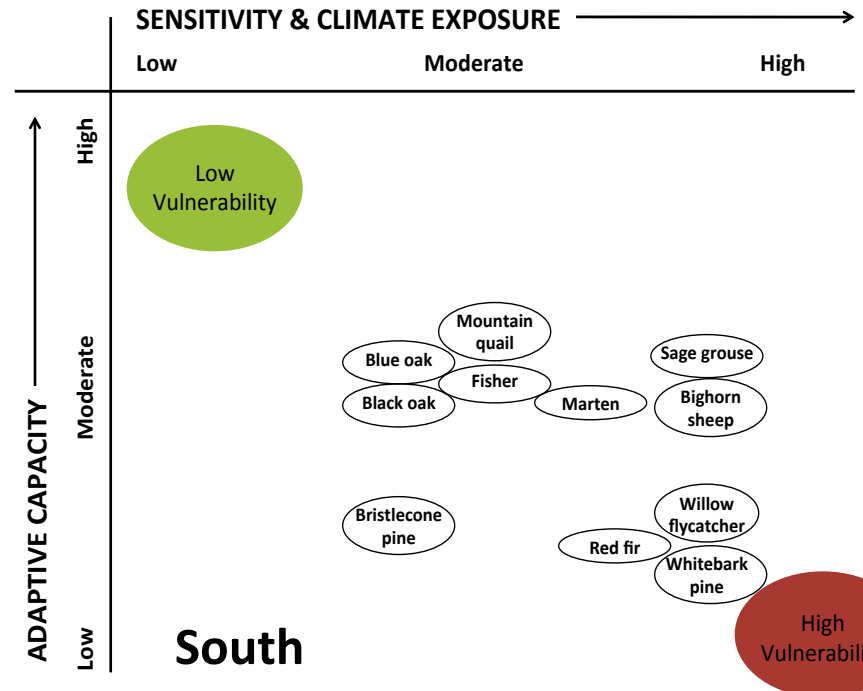
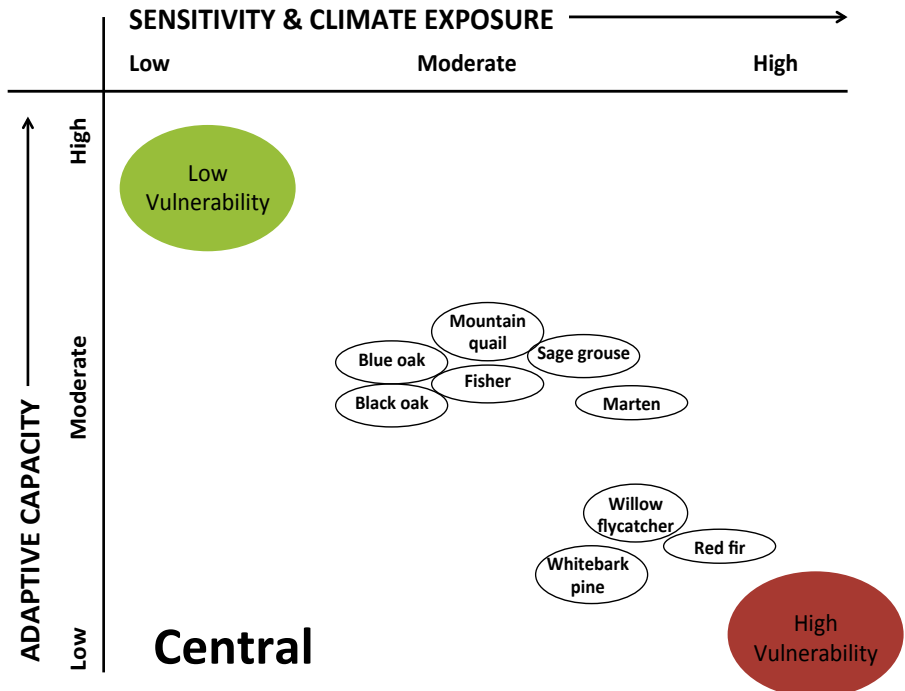
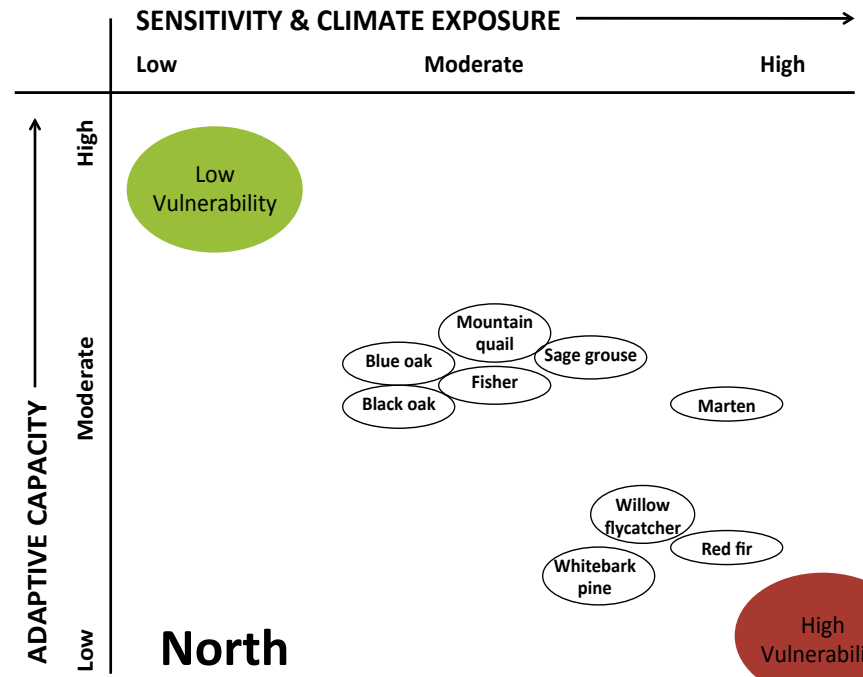
- **Future climate exposure:**
 - Changes in precipitation type, timing, and amount that affect hydrologic regimes and soil moisture
- **Adaptive capacity (mod-high):**
 - (+) Component species diversity
 - (-) Fragmented distribution
 - (-) Currently degraded state



Vulnerability Assessment – Summarized Results for Ecosystems



Vulnerability Assessment – Summarized Results for Species

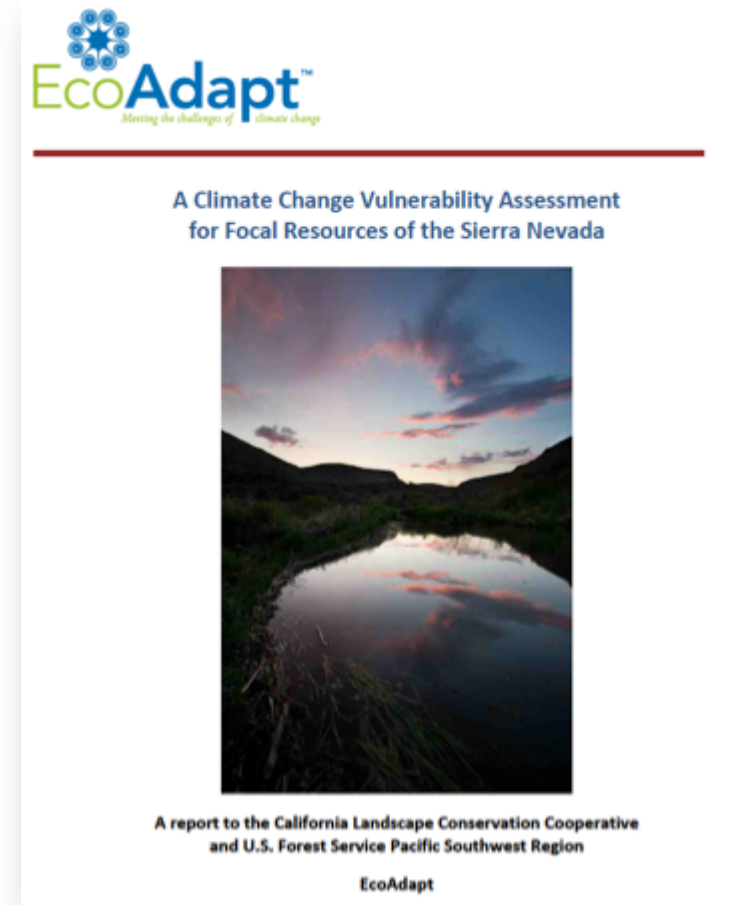


Vulnerability Assessment

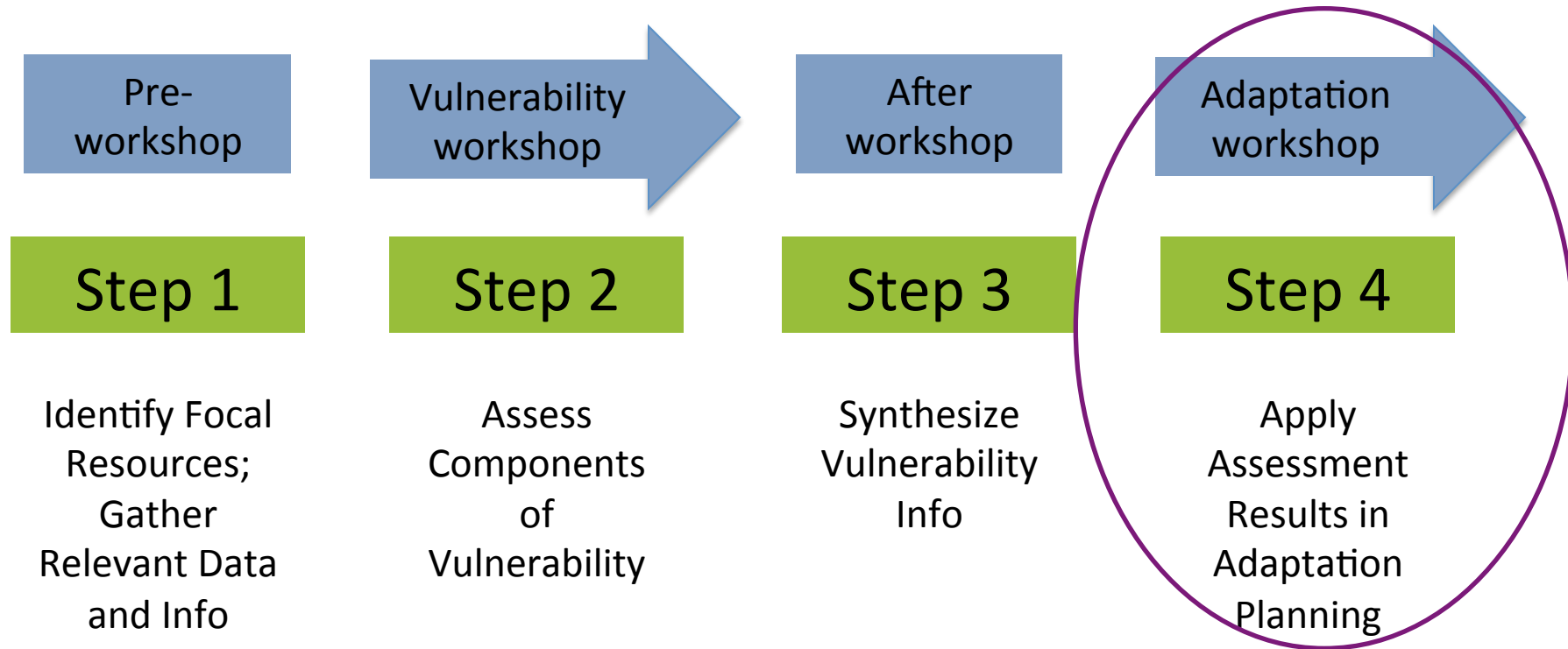
Products:

- Workshop support page
<http://ecoadapt.org/workshops/sierra-nevada-va-workshop>
- Vulnerability assessment report
- Focal resource findings summarized as:
 - Full syntheses (~8-20 pgs)
 - Briefings (~3-5 pgs)
- Living resource via TACCIMO

<http://www.taccimo.sgcp.ncsu.edu/>



Sierra Nevada Process



Apply Assessment Results in Adaptation Planning

- **Reduce Sensitivity**

- *Example:* Actively plant drought-tolerant species in an area projected to get drier



- **Reduce Exposure**

- *Example:* Replant riparian vegetation to limit water temperature increases

- **Enhance Adaptive Capacity**

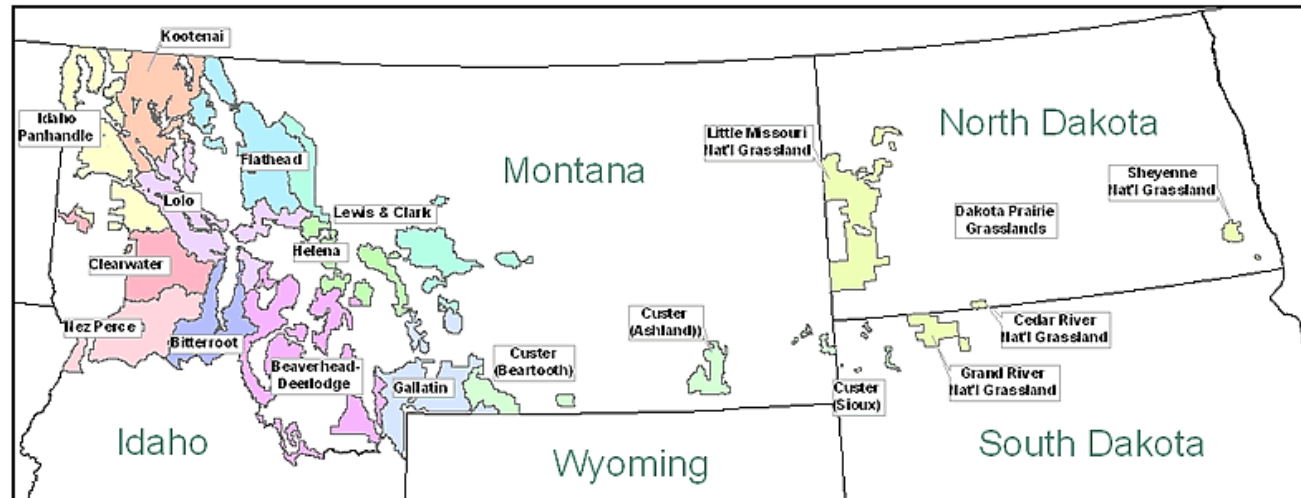
- *Example:* Remove coastal armoring to facilitate wetland accretion



Broader Impacts



- USFS Climate Change Scorecard
- USFS Bioregional Assessment (Forest Plan Revision)
- Info for early adopter forests
- USFS Region 1 (Idaho/Montana/Dakotas), Tongass NF
- And others!



Acknowledgements

Funders:

- Yale Mapping Framework



Partners

