

Sierra Nevada Climate Change Vulnerability Assessment and Adaptation Strategy for Infrastructure and Recreation



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Assessing vulnerabilities and adapting to climate change

Vulnerability assessment

Evaluation of the degree to which organisms and systems are susceptible to the effects of climate change

Adaptation

Adjustment in natural or human systems to mitigate harm, facilitate transitions, or exploit benefits of climate change

Assessing vulnerabilities and adapting to climate change

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Adaptation —→ Building resilience

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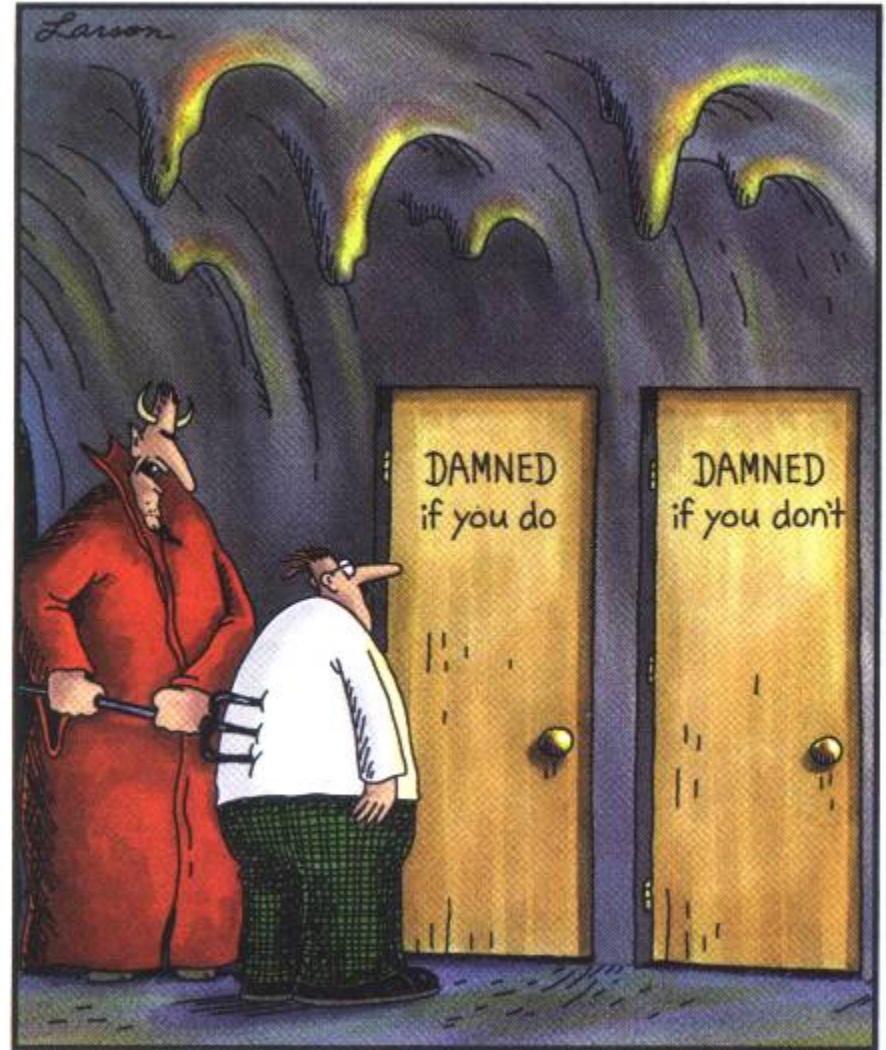
What is climate change adaptation?

Fine tuning of existing management plans and projects

Component of sustainable resource management

A form of risk management

Required by climate change response and planning guidance for agencies

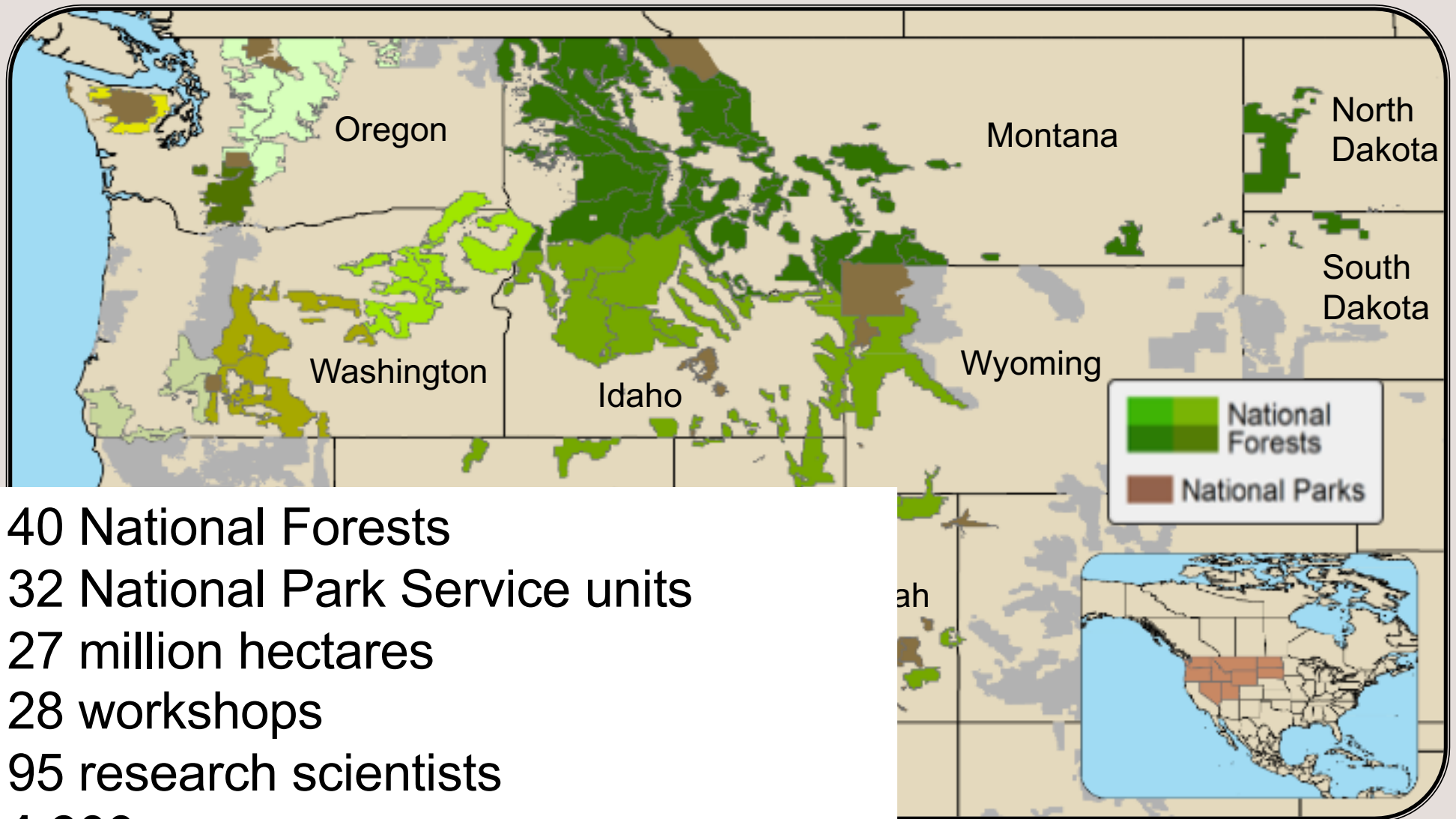


“C’mon, c’mon – it’s either one or the other.”

Adaptation partnership locations (*completed or in progress*)



Adaptation partnership locations *(completed or in progress)*



40 National Forests
32 National Park Service units
27 million hectares
28 workshops
95 research scientists
1,300 resource managers

The adaptation process

1. Vulnerability Assessment

Review climate projections and identify resource sensitivities.



2. Adaptation Planning

Develop science-based adaptation options.



3. Implementation

Incorporate adaptation strategies into existing management plans.

Start with a science-management partnership

Typical assessment topics

- Vegetation (ecological disturbance)
- Wildlife
- Water
- Fish

New assessment topics

- Recreation
- Infrastructure
- Ecosystem services
- Cultural resources

Products



United States Department of Agriculture

Climate Change Vulnerability and Adaptation in the Northern Rocky Mountains

Part 1

Jessica E. Halofsky, David L. Peterson, S. Karen Dante-Wood, Linh Hoang, Joanne J. Ho,
Linda A. Joyce, Editors



Forest
Service

Rocky Mountain
Research Station

General Technical Report
RMRS-GTR-374

March 2018



United States Department of Agriculture

Climate Change Vulnerability and Adaptation in the Intermountain Region

Part 1



Forest
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RMRS-GTR-375

April 2018

What does adaptation look like?

Vulnerabilities and adaptation

WATER

Vulnerabilities and adaptation

WATER

Vulnerability

- Higher peak flows in fall and winter



Vulnerabilities and adaptation

WATER

Vulnerability

- Higher peak flows in fall and winter



Adaptation strategy

- Design infrastructure to accommodate higher peak flows



Vulnerabilities and adaptation

WATER

Vulnerability

- Higher peak flows in fall and winter

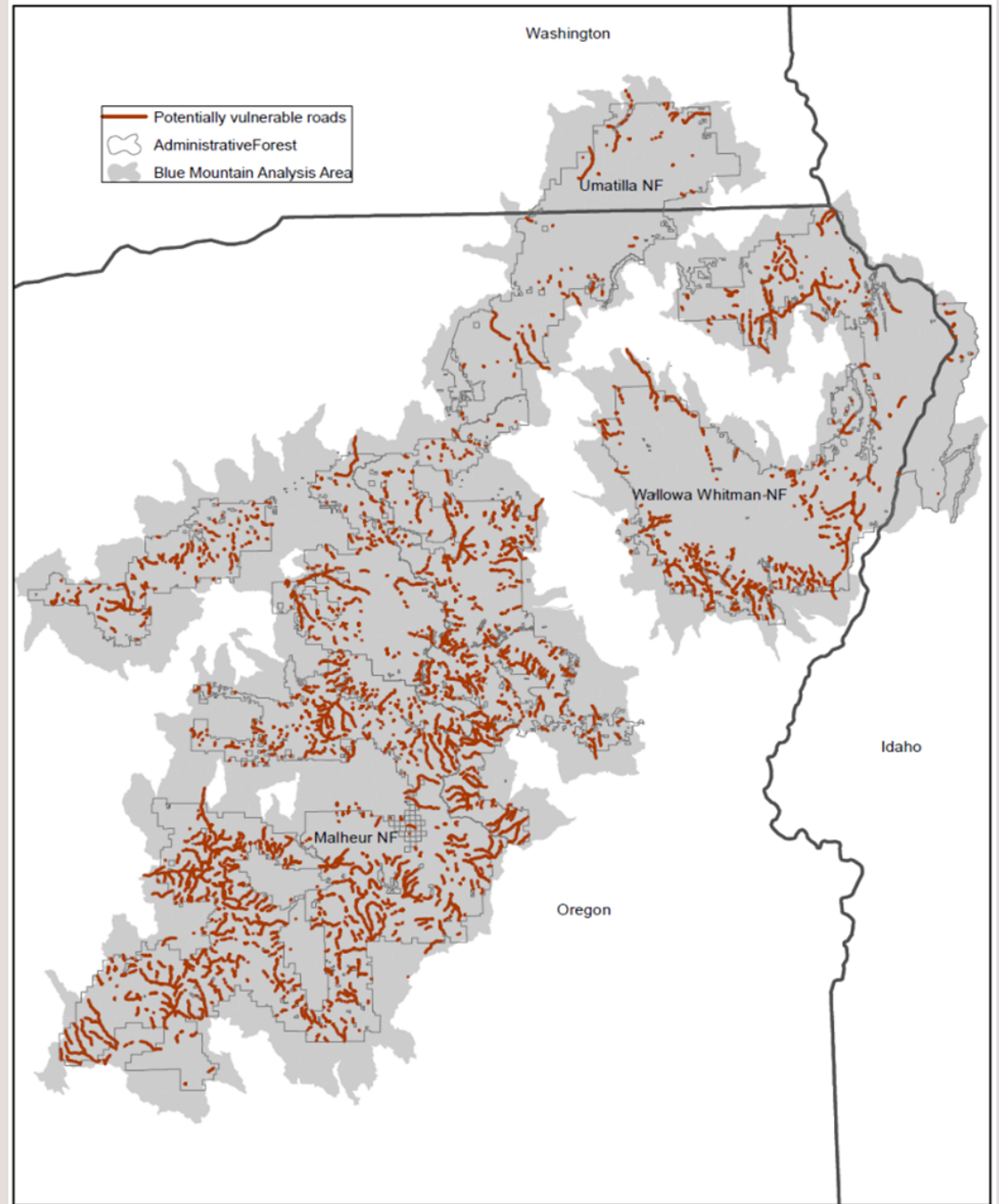


Adaptation tactics

- Install larger culverts
- Decommission roads in floodplains
- Relocate campgrounds subject to flooding



Assessing vulnerabilities: roads near streams



Expected effects: Warm-weather activities

Sensitivity to climate

- Increase in snow-free and ice-free days, days with suitable temperatures
- Presence/abundance of unique features (e.g., wildflowers), trail conditions, wildfire effects, vegetation and cover

Expected effects

- Overall increase in demand (++)
- Shifting seasons: Warmer “shoulder seasons” (+), extreme temps in summer (-)
- Shifting site preferences: higher elevations, response to fire/smoke (+/-)

Vulnerabilities and adaptation

SUMMER RECREATION

Vulnerabilities and adaptation

SUMMER RECREATION

Vulnerability

- Decrease in suitable sites for water-based recreation with increasing demands.



Vulnerabilities and adaptation

SUMMER RECREATION

Vulnerability

- Decrease in suitable sites for water-based recreation with increasing demands

Adaptation strategy

- Increase flexibility in water-based recreation site management and facility design



Vulnerabilities and adaptation

SUMMER RECREATION

Vulnerability

- Decrease in suitable sites for water-based recreation with increasing demands.

Adaptation tactics

- Increase length of boat ramps
- Manage lake and river access capacity
- Manage public expectations



Vulnerabilities and adaptation

WINTER RECREATION

Vulnerabilities and adaptation

WINTER RECREATION

Vulnerability

- Shorter winters with less snow, and wetter or icier snow



Vulnerabilities and adaptation

WINTER RECREATION

Vulnerability

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Adaptation strategy

- Increase recreation management flexibility



Vulnerabilities and adaptation

WINTER RECREATION

Vulnerability

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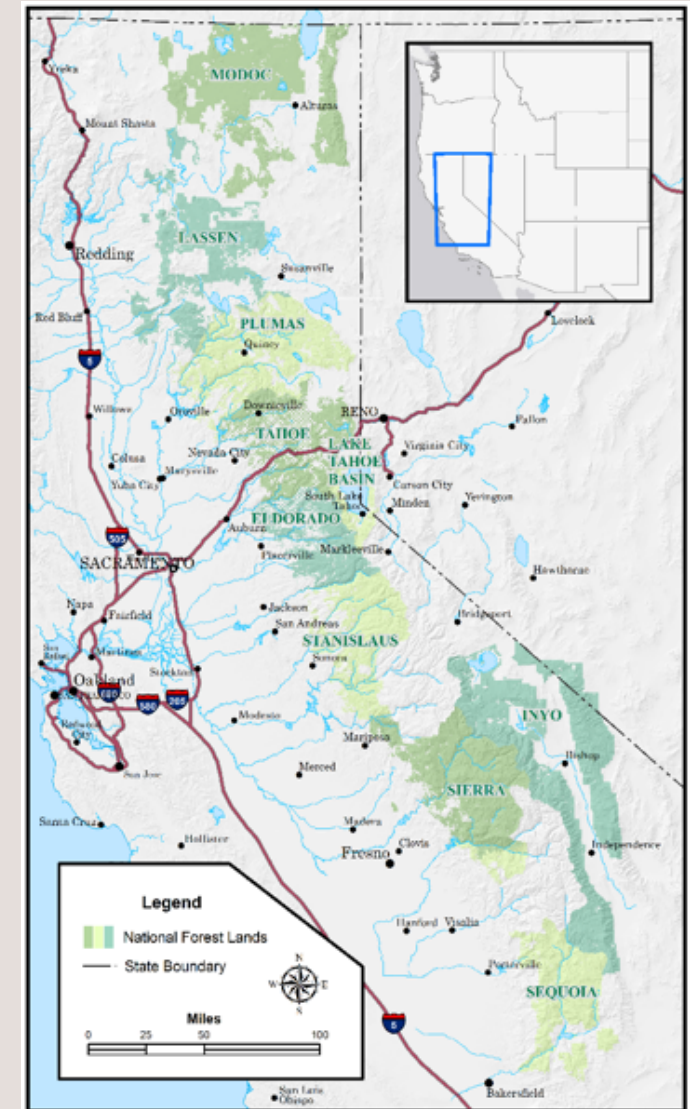
Adaptation tactics

- Expand facilities in areas where concentrated use increases
- Develop options for diversifying snow-based recreation



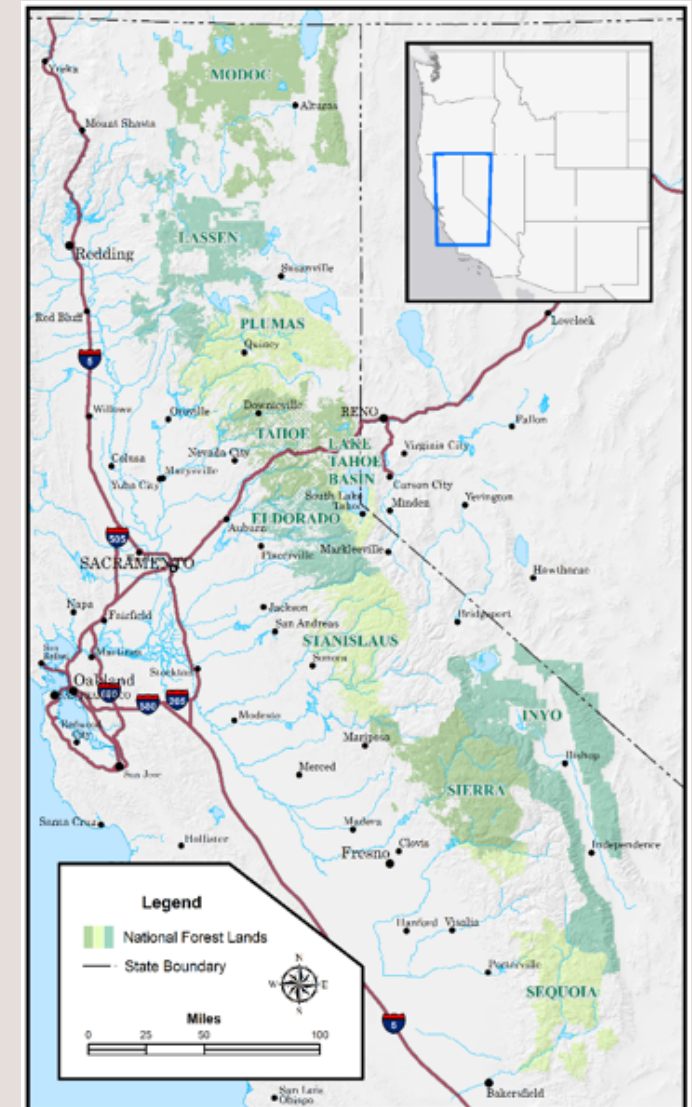
Sierra Nevada Recreation and Infrastructure Adaptation Partnership: Objectives

- Objective 1: Synthesize the best available science to assess climate change vulnerability and develop adaptation strategies for recreation and infrastructure resources on National Forests in the Sierra Nevada Mountain Range.



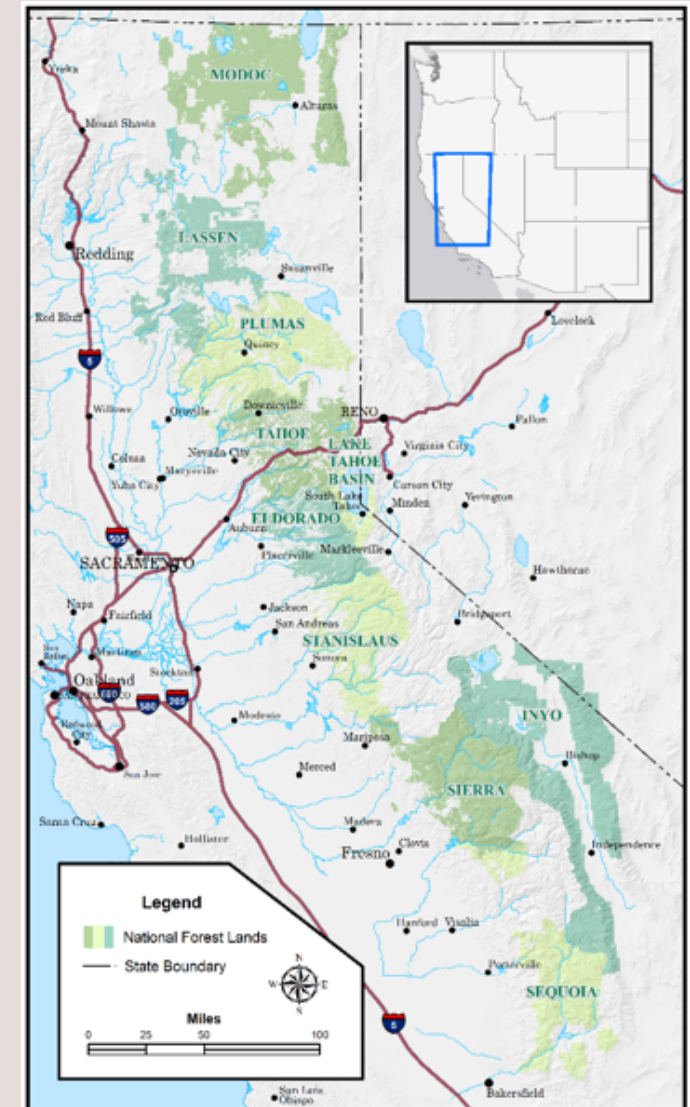
Sierra Nevada Recreation and Infrastructure Adaptation Partnership: Objectives

- Objective 2: Develop a framework and tools for managers to incorporate the best available science plus existing/complementary assessments into USFS recreation and engineering program assessments.



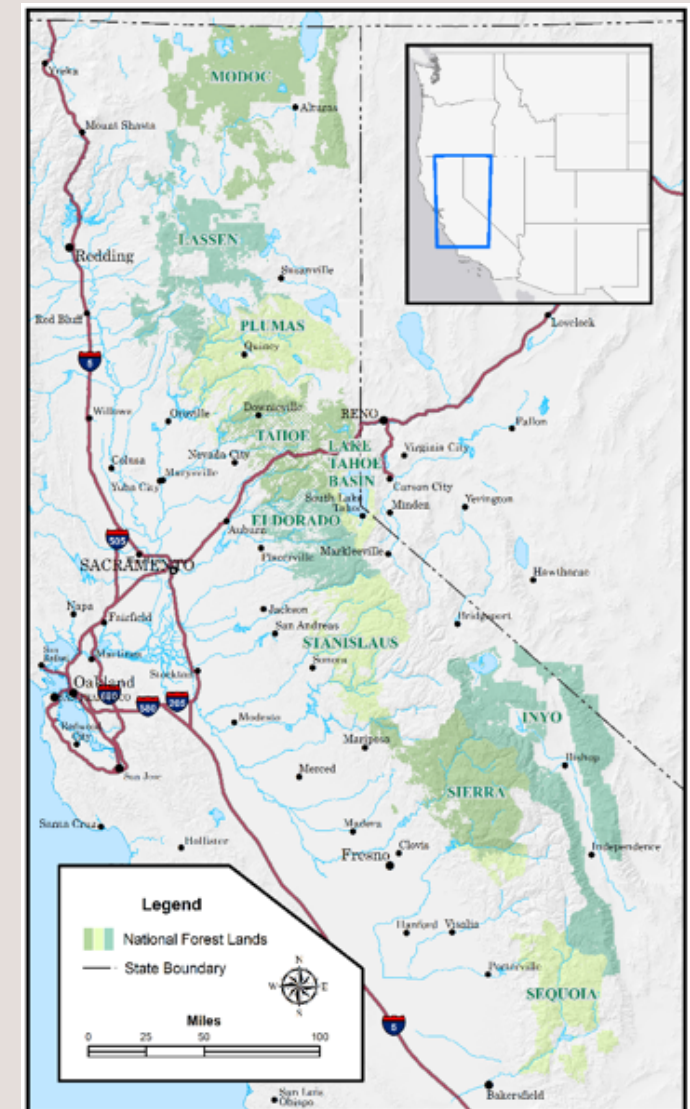
Sierra Nevada Recreation and Infrastructure Adaptation Partnership: Objectives

- Objective 3: Define priority regional- and forest-level climate change vulnerabilities so that such factors may be integrated in a cohesive and strategic manner throughout the land management planning process.



Sierra Nevada Recreation and Infrastructure Adaptation Partnership: Objectives

Objective 4: Produce a spatially explicit, peer-reviewed vulnerability assessment (with specific adaptation strategies noted) written to support the needs of Forest Service resource managers.



General Approach

Establish a science-
management partnership



Conduct a vulnerability
assessment



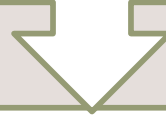
Identify adaptation strategies
and tactics



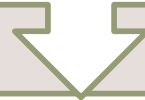
Develop and publish a peer-
reviewed report

Project Timeline

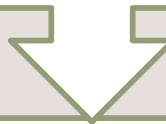
July 2018 – September 2018: Compile information for the vulnerability assessment



September 2018: Conduct expert elicitation workshop



September 2018-January 2019: Finalize vulnerability assessment



Spring 2019: Develop adaptation strategies and tactics



Late 2019: Publish General Technical Report

This assessment will build on existing resources including:

- EcoAdapt Climate Adaptation Project for the Sierra Nevada
- Sierra Nevada Bioregional Assessment
- Science synthesis to support socioecological resilience in the Sierra Nevada and southern Cascade Range.
- Draft U.S. Forest Service Climate Change and Transportation Resiliency Guidebook (developed in partnership with the VOLPE Center)
- California Climate Vulnerability Assessment of Macrogroup Vegetation

The vulnerability assessment will be linked to key management processes such as:

- Forest plan assessments and plan revision components
- Recreation Site Analysis process (new)
- Capital Investment Program (CIP) process
- Climate change and transportation resiliency analyses
- Cost-benefit or risk analysis based on transportation asset life-cycle cost (values analysis)

Vulnerability maps will include:

- 100-year flood event relative vulnerability maps by watershed for:
 - Roads and culverts,
 - Developed recreation sites
 - Trails
- Weather-based access vulnerability maps to inform:
 - Road opening and closures
 - Developed recreation site management
 - Special use permit provisions
- Recreation activity setting vulnerability maps
 - Key activities cross referenced with geographic or elevation based climate change effects to prioritize adaptation strategy implementation



Adaptation is a marathon, not a sprint

<http://adaptationpartners.org/>