Forest Management Strategies for Fuels Reduction and Sensitive Species Under Changing Climate Conditions

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Current Fuels Strategies:
Strategic Areas treated as Defense or Defensible Fuel Profile Zones

Defense zone treatment

Stanislaus-Tuolomne Experimental Forest 1929

- Most of the Forest Matrix: Fuels reduction using Strategically Placed Area Treatments (SPLATS) which generally reduce stem density and move structure toward a historic, more fire-resistant condition

- With climate change, however, are restoring forests to these conditions even an appropriate goal? Does the past still have lessons for managing forests as climate shifts?

GLOBAL CLIMATE CHANGE:

GOING WHERE NO PLANET HAS GONE BEFORE!

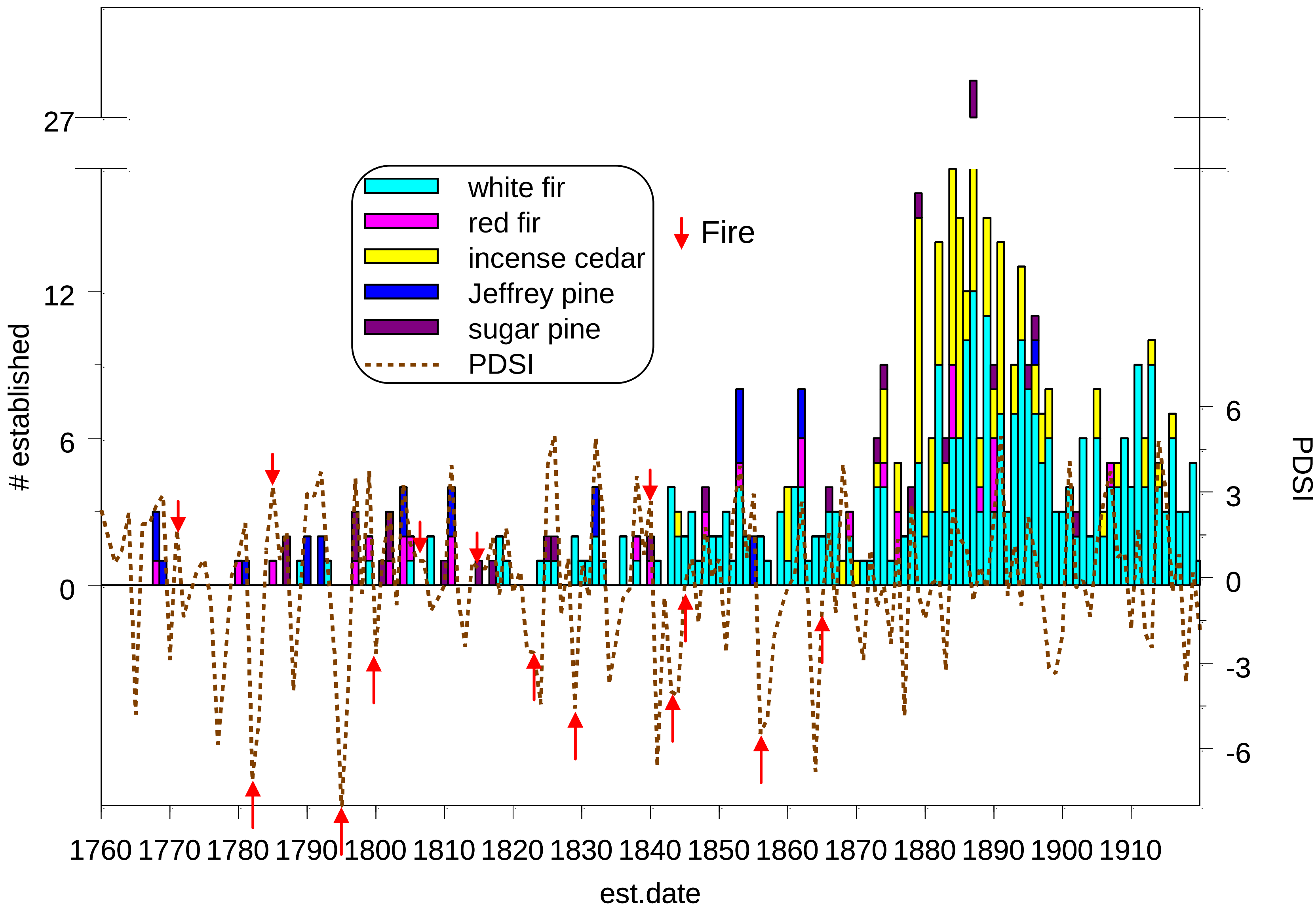
We have to use information and theory developed from studies of past and current forest conditions

- Very difficult to estimate the response of threatened and endangered species (TES) in forest environments to changing climate conditions. In general, a cautious approach is to maintain habitat connectivity and provide a variety of forest conditions.

- Established Sierran trees, on the other hand, have been remarkably resilient to episodic stresses such as prolonged La Niña droughts.

- Most changes to forest communities occur with either regeneration or mortality.

Before fire suppression (1865) recruitment and mortality was 'pulsed' by fire and climate, particularly El Nino events



Some scientists suggest the two greatest threats to providing future TES habitat are significant changes in forest conditions due to:

1)Increased probability, severity, and size of future wildfire regimes.

2)Chronic moisture stress resulting from fire suppression increases in stem densities, which may accelerate tree mortality, particularly of large tree associated with many TES.

California spotted owl on a giant sequoia

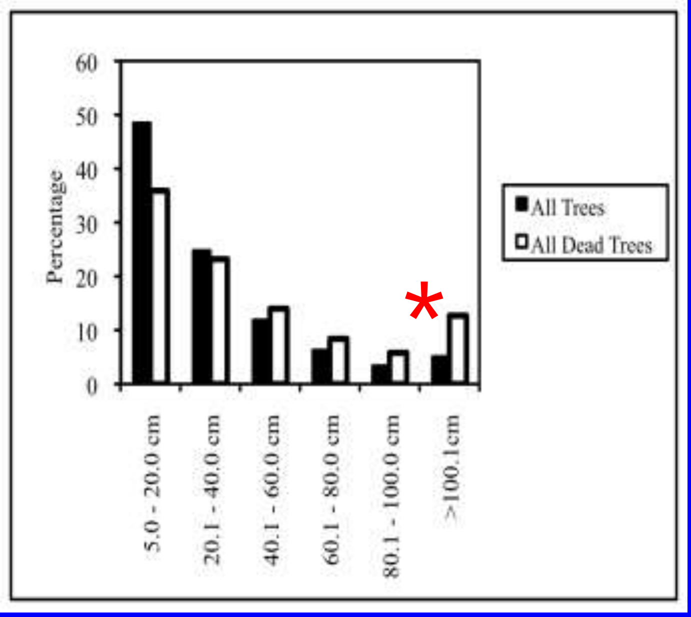
Forest Resilience: Greatest Challenge is Change in Mortality Patterns

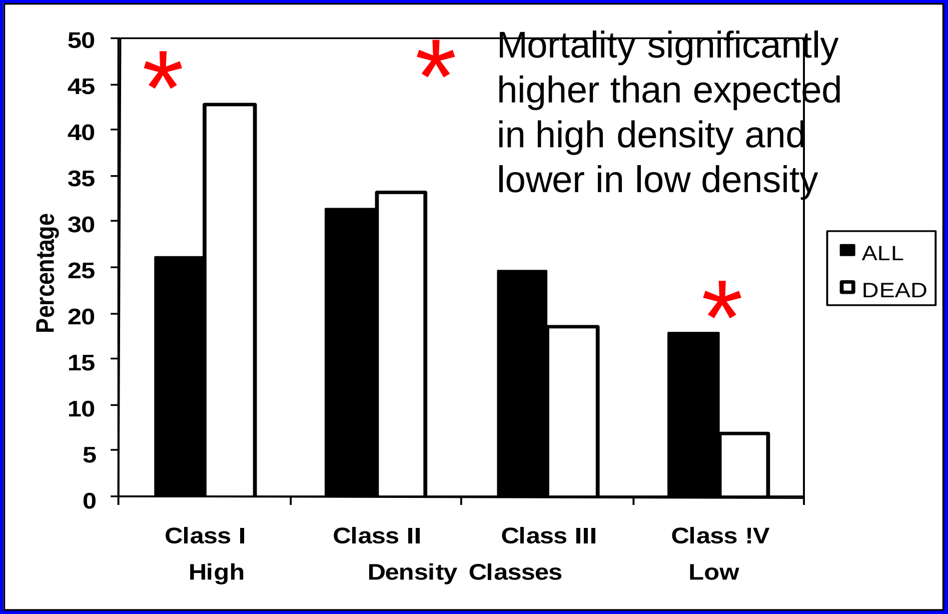
- Mortality in the forest is now primarily driven by drought and beetles

- Mortality is significantly higher than expected for large trees and those most crowded

- Tree density, from fire suppression contributes to drought stress

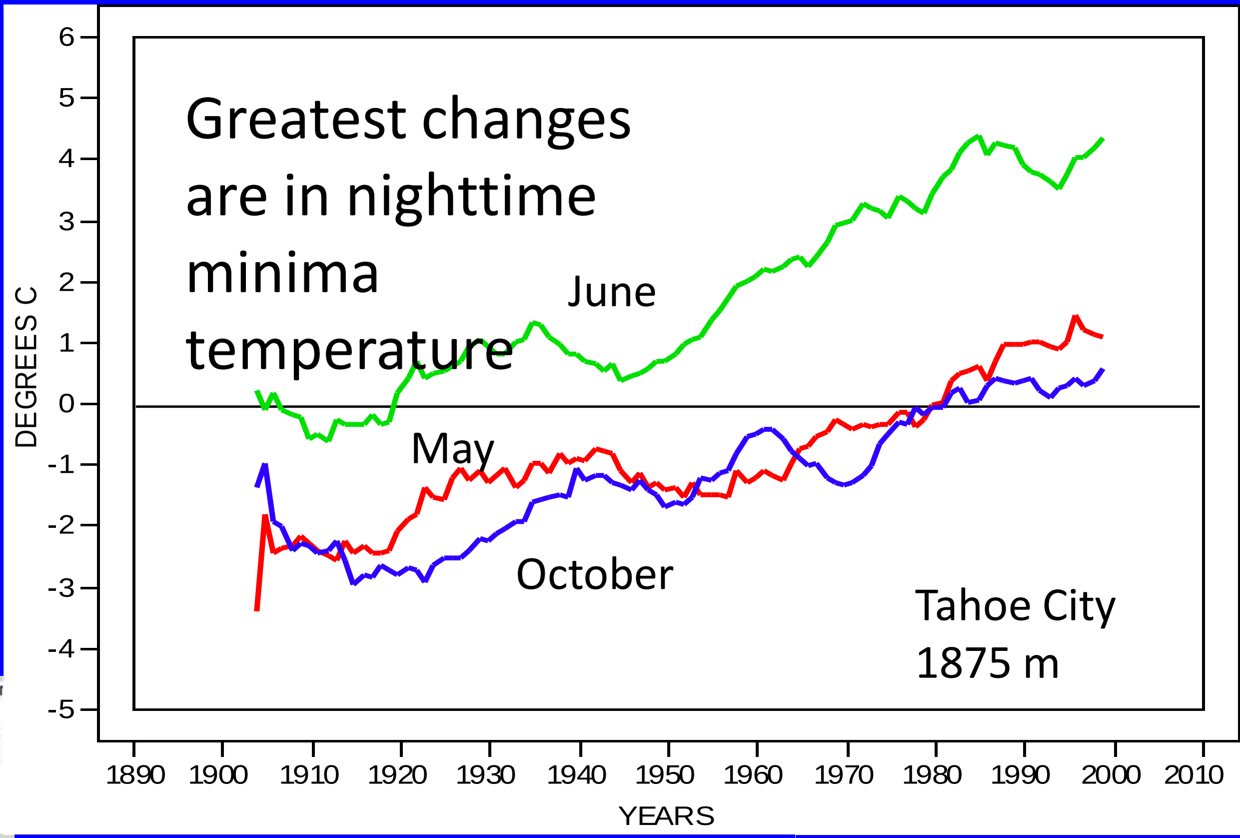
- The populations of some insects, including bark beetles, are kept in check by cold over-wintering temperatures

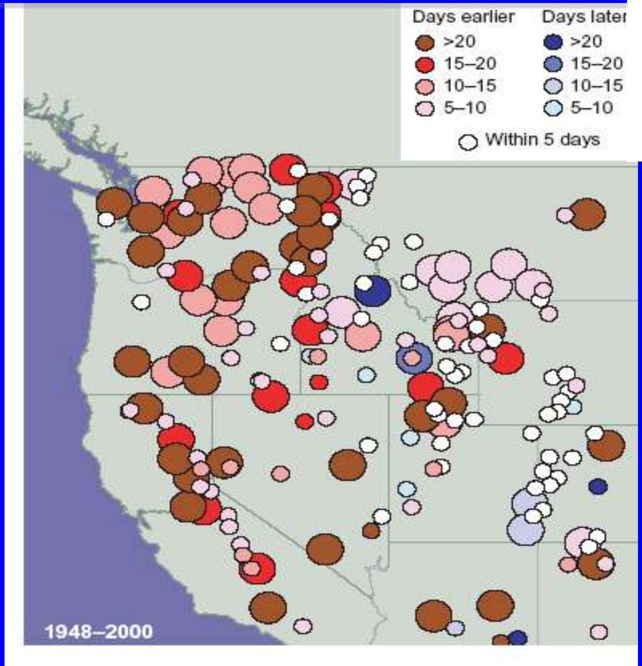




How might changing climate influence mortality?

Increase in beetle populations?





Courtesy of Hugh Safford

Earlier snow melt may increase drought stress

Reduction in fuels and stem density needed throughout the landscape matrix to increase forest resilience

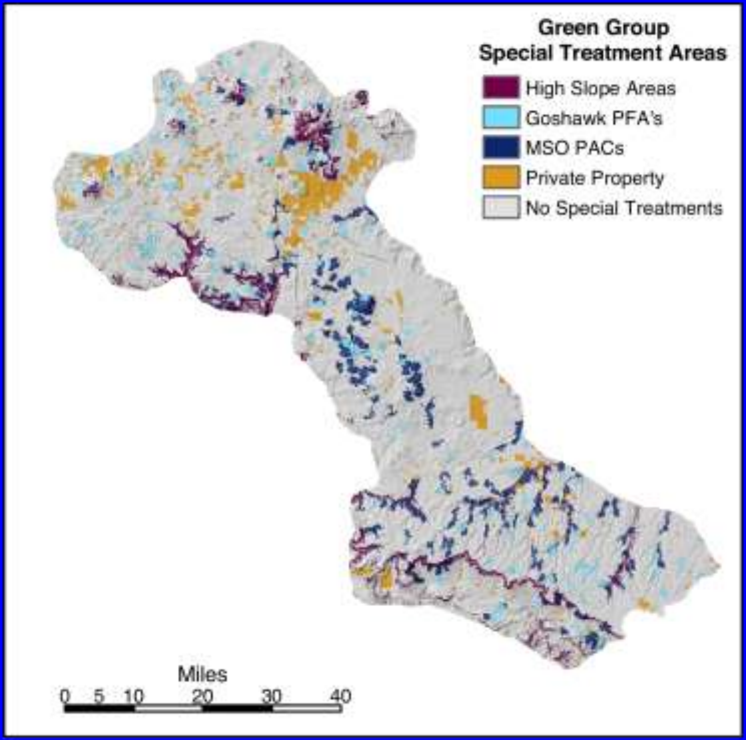
Area annually treated in CA for fuels reduction is below USFS goal of 50,000 ha/yr.

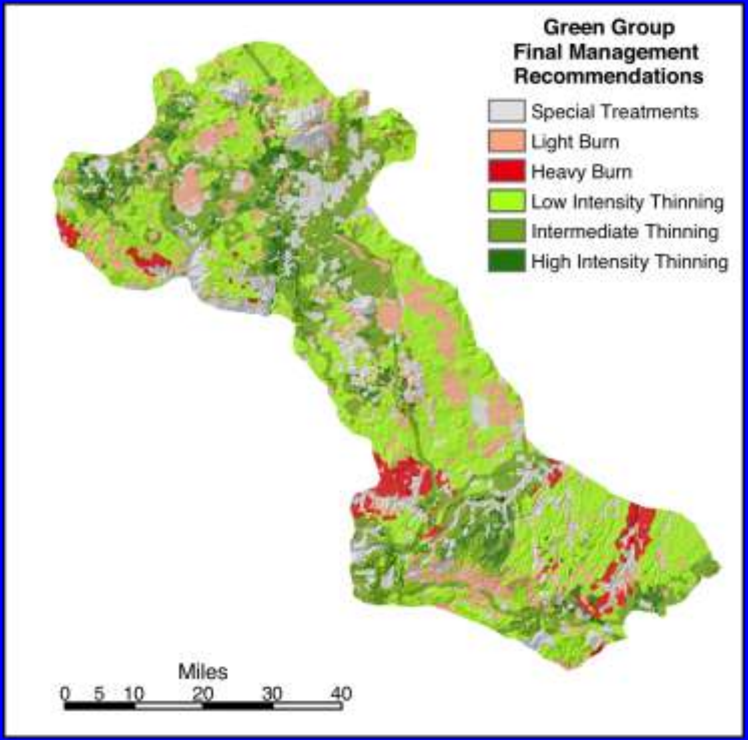
Historically fire burned about 1.8 million ha in CA each year (Stephens et al. 2007)

• Recent analysis of litigated fuels treatments found one of the most cited reasons was the lack of sufficient provisions for TES habitat

• One of the perceived conflicts is the association of some TES with forest conditions that have high surface and ladder fuel loads and high canopy cover.

Agency response is often to exclude TES core habitat from treatment, and than try to reduce fire severity in the landscape in the hope of maintaining TES core areas and their wider foraging habitat.





Final Management Recommendations for mixed-conifer forest southeast of Flagstaff, Arizona

Note congruence between MSO (Mexican Spotted Owl) and goshawk habitat and Special (light or no) Treatments

Background: Development of Mixed Conifer Management Suggestions

- In 2007, USFS Region 5 requested a summary of the science on fuels treatment and TES.

- Would fire science, forest ecology, and wildlife biology research provide contrasting or complimentary management concepts?

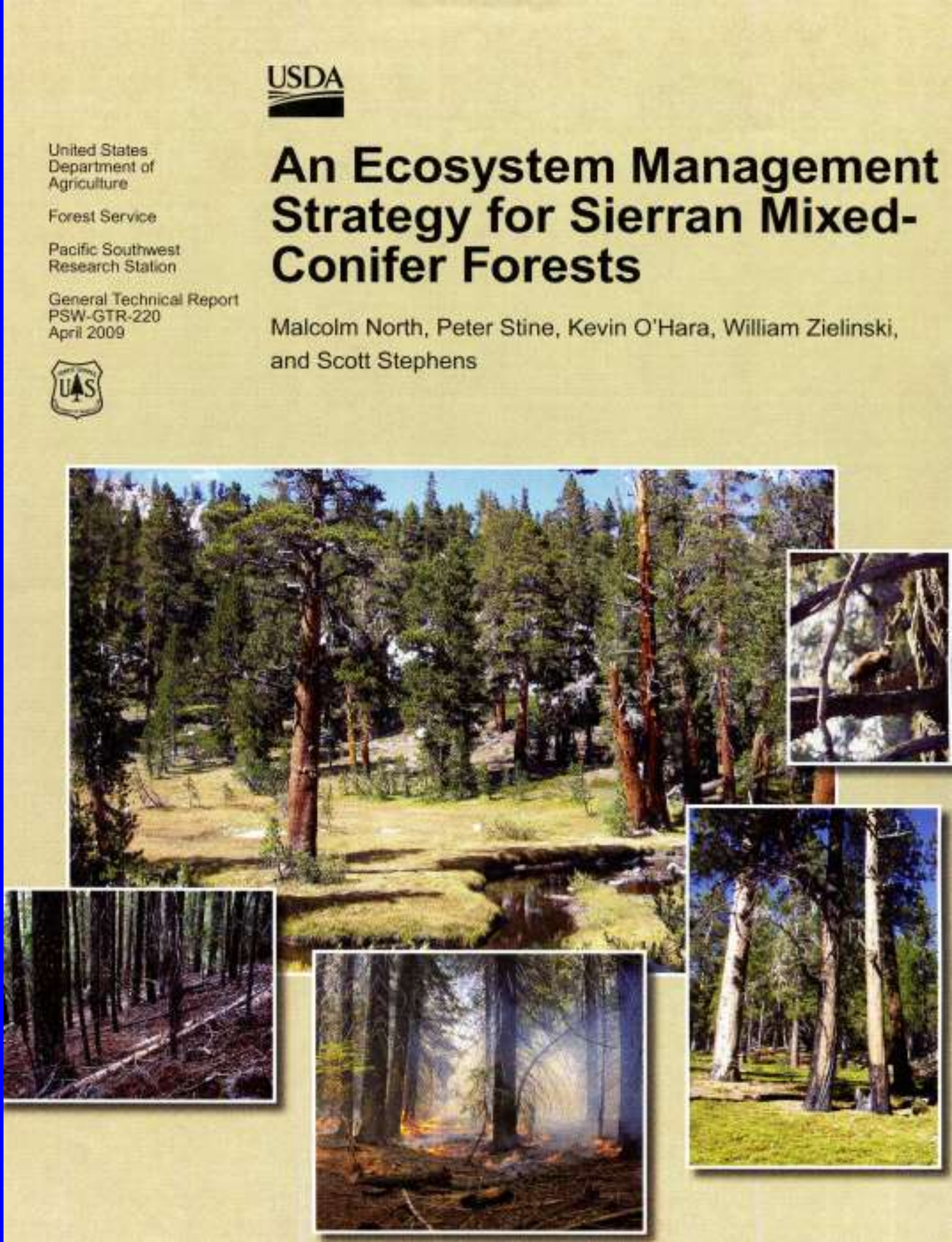
- Could complimentary concepts be translated into silviculture practices?

- Each discipline's research findings coalesced around the importance of variable forest structure and fuels conditions for ecological restoration, forest resilience, and wildlife habitat.

- The crux was defining a method for managers to implement that variability and for stakeholders to assess forest practices management

- Fire was keystone process shaping forest conditions

- Topography has a strong influence on fire frequency and intensity, which in turn shapes local forest structure and composition.



USDA

United States Department of Agriculture

Forest Service

Pacific Southwest Research Station

General Technical Report PSW-GTR-220 April 2009

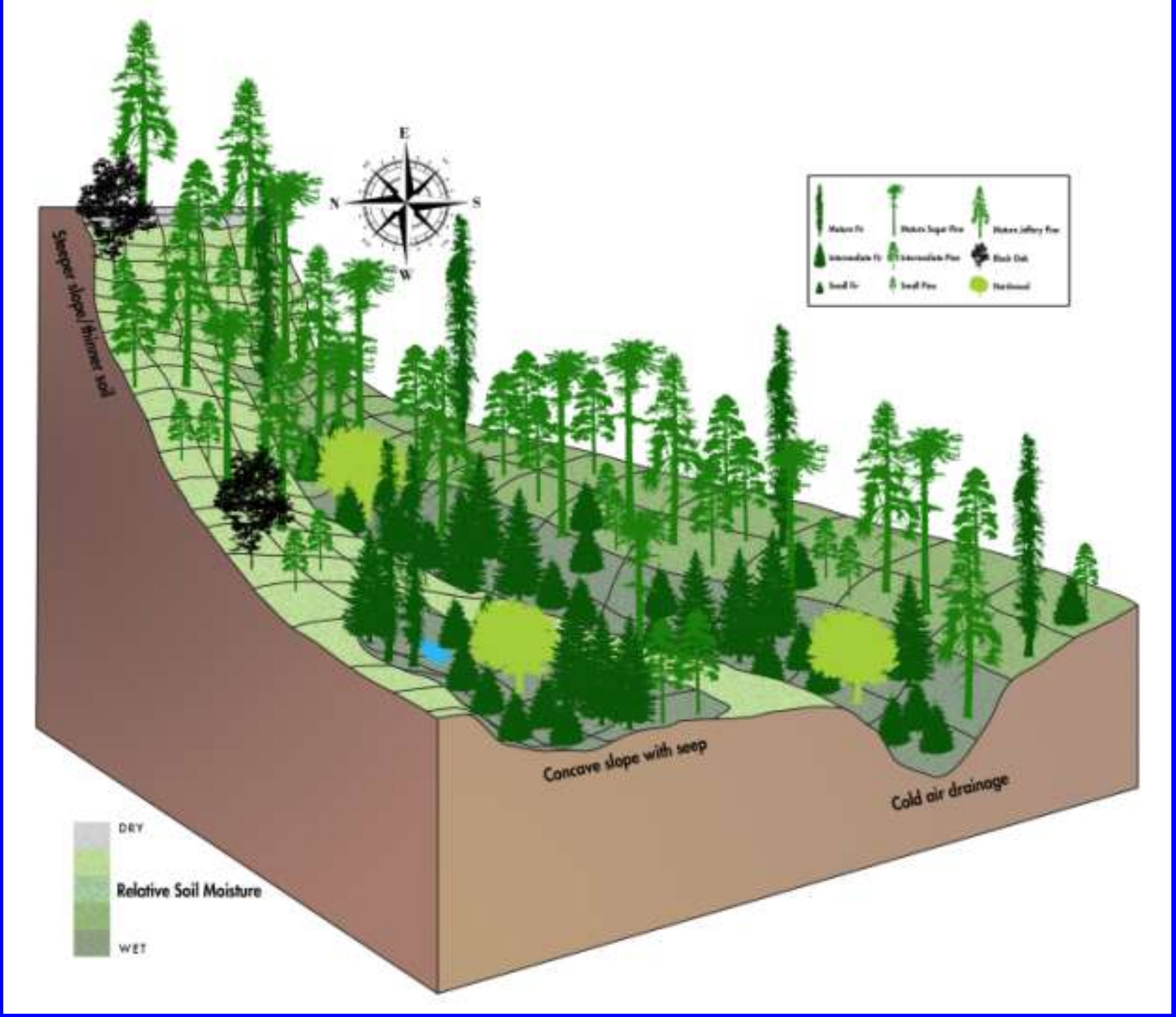
An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests

Malcolm North, Peter Stine, Kevin O'Hara, William Zielinski, and Scott Stephens

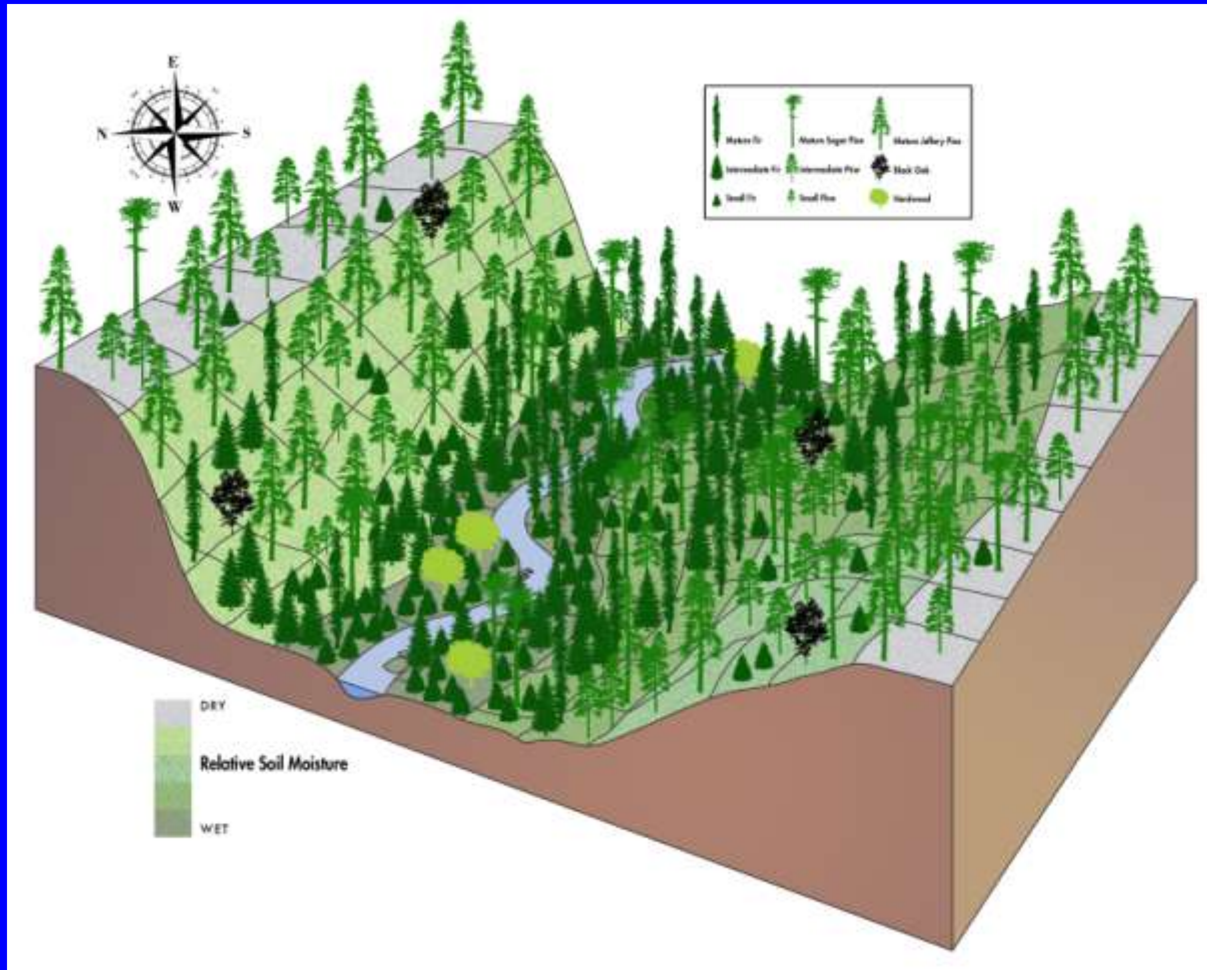
Stand-level Variability: Influences of Topography

Low density of pine on upper slope shallow soils

Active-fire stand structure in Aspen Valley, Yosemite NP: Note dense group of hardwoods in drainage



Stand-level schematic of how forest structure and composition would vary by small-scale topography after treatment. Cold air drainages and concave areas would have high stem densities, more fir and hardwoods and could provide TES habitat. With increasing slope, stem density decreases and species composition becomes dominated by pines



Landscape schematic of variable forest conditions produced by management treatments that vary by topographic factors such as slope, aspect, and slope position. Ridgetops have the lowest stem density and highest percentage of pine in contrast to riparian areas. Midslope forest density and composition varies with aspect: density and fir composition increase on more northern aspects and flatter slope angles. Riparian forest provide high canopy cover movement corridors.

For fuels treatments to be widely implemented, they must be able to pay for themselves, which is often the trees 20-30” in diameter

Suggested criteria for when a 20-30” tree might be removed:

- Species: only remove shade-tolerant, fire sensitive species (firs and cedar)

- Mid to upper slope topographic position where fire probably maintained lower large tree densities

- Ladder fuel trees: larger trees can still ladder fire if their canopy extends close to the ground

White fir 20-30” dbh with ladder fuel potential

Selected citations for landscape topographic control of fire regimes and resulting forest structure:

•Beaty, R. M., and A. H. Taylor. 2001. Spatial and temporal variation of fire regimes in a mixed conifer forest landscape, Southern Cascades, California, USA. Journal of Biogeography **28:955-966.**

•Falk, D., C. D. Miller, D. McKenzie, and A. E. Black 2007. Cross-scale analysis of fire regimes. Ecosystems **10:809-823.**

•Hessburg, P.F., J.K. Agee, and J.F. Franklin. 2005. Dry forests and wildland fires of the inland Northwest USA: Contrasting the landscape ecology of the pre-settlement and modern eras. Forest Ecology and Management 211: 117-139.

•Hessburg, P.F., R.B. Salter, and K.M. James. 2007. Re-examining fire severity relations in pre-management era mixed conifer forests: inferences from landscape patterns of forest structure. Landscape Ecology 22: 5-24.

•Heyerdahl, E., L. B. Brubaker, and J. K. Agee. 2001. Spatial controls of historical fire regimes: a multiscale example from the interior west, USA. Ecology **82:660-678.**

•Kellogg, L. B., D. McKenzie, D. L. Peterson, A. E. Hessl. 2008. Spatial models for inferring topographic controls on historical low-severity fire in the eastern Cascade Range of Washington, USA. Landscape Ecology **23:227-240.**

•Miller, C. L., and D. Urban. 1999. A model of surface fire, climate, and forest pattern, in the Sierra Nevada, California. Ecological Modeling **114:113-135.**

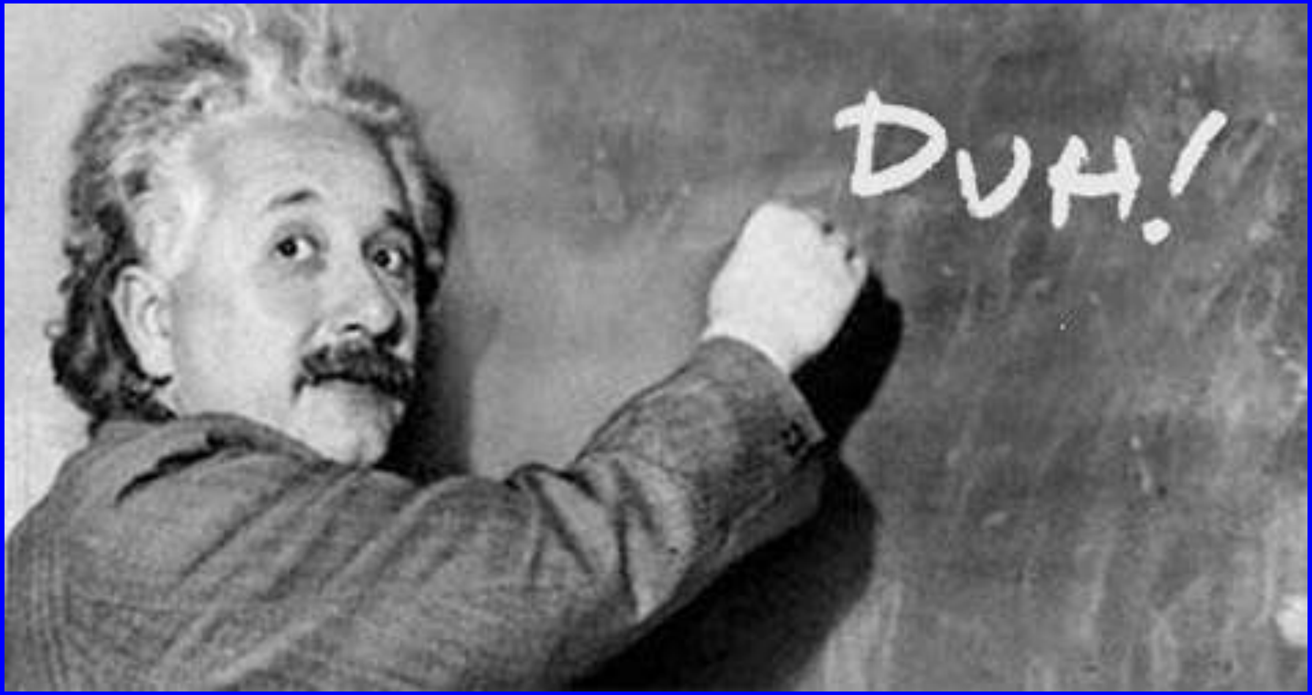
•Miller, C., and D. L. Urban. 2000. Connectivity of forest fuels and surface fire regimes. Landscape Ecology **15:145-154.**

•Stephens, S. L., and B. M. Collins. 2004. Fire regimes of mixed conifer forests in the northcentral Sierra Nevada at multiple spatial scales. Northwest Science **78:12-23.**

•Taylor, A. H. 2004. Identifying forest reference conditions on early cut-over lands, Lake Tahoe Basin, USA. Ecological Applications **14:1903-1920.**

•Taylor, A. H., and C. N. Skinner. 1998. Fire history and landscape dynamics in a late successional reserve, Klamath Mountains, California, USA. Forest Ecology and Management **111:285-301.**

- Current research is using landscape neutral models and fractal analysis to identify terrain complexity thresholds.
- Thresholds at which topographic control on spatial patterns of fire frequency and forest structure emerge.



• In many cases this is already how forests are being managed

• Fuels treatments are rarely uniformly applied

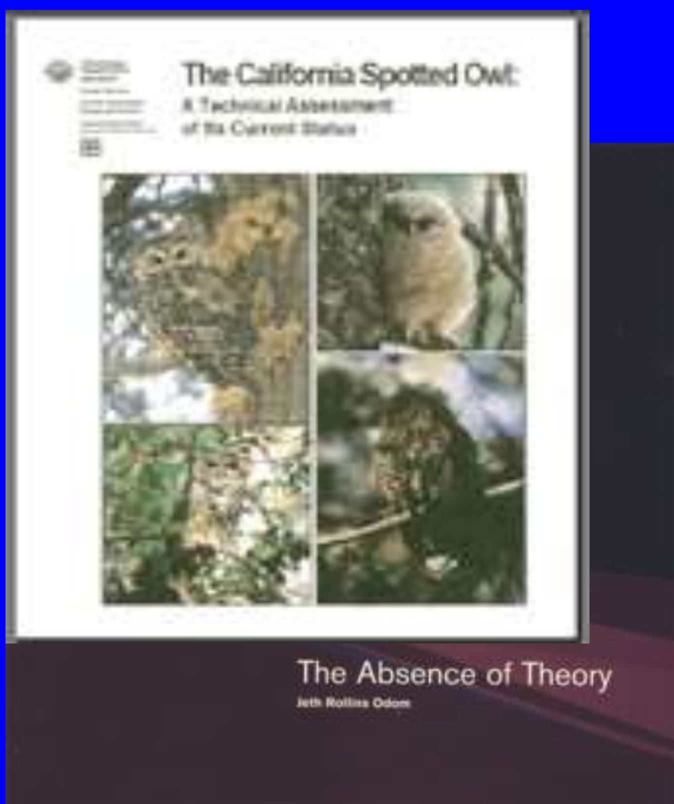
• In treated areas, stand structure varies by on-site conditions and across watersheds

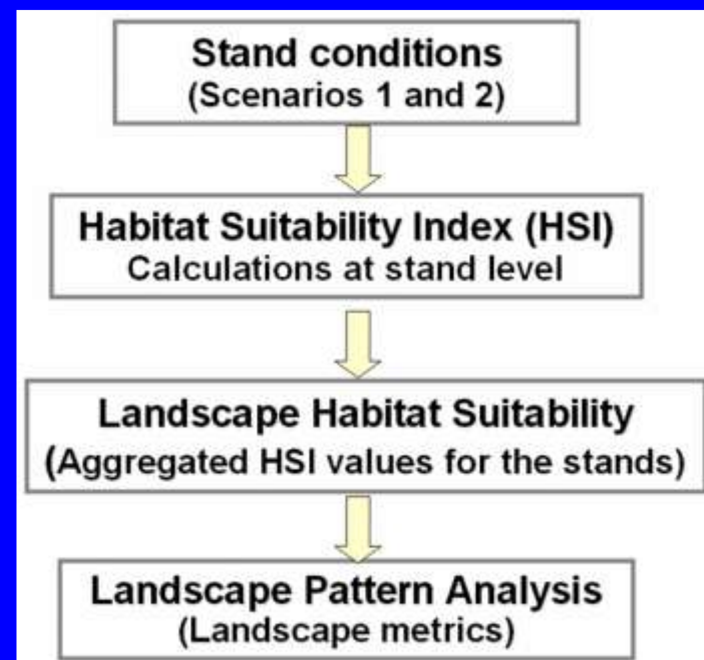

WHAT WE'VE
GOT HERE IS
A FAILURE TO
COMMUNICATE

• Research has failed to provide a comprehensive landscape plan for TES management OR

• An overarching concept of how TES historically thrived in frequent-fire conditions.

• Without that, its been difficult for managers to communicate how they create variable forest conditions or for stakeholders to evaluate and hold manager's accountable





FRAGSTATS method of calculating habitat in a landscape

Conclusions:

Under changing climate conditions, the best means of providing TES habitat in fuels treated landscapes, may be to produce the variable, resilient forest structure that these species evolved with.

This can only happen IF we can reach some common ground allowing fuels treatments to be widely implemented AND make them economically viable