Uneven-aged Forest Management

Impacts on species composition, stand health, and fire resiliency

Scott Watershed Informational Forum

Cole Humphrey RPF #3106 - Hearst Forests

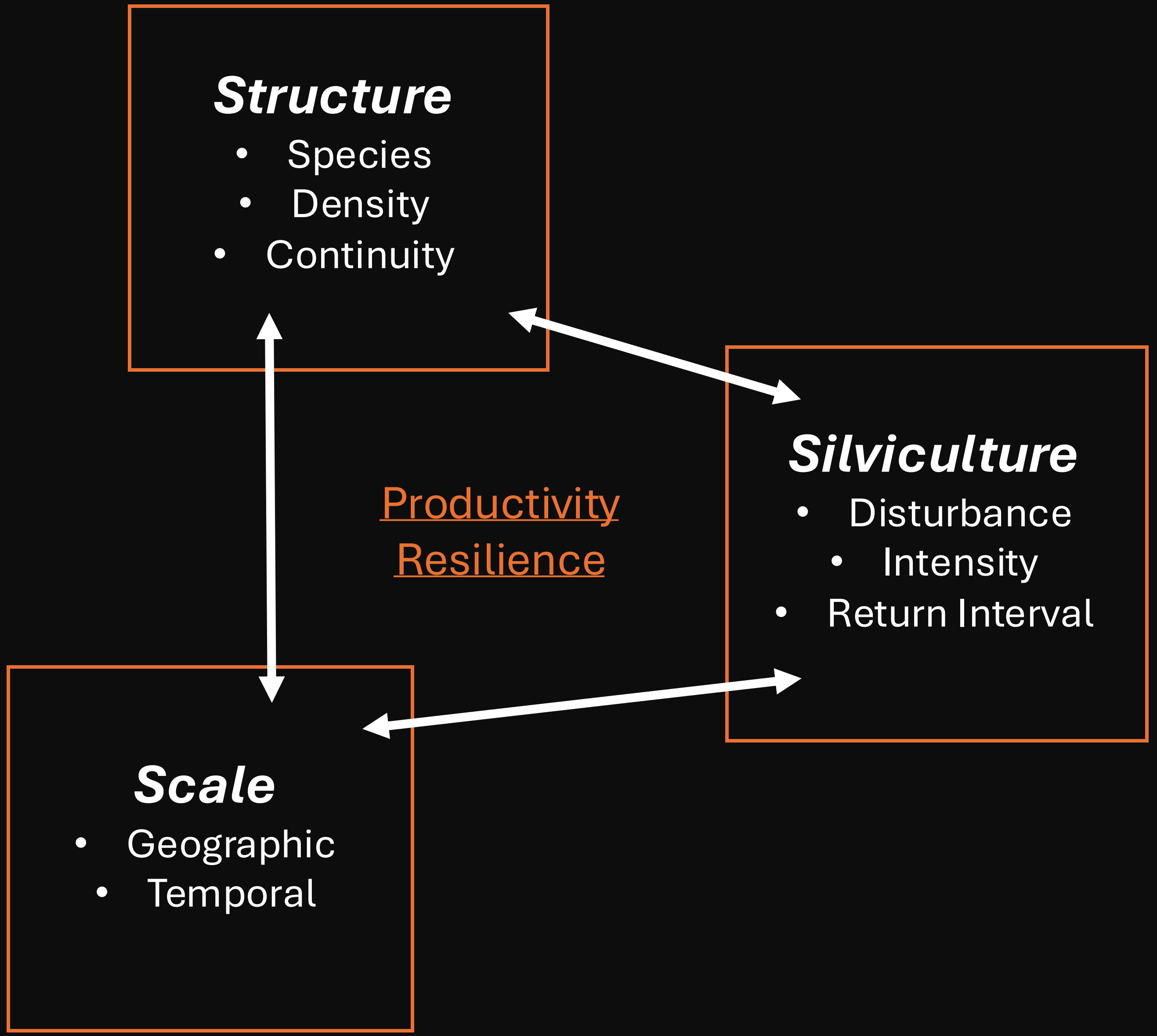
Perspective
&
Expertise

Goals

1. Define forest resilience and its relation to timber production
2. Recognize historical context on local forest conditions
3. Appreciate the nuanced details of unevenaged management and its realities in modern land management

Outline

- Fundamental Concepts
- Past Conditions
- Shift in Conditions
- Current Conditions
- Moving Forward



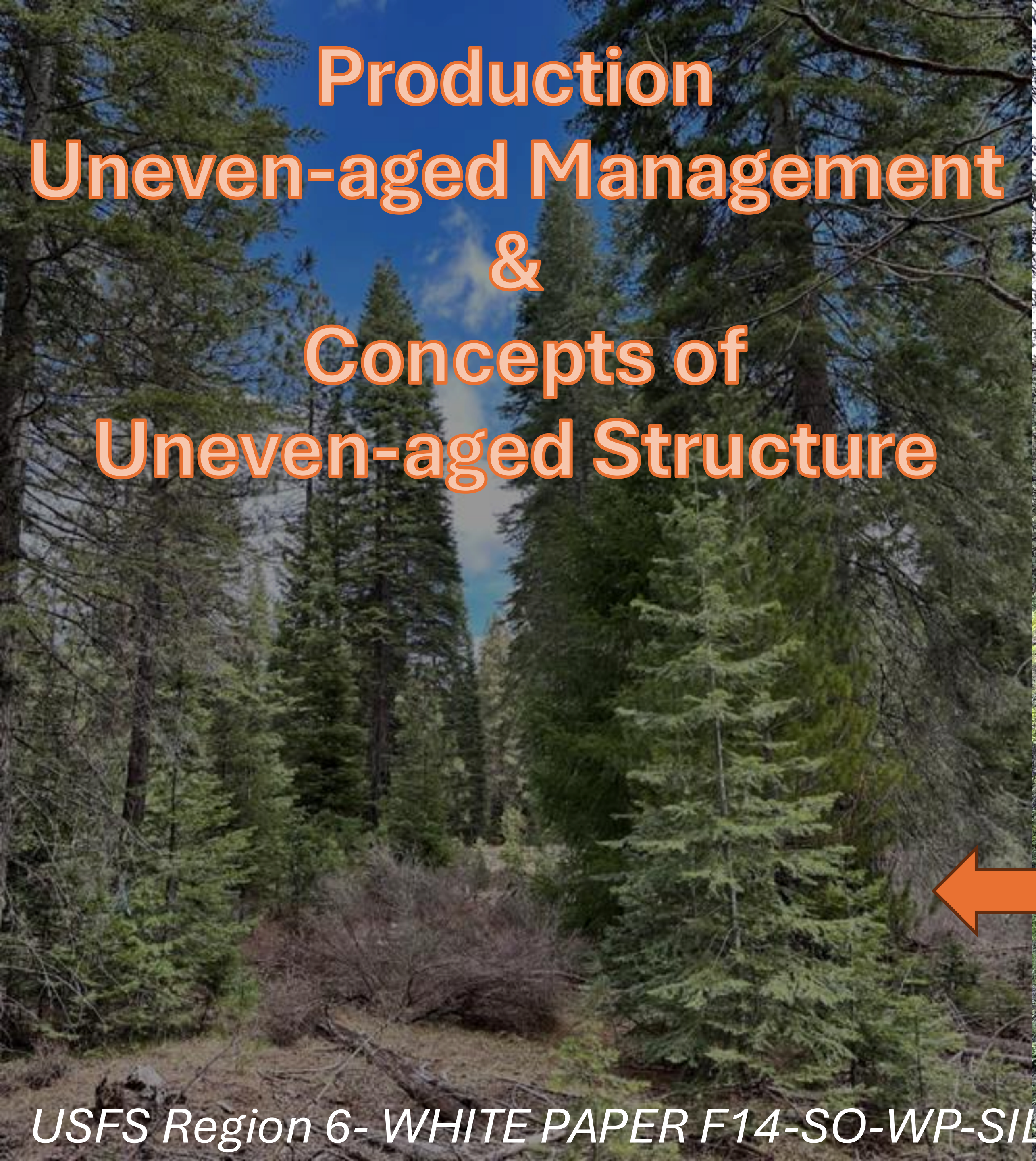
Resilience

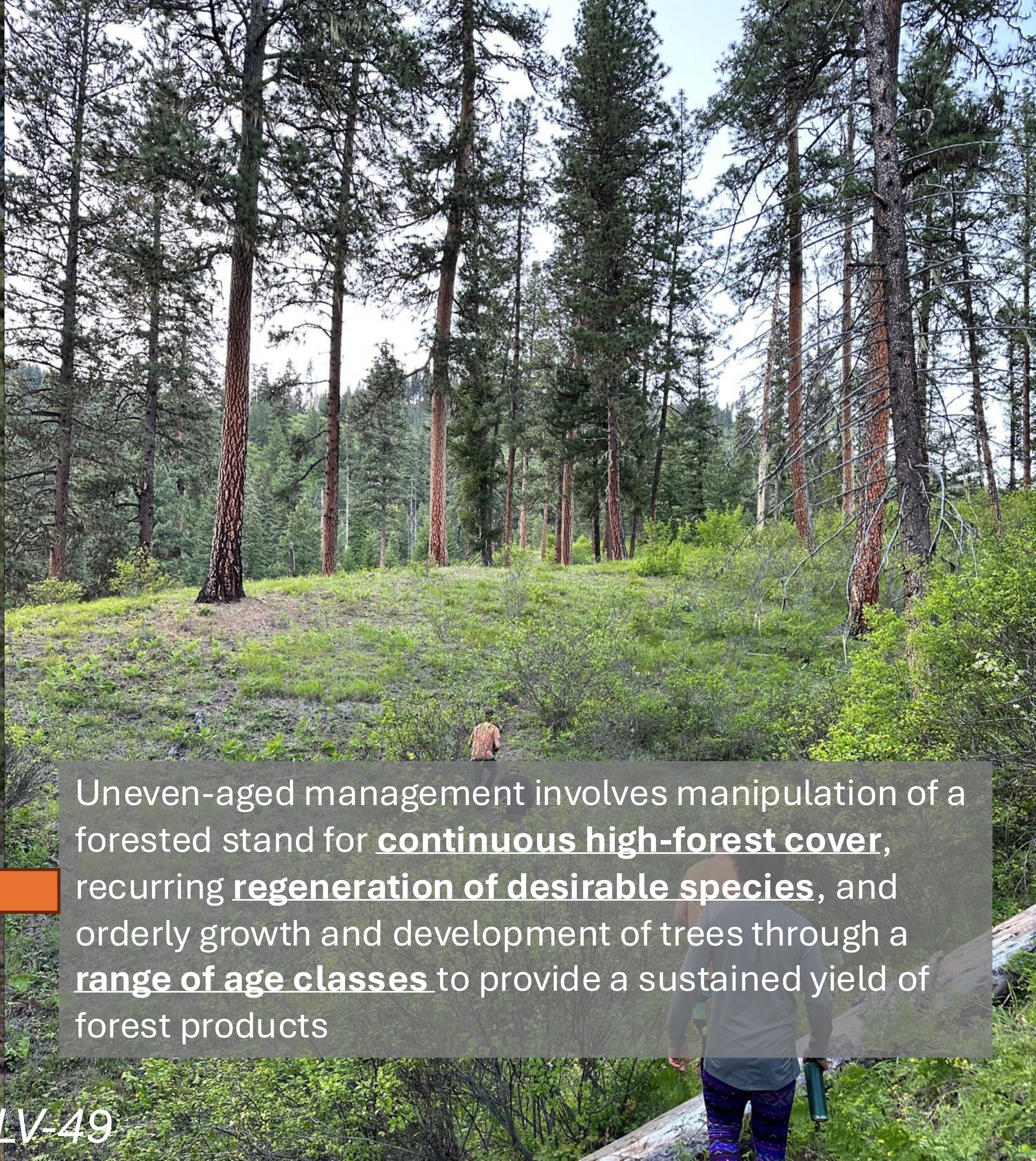
Resilience: the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et al 2004)

In our case what creates resilience to fire and drought?

- Specific Species- Pine, Cedar, Douglas-fir
- Tree size= bark thickness and root development
- Configuration- heterogeneity in fuel continuity

Production Uneven-aged Management & Concepts of Uneven-aged Structure





Uneven-aged management involves manipulation of a forested stand for **<u>continuous high-forest cover</u>**, recurring **<u>regeneration of desirable species</u>**, and orderly growth and development of trees through a **<u>range of age classes</u>** to provide a sustained yield of forest products

USFS Region 6- WHITE PAPER F14-SO-WP-SILV-49

Continuous High-Forest Cover

Density

- Measure density for occupancy of the site, when categorized can indicate stocking
- Foresters use density metrics to inform decision making
  - We want growth being fully utilized from the site
  - If a stand is too dense it'll 1.) reduce growth 2.) increase risk of mortality or other health issues
  - If a stand is understocked all potential growth at the site is not being utilized
- To quantify a value of density it can be expressed as either relative or absolute
- Absolute= direct observation or measurement, basal area or trees per acre
  - Is simply an indictor of density, difficult to directly compare between different stand conditions i.e. a lot small trees can equal to the same basal area/ acre as few large trees
- Relative= Uses ratios or coefficients to standardize occupancy
  - Combines a absolute density indicator with some measure of avg. tree size
  - Stand Density Index (SDI)
  - Relative Density (RD) a scale 0-100 of density

$$SDI = N\left(\frac{D}{25}\right)^{1.6}$$

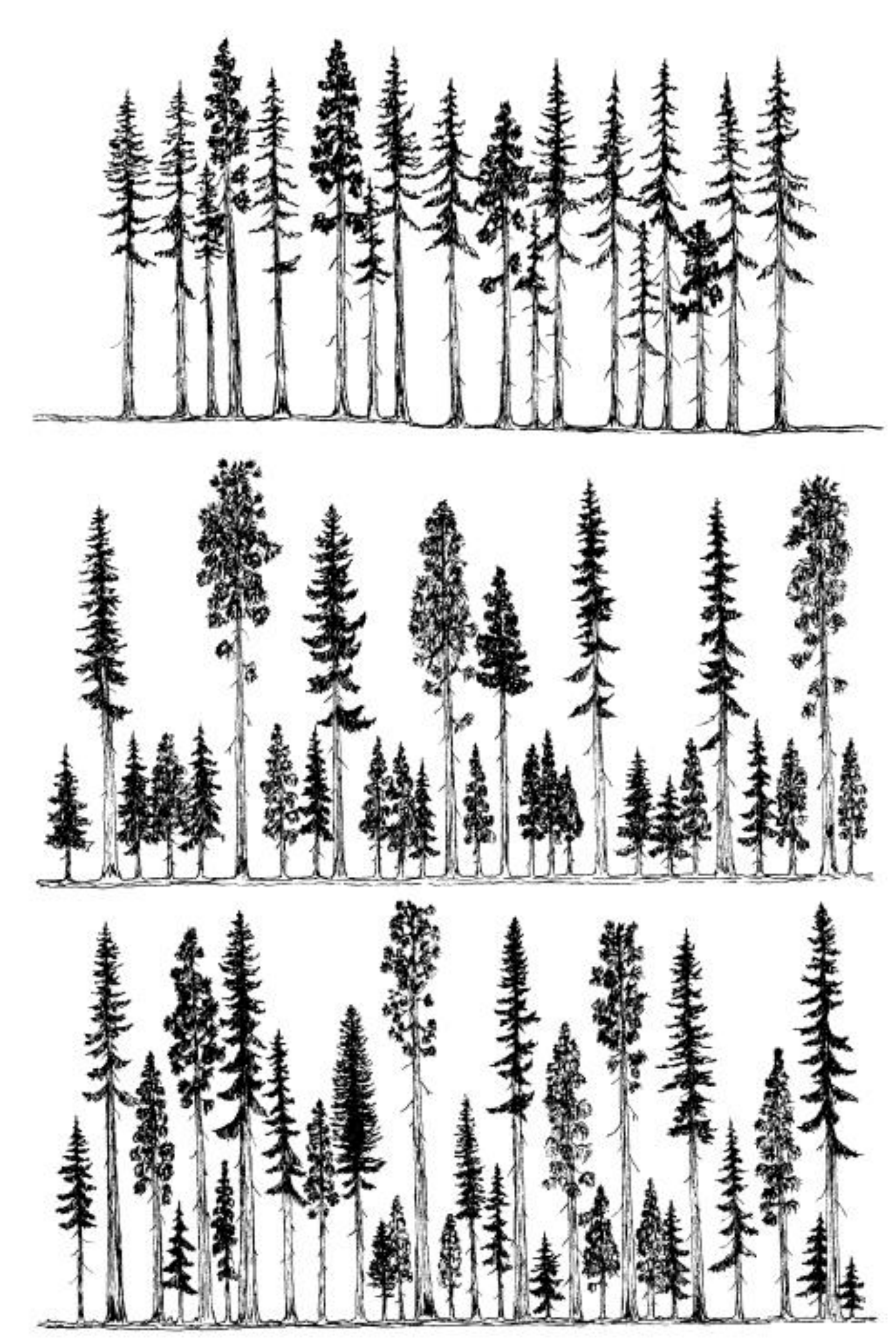
RD= SDI/SDI^{max}

Range of Age Classes

Ages Classes (Cohorts)

Stand Based

- **Cohort. ~one age class can encompass +/- 20 roughly**
- **Uneven-aged 3+ age classes**
- **Over time as shade tolerant species become more prevalent. Cohorts might be categorized more by crown class than age class.**



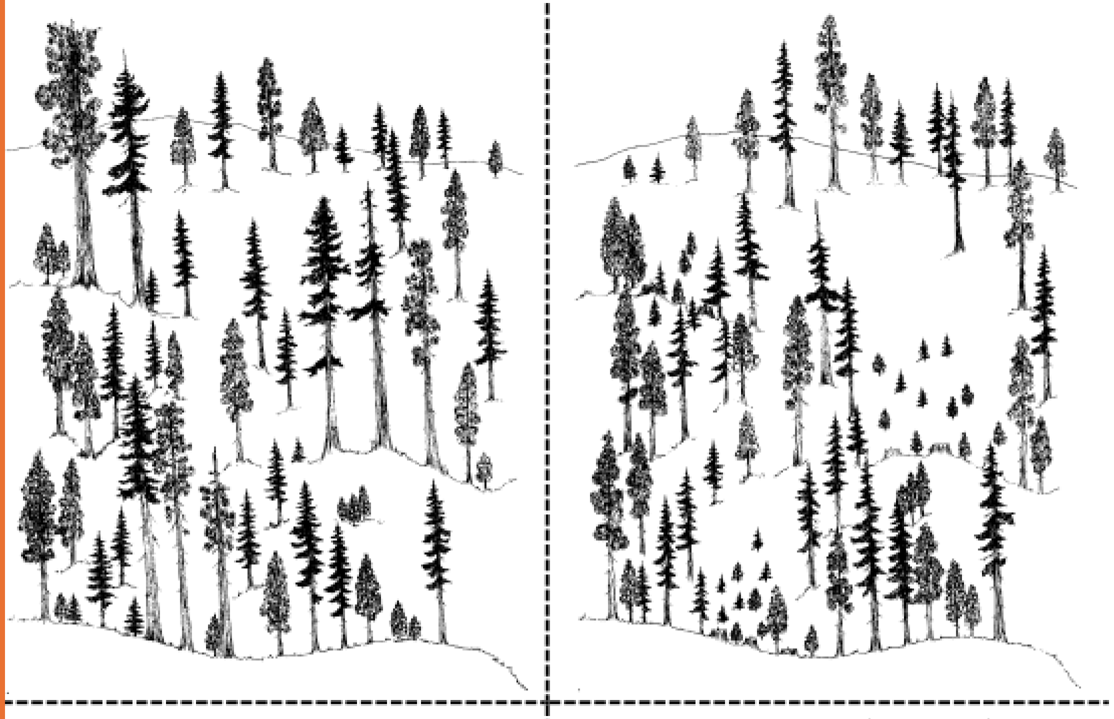
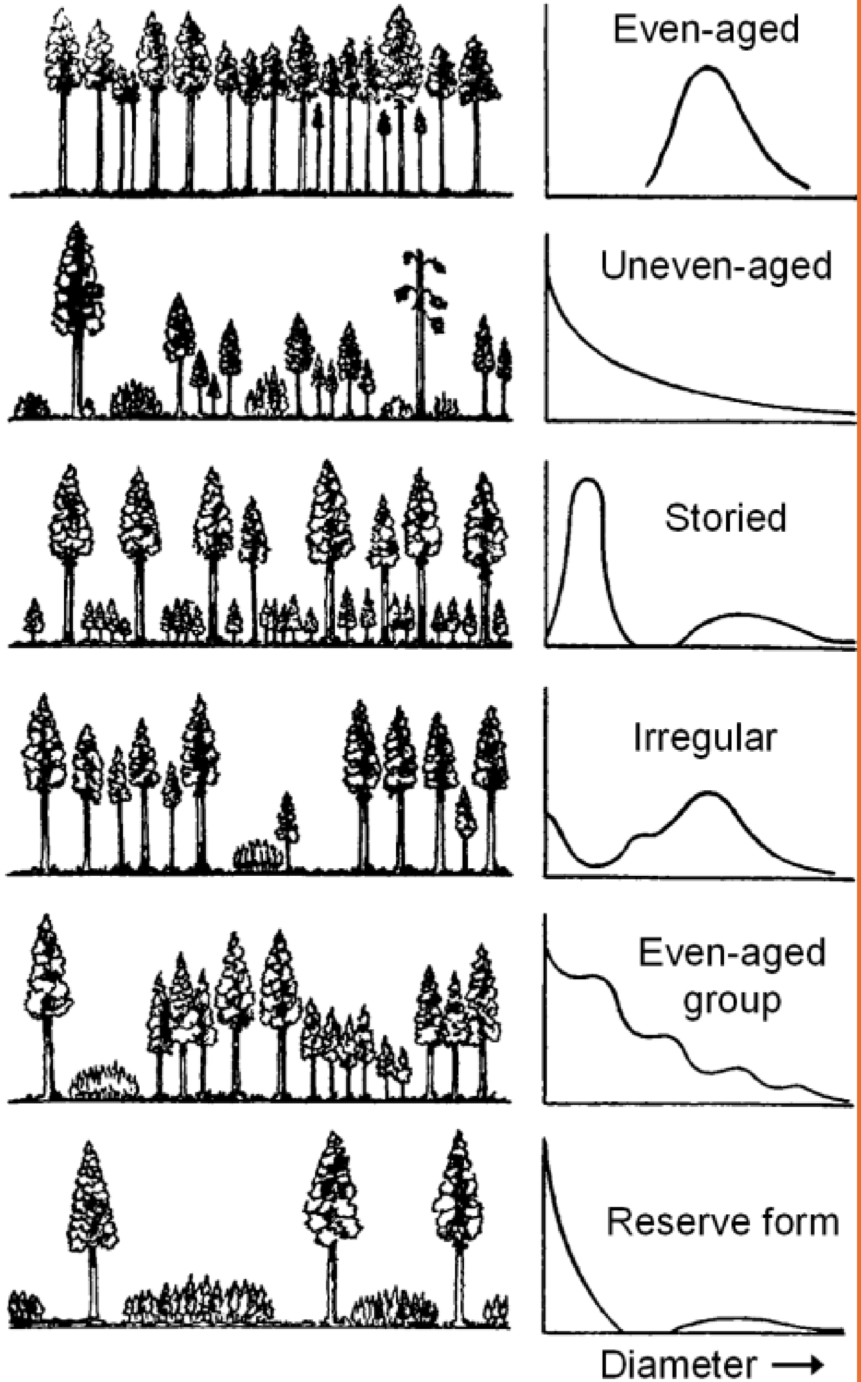


Figure 13 – Group selection cutting method (landscape perspective). A naturally groupy or clumpy stand (upper left) is best used with this uneven-aged method. In response to uneven-aged diameter distribution objectives, natural groups or clumps are identified and removed successively during multiple cutting cycles (upper right and lower right). As each group is harvested, young trees are established by natural regeneration or by outplanting (artificial reforestation). As uneven-aged management progresses, groups regenerate, mature, and are harvested according to parameters established by using the BDq approach to diameter regulation.



Regeneration of Desirable Species

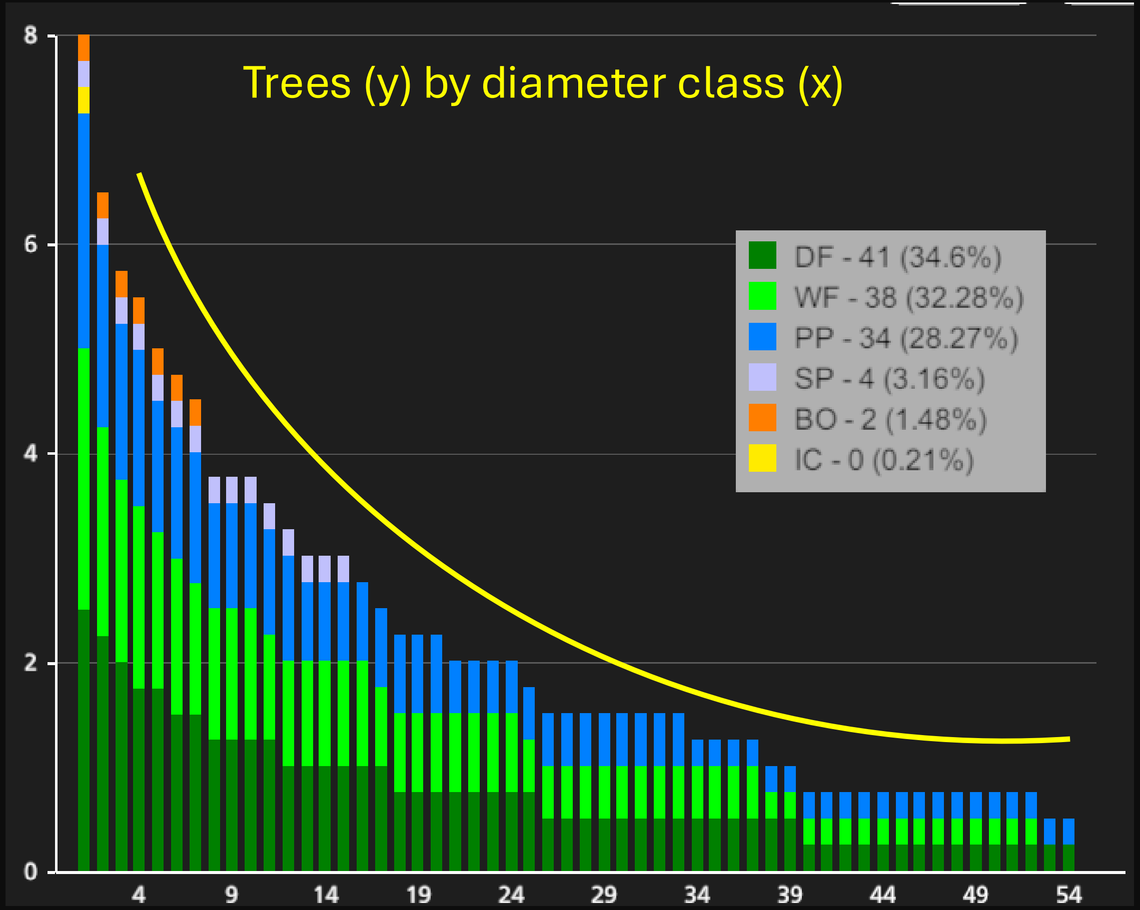
Regeneration favors Shade Tolerance

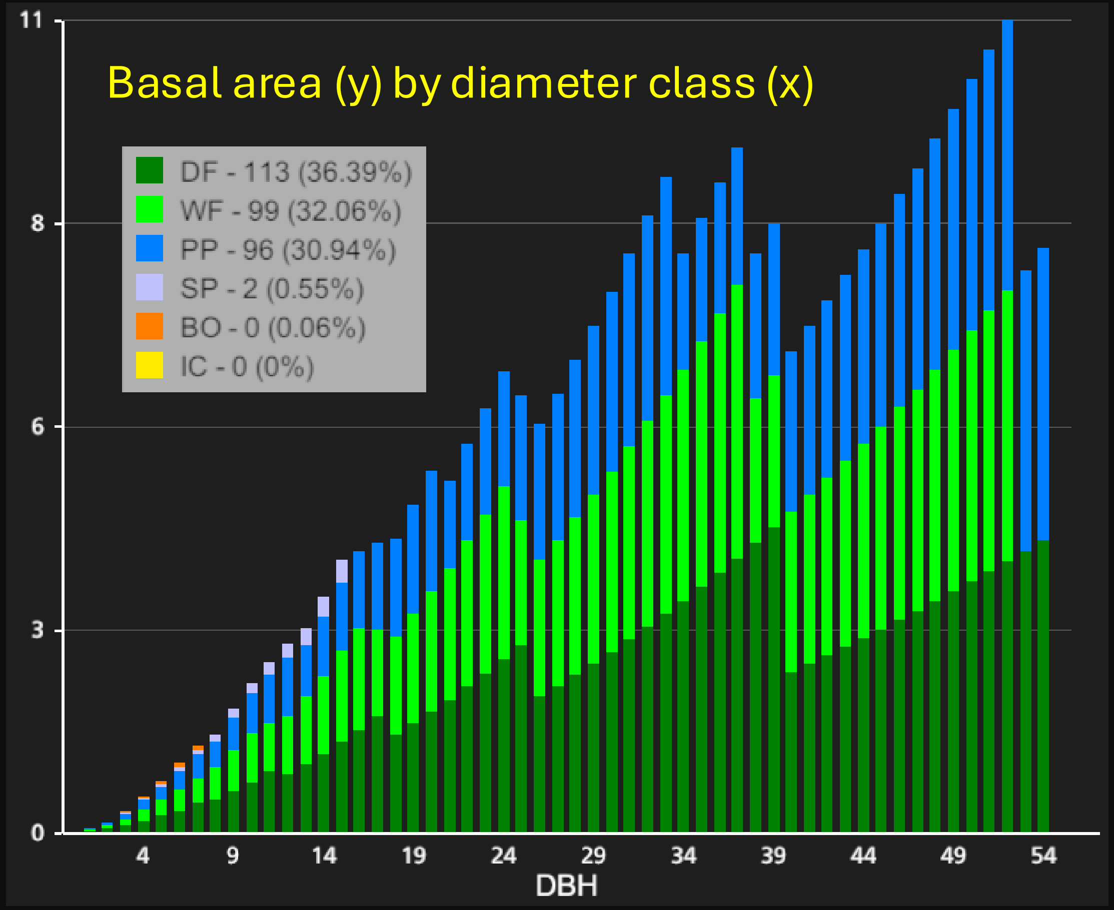
- “Continuous high-forest cover”
  - Results in reduced sunlight in understory
  - Increased litter base
- Certain species thrive in these conditions
  - White fir
  - Incense cedar
    - What do they have in common?

Summary (Per Acre)	
Trees:	118.50
BA Sq.Ft:	309.25
Scrib BF:	87,778
Bio Mt:	224
Cubic Ft:	13,782

QMD= 21.8

RD= 75



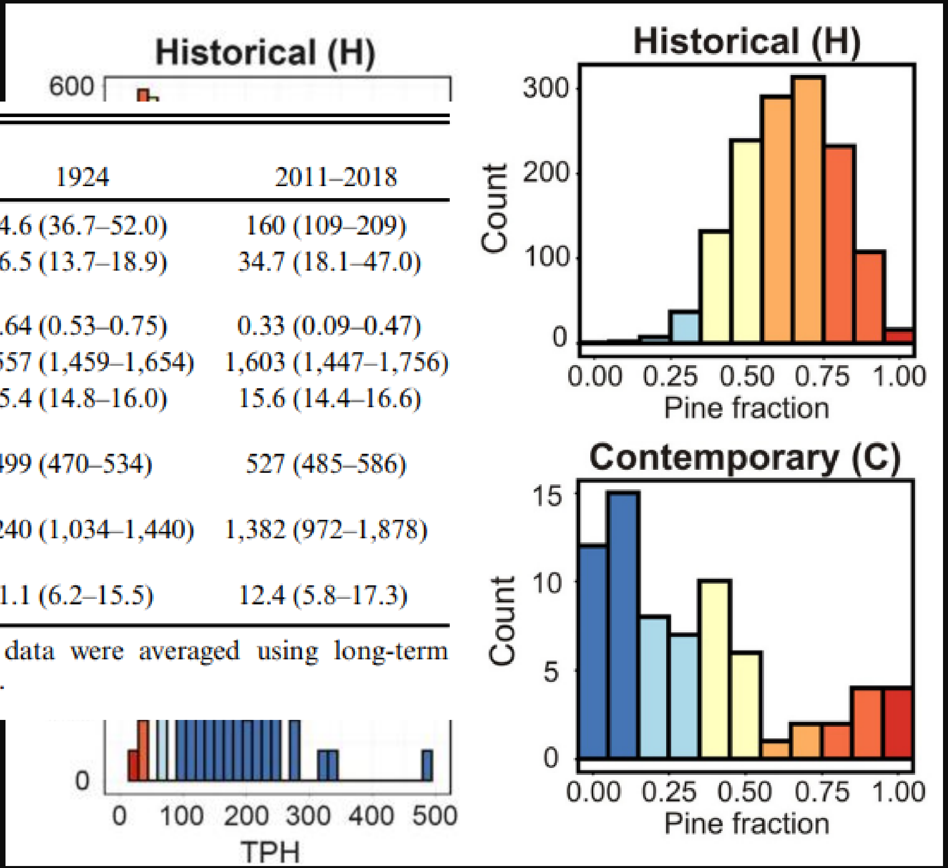


Comparing to Historic Conditions

- CA mixed conifer & pine dominant stands generally saw high frequency / low intensity disturbance events
- Moderate and high intensity also occurred but were most isolated due to low stocking
- Fire history (moderate/high) 1879-1970>>>
- “Suppression of the young growth has always been one of the serious results of fires…The land does not carry more than 35 per cent of the quantity of timber it is capable of supporting”-John Leiburg 1902

Forest structure and data	1924	2011–2018
Trees/ha	44.6 (36.7–52.0)	160 (109–209)
Live basal area (m^2/ha)	16.5 (13.7–18.9)	34.7 (18.1–47.0)
Pine fraction	0.64 (0.53–0.75)	0.33 (0.09–0.47)
Elevation (m)	1,557 (1,459–1,654)	1,603 (1,447–1,756)
Max annual temperature (°C)	15.4 (14.8–16.0)	15.6 (14.4–16.6)
Annual climatic water deficit (mm)	499 (470–534)	527 (485–586)
Annual precipitation (mm)	1,240 (1,034–1,440)	1,382 (972–1,878)
Slope (%)	11.1 (6.2–15.5)	12.4 (5.8–17.3)

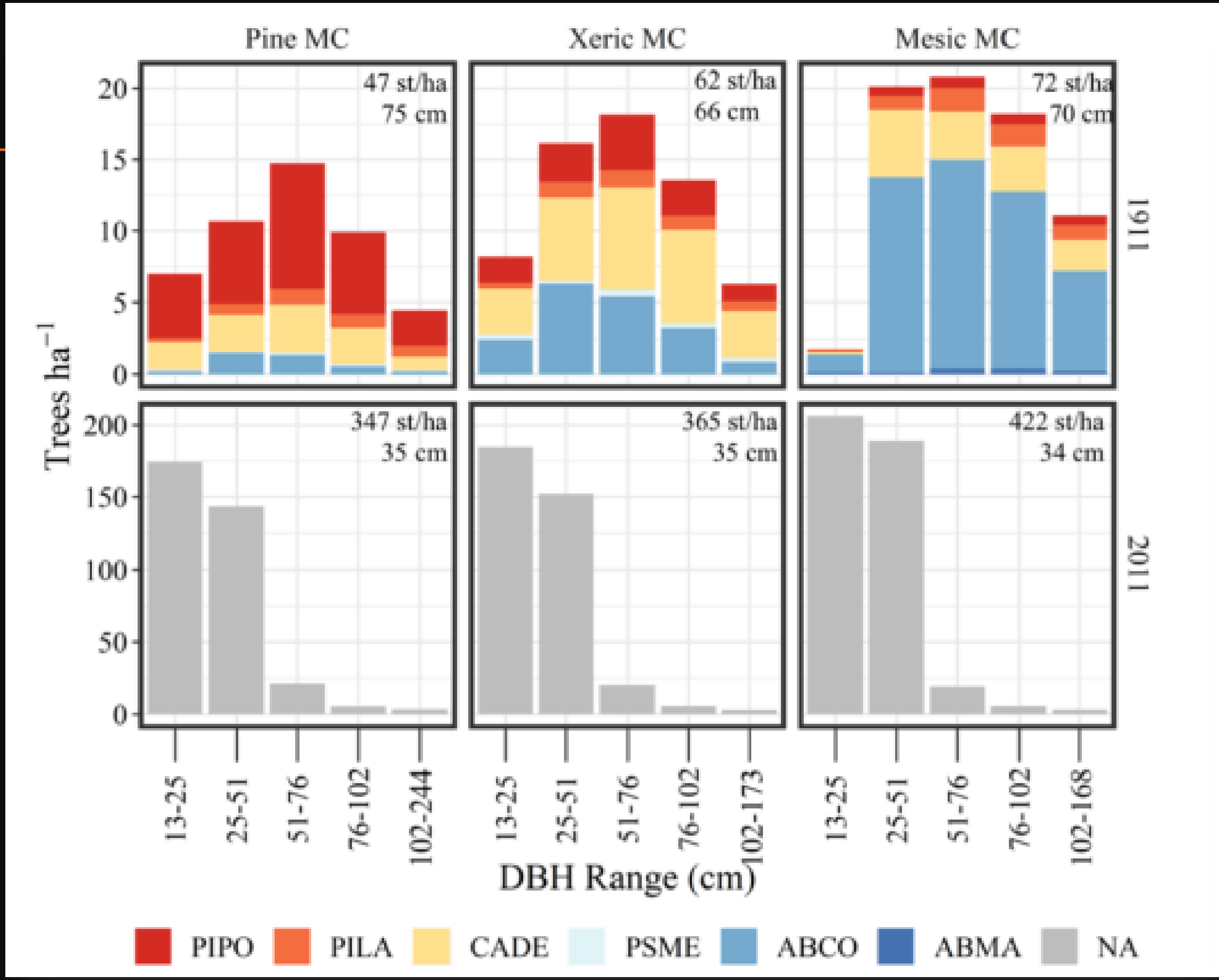
Note: Environmental data were averaged using long-term values from 1981 to 2010.

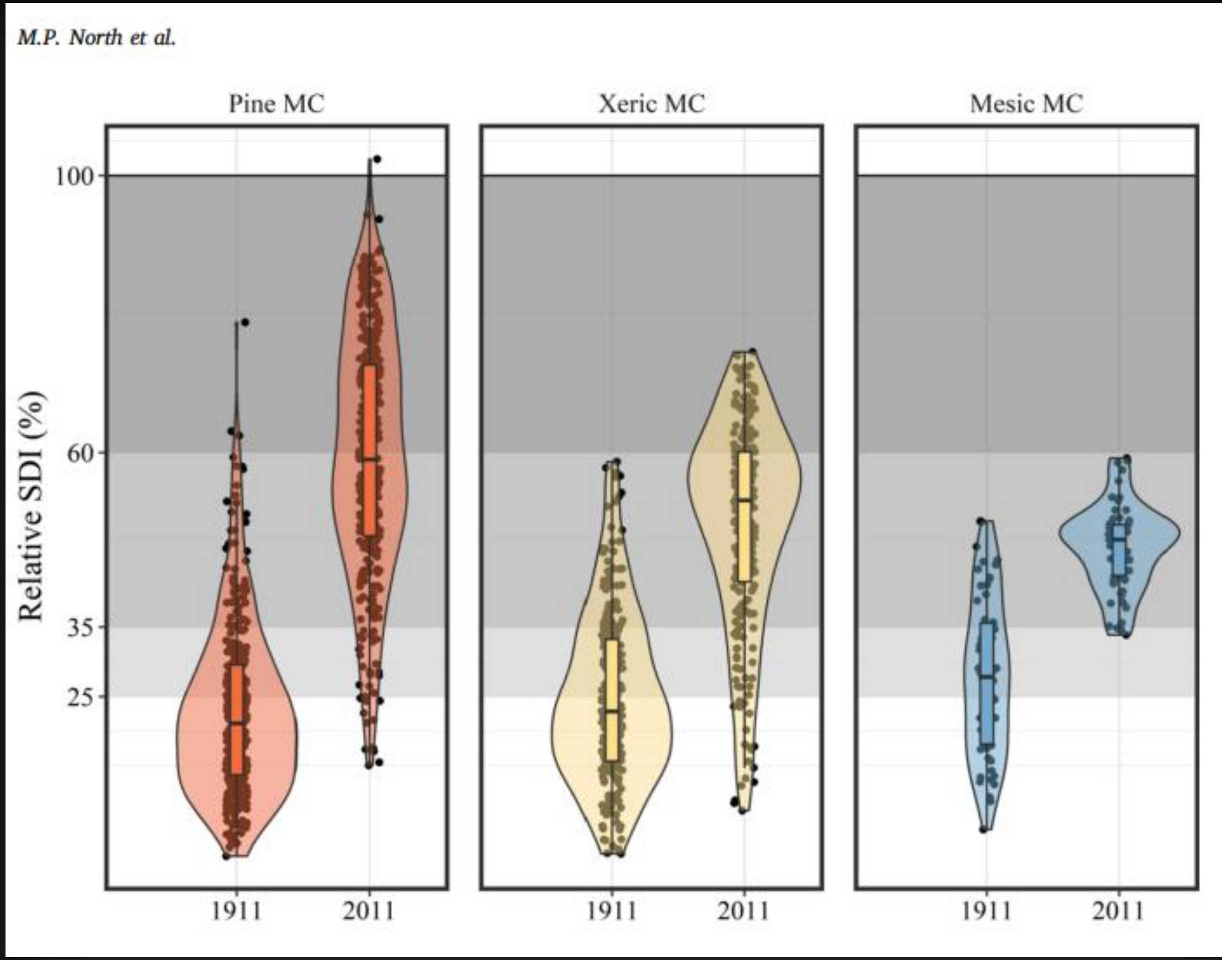


Collins, B. M., A. Bernal, R. A. York, J. T. Stevens, A. Juska, and S. L. Stephens. 2021. Mixedconifer forest reference conditions for privately owned timberland in the southern Cascade Range. Ecological Applications 31(7):e02400. 10.1002/eap.2400

Historic Structure Cont.

Operational resilience in western US frequent-fire forests
North M.P., Tompkins R.E., Bernal A.A., Collins B.M., Stephens S.L., York R.A.
(2022) Forest Ecology and Management, 507 , art. no. 120004

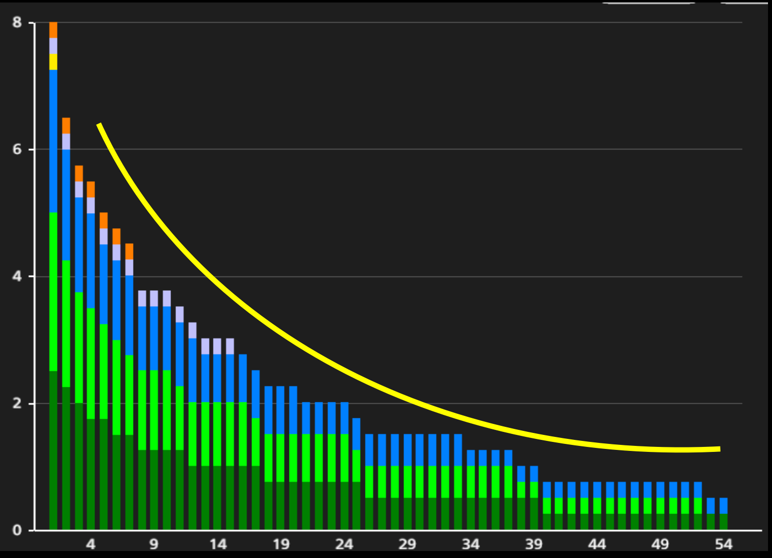




What caused these Structural Shifts?

- Fire Exclusion
- High grading
- Regulation Shifts

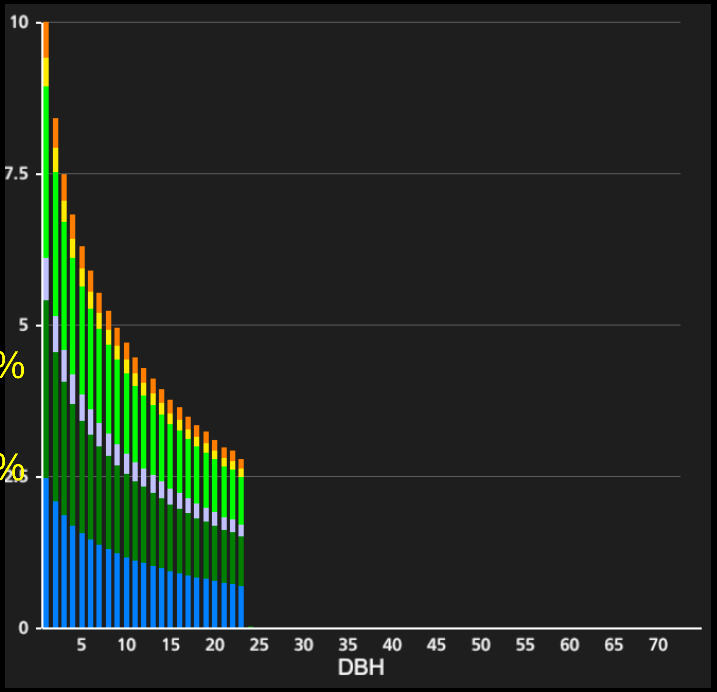
High Grade
Selective Cutting

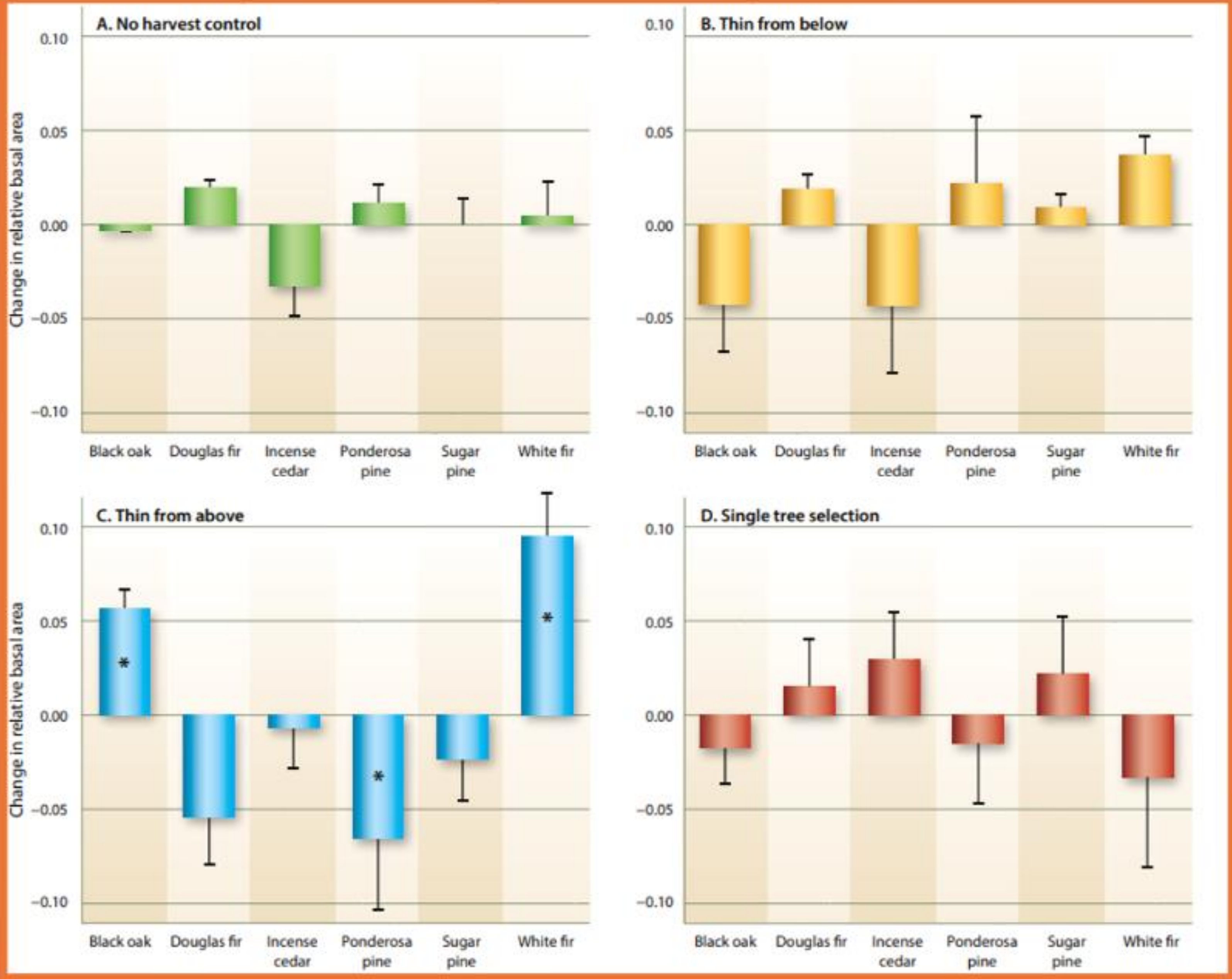


Cutting all 24”+ trees from our J curve stand

- DF - 41 (34.6%)
- WF - 38 (32.28%)
- PP - 34 (28.27%)
- SP - 4 (3.16%)
- BO - 2 (1.48%)
- IC - 0 (0.21%)

- DF - 21 (33.2%) ~1.4%
- WF - 20 (31.25%) ~1%
- PP - 17 (26.95%) ~1.5%
- SP - 4 (5.47%)
- BO - 2 (2.73%)
- IC - 0 (0.39%)





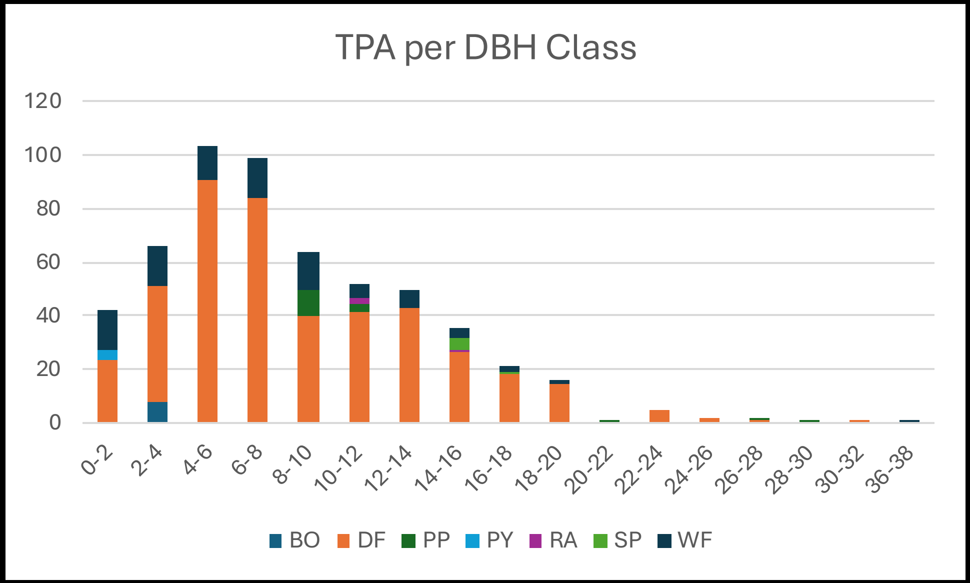
A. No harvest control
B. Thin from below
C. Thin from above
D. Single tree selection
Change in relative basal area
0.10
0.05
0.00
−0.05
−0.10
Black oak
Douglas fir
Incense cedar
Ponderosa pine
Sugar pine
White fir
*

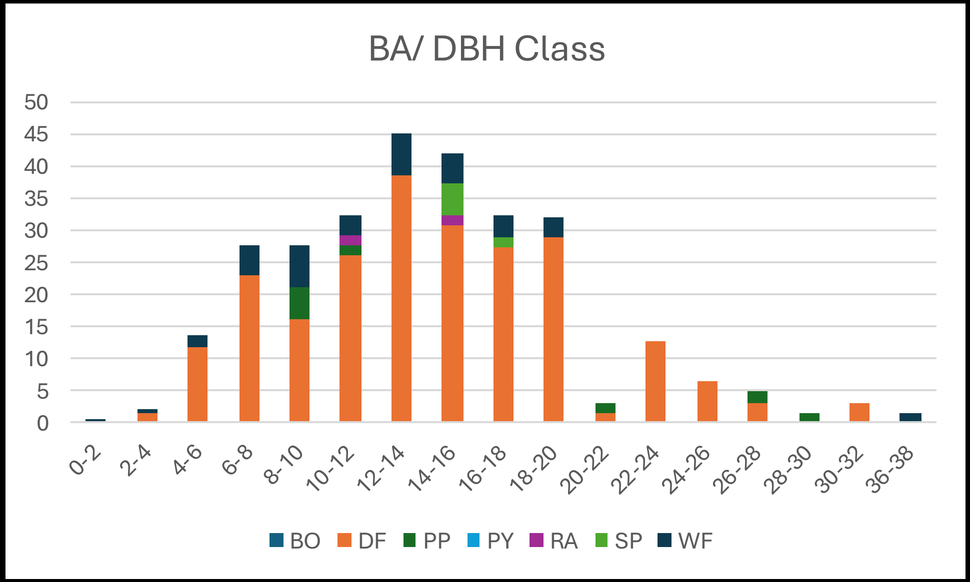
Regulatory Shifts

- Porter Cologne Act 1969
- 1970 California Environmental Quality Act
- 1970 National Environmental Policy Act
- 1970 CA Endangered Species Act
- 1972 Clean Water Act
- 1973 the California Forest Practice Act
- 1973 Endangered Species Act
- 1976 CA Timber Yield Tax
    - Prior to 1976 ad valorem property tax in place on CA private timberlands

- Multiple constraints are now added into forest planning
- Many of these constraints (WLPZ and habitat thresholds) require increased canopy cover (density)
- As we’re maintaining or increasing density, resilience has changed in the stand
- Another issue there might not be multiple age classes in the stand that you want to apply unevenage silviculture to

TPA= 561
QMD = 10.8
SDI = **635**
RD= 115!!!





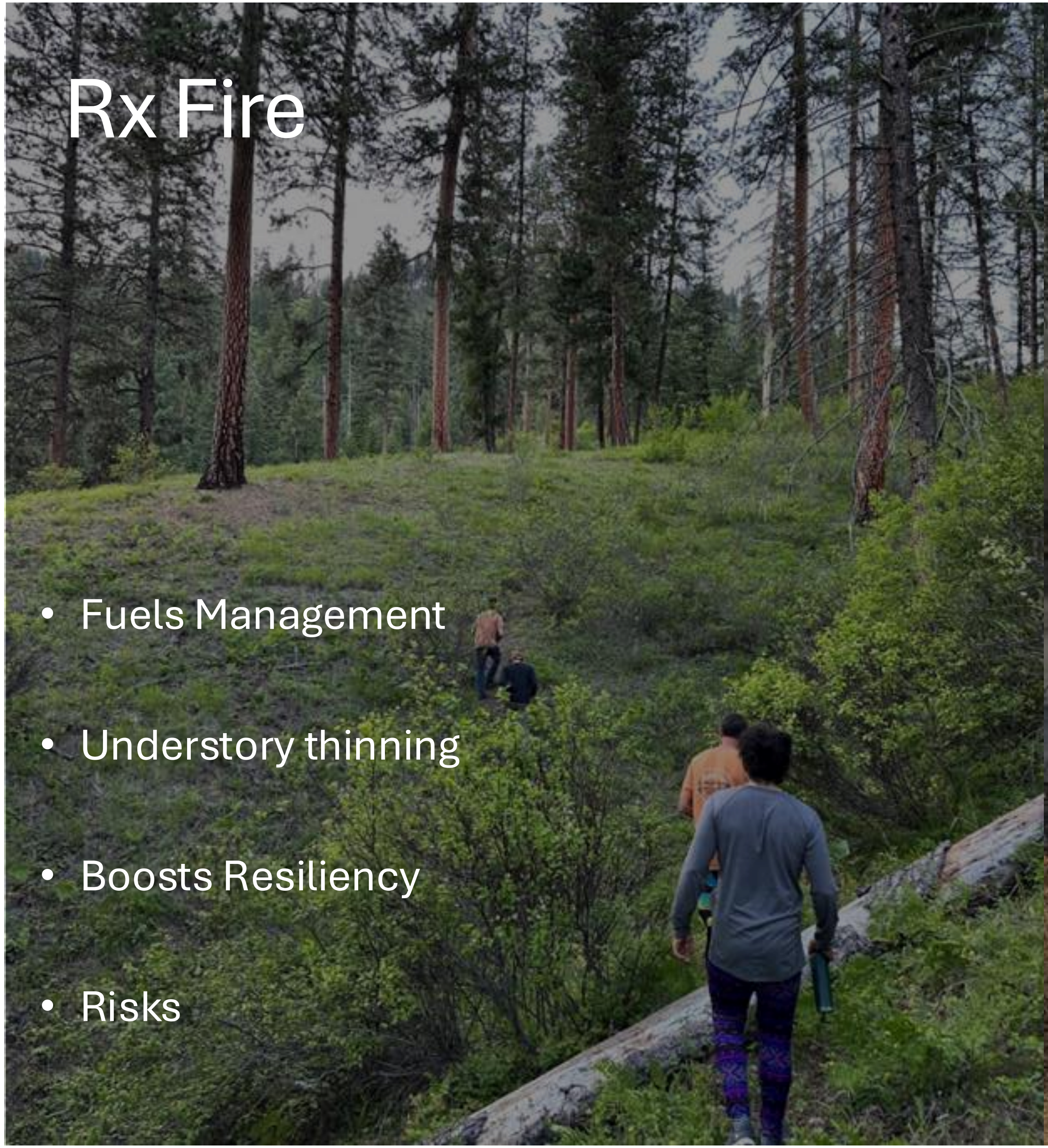
Moving Forward

PRESCRIBED FIRE

ECONOMICS

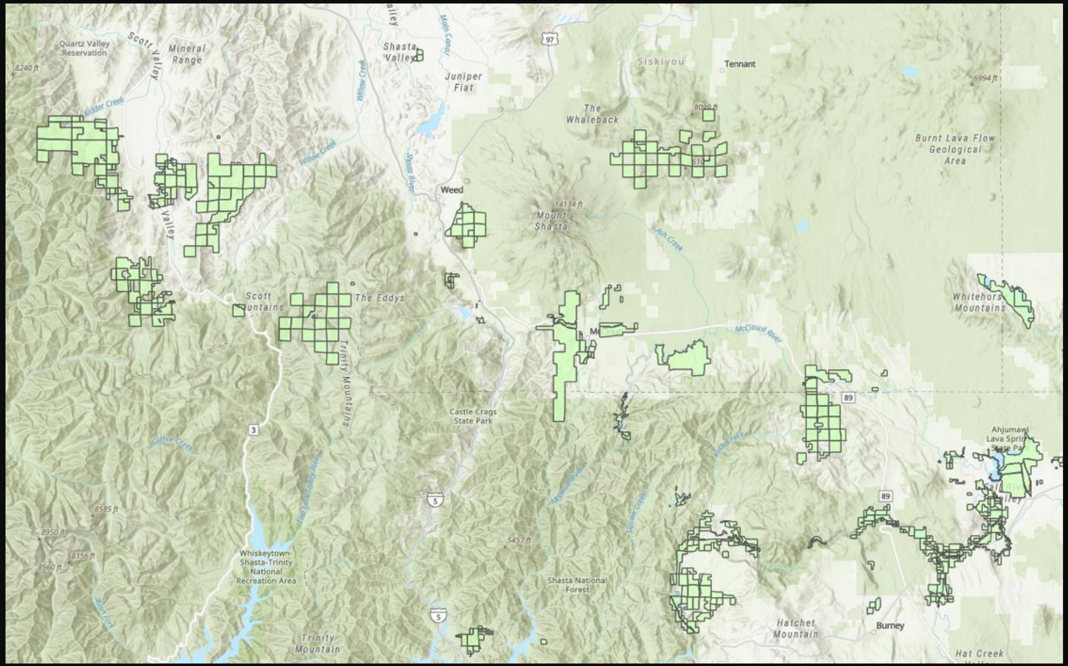
Rx Fire

- Fuels Management
- Understory thinning
- Boosts Resiliency
- Risks

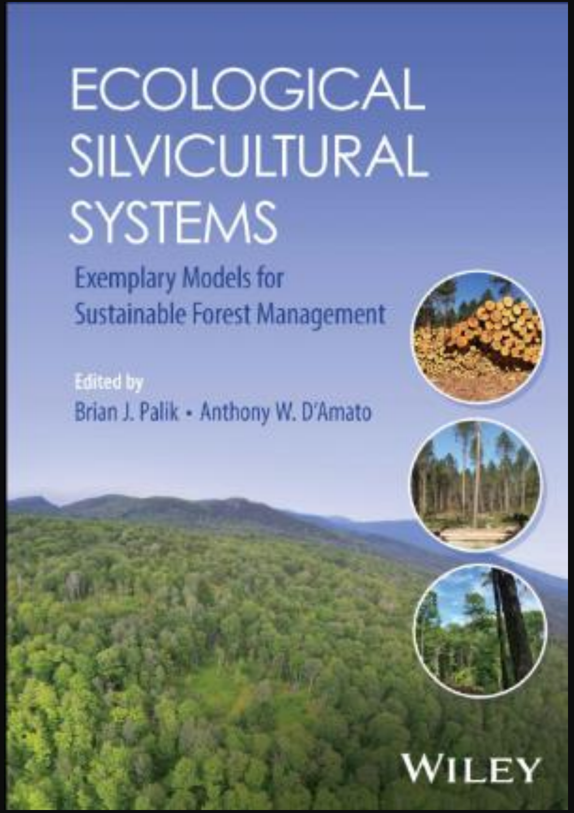


Economics

- Harvest Intensity
- Return Interval
- Conservation Easements
- Carbon Markets
- Grants



Questions?



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