Planting Conifers and Hardwoods after a Wildfire

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0. Topics

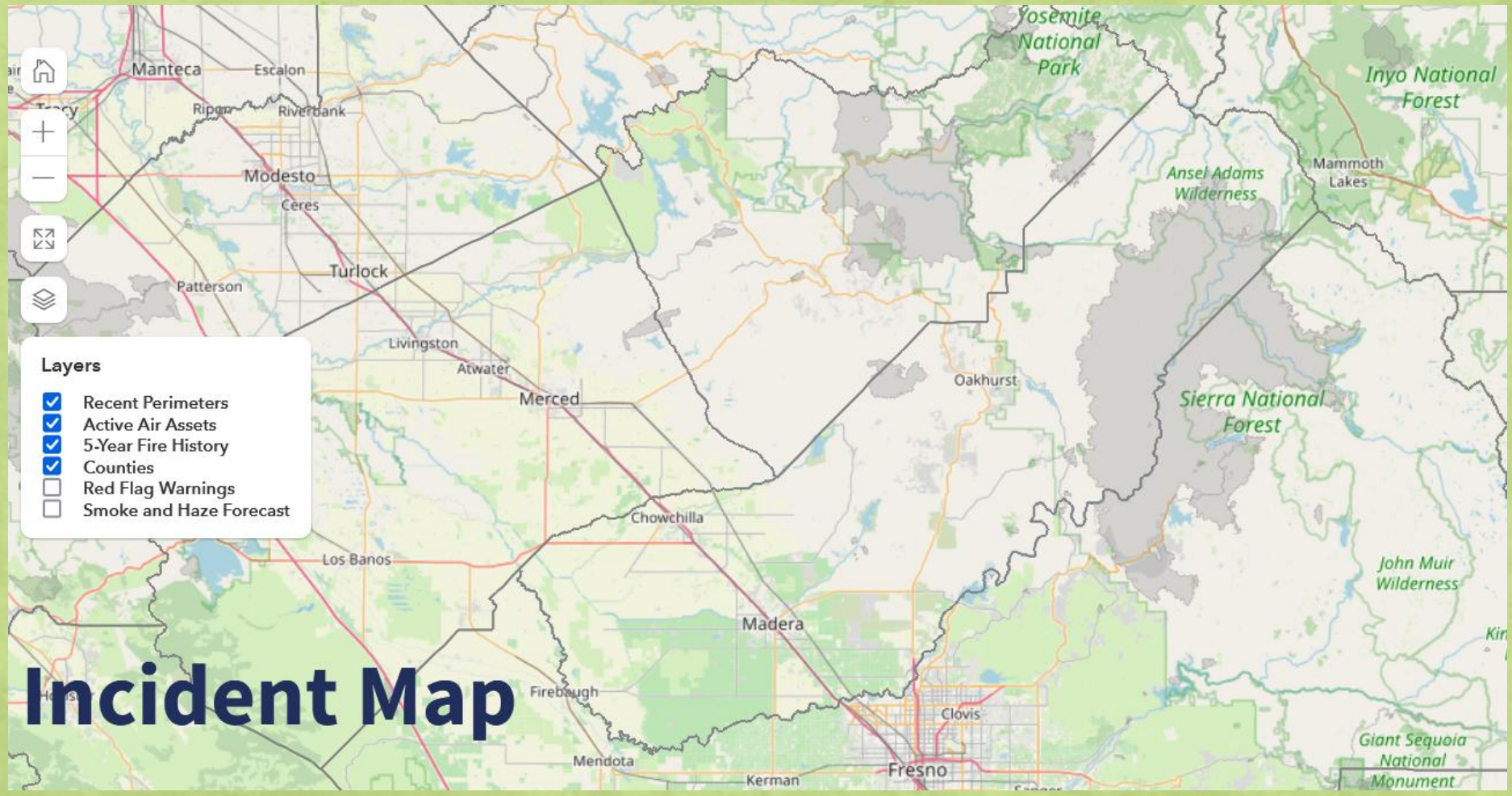
1. Introduction
2. Post-fire assessment
3. Local California native tree species
4. Plant materials, planting methods and steps, pest considerations, special tools, areal considerations, resources
5. The Hoedads: hippie entrepreneurialism, feminism in forestry, and economic reality
6. Plan for the future
7. References

1. Introduction: By the numbers (CalFire)

- 2025: 162,554 incidents; 653 wildfires; 59,851 acres burned; 30 fatalities; 16,251 structures
- 2024: 133,281 incidents; 251 wildfires; 155 acres burned; 0 fatalities; 0 structures
- 2023: 594,971 emergency responses; 7,127 wildfires; 324,917 acres burned; 4 fatalities (1 civilian); 71 structures (58 destroyed)
- 2022: 554,344 emergency responses; 7,477 wildfires; 363,939 acres burned; 9 fatalities (9 civilian); 1,279 structures (946 destroyed)
- 2021: 535,819 emergency responses; 7,396 wildfires; 2,569,386 acres burned; 3 fatalities (0 civilian); 3,846 structures (3,560 destroyed)
- 2020: 494,489 emergency responses; 8,648 wildfires; 4,304,379 acres burned; 33 fatalities; 11,116 structures destroyed

Creek Fire, Sep. 4, 2020, Fresno & Madera Counties

1. Introduction: Madera & Mariposa Counties



1. Introduction: California forests

- California area: ~100 million acres, ~33 million forest acres
- Conifers dominate ~58% of CA forest acres
  - Ponderosa Pine: 2.2 million acres
  - Mixed conifers (Douglas Fir, Ponderosa, Sugar, Jeffrey, Incense Cedar, White Fir): 7.8 million acres
  - Subalpine (Bristlecone, Mountain Hemlock): 390,000 acres
  - Other western conifers: 1.5 million acres
- Oak woodlands comprise ~13 million acres
- Ownership:
  - Federal: 57%
  - Non-industrial private: 29%
  - Logging industry: 11%

2. Post-fire assessment: Conifers

- Ponderosa Pine (*Pinus ponderosa*) after Oak Fire (Mariposa County, Jul – Sep, 2022)
- Crowns not burned
- Boles and trunks scorched, but outer bark intact
- Very good survival prospects
- Crown 50% burned? Poor survival prospects

2. Post-fire assessment: Conifers

- Incense Cedar (*Calocedrus decurrens*) after Oak Fire
- Snag on the right
- Crowns not burned
- Boles burned around the circumference
- Good survival prospects

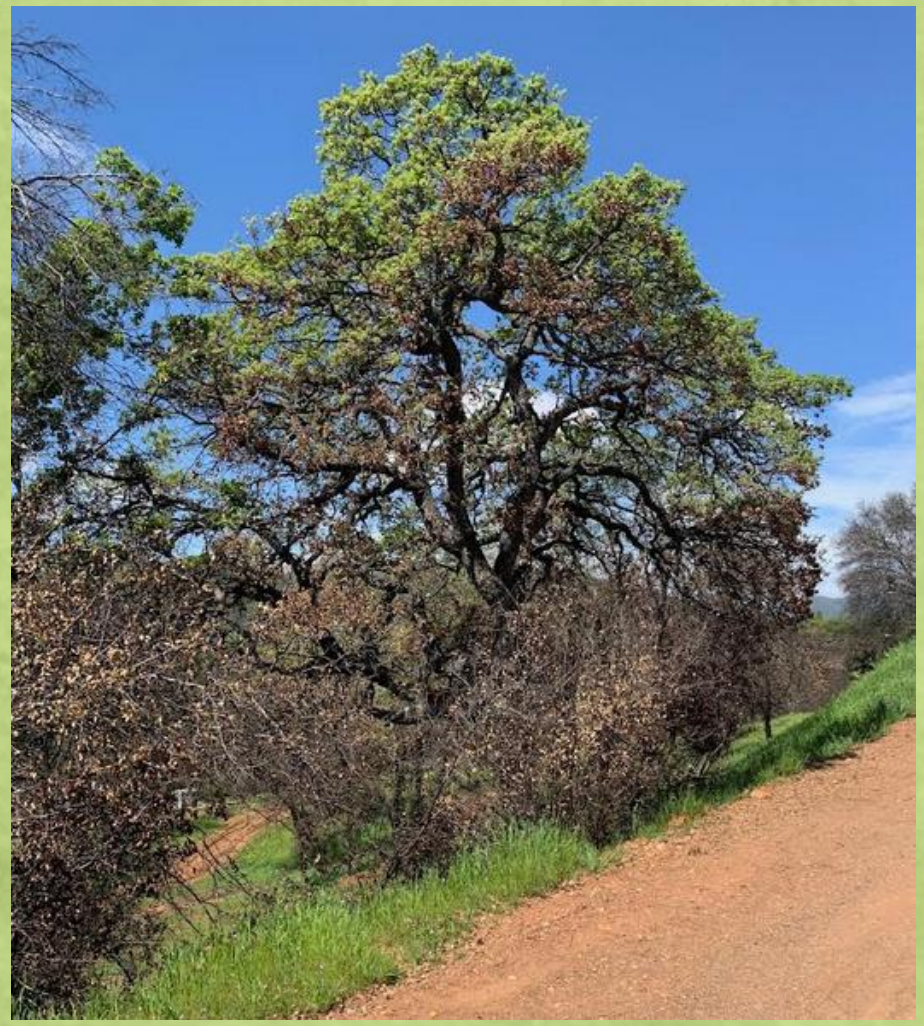
2. Post-fire assessment: Hardwoods

- Bigleaf Maple (*Acer macrophyllum*) after Oak Fire
- Trunk bark delamination: dead and gone
- Crown 50% burned? Poor survival prospects
- Oak tree crown 50% burned? Fair survival prospects

2. Post-fire assessment: Hardwoods

- Canyon Live Oak (*Q. chrysolepis*) after French Fire, July 2024, Mariposa CA
- Crown ~50% burned
- Appears to be recovering
- Note Gray Pine in lower right foreground: Consumed by fire and lost

2. Post-fire assessment: Hardwoods



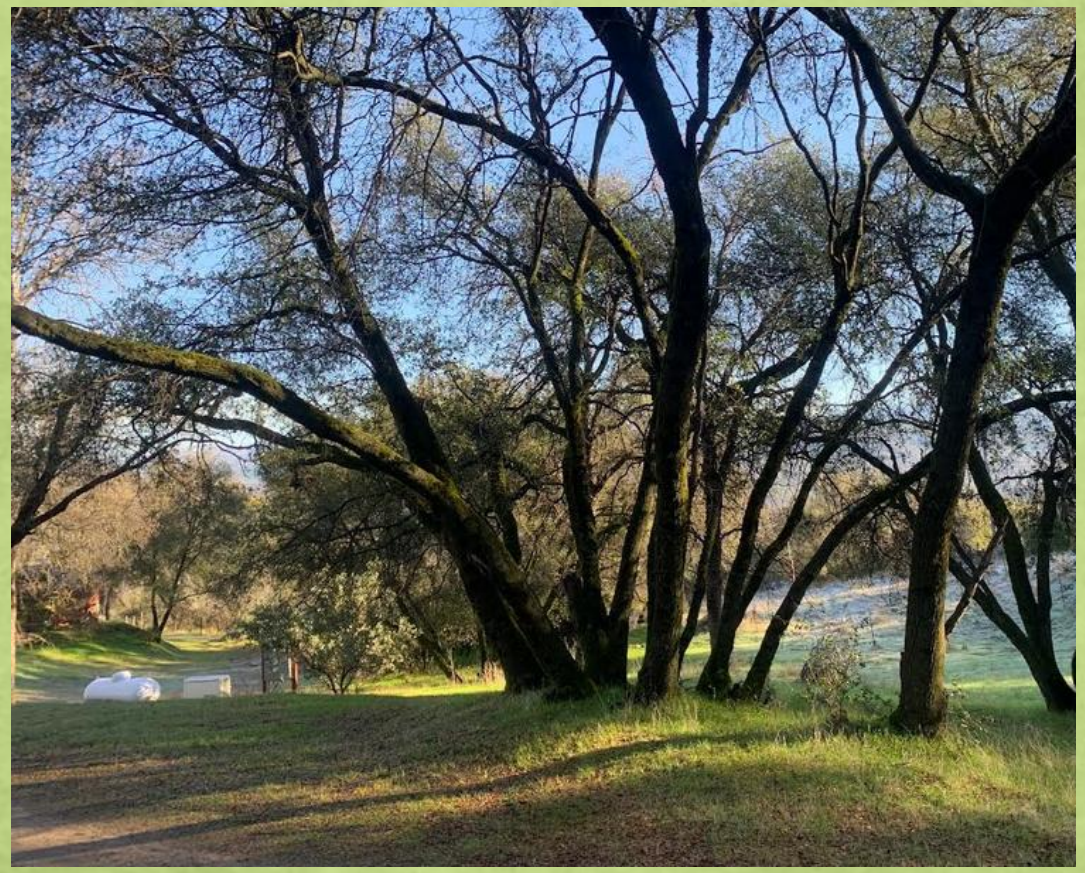
- Valley Oak (*Q. lobata*) after French Fire
- Crown ~20% burned, trunk scorched somewhat
- Recovering well

3. Locals (low elevation): Gray (Foothill) and Knobcone Pine

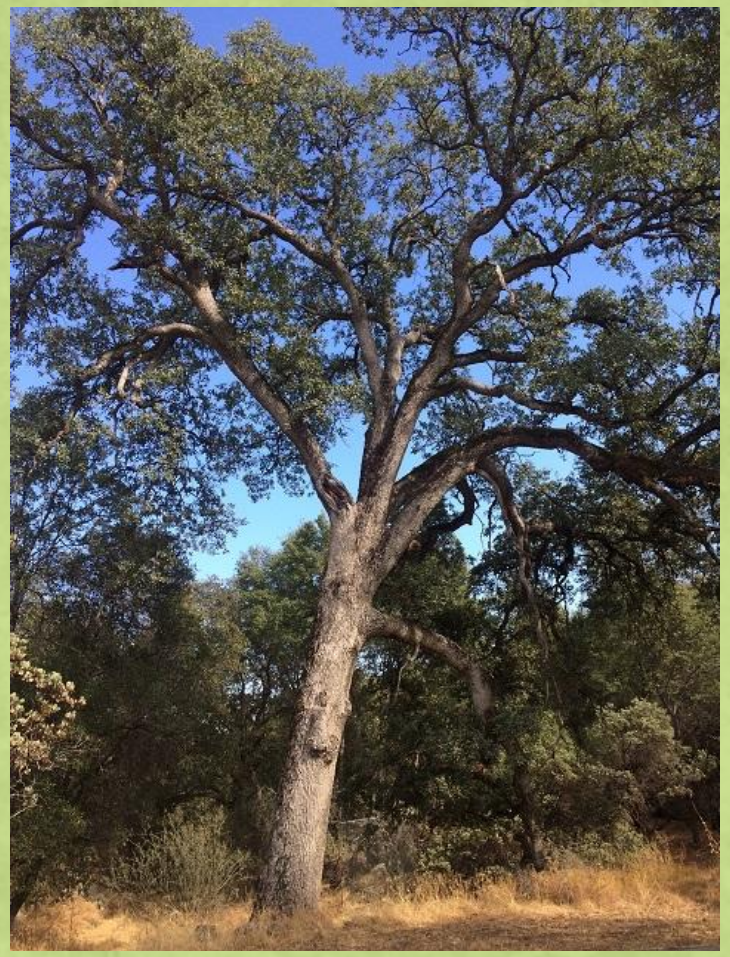
Pinus sabiniana, especially fire-prone, "self-pruning", grayish needles, forking trunk, round crown

- *Pinus attenuata*
- Good restoration tree
- Cones attached to branches, not tips; 3 needles
- Serotinous cones, open only with fire, stay in seed bank for many years
- Quick growing: 3 feet/year
- Suitable for lower elevations in our area
- Conical shape, medium green leaves

3. Locals (low elevation): Interior Live and Blue Oak



Quercus wislizenii, evergreen, multi-branched trunk, leaf shiny green on bottom



- *Q. douglasii*
- Deciduous, foothills to 3,000 feet
- Leaf gently lobed, bluish; white trunk with vertical striations
- Slow-growing, deeply rooted

3. Locals (low elevation): Valley Oak and Northern California Black Walnut

- *Q. lobata* , deeply lobed leaf
- Deciduous, Central Valley, foothills, lower mountains
- Plant near water source
- Grows quickly
- Arguably the largest North American oak
- Typically: V-shaped trunk

Juglans hindsii, great shade tree, allelopathic, low water, you must work to get enough of the great tasting walnuts to eat

3. Locals (middle elevation): Ponderosa and Sugar Pine

- *P. ponderosa*, beginning ~2,500 feet, largest specimen 268 ft.
- Like Jeffrey Pine, but no smell
- Most widespread pine in west
- Subject to bark beetle infestation

- *P. lambertiana*, beginning ~3,000 feet, largest specimen 273 ft.
- Long cones: 2 ft.
- Quick growing
- Subject to bark beetle infestation
- Never found in pure stands

3. Locals (middle elevation): Canyon Live and Black Oak

- *Q. chrysolepis*, beginning ~2,500 feet
- Evergreen, most widespread oak in California
- Leaf is leathery on bottom

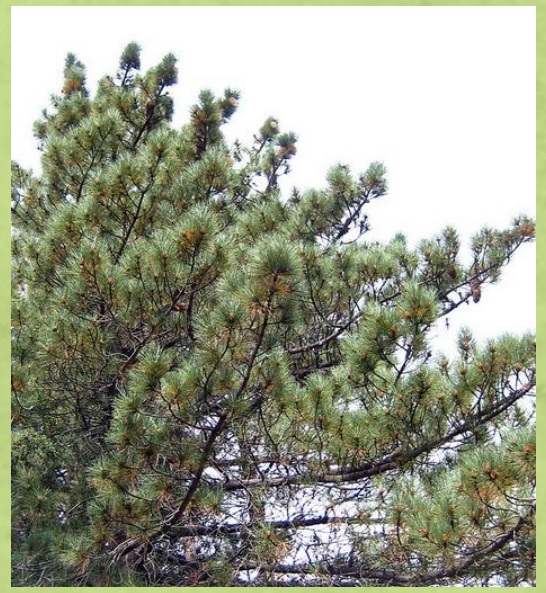
- *Q. kelloggii*, slopes above ~3,000 feet
- Good fall color
- Best tasting acorn among all native oaks

3. Locals (middle elevation): Bigleaf Maple and White Alder

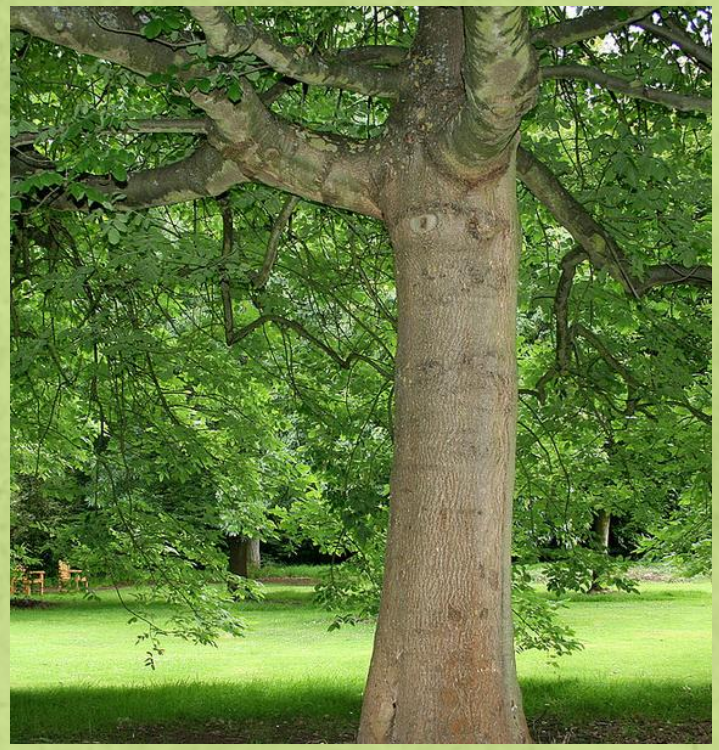
- *Acer macrophyllum*, beginning ~3,000 feet
- Good golden fall color, prefers riparian areas
- Huge leaf: 12 inches; fast growing

- *Alnus rhombifolia*, forested areas above ~2,000 feet
- Moist soils, fast growing
- Copious male and female (above) catkins

3. Locals (middle elevation): Coulter (Bigcone) Pine and Oregon Ash



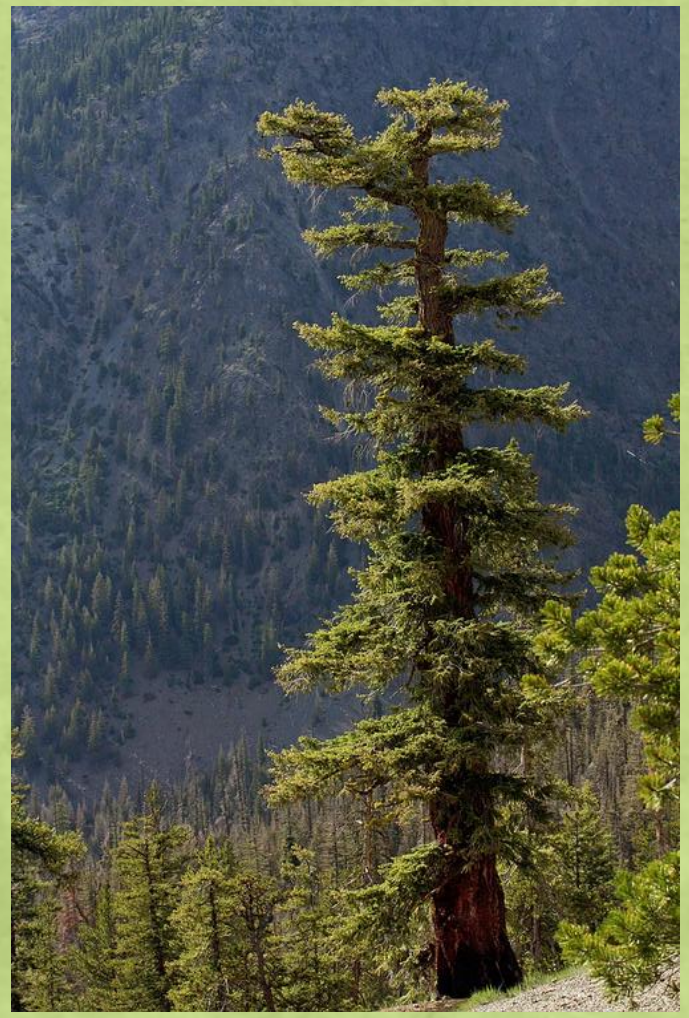
- *Pinus coulteri*, beginning ~2,000 feet
- Cone weighs up to 10 lbs.
- Slow growing, soft wood, ornamental



- *Fraxinus latifolia*, above ~2,000 feet
- Moist soils, fast growing when young
- Sunny location necessary

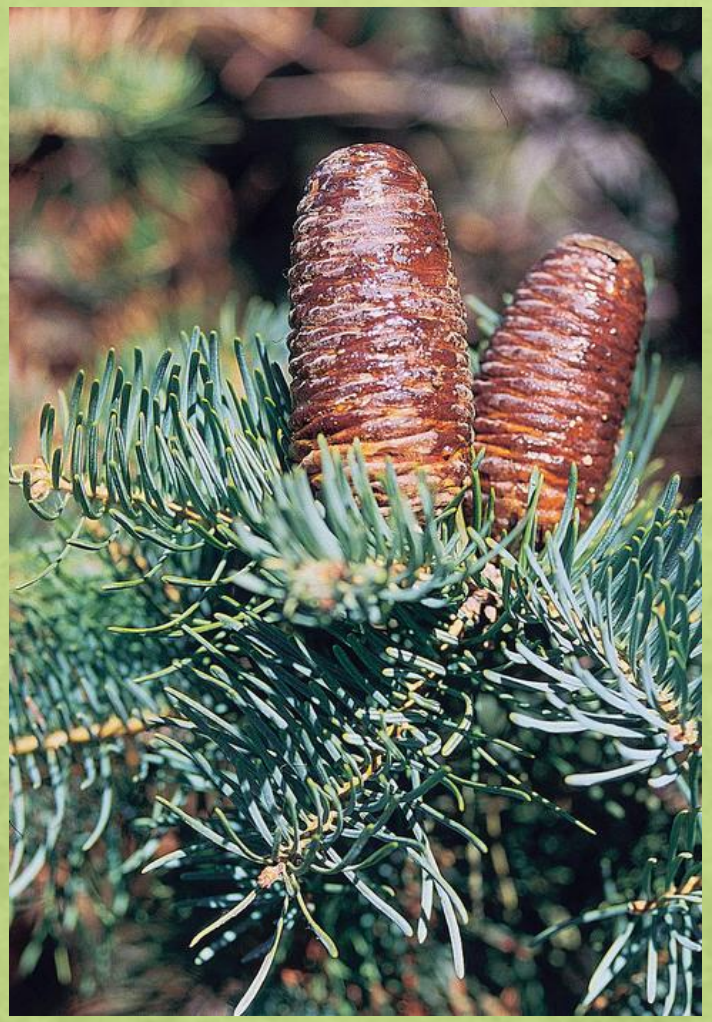
3. Locals (higher elevation): Jeffrey Pine and Douglas Fir

- *P. jeffreyi*, beginning ~4,000 feet
- Confused with Ponderosa Pine
- Resin heavy with n-heptane (above): very volatile, smell of butterscotch



- *Pseudotsuga menziesii*, not a true fir (genus *Abies*)
- Mountains beginning ~3,000 feet, up to ~7,000 feet
- Historical specimens over 400 feet
- Pure stands; better fire resistance than other conifers
- Leaves flat, not in fascicles, circle the branch
- Plant with Canyon Live Oak:
  - *Q. chrysolepis* has ectomycorrhizal fungi around the roots
  - Very beneficial for growth of young Doug Firs!
- Interesting tidbit: US Navy *Avenger*-class minesweepers built with Doug Fir hulls

3. Locals (higher elevation): White (Balsam) Fir and Incense Cedar



- *Abies concolor*, beginning ~4,000 feet
- Common in Sierra Nevada
- Needs rich soil & moderate water
- Attractive, but does not do well below its preferred altitude

- *Calocedrus decurrens*, mountains beginning ~3,000 feet, but much more common over 4,000 feet
- Beetle resistant
- Three other species in genus, all in east Asia

4. Plant materials: Potted trees

- Potted seedlings—about one- to two-feet high—still come in standard, cylindrical one-gallon nursery containers; not large potted or crated trees
- Seedlings in smaller *tree pots* or *plugs*
- But nowadays more commonly grown in tapered, ribbed plastic containers (tree pots):
  - Square in cross-section
  - Two to four years old

Plugs:

- Smaller, cylindrical tubes, about two inches in diameter
- Plants are cheaper and less hardy
- Generally, only one year old post-germination
- For mass plantings

4. Plant materials: Selection criteria

- Tempting to select plants that are taller, anticipating that they will grow sooner to a desired height
- But, instead, one should favor plants that are thicker at their base: higher success rate for survival; likelihood of their having better root structures; seedling survival is the key

4. Planting methods and steps: Time and place

- Early spring or fall are best times
- A site on the shady side of a stump or log is perfect
- If unsure about site drainage, dig a 12 inch deep hole, fill with water, and check that it empties out after 12 hours
- Clear the spot of any slash to expose the underlying soil.

4. Planting methods and steps: Plant in ground

1. With a post-hole shovel (a drain spade):
    a. Dig a hole about twice the volume of the tree pot (4 inch treepot → 6 inch square hole); a square hole is better for good root development
    b. Deep enough so that the pot soil matches the surrounding ground level
    c. Think about gophers, carefully, and insert gopher cage into hole if necessary
2. Tip the potted plant over, pinch the sides, letting it slide out, and settle it into the hole
3. Refill the hole with native soil, except:
    a. In the case of a very hot local fire—indicated by the presence of white ash in the immediate area—add some mycorrhizal fungi soil amendments
    b. If soil does not drain well, add play sand, pea gravel, or fine organic material with the fill
4. Watering:
    5. Level off the spot around the plant, water the plant in thoroughly
    6. Add coarse mulch around the new tree, maybe a rock too
    7. Water one gallon once per week until the first soaking rains arrive in the fall

4. Pest considerations: Deer and gophers

- Deer screen:
  - Three stakes & screen about 4 feet high
  - Hardware cloth (½”) around trunk for small tree
  - Deer might be exceptionally hungry after a wildfire
- Gophers:
  - May not be a concern on open landscape
  - A concern near structures
  - Not so much in a drainage, subject to flooding
- Metal screen on bottom of gopher cage is a problem for maturing tree roots:
  - Open bottom screen at least 18” deep
  - Use ½” or ¼” hardware cloth
  - Sticks up about 6” above the ground (gophers come out at night, but are afraid of heights)
  - Alternative is wooden, decomposable, perforated bottom gopher cage (left)

4. Special tools: Dibble and hoedad for plug seedlings

- Important to ensure that the lower portion of the plug is firmly surrounded by soil when the hole is closed
- Dibble with a foot step (right)
- Professional foresters—with many plugs to put down--use a special tool, called a *hoedad*, for this purpose (left photo)
- Hoedad is a short-handled hoe with an elongated blade:
  - Planter strikes the blade into the ground
  - Wiggles the handle to-and-fro to create a V-shaped indentation
  - Seedling plug is dropped into the depression
  - Hoedad is struck again into the ground adjacent to the plug and the handle pressed down
  - Deep blade closes the deep soil around the plug's lower roots
  - With a stomp of the boot from above, the forester closes the planting hole
- An accomplished forester does this in 30 seconds

4. Areal considerations

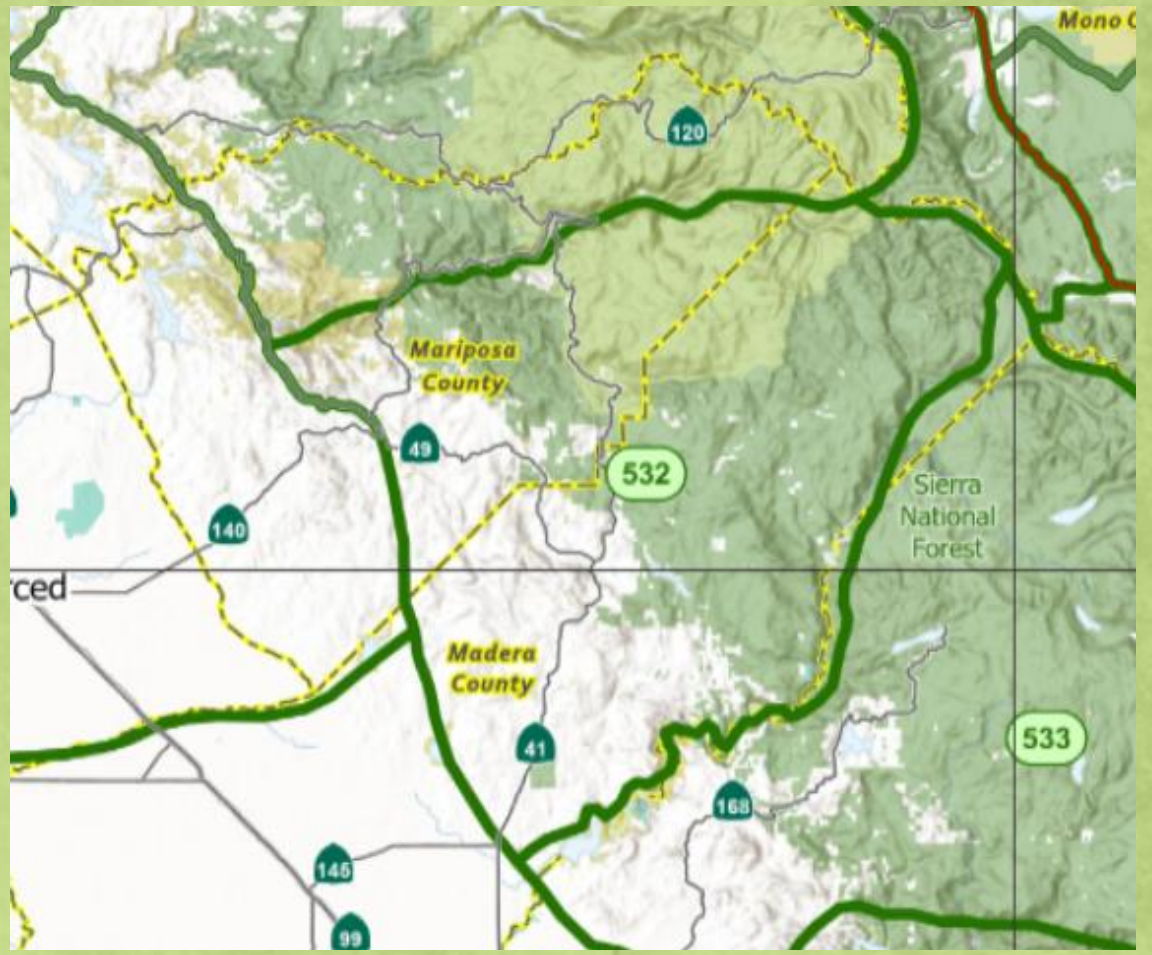
Example: A ponderosa pine has a scorched trunk, but suffered little burning in the crown. How close should a plant seedling be set?

1. Trunk diameter of 10 inches
2. 10 + 6 = 16
3. Convert to feet: 16 feet

- Seedlings are widely separated in mass plantings: 10-12 feet
- Rule: Diameter of trunk (inches) plus 6 (inches), converted to feet
- Plan for a mature tree with a 5” trunk diameter
- 5” + 6”, converted to feet: 11 feet separation between seedlings set in ground

4. Resources: seedlings

- Grown from seeds collected according to ecotype
- Available to landowners at L.A. Moran Reforestation Center:
  - Unburned landscape: nominal cost ~$.75/seedling
  - Burned landscape: free
  - Landowner picks up in Davis, CA
  - Shipping available (contact LAMRC)
  - Seedling requests for pickup 11/26 to 4/27 are open
  - Some overstock availability, but right now not in our local area (532)
- Species selection limited to conifers by ecotype



5. Hoedads: Hippie entrepreneuralism

- Clear-cutting prevailed in Pacific Northwest forests up until 1990s
- Need for conifer replanting services
- Outgrowth of the hippie movement:
  - Environmentalism
  - Cooperative business model
  - Back To The Land movement, communes
- Hoedads Reforestation Cooperative (HRC), Eugene, OR 1971-1994:
  - 1971: early contracts awarded
  - 1973: recruitment efforts
  - Debates: by the crew, by the hour, or by the individual worker's product
  - Crews organized their own economy
- Thrived in the 1980s
- Named themselves after their signature tool

5. Hoedads: Feminism in forestry

- Women entered the HRC operations in large numbers
- Most crews were mixed men and women
- Some all-female crews
- Novel development in forestry work
- HRC successfully challenged the notion that forestry was an all-male occupation

5. Hoedads: Economic reality takes hold

- Growing environmental consciousness in 1990s
- USFS ended clear-cutting practices
- Lawsuits from Associated Reforestation Contractors (ARC), founded to challenge worker-owned business model
- ARC competed against HRC using immigrant labor (H-2Ba visas)
- Fighting forest fires used half of USFS budget: financial pinch
- HRC disbanded 1994-1995

6. Plan for the future: Enough said?

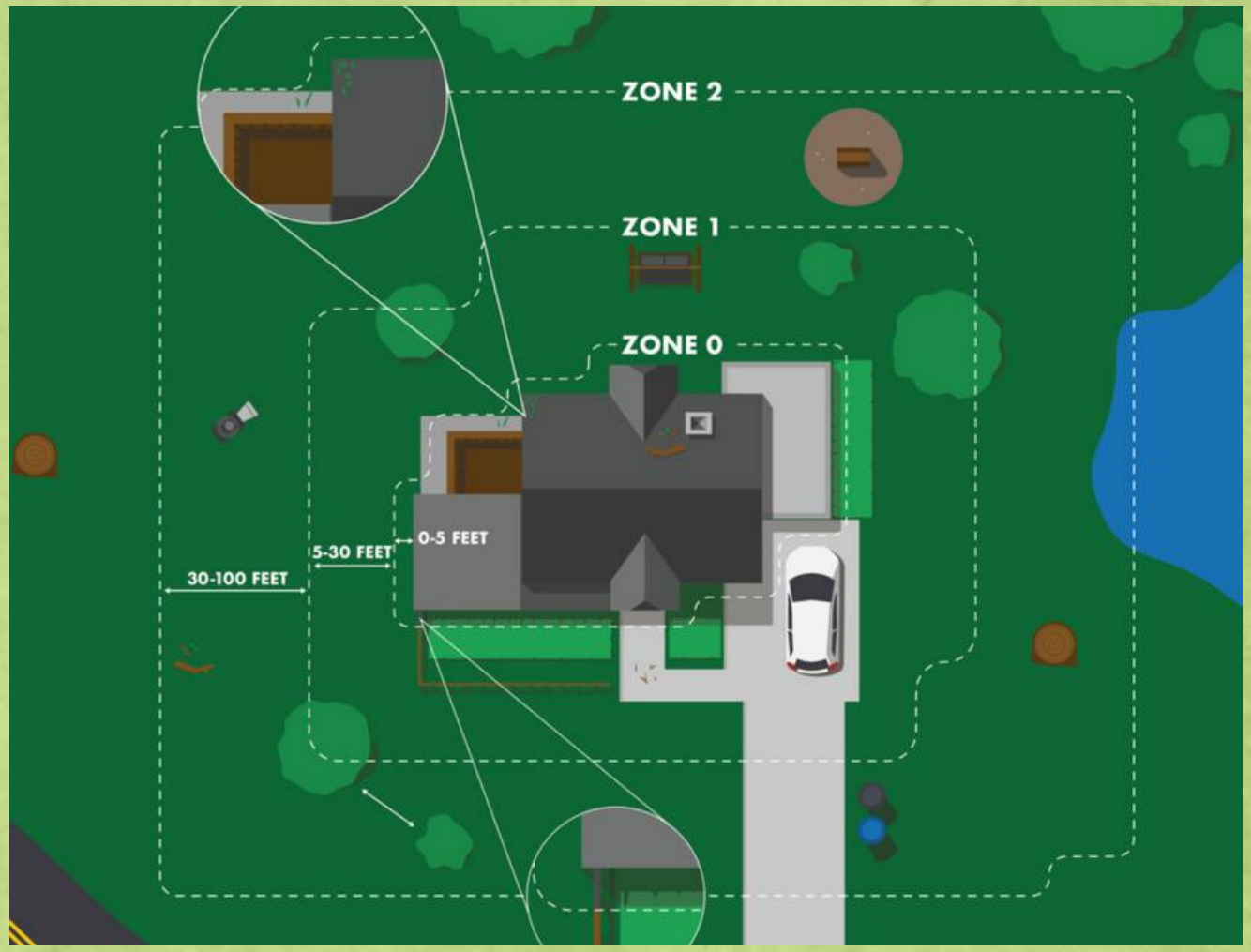
6. Plan for the future: Millikins' Lahaina house

- Couple purchased 100-year-old house in 2021 and began to remodel it
- Replaced asphalt roof with commercial grade steel roof
- Worried about termite damage, they removed vegetation around the structure and placed river rock adjacent to the outside walls
- According to fire experts, the Millikins' establishment of a combustibles-free **Zone Zero** around the house was the key to saving it

Blown embers: (1) hit the roof, fall off and ignite surrounding vegetation; (2) are blown against house walls, fall to the ground, and catch combustibles on fire; or (3) set the roof on fire

6. Plan for the future: CalFire zones

- No vegetation in Zone 0
- Trees and shrubs in Zone 1, but avoid resinous trees (conifers) close to the structure
- Well-spaced: Don't allow a continuous canopy
- Follow the 6 feet pruning clearance and 3X rules
- No branches overhanging the house
- Keep gutters clear of leaves and debris
- Non-combustible soffits and Wildland Urban Interface (WUI) compliant vents
- Grade A shingles or metal roof



6. Resources and references

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