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Ecology Highlights

Forest Service Region 5 Ecology Program 2014-2015

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Highlights Report:

USDA Forest Service Region 5 Ecology Program, 2014–2015

The Pacific Southwest Region (Region 5) Ecology Program serves multiple roles in the Region, including science application to resource management; inventory and monitoring of conditions and trends in vegetation, fire, and fuels; science support to Forest planning; climate change interpretation; statistical and analytical support to Forest and District projects; education and outreach; and assistance to field units, the Regional Office, OGC and the Department of Justice in matters of appeals and litigation.

We are also a national leader in partnerships and collaborative endeavors with other federal and state agencies, universities, and non-governmental organizations. Current Forest Service priorities revolve around Forest planning, ecological restoration, ecosystem services, and climate change response, and the Region 5 Ecology Program is uniquely positioned and qualified to support these priorities.

In addition to the comprehensive annual report we put out each year, this mid-year Highlights Report provides more detail on selected projects and programs. We hope you enjoy it!

Sincerely,
Hugh Safford, Regional Ecologist

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2010 Sheep Fire on the Giant Sequoia National Monument and Kings Canyon National Park

Monitoring Fire Severity Patterns in Resource Objective Wildfires of the Southern Sierra Nevada

Project Goals:

- Quantify vegetation burn severity patterns (e.g., high severity proportion and mean patch size) resulting from resource objective wildfires burning in forest ecosystems of the southern Sierra Nevada National Forests.
- Compare current vegetation burn severity patterns to the Natural Range of Variation (NRV) to determine whether current resource objective wildfires are burning within the NRV.

"Expanded use of resource objective wildfires can vastly increase the scale of forest restoration"

Key Findings & Products

- Wildfires burning in suitable weather and terrain provide excellent opportunities to restore and maintain the resilience of forest ecosystems in large landscapes.
- In the National Forests of the southern Sierra Nevada, we analyzed 17 large wildfires between 2003 and 2011 that were managed for natural resource objectives and found that they were mostly successful in meeting fire severity objectives based on the NRV concept.
- The fire severity indicators and NRV information used in this study were directly incorporated into the monitoring strategy for the new Forest Plans of the Inyo, Sequoia, and Sierra National Forests.
- Full publication, available online: Meyer, Marc D. 2015. Forest Fire Severity Patterns of Resource Objective Wildfires in the Southern Sierra Nevada. Journal of Forestry 113(1): 49-56.
- CFSC research brief available online
- NRV information available online: Ecology Program NRV assessments for Sierra Nevada

The 2011 Lion Fire on the Sequoia National Forest is an example of a large wildfire managed for resource objectives that may provide ecological benefits to forest landscapes. Image Credit: Inciweb.

Project Overview:

We compared the NRV in several fire severity indicators (i.e., fire severity proportions, mean and maximum high-severity patch size) with patterns observed from 17 large wildfires that burned over 95,000 acres in the southern Sierra Nevada. This analysis focused on National Forest lands in the region but also included more than 64,000 acres that burned across Forest Service and National Park Service administrative boundaries. We incorporated information from historic, contemporary reference, and modeled sources to define the NRV in mid-elevation coniferous forests of the region. This unique combination of historic and contemporary reference data to define the NRV represented a relatively new application of a thoroughly-tested concept currently supported by Forest Service planning efforts.

Virtually all wildfires managed for resource objectives in the National Forests of the southern Sierra Nevada were within the NRV with respect to fire severity indicators. These patterns were relatively consistent across a range of large wildfire sizes (1,000 to 20,700 acres) and mid-elevation forest types in the region, although larger wildfires tended to produce larger maximum high-severity patches. Only the largest resource objective wildfire in the study (2011 Lion Fire) had a single maximum high-severity patch size that approached the upper NRV value. Our results suggest that the continued and expanded use of resource objective wildfires has the potential to vastly increase the scale of forest restoration efforts in the Sierra Nevada, especially in large wilderness and roadless areas or self-contained firesheds.

Contact (for more info)

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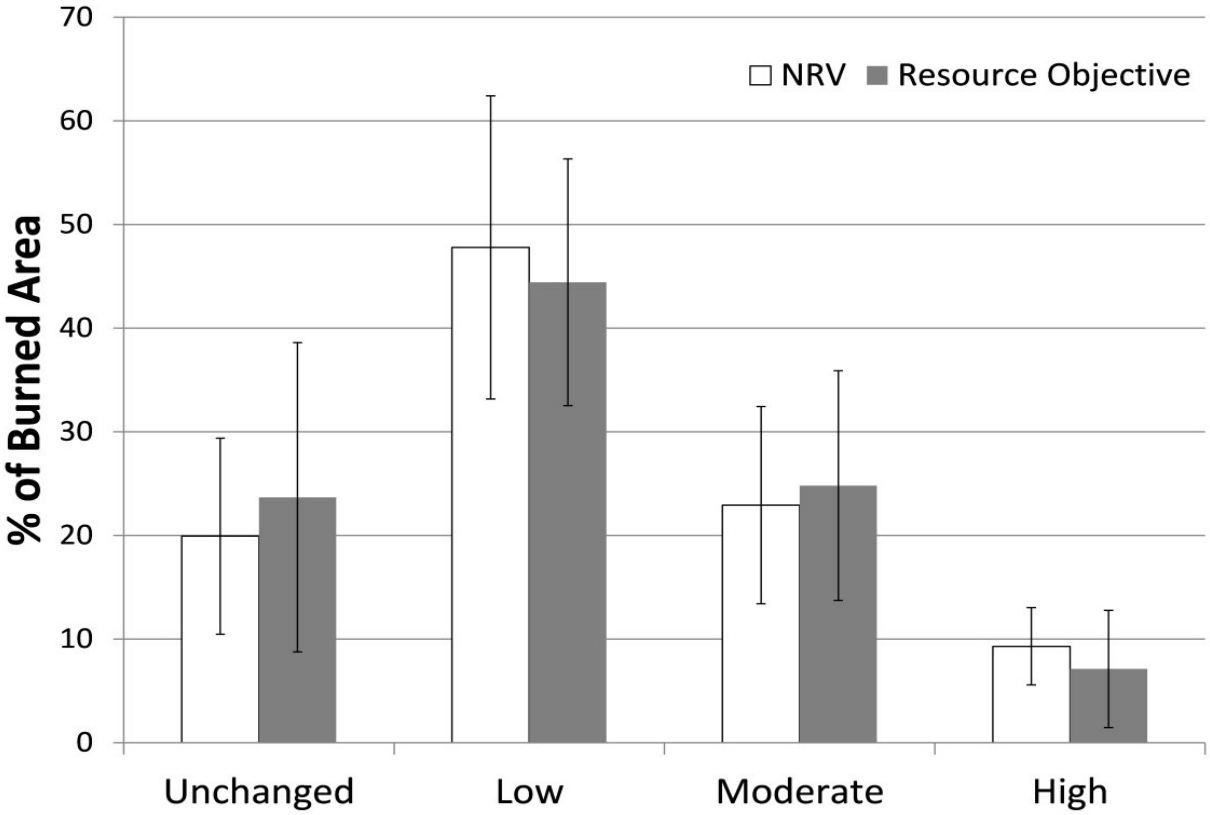
Key partners

Brad Quayle, GIS Specialist and Program Leader, and Tony Guay GIS Analyst, USDA Forest Service, Remote Sensing Applications Center, Rapid Disturbance Assessment and Services Program

Jay Miller, Remote Sensing Specialist, USDA Forest Service, Region 5 Fire and Aviation Management



Mean proportions of fire area burned in four fire severity classes by 17 southern Sierra Nevada wildland fires managed for resource objectives, versus desired conditions based on Ecology Program NRV assessments

FireScape Mendocino

FireScape (Fire Integration in Restoration Ecology using Science and a Collaborative Approach with a Partnership Emphasis) is a collaborative approach to land management that incorporates the best available science and adaptive management principles on a landscape scale with the involvement of partners and shared resources. The vision of FireScape Mendocino is a resilient landscape that provides sustainable habitats for people and animals while supporting the social and economic needs of our communities.

FireScape Mendocino is a collaborative effort to shape the future of fire-prone landscapes in and around the Mendocino National Forest by addressing forest health related planning, implementation, adaptive management, and the sharing of lessons learned. The group, facilitated by the Fire Learning Network (a joint project of The Nature Conservancy, the USDA Forest Service, and several agencies of the US Department of the Interior), is using the Open Standards for the Practice of Conservation for its foundational planning. The FireScape Mendocino landscape starts with nearly 1 million acres of National Forest system lands and expands the analysis area to include lands owned by other federal, state, and local agencies as well as private landowners. The first workshop was held in November 2013. Shared values of the group include: fire adapted communities; fire adapted landscape mosaic; cultural heritage (past, present, and future); diverse economic opportunities; outdoor recreation opportunities; terrestrial species, structure, and function (including chaparral, oak habitats, meadows, and late seral conifer forest); and aquatic and riparian habitat, structure, and function.

Workshop in Paskenta, participants discuss threats to shared values, Photo credit: Mary Huffman/TNC

The Ecology Program has been working closely with the FireScape collaborative through participation in and presentations at workshops and field exercises, as well as by serving as members of the large-scale vegetation management subgroup. We are helping guide discussions on large scale landscape restoration by providing expertise on ecological processes and climate change, assisting with the translation of current science to management, and by identifying and helping to fill information gaps

James Russ, President of Round Valley Indian Tribes Tribal Council, discusses a recent fuel break project near Covelo (Photo credit: Don Amador).

Contact:

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- Working groups within FireScape Mendocino Collaborative include:
  - Fire Adapted Communities
  - Large-scale Vegetation Management
  - Fire and Recreation Infrastructure
  - Tribal Involvement
  - Air Quality Issues
- Focal project areas:
  - Paskenta
  - Covelo/Eel River
  - Lake Pillsbury
  - Upper Lake
  - Stonyford

Core team co-lead, Chad Roberts, discusses forest management with the group during a field exercise. (Photo credit: Don Amador)

Geographic scope of FireScape Mendocino

Key partners

- American Forest Resource Council
- Blue Ribbon Coalition
- Bureau of Land Management
- CAL Fire
- California State Parks OHM Recreation Division
- California Wilderness Coalition
- Central Valley Regional Water Quality Control Board
- Crane Mills
- Environment Now
- Environmental Protection Information Center (EPIC)
- Lake County Fire Safe Council
- Lake Pillsbury Homeowners Association
- Mendocino Redwood Company and Humboldt Redwood Company
- Office of Congressman Doug LaMalfa
- Office of Congressman Jared Huffman
- Round Valley Confederated Indian Tribes
- Sierra Pacific Industries
- Tehama County Resource Conservation District
- The Nature Conservancy's Fire Learning Network
- Tuleyome/Yolo Audubon Society
- USDA Forest Service - Mendocino National Forest
- USDA Forest Service – Region 5
- USDA Natural Resources Conservation Service
- West Ecosystems Analysis
- Private landowners, citizens, and foresters

Influence of post-fire vegetation and fuels on fire severity patterns in re-burns: Implications for restoration

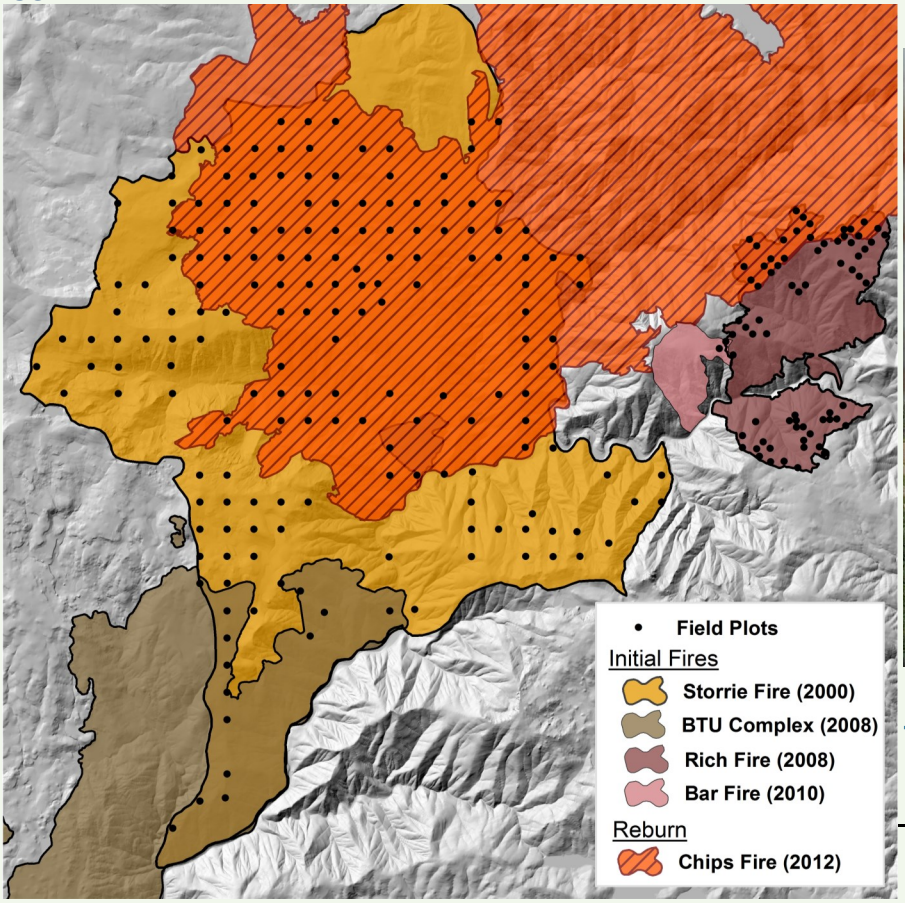
In the face of changing climatic regimes and increases in extreme fire weather, forest managers may feel they have few options to restore low and moderate severity fire regimes. However, recent work by the Sierra Cascade Ecology program and PSW researchers suggest that vegetation composition, structure, and fuels are important drivers of fire severity in both initial and subsequent fires.

"Initial high severity fire led to an increase in standing snags and shrubs, which promoted high severity fire in the reburn."

Key Findings

- Results from our study suggest that fire may be reinforcing rather than restoring altered conditions in the Sierra Nevada.
- The risk of future high severity fire may be higher in areas that have already burned at high to moderate severity, especially in areas that have a high density of standing snags and regenerating shrubs.
- Management activities, such as thinning, prescribed fire, or managed wildland fire, should be considered as tools for moderating fire behavior not only prior to initial fires, but also before subsequent reburns.

Locations of field plots (n=249) within overlapping fires on the Plumas and Lassen National Forests, California, USA



The 2000 Storrie Fire on the Plumas National Forest

Collecting post-fire field data

Project Overview:

Increasing incidence of large wildfires with extensive high severity effects across the western U.S. has shifted the focus of land management toward post-fire landscapes. Restoration of specific resources damaged by wildfire is often the primary focus of management efforts; however there is growing recognition that larger scale post-fire management may be needed to promote resilience to subsequent fires. In areas where fire regimes and forest structure have been dramatically altered, there is increasing concern that contemporary fires have the potential to set forests on a positive feedback trajectory with successive reburns, one in which extensive stand-replacing fire could promote more stand-replacing fire.

Between 2009 and 2012, we established 249 forest and fuels inventory plots within the footprint of four overlapping fires that burned between 2000 and 2010 (see map below). Shortly after data collection, the 2012 Chips Fire reburned 118 of our plots. The information obtained from these field plots allowed for a unique set of analyses investigating the effect of vegetation, fuels, topography, fire weather, and forest management on reburn severity. We also examined the influence of initial fire severity and time since initial fire on influential predictors of reburn severity.

We found a positive relationship between initial fire severity and the severity of the subsequent reburn. We also found that beyond the overarching influence of fire weather, two of the most influential variables driving reburn severity patterns were snag density and shrub cover, both of which were influenced by initial fire severity and time since initial fire. These results suggest that initial high to moderate severity fire led to an increase in standing snags and shrub vegetation, which in combination with severe fire weather, promoted high severity fire in the subsequent reburn. In areas where frequent high severity fire is undesirable, managers may consider implementing treatments such as thinning, prescribed fire, or managed wildland fire to moderate fire behavior not only prior to initial fires, but also before subsequent reburns.

Contact (for more info)

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Key partners

Brandon Collins, Pacific Southwest Research Station and UC Berkeley

Nine years after the 2000 Storrie Fire, high severity patches are dominated by standing snags, coarse woody fuels, and dense shrub cover.

Understanding the Value of Chaparral

A workshop highlighting:

- **Status and Trends in Chaparral-** Phil Rundel, Kat Anderson, Jon Keeley, Char Miller, Alex Syphard & Steve Davis
- **Bio-physical Services-** Jon Keeley, Megan Jennings, Keith Lilley, Chris Solek, Pete Wohlgemuth & Darrel Jenerette
- **Cultural Services-** Pat Winter & Rick Halsey
- **Ecosystem Service Assessment-** Hugh Safford, Emma Underwood, Cloe Garnache & Frank Lupi

Chaparral Restoration Project

The southern California Province spans 3.7 million acres of National Forest land, most of which is dominated by chaparral vegetation. This highly diverse vegetation type interfaces with urban areas that are home to over 20 million people. Despite chaparral providing the backdrop to southern California, this widespread vegetation type is undervalued and underappreciated. To raise awareness of this valuable resource, the Pacific Southwest Regional Ecology Program, in coordination with California Fire Science Consortium and the Angeles National Forest hosted a 3 day workshop and 2 day field trip focused on '*Understanding the Ecological Value of Chaparral Landscapes: Ecosystem Services, Human management and Future Trends*'.

Over 150 attendees gathered on June 8-11th, 2015 at the Angeles National Forest to hear the world's leading experts discuss a diversity of chaparral-centric topics ranging from Native American uses, to biodiversity, to water provision and erosion control. Participants represented diverse groups including National Parks, non-profits, academic institutions, state and city officials and concerned citizens. The workshop was followed by a poster presentation and field trips to the San Gabriel River (see inset) and Station Fire burn scar.

The workshop generated important dialogue concerning the ecological value of chaparral, the ecosystem services that chaparral landscapes provide and projected trends in the sustainability of this precious and unique natural resource. This effort is being followed-up by an edited book volume highlighting the 'Ecological Value of Chaparral Landscapes' to be published by Springer in early 2017.

Keith Lilley (LA DPW) describes the effects of fire and subsequent sedimentation on reservoir capacity and dam function along the San Gabriel River.

Jerry Bird, Marty Dumpis, and Steve Bear discuss chaparral issues on a workshop field trip

Presentations can be viewed at: http://www.cafiresci.org/announcements-source/category/2nd-annual-southern-chaparral-symposium-talks-are-posted

Acknowledgements: Marty Dumpis (USFS), Jennifer Hooper (USFS), Emma Underwood (UC Davis), Marti Witter (NPS), Stacey Frederick (CA Fire Science Consortium), The Nature Conservancy & Angeles National Forest.

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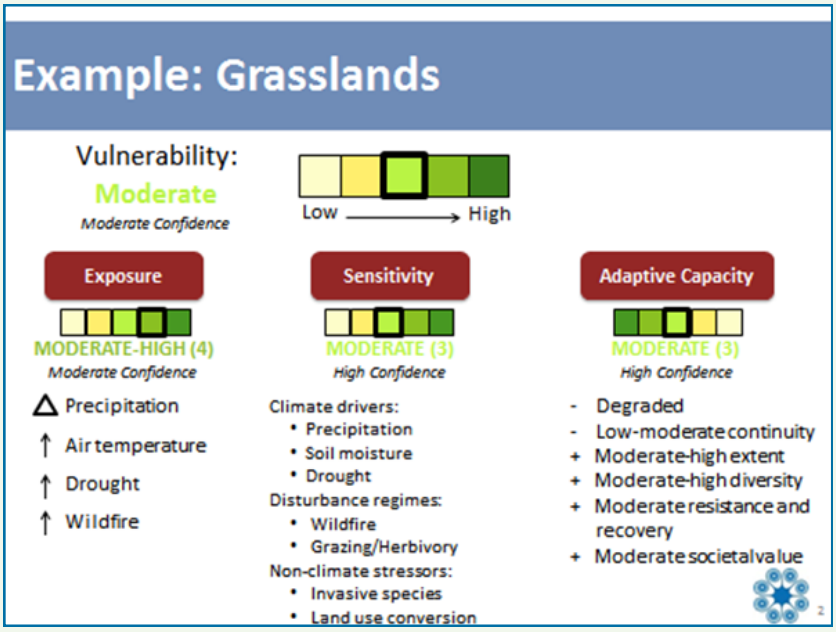
Climate Change Vulnerability Assessments for Southern California Habitats

Overview

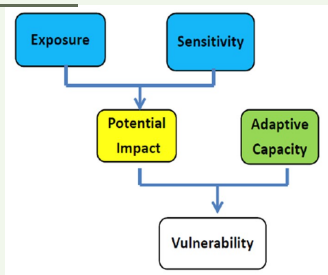
We partnered with EcoAdapt to assess the vulnerability of 12 focal habitats in the southern California National Forests. The goal was to identify which habitats are most vulnerable to climate change and why. The following steps were used to evaluate vulnerability:

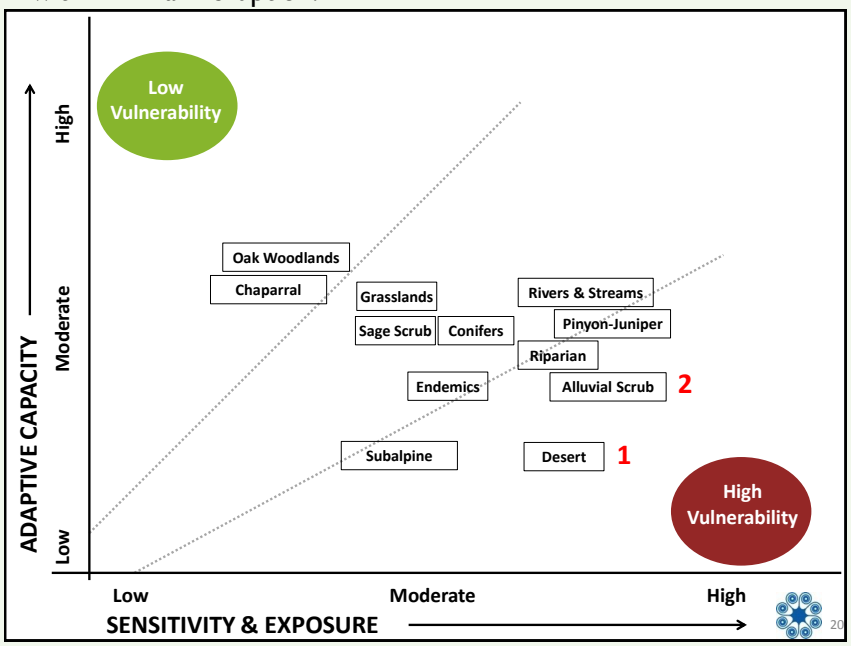
- EcoAdapt compiled habitat vulnerability information and regional climate projections.
- Habitat information was distributed to 3-5 habitat experts; each of whom completed an online vulnerability survey and reviewed a draft narrative using the provided information.
- EcoAdapt integrated comments and scores from experts to finalize vulnerability assessments.



Key vulnerability components :

- **Exposure**: Measure of how much of a change in climate or other environmental factor a resource is likely to experience
- **Sensitivity**: Measure of whether and how a resource is likely to be affected by a given change in climate.
- **Adaptive Capacity:** Ability to accommodate or cope with climate change impacts with minimal disruption.





General Trends

- Climate Stressors and Disturbance Regimes
  - Precipitation variability
  - Drought
  - Soil moisture
  - Wildfire
- Non-Climate Stressors
  - Invasive species
  - Land use conversion
- Adaptive Capacity
  - + Relatively high species diversity
  - + Provide many ecosystem services
  - - Fragmented and currently degraded

Contact

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Partners and Products

EcoAdapt, California Landscape Conservation Cooperative, Conservation Biology Institute

http://ecoadapt.org/programs/adaptation-consultations/socal

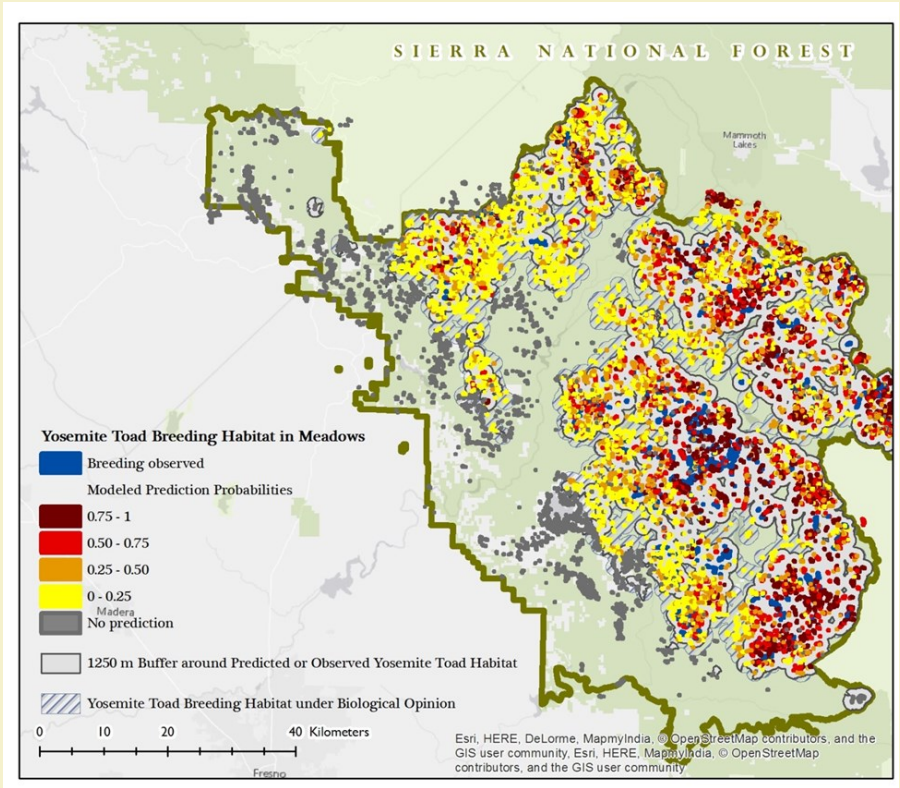
Yosemite Toad Breeding Occupancy Modeling on the Sierra National Forest

Yosemite Toad

Yosemite toad (*Anaxyrus canorus*) is a Federal Threatened Species that breeds in shallow water associated with meadows in the central and southern Sierra Nevada. Despite the importance of Yosemite toad breeding habitat to the long-term conservation of the species, little information is available to evaluate the breeding occupancy patterns of Yosemite toad on the National Forests in Region 5. To address this information gap, we developed a spatially-explicit model of Yosemite toad breeding occurrence probability on the Sierra NF based on the model of Berlow et al. (2013) for Yosemite National Park. Our model can help the Sierra NF to refine restoration objectives and project planning and meet the intent of the U.S. Fish and Wildlife Service Biological Opinion (BO). The U.S. Fish and Wildlife Service were highly supportive of these modeling efforts on the Sierra NF, and there is potential for expanding this project to encompass other National Forests in Region 5.

Project Approach

- We used a recently published spatially-explicit model of Yosemite toad (*Anaxyrus canorus*) breeding probability in meadows of Yosemite National Park (i.e., Berlow et al. 2013) to more precisely determine the occurrence of Yosemite toad breeding habitat on the neighboring Sierra National Forest.
- The spatial model was trained using 154 meadows in Yosemite NP with breeding toad detections, and 1,165 YNP meadows that had no detections. We validated our model using over 2,000 meadow locations from the Sierra NF (414 with breeding detections, 1,598 without).



Distribution of Yosemite toad breeding habitat prediction probability quantile classes for the Sierra National Forest.

Key Points

- Our model accurately predicted Yosemite toad breeding occurrence in 82% of Sierra NF meadows, while accurately predicting non-detection of breeding occurrence in 60% of meadows.
- We used several metrics in our occupancy model related to elevation, slope, normalized difference water index (NDWI), normalized difference vegetation index (NDVI), snowpack, precipitation, and temperature.
- Our results indicate that the Yosemite toad occupancy model developed for Yosemite National Park by Berlow et al. (2013) has high potential for estimating meadow occupancy of breeding toads on the neighboring Sierra National Forest. These results will help map suitable breeding habitat for Yosemite toad on the Sierra NF, where this information was previously unavailable.
- Future modeling efforts may be expanded to other National Forests in Region 5 to evaluate suitable breeding habitat of Yosemite toad as defined by the recent U.S. Fish and Wildlife Service Biological Opinion (BO).
- For occupancy model publication see: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0072200]

Contact (for more info)

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Key partners

- Steven Lee and JR Matchett, U.S. Geological Survey, Western Ecological Research Center, Yosemite Field Station, Oakhurst, CA
- Steven Ostoja, Ecosystem Staff Officer, Sierra National Forest, Clovis, CA

Yosemite toad breeding habitat in a wet meadow of Yosemite National Park.

"Our model accurately predicted Yosemite toad breeding occurrence in 82% of Sierra National Forest meadows"

Power Fire landscape

Power Fire Ecological Framework and Reforestation Project

We utilized field inventory and monitoring combined with historical information and reference site conditions to identify desired conditions and restoration objectives for the Power Fire.

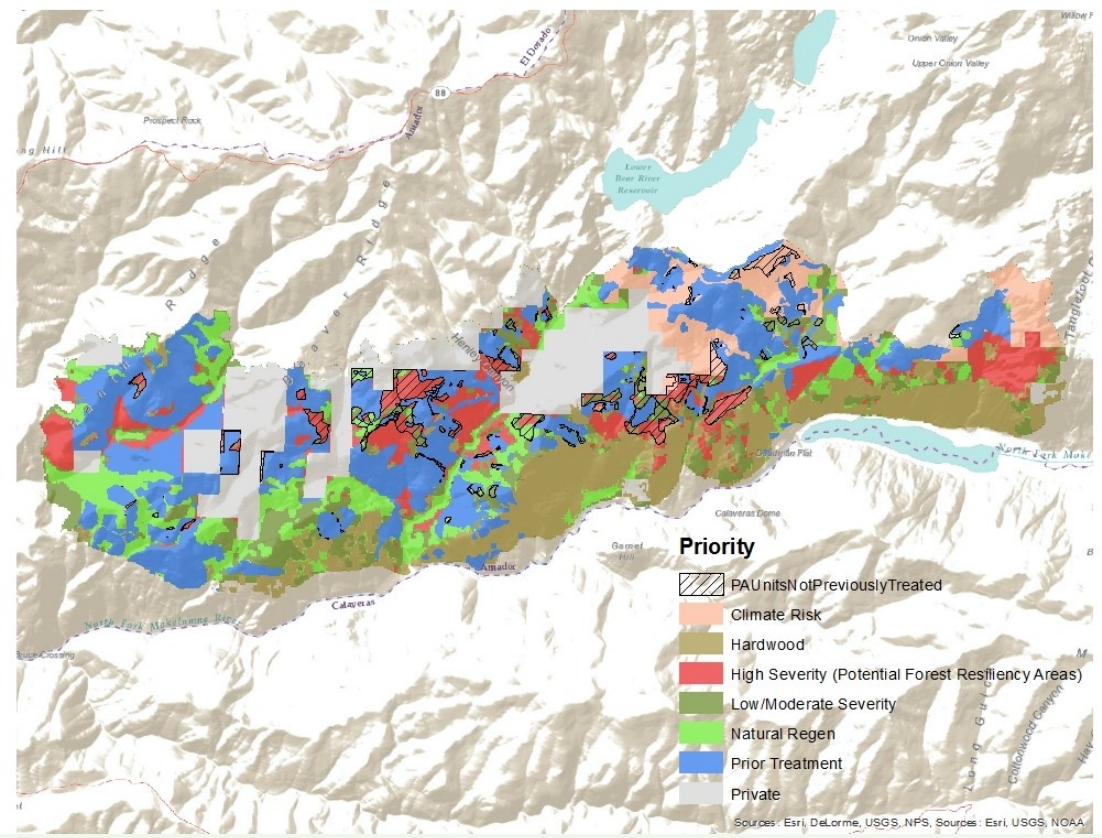
Overview

The Power Fire was reported on October 6, 2004. The fire burned at varying intensity on approximately 17,005 acres on the Eldorado National Forest and on private timberlands. During the summer and fall of 2005 the Power Fire Restoration FEIS was implemented on 60% of the project.

Following large scale fires, an opportunity exists to define a landscape scale strategy to realign restoration treatments with an area. We completed an ecological assessment of the Power Fire to guide management from an ecological perspective. The ecological framework combined data on historic condition, conditions immediately prior to the fire, post fire conditions, and long term climate expectations for the area to inform management actions. Specifically we looked at changes in vegetation resulting from the fire, landscape position (elevation, slope, aspect), climatic water deficit, and forest regeneration potential.

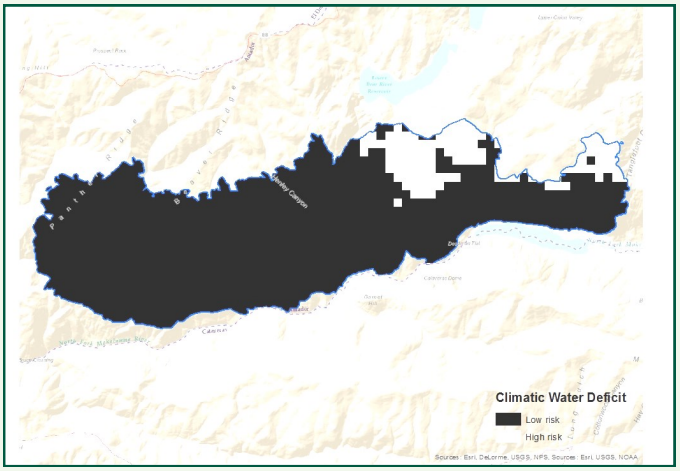
In addition, we summarized the literature on the natural range of variation (NRV) for long term desired stocking, cluster arrangements and species proportions based on topographic position. We combined the ecological framework with the desired stocking NRV to develop an alternative in the Power Fire Reforestation Environmental Impact Statement.

"Areas in the Power Fire that burned at lower severities are likely to maintain their structure and function into the future"



Ecological framework for the Power Fire area with proposed treatment units in the current decision that were not identified as previously treated. The GIS data should be used to look at overlapping spatial layers.

Key Findings and Recommendations



- Ecological Framework key findings:
  - Areas in the Power Fire that burned at lower severities are likely to maintain their structure and function into the future, while areas that burned at higher severities will shift to an early seral state.
  - The total area burned was weighted heavily towards large patches; 84% of the total high severity area was in patches >150 acres.
  - In the Power Fire the greatest risk of an increased climatic water deficit under a warming climate is in the northeast portion of the burned area primarily along ridges and to a lesser extent on southwest facing midslopes.
- Several of the general reforestation recommendations included:
  - Areas that burned at low and moderate fire severity should be excluded from post-fire treatment (i.e. thinning and revegetation) and maintained through a robust prescribed fire treatment program to maintain the beneficial effects from the fire.
  - Where natural regeneration is unlikely to be reliable to achieve future desired conditions within a desirable timeframe, prioritize reforestation efforts where past, pre-fire and future climate information indicates that coniferous forest stands are likely to be more sustainable and resilient into the future (forest resiliency areas).
  - Use landscape position to help guide reforestation densities, arrangement, and species composition to steer forest stands to more resilient future conditions.
  - Efforts to sustain reforestation efforts should include both planted and natural regeneration areas.
  - Release treatments should target shrubs based on species, height, and the extent to which they are directly interfering with the growth of the planted seedlings.
  - Minimize reforestation efforts in locations identified as having a high risk of climatic water deficit (High Climate Risk). If reforestation activities do occur in these areas reduce the stocking levels or adjust the species composition to account for future water deficits.

Contact (for more info)

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Key partners

Amador-Calaveras Consensus Group https://acconsensus.wordpress.com/

Power Fire Landscape

Restoring infrequent, high severity fire regimes to maintain Baker cypress

"The Mud Lake unit is at significant risk of another high severity fire before the Baker cypress population can mature."

The 2007 Moonlight Fire resulted in high severity fire effects throughout the Mud Lake RNA, promoting substantial Baker cypress regeneration. However, these seedlings have not yet produced cones. If a fire occurs before this population can mature, it will be extirpated.

Key Points

- Baker cypress is a serotinous species that regenerates after fire from seeds accumulated in cones. Baker cypress are adapted to fire regimes of high severity with long (i.e. >30 year) return intervals. Fires occurring more frequently have extirpated other populations of cypress.
- The Baker cypress population at the Mud Lake Research Natural Area (RNA) consists primarily of immature trees (without cones) after the 2007 Moonlight Fire.
- As a result of pre-fire forest densification caused by over 100 years of fire suppression, the Mud Lake RNA currently has very high fuel loads of standing snags and down logs. The Mud Lake unit is at significant risk of another high severity fire before the Baker cypress population can mature.
- We designed a fuel treatment project to protect and maintain the population of Baker cypress at the Mud Lake RNA by creating conditions that promote a natural fire regime of infrequent, high severity

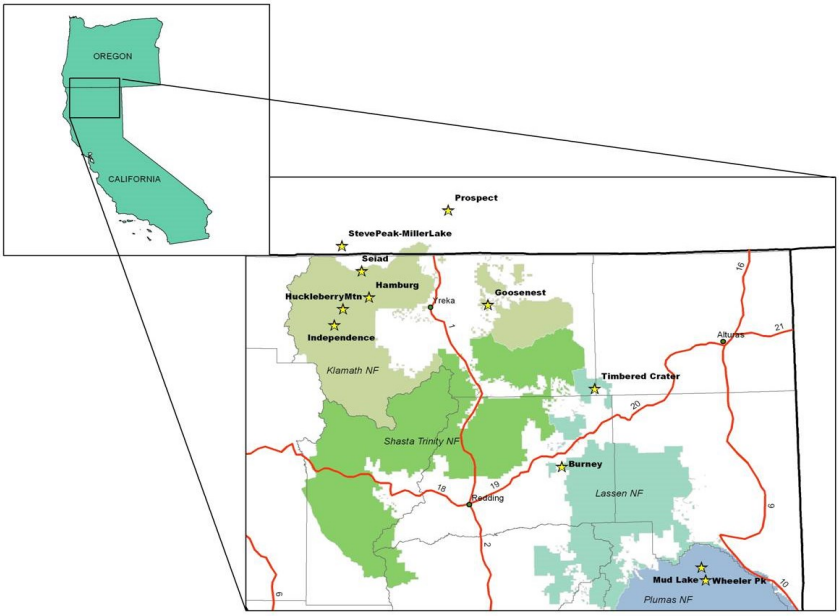

Figure 1: Distribution of Baker cypress

Project Overview:

Baker cypress (Hesperocyparis bakeri) is a rare fire-adapted conifer known from only 11 widely scattered locations in northern California and southern Oregon (Figure 1). Baker cypress possess serotinous cones that open in response to high severity fire, and seeds that require high sunlight and exposed mineral soil characteristic of burned areas to germinate. Cypress species lack the ability to resprout, and therefore cypress populations must reestablish from seed. The primary seed source for post-fire regeneration comes from seeds accumulated inside cones. If fires occur too frequently, cypress may not have sufficient seeds to regenerate the population. Baker cypress do not begin producing cones until they are at least 14 years old, and require between 35 and 50 years to develop sufficient canopy seed storage to re-establish the population after fire.

The 2007 Moonlight Fire resulted in high severity fire effects throughout the Mud Lake RNA, promoting substantial Baker cypress regeneration (Figure 2). However, these seedlings have not yet produced cones. If a fire occurs before this population can mature, it will be extirpated. Other California cypress species have declined, and one is threatened with extinction, as a result of too frequent fire. The Mud Lake RNA is currently characterized by extremely high fuel loads and high densities of standing snags. (Figure 3) These conditions are a direct result of pre-fire forest densification caused by over a century of fire suppression. Research conducted on the Plumas and Lassen National Forests found that areas that had previously burned at high severity were reburning at high severity after a period of only 10 years (see highlight: Influence of post-fire vegetation and fuels on fire severity patterns in reburns: Implications for restoration). These findings further emphasize that the Mud Lake RNA is at significant risk of another high severity fire before the Baker cypress population can mature.

Figure 2: Baker cypress regeneration after the 2007 Moonlight Fire

We designed a 285-acre fuel reduction project, consisting of grapple piling small snags and downed logs, followed by pile burning, while avoiding areas that support cypress seedlings. These treatments are designed to break up fuel continuity and promote heterogeneity while creating a strategic fuel break around the Mud Lake RNA. We hope this project will not only reduce the potential for high severity fire during the next 30 to 50 years, but will also create a fuel break that could be used to allow high intensity fire to safely burn through the Mud Lake RNA when conditions are appropriate in the future. If we do not create conditions that allow a high severity, infrequent fire regime to occur at this site, the long-term sustainability of Baker cypress at the Mud Lake RNA is in jeopardy.

Figure 3: High snag densities and surface fuel loads at the Mud Lake RNA

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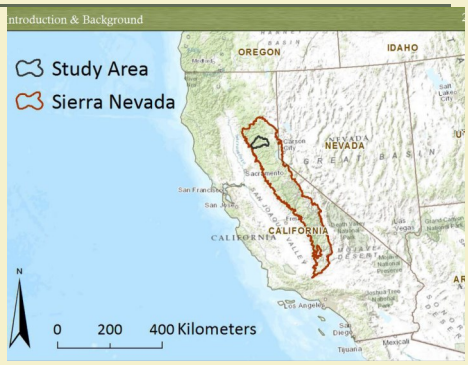
Modeling the Historical Range of Variation in the Yuba River Watershed

Historic Range of Variation (HRV) analysis is a useful tool for landscape planners looking to restore ecological integrity. This project quantified the historical range of variation for vegetation structure in the Upper Yuba River Watershed on the Tahoe National Forest, utilizing a stochastic, spatially explicit model previously developed for use in the Rocky Mountains. Project outputs provide the first spatial estimate of probable pre-Euroamerican settlement conditions for a major river watershed in the Sierra Nevada and will be invaluable to Forest planning and restoration project development and evaluation.

Key Products

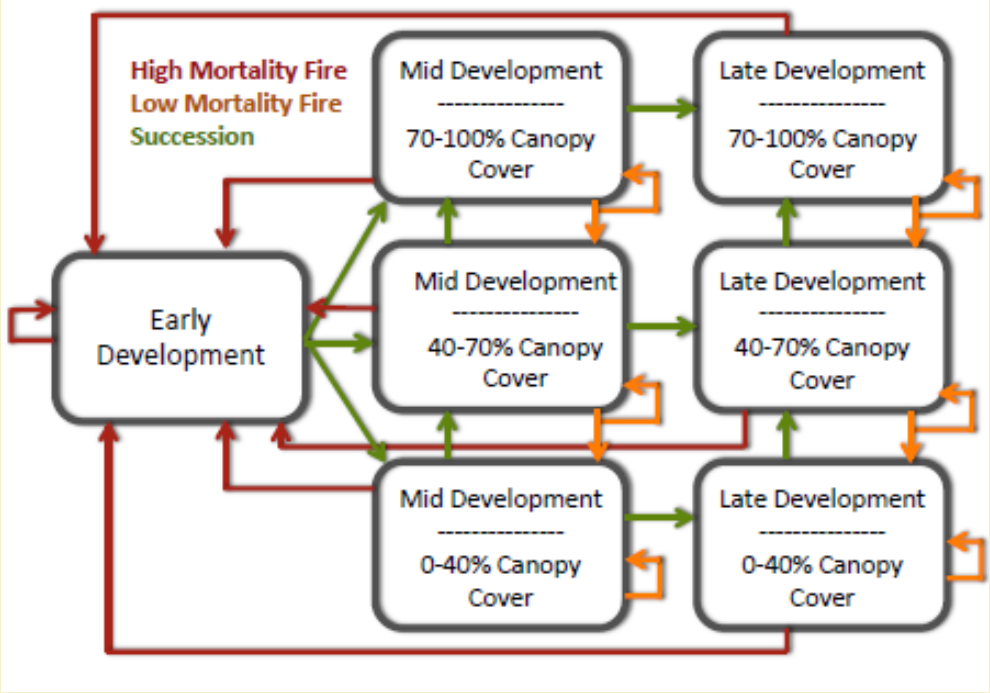
- A complete compendium of vegetation cover types in the Upper Yuba River Watershed that covers vegetation descriptions, disturbance regimes, vegetation seral stages, and references;
- Models outputs detailing disturbance regimes, landscape composition and landscape configuration for major vegetation types in the Upper Yuba River Watershed;
- Assessment of the current departure of the landscape in relation to the historic range of variation;
- Management recommendations and relevant uses for forest planning.



Study Site

Contact (for more info)

Becky Estes, Central Sierra Province Ecologist, 100 Forni Road, Placerville, CA 95667, bestes@fs.fed.us



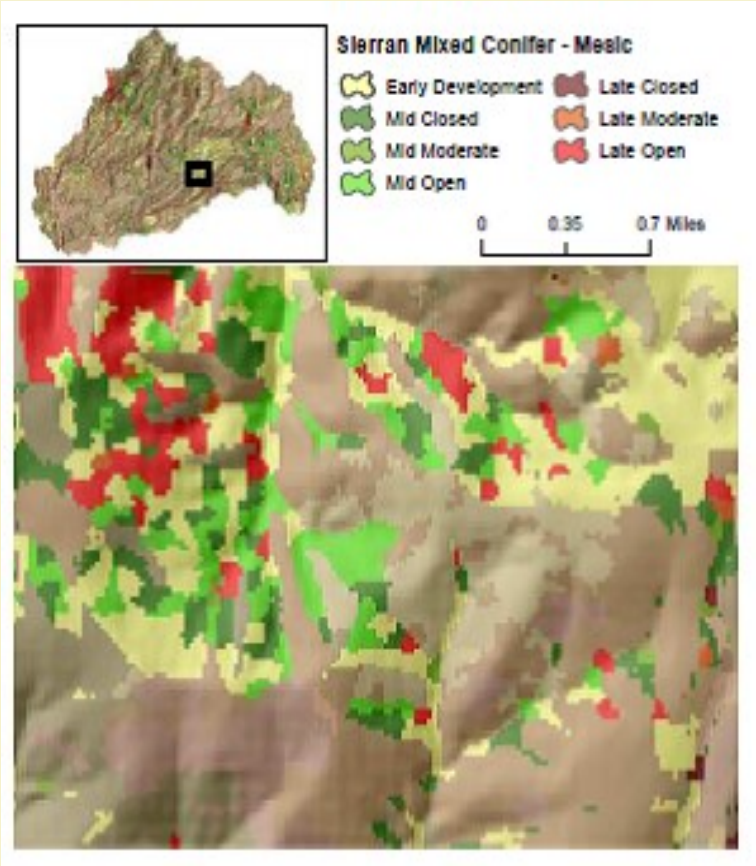
State-Transition model for non-shrub seral types

Project Overview

Working collaboratively with the Tahoe National Forest and partners at the University of Massachusetts, we capitalized on the existence of a spatially explicit and raster-based stochastic model ("RMLands") developed for use in the Rocky Mountains. RMLands is a spatially explicit, stochastic, landscape level disturbance and succession model which runs a linked suite of state and transition models similar to the Landfire Biophysical models. The tool simulates change over large temporal and spatial scales. Disturbances such as fires of differing severities are simulated from initiation and spread based on a particular locations susceptibility to fire and then a high or low severity outcome is produced. These outcomes drive the vegetation composition, seral stages, and landscape configuration and can be summarized across the landscape or by vegetation types.

In order to make these models relevant to the Upper Yuba River Watershed, an iterative process was employed involving relevant experts in the dominant vegetation types to help modify parameters and select pertinent data layers. This modified RMLands version, adapted for the Sierra Nevada, was then used to simulate the historic range of variability during the reference period. Model outputs which are still in the development phase will be used to assess the departure of the current landscape from the historic range of variability. These results will assist the forest in project and forest level planning. Currently we are working with UMass and the Tahoe NF to assess to what extent different management scenarios in the watershed are able to create fire-resilient conditions that are similar to the HRV.

"Plan decisions affecting ecosystem diversity must provide for maintenance or restoration of the characteristics of ecosystem composition and structure within the range of variability that would be expected to occur under natural disturbance regimes" - USFS 2012 Planning Rule

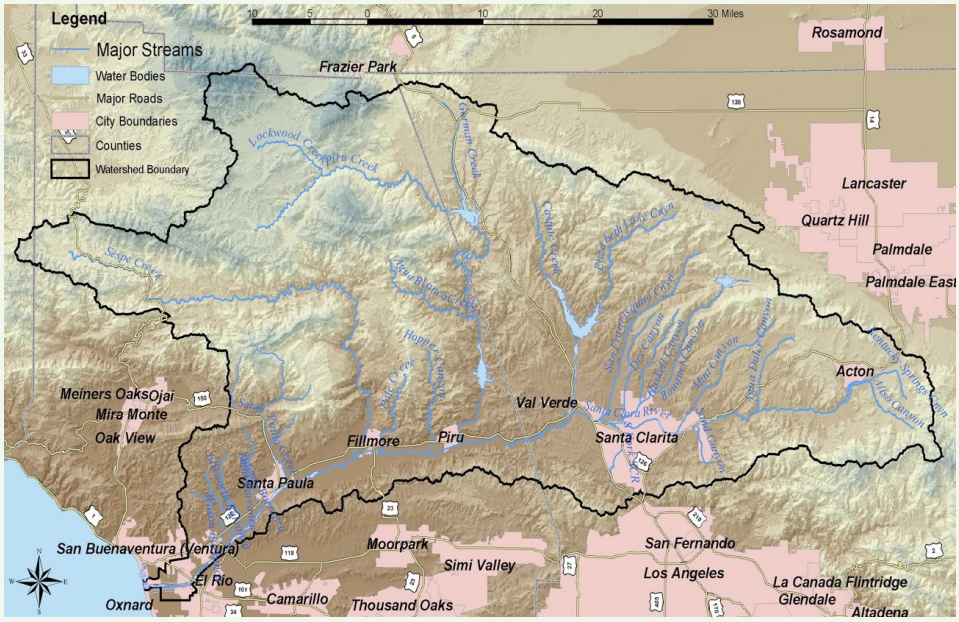


An example of timestep 4 showing the seral stages at one time step in Sierran Mixed Conifer Mesic.

Key partners

Kevin McGarigal and Maritza Mallek, University of Massachusetts, Amherst
Tahoe National Forest Service Staff

Valuing Ecosystem Services in southern California watersheds



Santa Clara Watershed

Project goals

- To increase understanding of ecosystem services in chaparral-dominated landscapes
- To provide a transparent framework to;
- Assess damages post fire
- Estimate the impacts of climate change on ecosystem services
- Guide management activities with greatest ecosystem services return on investment
- To help communicate the value of chaparral and federal lands in the watershed
- To complement the growing role of ecosystem services within the US Forest Service

Projected outcomes

- Digital and hardcopy maps of six ecosystem services; GIS products highlighting priority areas for different services and bundles of services for management focus
- A website which provides socio-economic data associated with the value of each ecosystem service, the results of the recreational use survey, and a searchable database of the benefit-transfer studies used
- An interactive GIS-based tool that will assist in the valuation of ecosystem services for project areas and planning landscapes, as well as efforts like postfire cost recovery assessments
- Outreach materials to demonstrate the public benefit of natural landscapes and highlight the contribution of National Forest lands
- A project report, and three peer-reviewed articles

A unique opportunity

- To date, no valuations conducted for chaparral-dominated landscapes to inform fire damage assessments or the return on investment of management actions, including climate change adaptation
- Climate projections indicate significant impacts in southern California
- The human beneficiaries of these services live in close proximity to the National Forests
- These landscapes are recognized as a biodiversity hotspot
- Findings will contribute to an understanding of services across Mediterranean habitats globally
- It will provide southern National Forests with data and tools for more holistic management of resources

Contact (for more info)

Hugh Safford, Regional Ecologist, Pacific Southwest Region, 1323 Club Drive, Vallejo, CA 94592; Phone: 707-562-8934; E-mail: hughsafford@fs.fed.us

Project Overview:

Project Workshop, Santa Maria CA

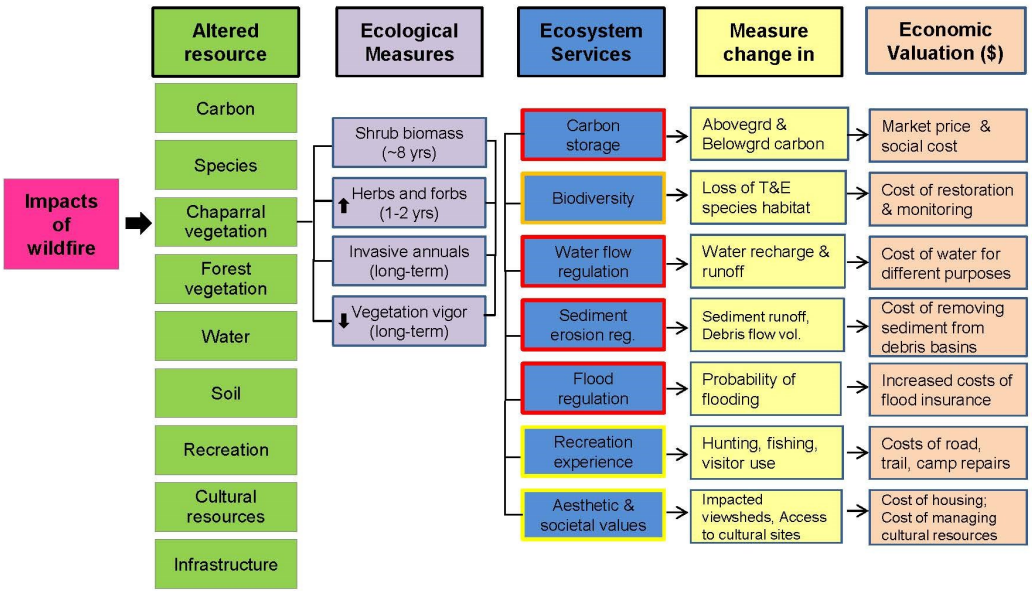
This three year project (started October 2014) between USFS, UC-Davis, and Michigan State University aims to spatially measure and economically value six ecosystem services in the Santa Clara River Watershed. Funding for the project has come from the USFS Pacific Southwest Region, the Western Wildland Environmental Threat Assessment Center (WWETAC), the California Landscape Conservation Cooperative (LCC), UCD, and MSU. Services being assessed include carbon storage, water quantity (runoff and recharge), sediment erosion regulation, biodiversity, and recreation. The project is also working in close collaboration with an assessment being carried out of the vulnerability of southern California to climate change by UC-Davis and the Rocky Mountain Research Station. To measure these services we are using a combination of geographic data, remotely sensed data, and modified regional spatial models. To economically value the services we are using a combination of benefit-transfer methods and implementing a primary survey for informing recreation values. Once these baseline data have been compiled we will: (a) measure the impact of up to four major fires on the quantity and value of ecosystem services (e.g., Piru, Ranch, Copper and Powerhouse); (b) assess the impact of climate change on these ecosystem services; and (c) develop a decision making information tool for natural resource managers.

Key partners

Emma Underwood-Russell, project manager, University of California-Davis; Cloe Garnache and Frank Lupi, resource economists, Michigan State University; Lorie Srivastava, economist, UC-Davis; Jim Quinn, Information Center for the Environment, UC-Davis; USFS Pacific Southwest Research Station – Riverside Lab

Means-End Framework* for linking the impacts of disturbance, climate change, or mgt actions on ecosystem services and how these services can be measured and valued.

*Fire example given is highly simplified to show key points



Project Team

US Forest Service: Hugh Safford (Regional Ecologist), Nicole Molinari (Province Ecologist), Mark Metcalfe (Regional Economist)

University of California, Davis: Emma Underwood (Spatial Ecologist), Allan Hollander (Biogeographer), James Quinn (Spatial Ecologist)

Michigan State University: Frank Lupi (Resource Economist), Cloe Garnache (Resource Economist)

For more information contact: hughsafford@fs.fed.us

United States Department of Agriculture

Ecology Highlights

Forest Service Region 5 Ecology Program 2012-2013

Region 5 Ecology Program

Forest Service

Pacific Southwest Region
Ecology Program

2014/ 2015