Ecosystem Services at Risk: The Environmental Cost of High-Severity Fire




Outline:

1. What are ecosystem services?
2. What underpins the support of these services
3. What is the impact of high-severity fire?
4. What can we do?

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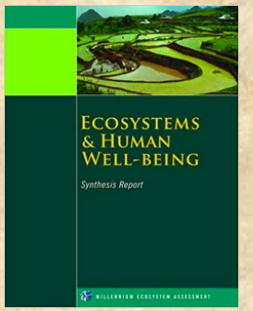
For publications and a copy of this talk go to: http://northlab.faculty.ucdavis.edu/

1) What Are Ecosystem Services: "benefits people obtain from ecosystems".

The 2006 Millennium Ecosystem Assessment defined four categories of ecosystem services



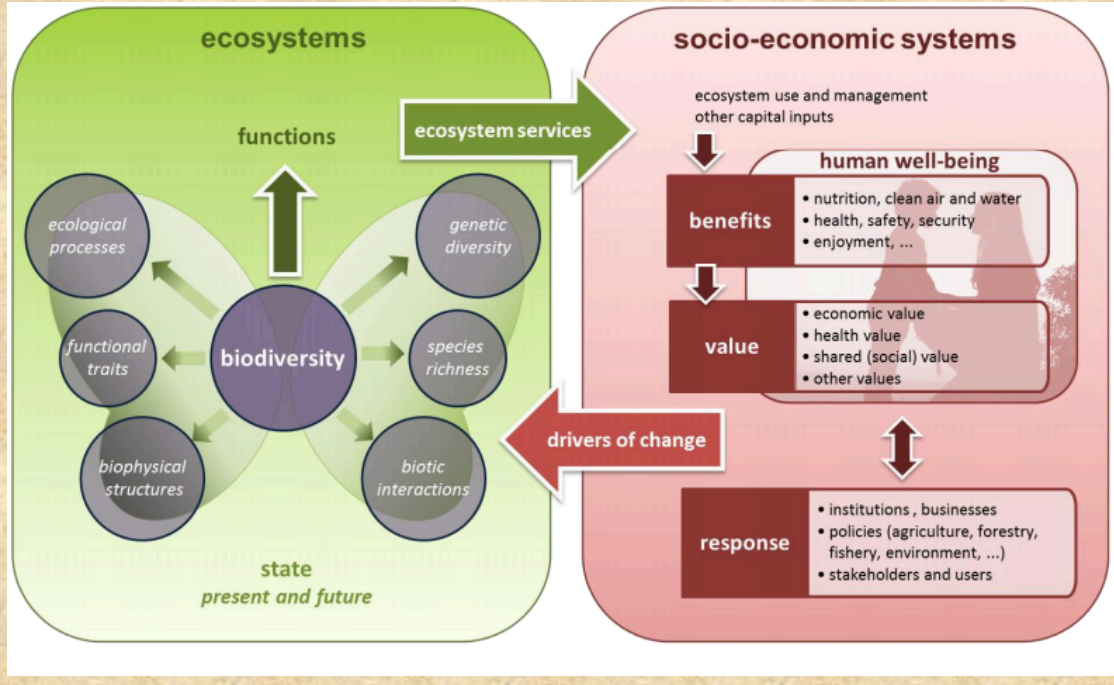
1) **Provisioning: wood, water, food, fuel and bioproducts**

2) Regulating: influences our climate, absorbs CO^2 and releases oxygen, water quantity and quality

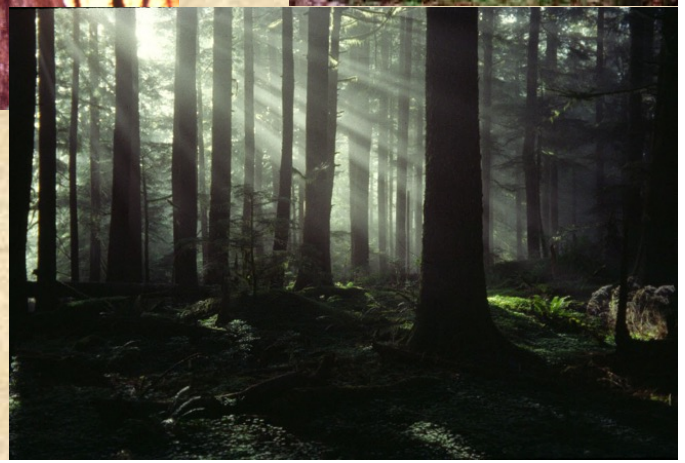
3) Cultural: influences our beliefs and traditions, provides recreation, supports mental and spiritual well being

4) Supporting: underpin life on Earth through the cycling of nutrients, soil formation, photosynthesis, etc.

Socio-Ecological Resilience



Many of these ecosystem services are supported by retaining the forest's 'backbone'…
its large trees



Example: Forest Carbon

Globally, forests contain more than twice the amount of carbon that is in the earth's atmosphere.

Forest's uptake carbon by converting atmospheric CO_2 into biomass, a process that removes (offsets) 15-20% of anthropogenic emissions.

How can we increase uptake and stabilize carbon stores?

Conserve large trees because:

- Bigger is better: one tree with a 5 foot diameter contains as much carbon as 1,000 6" diameter trees.
- Large trees accumulate carbon much faster than small trees
- Carbon in large trees is more stable because its less susceptible to fire and drought

3) What is the impact of high-severity fire?

By definition, high-severity fire kills >75% (usually >90%) of the large, overstory trees

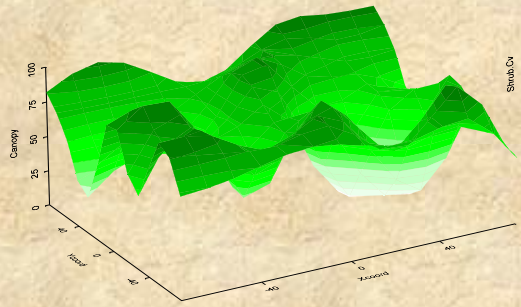
Impacts:

Overly dense, fuel loaded forests starting to 'crown out'

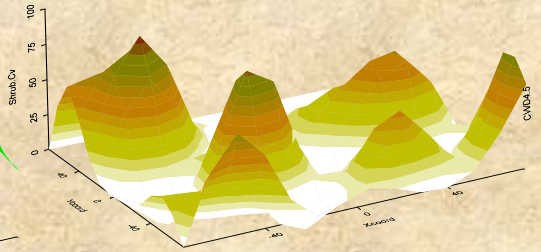
Fire suppression and high-severity fire homogenize the landscape
Why is that important? Forest structural variability (anchored by large trees) is tightly linked to ecosystem process and health

Vegetation Structure:

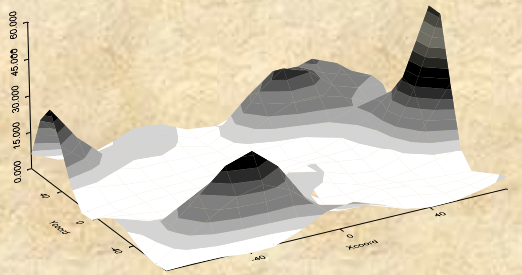
Forest Canopy Gaps



Ceanothus Cover

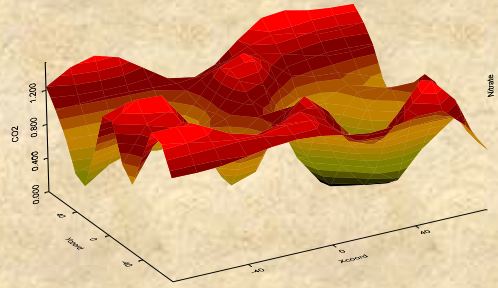


Litter Depth

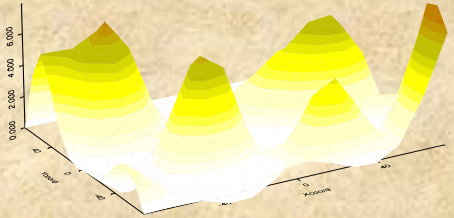


Ecosystem Process:

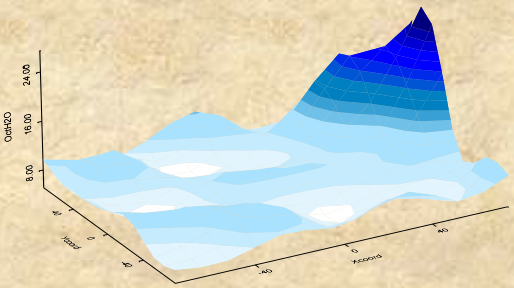
PAR



Available Nitrogen



Soil Moisture



4) What Can be Done?
Shouldn't/Couldn't we just leave the forest alone?

Historic Forest Conditions

Forests were open enough that there was "little difficulty in riding on horseback" (John Muir)

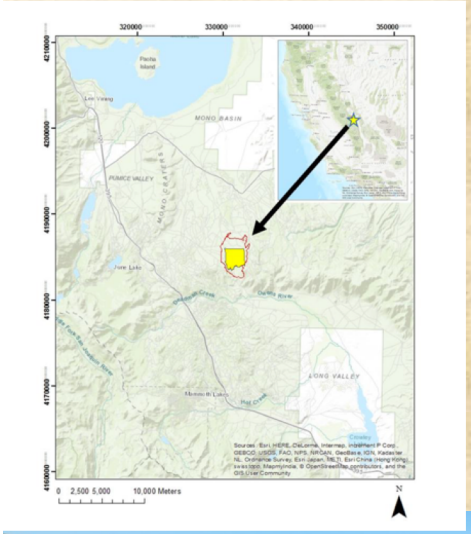
Modern Forest Conditions

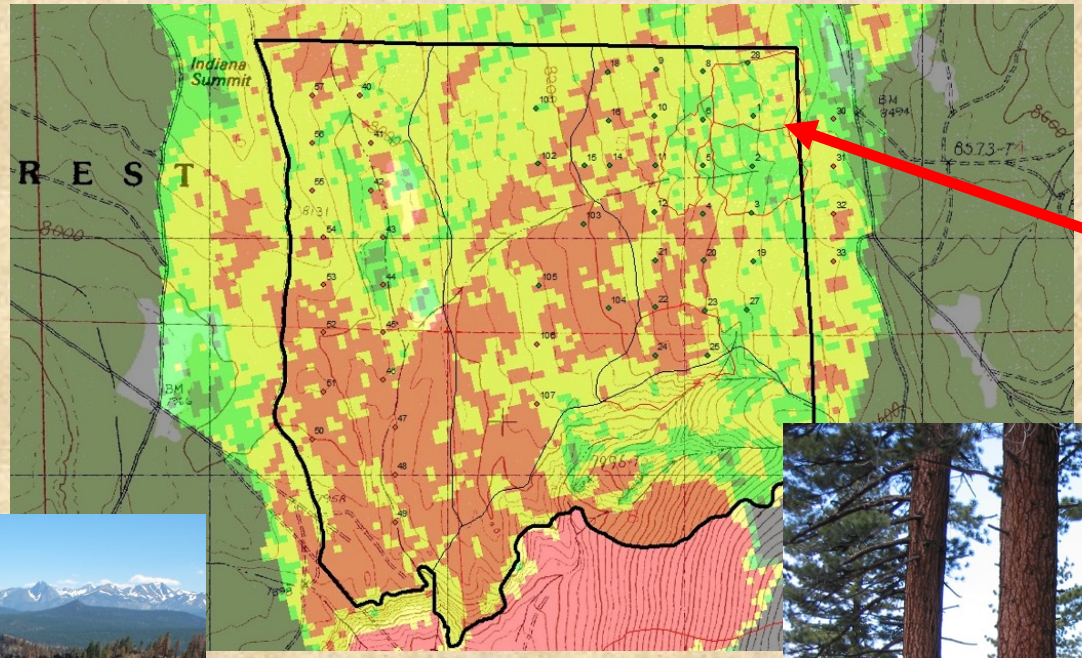
We're responsible for this mess

Fire Ecology Vol. 5, No. 3, 2009, doi: 10.4996/fireecology.0503020
CLIMATE, RAIN SHADOW, AND HUMAN-USE INFLUENCES ON FIRE REGIMES IN THE EASTERN SIERRA NEVADA, CALIFORNIA, USA
Malcolm P. North, Kip M. Van de Water, Scott L. Stephens, and Brandon M. Collins

Jeffrey pine forests near Mammoth burned, on average, every 9.7 yr. with the last fires in the early 1950s➔Missed 6 fire cycles

Local Lesson: Indiana Summit RNA (CA's first Research Natural Area [est. 1932])





Green: low severity
Yellow: moderate severity
Red: high severity

1990s prescribed fires that had reduced fuel loads

The 2016 Clark Fire burned into the RNA's old-growth Jeffrey pine

Unlike the western Sierra, we're fortunate that dry eastside forests are less fuel productive and fire explosive, but…In most California forests, fire is inevitable.

9/6/20: Creek Fire pyrocumulonimbus cloud over 50,000' high…energy released may have been in the 'nuclear' range

That fire can either burn in fuel-loaded forests, degrading the environment and threatening communities

OR

Burn into treated forest at low to moderate severity helping to restore a more resilient ecosystem