Replanting strategies under changing wildfire, climate and budget conditions

Increasing frequency & severity of stressors (i.e., fire, drought) ➡ build resilience in young stands

Tamm Review: Reforestation for resilience in dry western U.S. forests

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Are current reforestation practices, often regularly spaced pines, well adapted to a more stressful future?

Objectives:

- Bypass uncertain natural seeding & vulnerable seedling stage
- Crowns soon interlock controlling light resources
- Rapid initial height and diameter growth for at least 20 yrs

Why the focus on tree regeneration quickly gaining site control?

Most western fire-dependent forests have 'aggressive' shrubs, both re-sprouters and with long-lived seed, that rapidly recolonize burns, outcompete conifers for near soil surface moisture, and kill or reduce growth of tree regeneration

This has led to competing veg. management and/or high density planting to shade out shrubs

Shrub cover almost 100% 8 years after Angora Fire

Forest Service

Minimum Recommended and Acceptable Stocking Levels			
Forest Type	R5 Site Class	Recommended TPA	Minimum TPA
Ponderosa & Jeffrey Pine	0 and 1	200	150
	2	200	125
	3	150	100
	4 and 5	125	75
Red/White Fir	All	300	200
Douglas-fir	All	225	125
Mixed Conifer	All	200	150

Pacific Southwest Region

Current stocking is 3-5 times historic densities:

Pondo pine: 51 tpa (range 29-64 tpa)

Red fir: 65 tpa (range 48-84 tpa)

Mixed conifer 64 tpa (range 24-133 tpa)

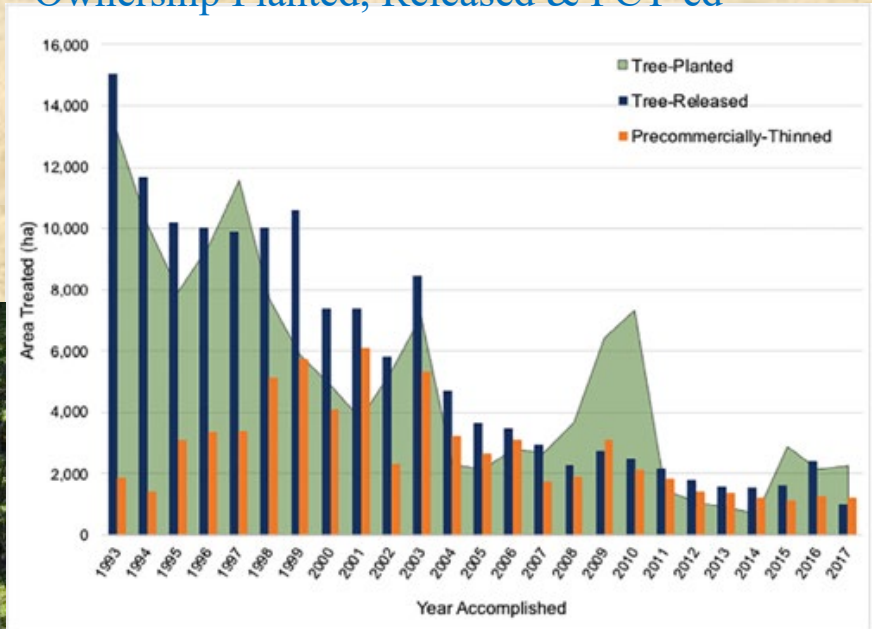
Problems with high-density gridded reforestation

- Method is heavily dependent on costly 'course correction'
- Precommercial thinning (PCT) needed to reduce density, change composition, and spatial pattern
- Need to reduce shrubs with manual herbicide or labor intensive grubbing
  - USFS Regions 1-6: 40% decline in acreage released
  - USFS All Regions: Budgets stagnant to shrinking

Without follow up, maturing plantations will likely lack spatial heterogeneity associated with fire resilience

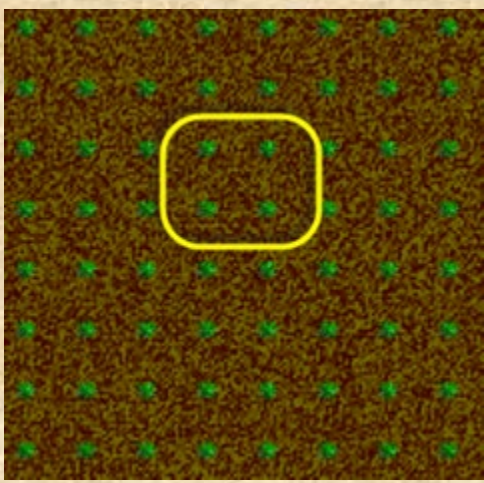
Yosemite mixed conifer with restore fire regime ICO pattern: individual trees, clumps of trees & openings

Region 5: Declining Acres of Sierra Nevada NF Ownership Planted, Released & PCT'ed



High Density Plantations Lack Resilience

- To fire: when burned often leads to 100% incineration (foliage close to ground, crowns interlocked)



- To drought: With uniform density/competition, there is no variability in the competitive/ resource capture area.
- Regular spacing is a crop production strategy for maximizing growth

- Given increasing acreage needing reforestation and declining budgets, do we need to adjust reforestation practices?

Reforestation For Resilience: 3 main objectives

1) Triage: Divide reforestation area into zones by potential seeding and access/costs
2) Aligning forest conditions with topography: Composition, density, pattern should vary and be aligned with microsite water & fire patterns
3) Restore keystone process: Build young forest resilience with the use of early, frequent prescribed fire

Stand structure and pattern of an active-fire forest, Sierra San Pedro del Martir, Baja

#1) With limited money and personnel resources, use zones With different strategies

Z1: Interplant as needed within seed dispersal distance of green trees

Z2: Cluster/regular planting in accessible (for salvage & planting) areas beyond dispersal

Z3: Plant founder stands in remote, inaccessible areas with cost and safety challenges

A partially salvaged area two years after the 2014 Eiler Fire in Northern California

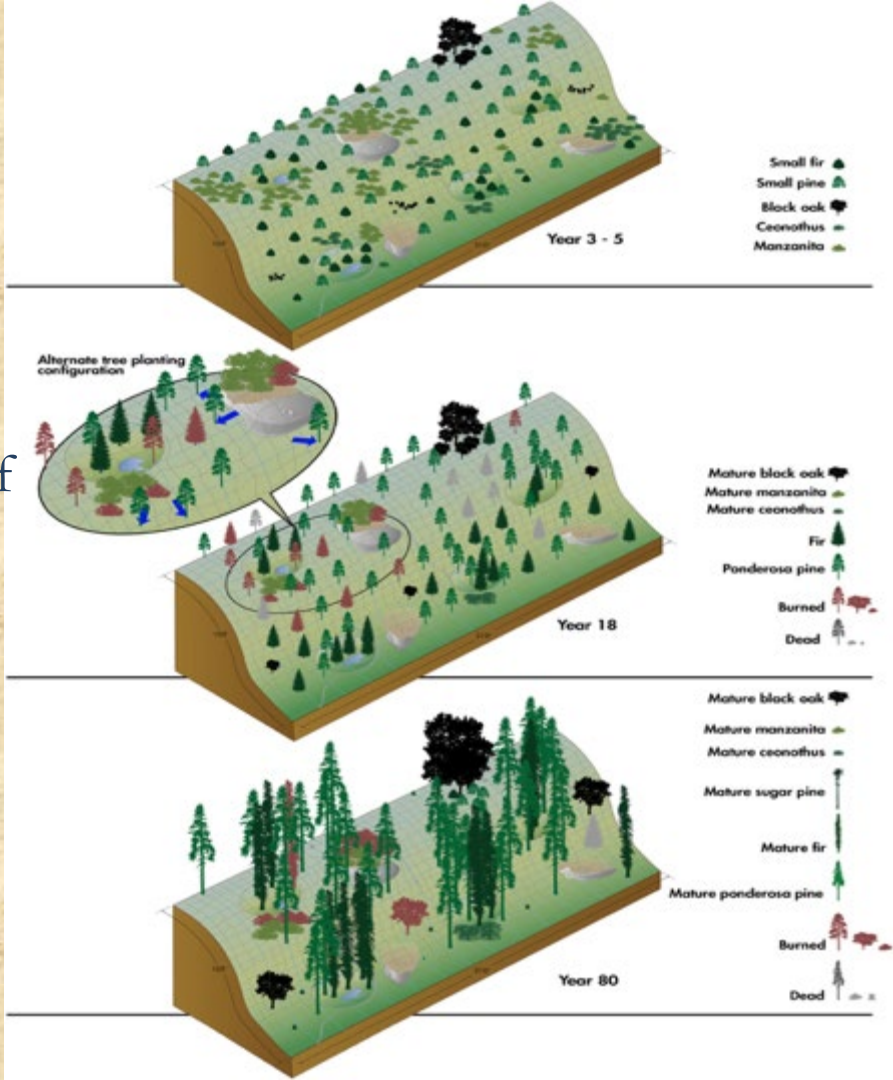
#2 Planting Scheme: Clustered & Regular

Schematic of the initial planting & subsequent stand development for a 0.5 ac (105 X 210ft) slope of forest.

Clusters of seedlings planted where there is more water (concavities), species varies with local projected fire intensity, and low density of regularly spaced seedlings planted between clusters.

'Martir' Baja forest structure resilient to drought and fire

Spatial Pattern in the Beaver Creek Pinery

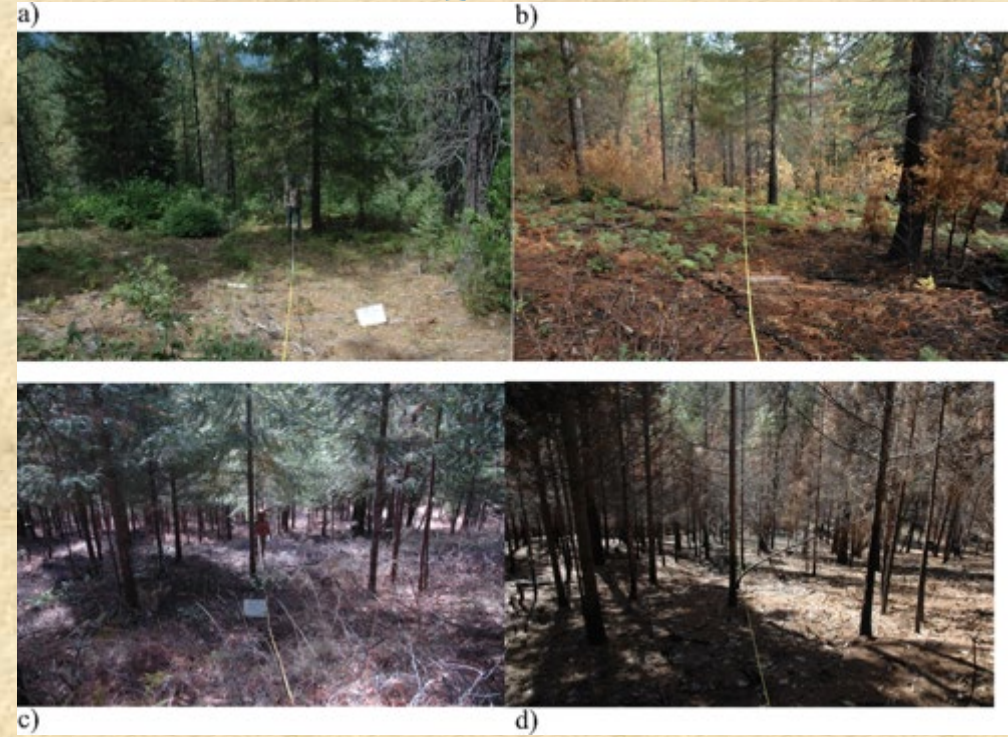


#3: Restore Keystone Process: Build early resilience and genetic selection for fire tolerance with prescribed fire

Before and after examples of young stand Rx burns on the Shasta-Trinity National Forest.

The upper pair, a) and b), show a mixed-conifer plantation spring burned 33 years after planting. Surface fuels were reduced, as was density by killing smaller trees.

The lower pair, c) and d), showing cost-effective burn in a 25 yr old stand that acted like a pre-commercial thin reducing natural recruitment density.



Rx fire re-establishes selective mortality favoring phenotypes with thicker bark and early branch abscission

For modern reforestation practices to be resilient, they should consider adapting tree composition and density to microsite

- Varying the density and pattern of planting with water and burn behavior will increase variability in resource competition, fuel loads, and wildlife habitat conditions.

- Shrub control…shrubs reduced in tree clusters through shading and more extensively throughout the stand with cost-effective prescribed burning. Young, wet shrubs are a useful heat sink for reducing fire intensity.

- Initial planting pattern and frequent burning foster resilient stand development and spatial patterns without depending on costly future treatments or hoped for commercial thinning to adjust the developing forest.

Questions?

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