Safeguarding California: Preparing for Climate Risks

an update to the
2009 California Climate Adaptation Strategy

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Public Workshop & Listening Session

CALIFORNIA natural resources AGENCY

Climate Adaptation: California's Forests

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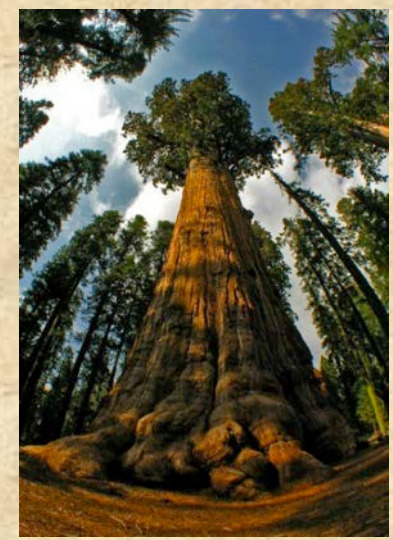
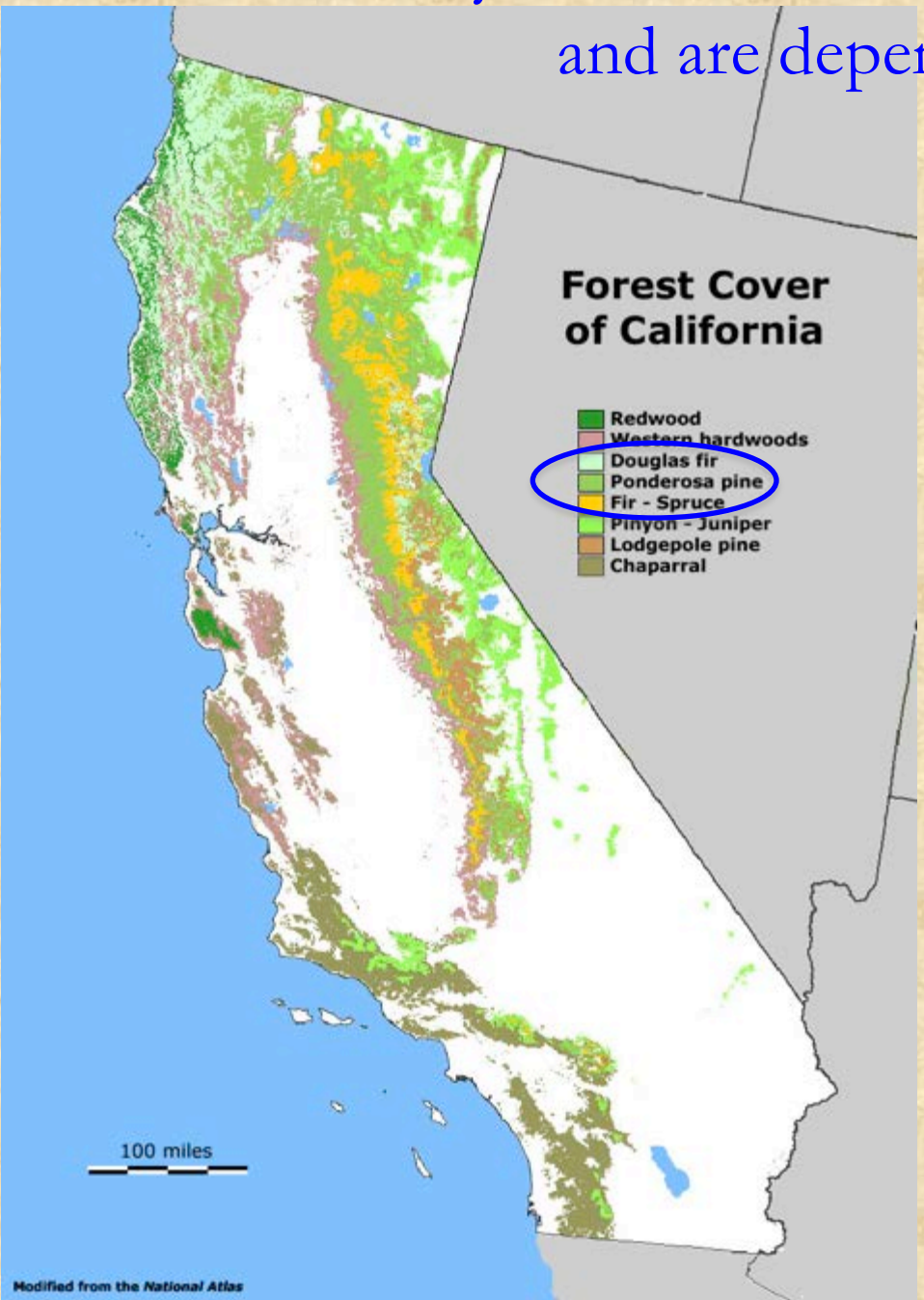
California's Forests



- Contain the tallest (Hyperion [coast redwood] 115.7 m) and largest (General Sherman [giant sequoia] @ 55,000 ft^3) trees in the world
- Some of the forests are among the most productive and long-lived in the world
- California's National Forests are growing at the rate of 3.7 billion board feet/year on 9.8 million acres of non-reserve land
- On Public Land Forests (ex. Forest Service) harvest levels are at 8% of growth
- **Many forests are overstocked with small trees that significantly reduce forest resilience to climate change, wildfire, and pests/pathogens.**

Many of California's forest evolved with and are dependent on fire

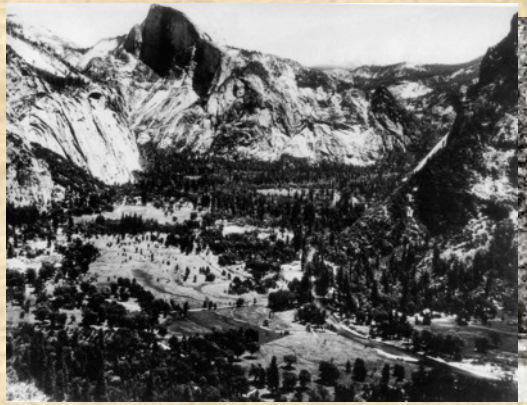


Forest Type	Fire Return Interval (yrs)
Douglas-fir Current FRI	≈12-17 ≈480
Ponderosa pine Current FRI	≈4-10 ≈275
Mixed conifer Current FRI	≈12-20 ≈690
Fir: White Current FRI	 ≈30-50 ≈850

Historic and Current Forest Conditions and Fire Severity

Time Period

Historic
(pre 1870)



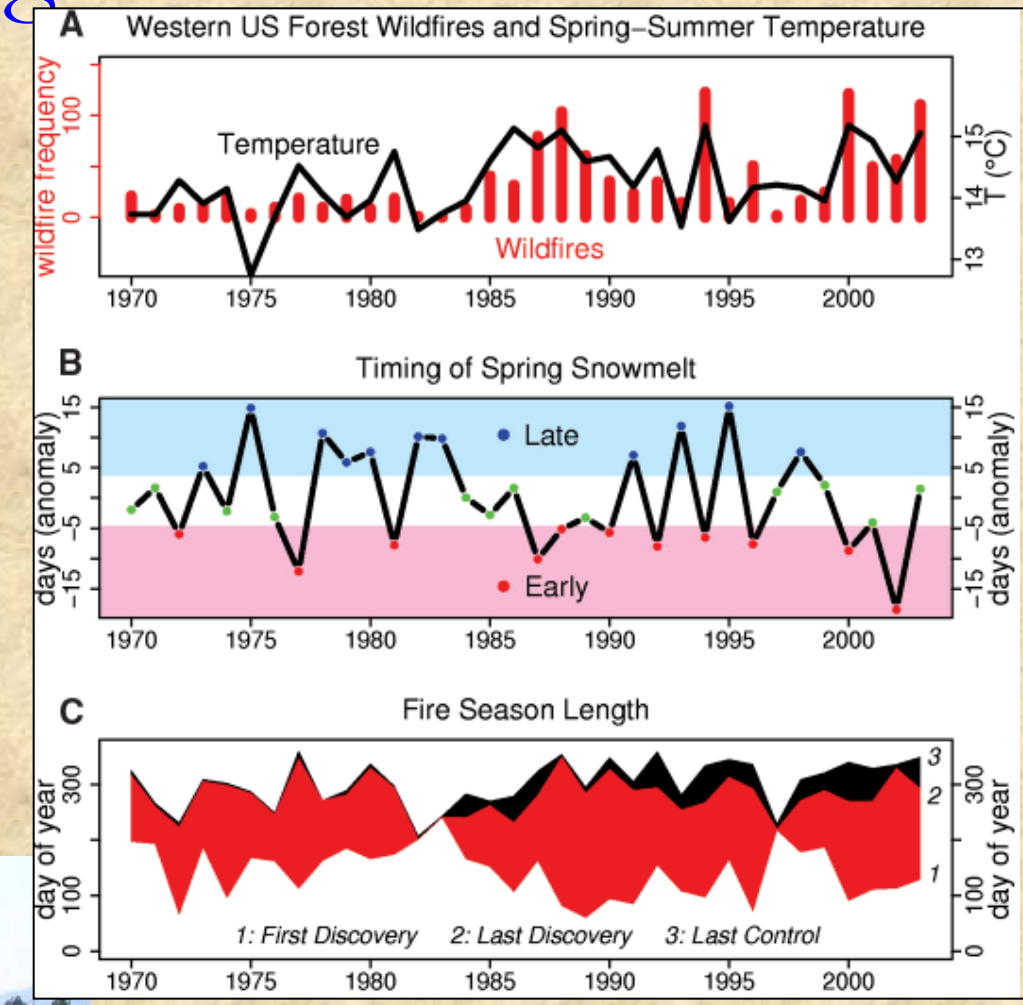
Current wildfires burn differently: mostly high-intensity crown fires that kill most trees even the large, old ones.

Current
(after 1970)

Climate Change = More Fires

A. Fire frequency and temperature
B. Snowmelt timing
C. Fire season length

But burns will likely be large, high-severity fires, like the recent Rim Fire



Westerling et al. 2006. Science

How does fire-suppressed forest conditions affect ecosystem processes?

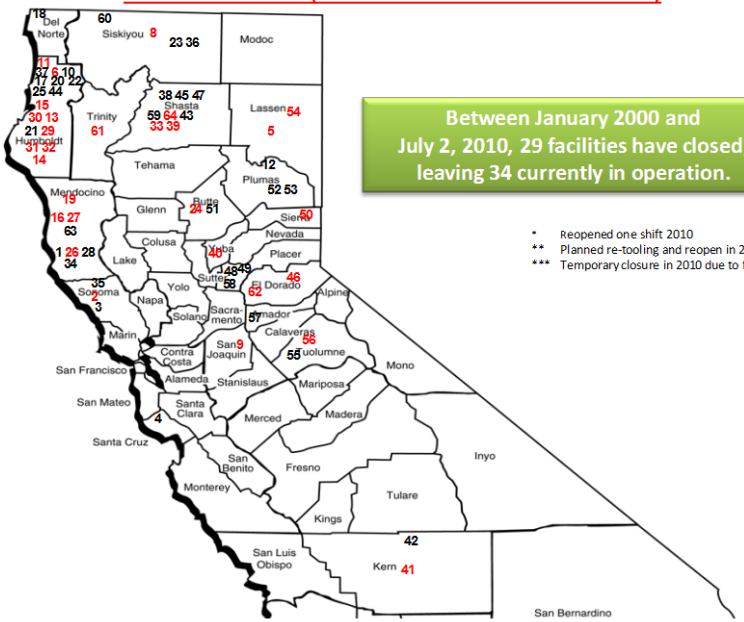
1) High stem density: Changes mortality from fire to drought and insects. Many ecosystem processes are ‘stalled’.

2) High canopy cover: dramatically reduces variability in microclimate and wildlife habitat, reduces surface snowpack depth slowing decomposition.

3) Fuels accumulations: Heavy litter and coarse woody debris homogenizes the forest floor substrate reducing understory plant diversity and cover.

Why not thin the forest?
Lack of Infrastructure to Process Woody Material

California Forest Industry
Primary Manufacturers Currently in Operation
2000-2010 Closures (sawmills unless otherwise indicated)



Between January 2000 and July 2, 2010, 29 facilities have closed, leaving 34 currently in operation.

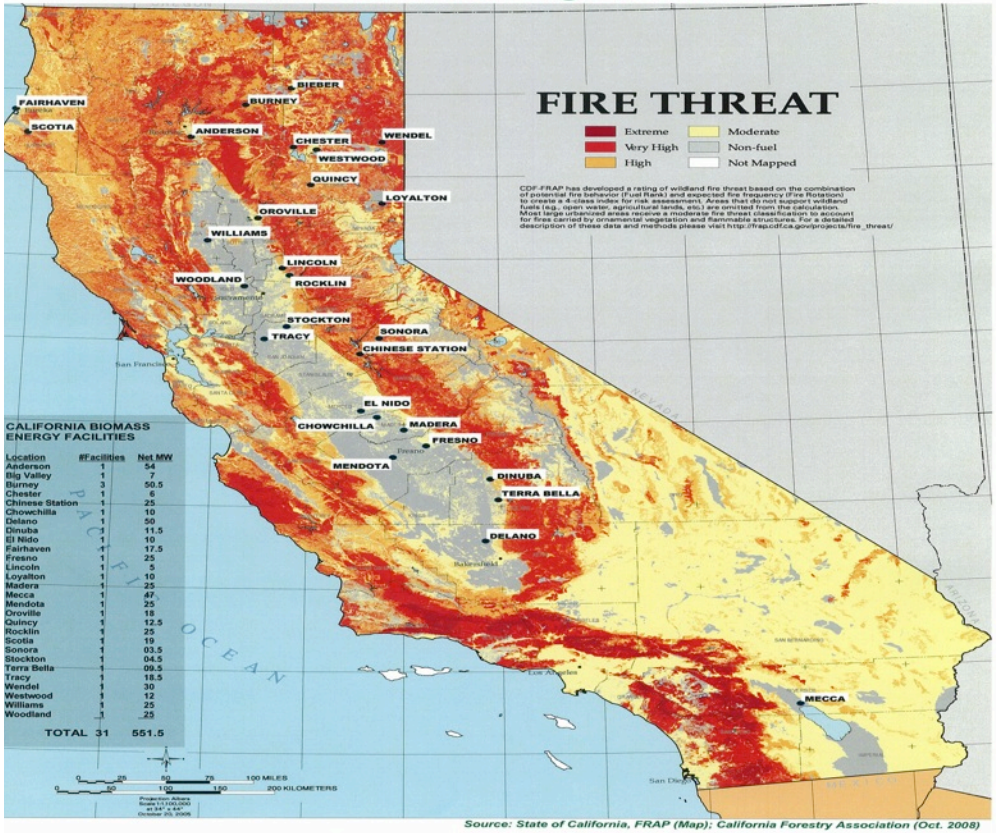
* Reopened one shift 2010
** Planned re-tooling and reopen in 2011
*** Temporary closure in 2010 due to fire

1. Agwood Mill & Lumber (Ukiah)
2. **Annapolis Milling (Annapolis)**
3. Berry's Sawmill (Cazadero)
4. Big Creek Lumber Co. (Davenport)
5. **Big Valley Lumber Co. (Bieber)**
6. **Blue Lake Forest Products (Blue Lake)**
7. BLANK
8. **California Cedar Products (McCloud)**
9. **California Cedar Products *[pencil slat]* (Stockton)**
10. California Redwood (Korbel)
11. **California Redwood (Orick)**
12. Collins Pine Co. (Chester)
13. **Eel River Lumber Products (Fortuna)**
14. **Eel River Sawmills Inc. (Redcrest)**
15. **Evergreen *[pulp]* (Samoa)**
16. **Georgia-Pacific (Fort Bragg)**
17. Hambro Forest Products *[board]* (Arcata)
18. Hambro Forest Products *[board]* (Crescent City)
19. **Harwood Products (Branscomb)**
20. Humboldt Flake Board (Arcata)
21. Humboldt Redwood Co. (Scotia)
22. Humboldt Redwood Co. (Arcata)
23. J.H. Baxter *[preserve]* (Weed)
24. **Louisiana-Pacific *[board]* (Oroville)**
25. Mad River Redwood [fencing] (Arcata)
26. **Masonite/Intl Paper *[board]* (Ukiah)**
27. **Mendocino Redwood (Fort Bragg)**
28. Mendocino Redwood (Ukiah)
29. **PALCO (Carlotta moved to Scotia)**
30. **PALCO (Fortuna)**
31. **PALCO [mill A] (Scotia)**
32. **PALCO [mill B] (Scotia)**
33. **Pry-Core, Inc. *[veneer]* (Anderson)**
34. R.J.S. Lumber Co. (Philo)
35. Redwood Empire (Cloverdale)
36. Roseburg Forest Products *[veneer]* (Weed)
37. Schmidbauer Lumber Co. (Eureka)
38. Shasta Green (Burney)
39. **Shasta Paper Company *[pulp]* (Anderson)**
40. **Sierra Cedar Products (Marysville)**
41. **Sierra Forest Products (Dinuba)**
42. Sierra Forest Products (Terra Bella)
43. Sierra Pacific Ind. (Anderson)
44. Sierra Pacific Ind. (Arcata)
45. Sierra Pacific Ind. (Burney)
46. **Sierra Pacific Ind. (Camino)**
47. Sierra Pacific Ind. (Central Valley)
48. Sierra Pacific Ind. [large log] (Lincoln)
49. Sierra Pacific Ind. [small log] (Lincoln)
50. **Sierra Pacific Ind. (Loyalton)**
51. Sierra Pacific Ind. (Oroville)
52. Sierra Pacific Ind. [large log[(Quincy)
53. Sierra Pacific Ind. [small log] (Quincy)*
54. **Sierra Pacific Ind. (Susanville)**
55. Sierra Pacific Ind. (Chinese Camp)
56. **Sierra Pacific Ind. (Standard)****
57. Sierra Pine *[board]* (Martell)
58. Sierra Pine *[board]* (Rocklin)
59. Sound Studs *[stud]* (Anderson)
60. Timber Products Co. *[veneer]* (Yreka)
61. **Trinity River Lumber Co. (Weaverville)*****
62. **Wetsel-Oviatt (El Dorado)**
63. Willits Redwood (Willits)
64. **Wisconsin-California (Anderson)**

Source: California Forestry Association & Paul F. Ehinger & Assoc. (Nov. 5, 2009)

46% of Mills Closed in the Last Decade

BIOMASS ENERGY:
Producing Renewable Energy, While Lowering the Risk of Wildfire and Reducing Greenhouse Gases



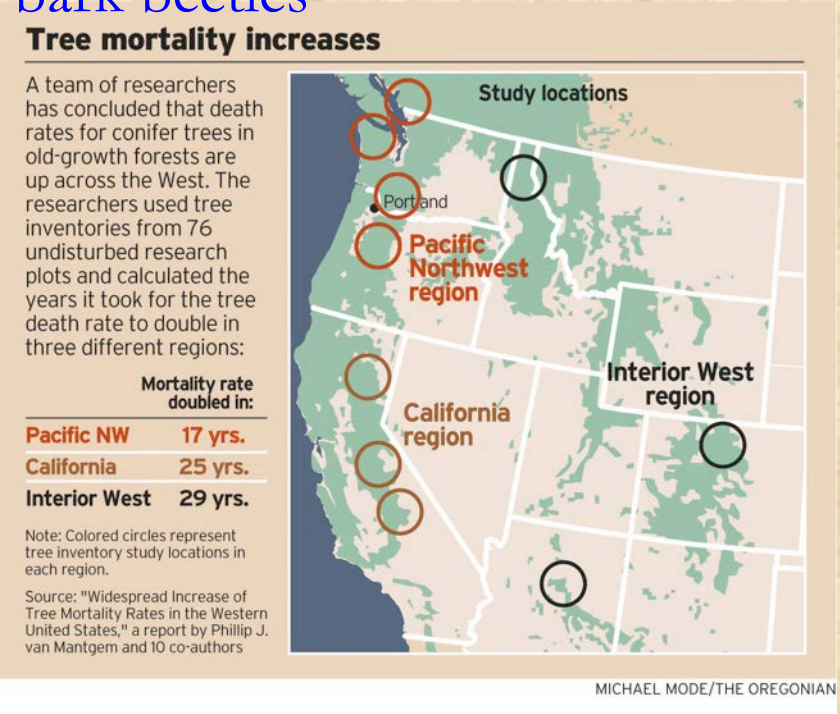
CALIFORNIA BIOMASS ENERGY FACILITIES

Location	#Facilities	Net MW
Anderson	1	54
Big Valley	1	7
Burney	3	50.5
Chester	1	6
Chinese Station	1	25
Chowchilla	1	10
Delano	1	50
Dinuba	1	11.5
El Nido	1	10
Fairhaven	1	17.5
Fresno	1	25
Lincoln	1	5
Loyalton	1	10
Madera	1	25
Mecca	1	47
Mendota	1	25
Oroville	1	18
Quincy	1	12.5
Rocklin	1	25
Scotia	1	19
Sonora	1	03.5
Stockton	1	04.5
Terra Bella	1	09.5
Tracy	1	18.5
Wendel	1	30
Westwood	1	12
Williams	1	25
Woodland	1	25
TOTAL	31	551.5

Source: State of California, FRAP (Map); California Forestry Association (Oct. 2008)

Sparse distribution of biomass processors (2008)

Fire suppression increase stem density, making trees more prone to drought and bark beetles



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

- Increased tree density from fire suppression contributes to drought stress

- Climate change is likely to make this a substantial problem: greater annual weather variability, higher evaporative demand, bark beetle populations are kept in check by cold over-wintering temperatures—a condition that is likely to become more rare

Why Forest Carbon Matters: Climate Mitigation Potential

- About 31% of the world is covered by 4 billion hectares of forest (FAO definition of $\geq$ 10% tree cover)
- Forests (vegetation and soil) store > 2 times the amount of carbon present in the atmosphere (FAO 2005)
- Terrestrial ecosystems, of which forests are major contributors, remove nearly 3 Pg C $year^{-1}$, and forests alone absorb about 12% of all human CO_2 emissions.
- Of natural disturbances, wildfire has the greatest global impact on forest carbon stocks, contributing an estimated 3.43 billion tons of CO_2 into the atmosphere annually (FAO 2006; Bowman *et al.* 2009).

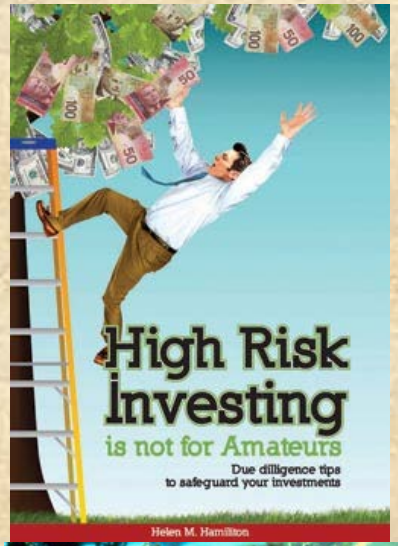
Another problem caused by deforestation

Carbon Carrying Capacity:

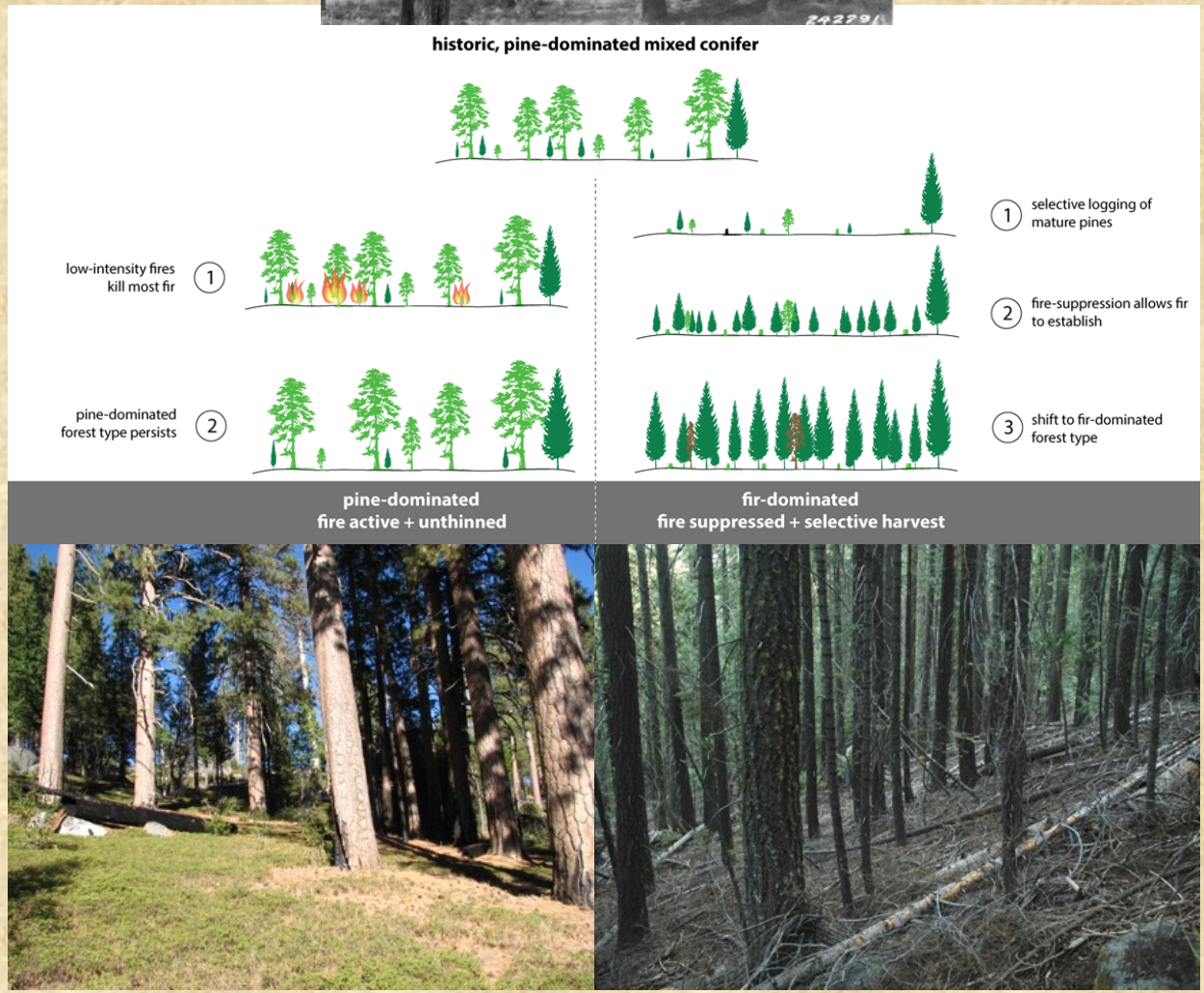
The potential carbon mass that a forest can store under prevailing environmental conditions and natural disturbance regimes

- Keith H, Mackey BG, and Lindenmayer DB. 2009. Re-evaluation of forest biomass carbon stocks and lessons from the world's most carbon-dense forests. Proc. Nat. Acad. Sci. 106: 11635-11640.

Carbon Banking: Risk vs. Security



More Stable



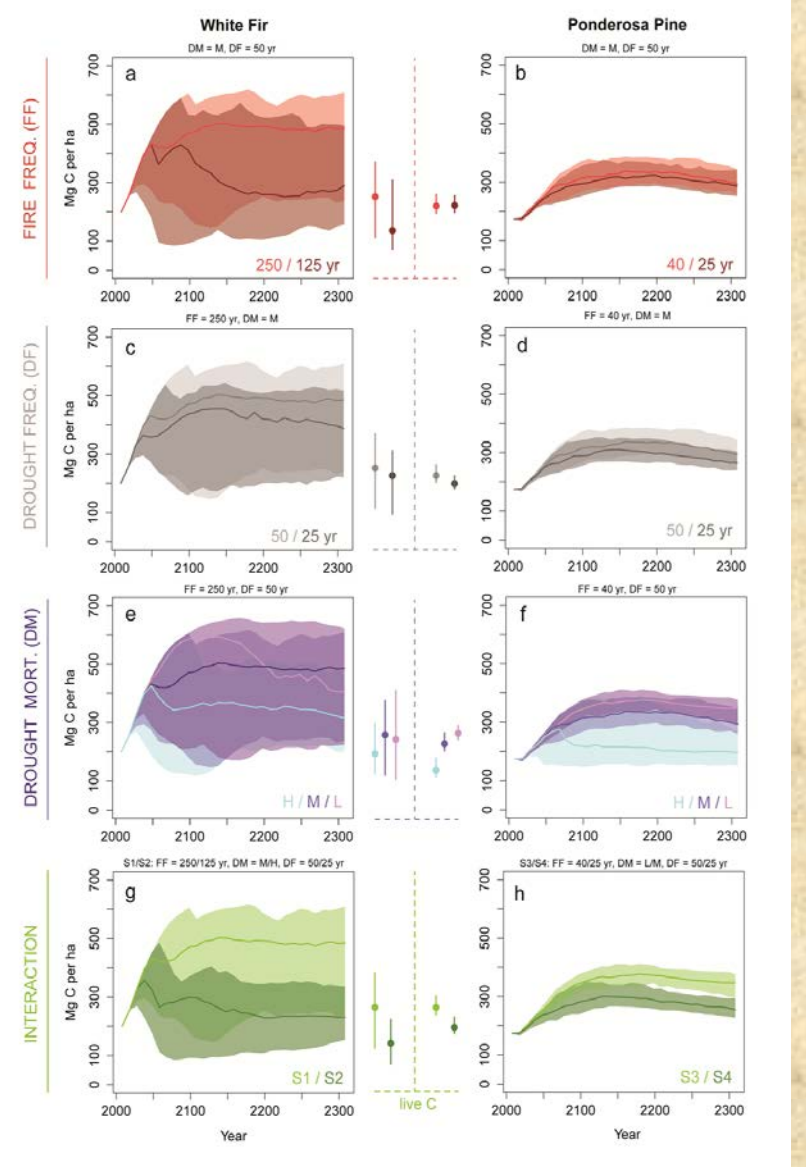
Higher Risk

Carbon Stability and Risk: Modeling of carbon over next 300 yr with different future drought and fire scenarios

- White fir condition—most common in CA's mid-elevation forests: forests are left alone and fire suppression continues.

- Pine condition: thinning and/or prescribed fire are used to shift and than maintain a pine-dominated stand that is more drought and fire resilient.

- Actively managed pine condition has much more reliable, stable carbon stocks (smaller size of the shaded area at right) than white fir because both species and stand conditions (low density of large trees) are more tolerant of likely future drought and fire conditions.



In Sum:

Many forests are unstable due to fire suppression and past logging

They are not resilient to additional stress such as climate change, and likely to experience increased mortality

Management (i.e., mechanical and fire) that reduces forest density (making stands more drought and pest resistant) and fuel loads will greatly benefit forest resilience and increase carbon stability