Integrating Climate Change into Regional Conservation Design for the Southern Sierra

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Southern Sierra and Tehachapi Region

Size: 7,033,942 acres

Ecological convergence: four ecoregions intersect (Sierra Nevada, Great Central Valley, South Coast, and Mojave Desert)

Elevation: 200 ft to 14,491 ft (Mount Whitney)

Terrestrial Systems: grasslands, oak woodlands, chaparral, mixed conifer forest, including 60 groves of giant sequoia, alpine and sub-alpine, Mojave Desert and Joshua tree scrub, and sage brush-pinyon juniper.

Aquatic Resources: Alpine lakes, five major rivers, 3,750 miles of perennial streams, riparian wetlands, and vernal pools

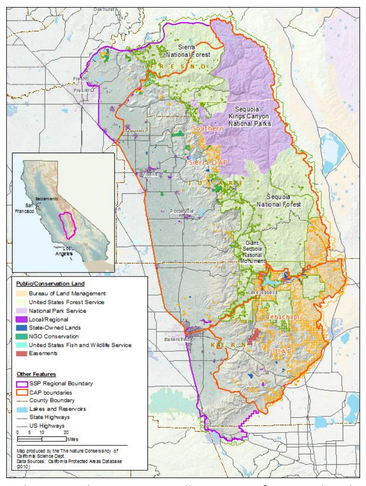
Species: >60 endemic species. Iconic species such as giant sequoia, blue oak, condors, Valley oaks, bristlecone pine, and 13 species listed under the federal Endangered Species Act. 90% of state's amphibians have part of their range within study area, along with 85% of reptile, 80% of mammal, and 57% of bird species.

Landscape Integrity and Connectivity: High landscape integrity except portions of the lower foothills and the Valley floor where land use is irrigated agriculture, urban centers, and roads.

Background

The Southern Sierra Partnership, an alliance of six conservation organizations, is dedicated to collaborative action with stakeholders and decision-makers to protect and steward critical lands and ecological processes which are essential to sustaining human and natural communities.

In 2010, the Partnership developed a regional conservation design which takes into account the current distribution of ecosystems and threats, as well as, the projected effects of climate change. Modeling was done by The Nature Conservancy with Marxan software.



Study Area. There are 2.8 million acres of National Parks, Forests, Monuments, Wilderness Areas, and state reserves.

Objectives :

1. Characterize the biodiversity, ecosystem services, ownership patterns, threats, and land uses
2. Examine how a changing climate will impact or interact with the threats, and anticipate long-term responses in the landscape
3. Develop a regional conservation vision that

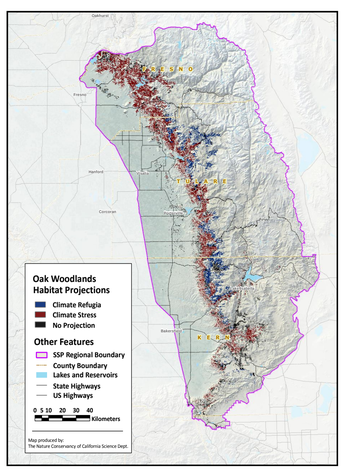
   -- Captures landscape connectivity and intactness to foster climate adaptation

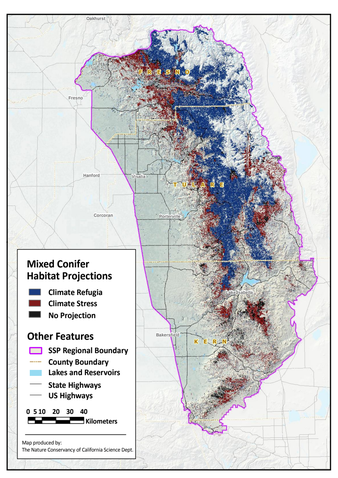
   -- Articulates the long-term conservation design goals for the region.

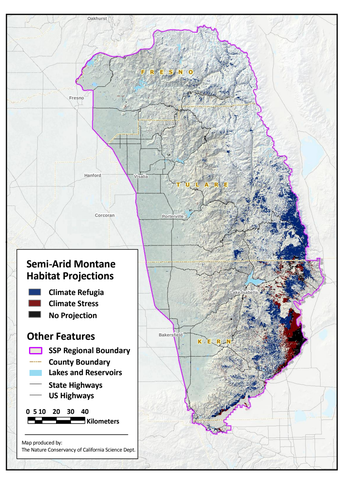
   -- Acknowledges the spatial and temporal changes that will occur with a changing climate, relative to existing conservation investments, land uses, and ecosystem services

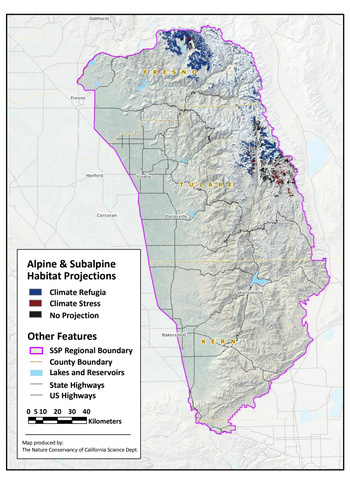
Methods

1. We overlaid the current distributions of the vegetation targets with species' distribution climate model results to assess what parts of the habitat targets' current distributions are projected to be stressed versus stable.









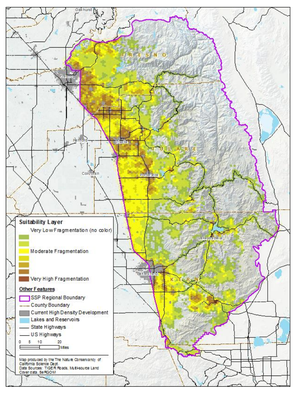
2. Representation Goals: We set higher goals for the stable areas and lower goals for the stressed areas on the assumption that stressed areas will continue to play an important role in the ecosystem and will be important to connect with potential *refugia*. We stratified goals across ecoregional subsections to capture regional variability.

The amount of current target distribution by climate change projection from the species distribution models (see adjacent Climate Vulnerability poster). The goals are those that were used for the climate-adapted site selection scenarios. The parts of the current range of targets where model agreement was low received the default goals for the climate-adapted *Marxan* runs.

SSP Target Group	SDM Status	Total Areas (Ac)	Current Target Area (Ac)	% of Current	Low Goal	High Goal
Oak Woodlands	Low Agreement	111,024	505,229	21.97%	30%	50%
	Stress	279,537		55.33%	25%	45%
	Stable	111,422		22.05%	45%	65%
Semi-arid Montane	Low Agreement	100,821	700,858	14.39%	30%	50%
	Stress	109,295		15.59%	20%	40%
	Stable	486,929		69.48%	40%	60%
Alpine and Subalpine	Low Agreement	67,337	254,372	26.47%	30%	50%
	Stress	17,069		6.71%	20%	40%
	Stable	167,649		65.91%	40%	60%
Desert Scrub	Low Agreement	65,373	154,313	42.36%	30%	50%
	Stress	88,929		57.63%	25%	45%
	Stable	11		0.01%	45%	65%
Mixed Conifer Forest	Low Agreement	194,753	1,634,784	11.91%	30%	50%
	Stress	478,350		29.26%	20%	40%
	Stable	957,473		58.57%	40%	60%

3. We "locked in" current foothill & valley protected lands (n=27). To avoid fragmented landscapes, we used a habitat suitability model based on road density, intensive agriculture, and housing density.

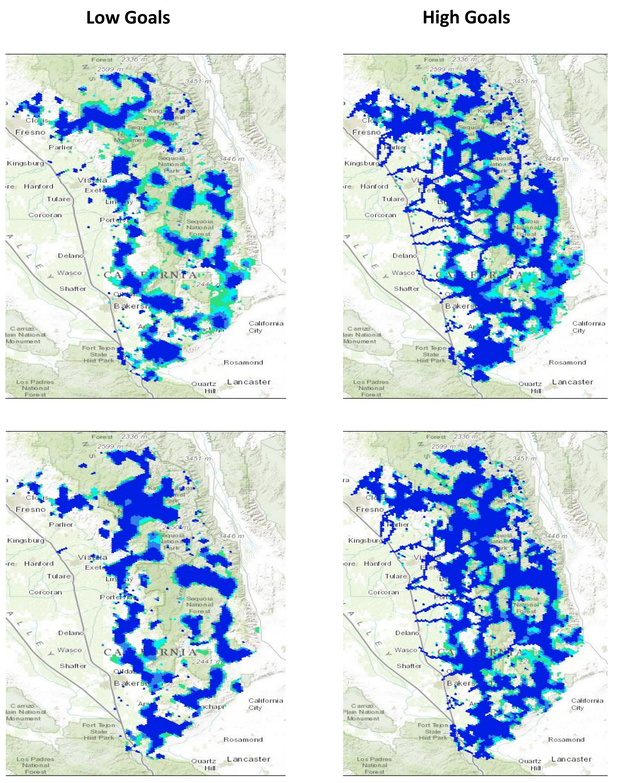
Habitat Suitability Model

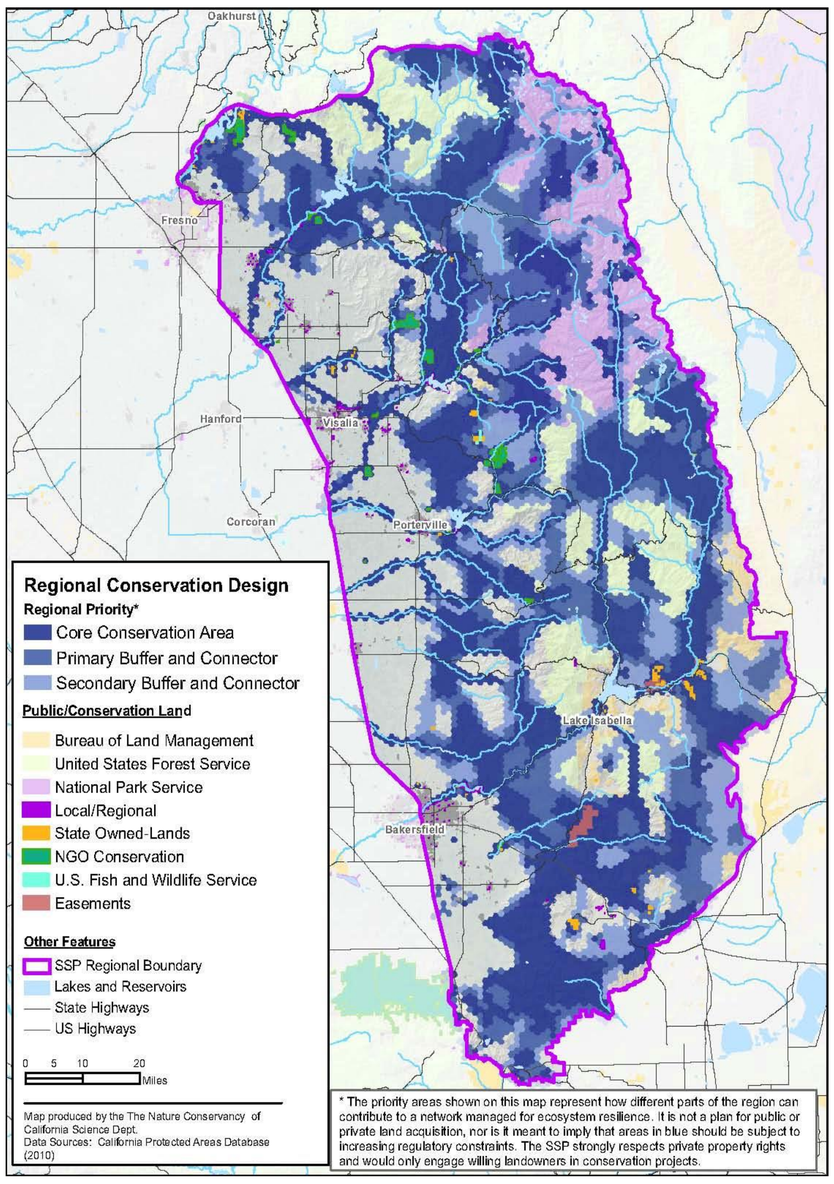


4. We incorporated landscape features assumed to foster climate adaptation.

Resilience features	Assumptions
Temperature gradients: average slope of January minimum temperature	Areas with steeper temperature gradients will facilitate access to suitable climate
Topographic moisture potential : amount per planning unit	Areas that are topographically likely to accumulate or hold water will buffer temperature and drought stress
Distance from perennial water/key riparian corridors	Habitats and species closer to perennial water will have lower drought stress.

Planning Scenarios: We ran site-selection scenarios for the low and high goal goals, with both current and climate-adapted inputs, to generate four regional design scenarios. Climate adaptation features and expert input were incorporated in the high adaptation scenario. The four scenarios were synthesized into one set of priorities – the regional conservation design.





Results and Discussion

The resulting regional conservation design (right map) prioritizes the landscape into core areas (33% of study area) primary and secondary buffer and connectors (14% and 13% respectively). The regional conservation design is not meant to be a definitive recipe for success or a plan for public or private land acquisition or new regulations. It serves as an initial hypothesis of what it will take to conserve the natural systems of the region in the face of climate change. The regional conservation design, spatial datasets, and conservation recommendations are presented in the *Framework for Cooperative Conservation and Climate Adaptation for the Southern Sierra Nevada and Tehachapi Mountains (2010*) and posted in DataBasin. **http://tiny.cc/9ls1rw**