

A photograph of a forest fire scene. In the foreground, a yellow fire hose lies on the ground, winding from the bottom left towards the center. The ground is covered in dry leaves and twigs. In the middle ground, there are several fires burning on the forest floor, with bright orange flames and thick white smoke rising from them. A large, dark tree trunk stands prominently in the center. The background is filled with more trees and a hazy, smoke-filled atmosphere. The overall scene depicts a controlled fire in a forest setting.

# Using Prescribed Fire for Forest Management in the Sierra Nevada

*Why and how*

*Susie Kocher, Registered Professional Forester #2874, University of California Cooperative Extension, October 8th, 2022*

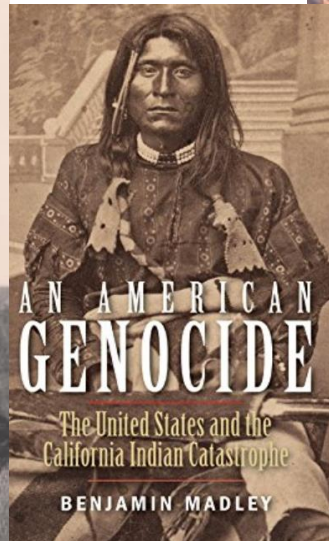
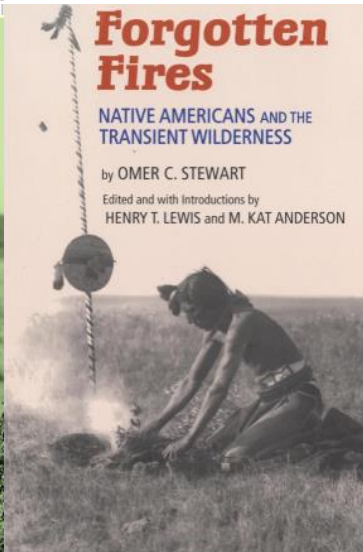
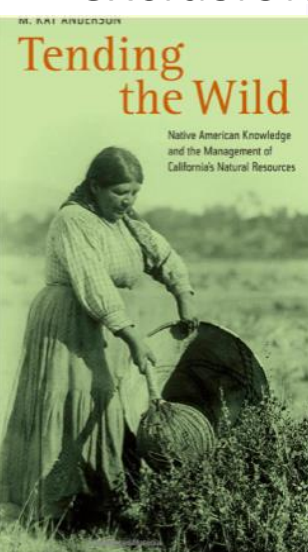
# Why prescribed fire?

- An important tool for managing forest fuels and density (along with thinning, mastication, & grazing)
- Forest ecosystems are fire adapted so important for forest health
- Can be used for managing important plants (cultural burning) or reducing invasives or encroaching brush
- Can be used on small to large acreages, in WUI and in remote areas
- Is a tool accessible to private landowners, winter burns low risk
- Often low cost



# Sierra Nevada forests are frequent fire forests

- Both natural (lightning) and anthropogenic starts
- California Indians managed the landscape with fire for at least 10,000 years before colonization
- Practices and population mostly maintained under Spain & Mexico
- 1849 California Gold Rush led to widespread genocide and fire exclusion



*The past is never dead. It isn't even past. –William Faulkner*

Low severity  
fire leaves  
scars on trees  
but doesn't  
kill them

Past fire frequency can be  
determined from the years  
between fire scars on a  
single tree or on several  
trees in an area

1897  
1889  
1883

1872

1867

1854

1852

1844

1834

1840

1832

1827

1820

1816

1810

1802

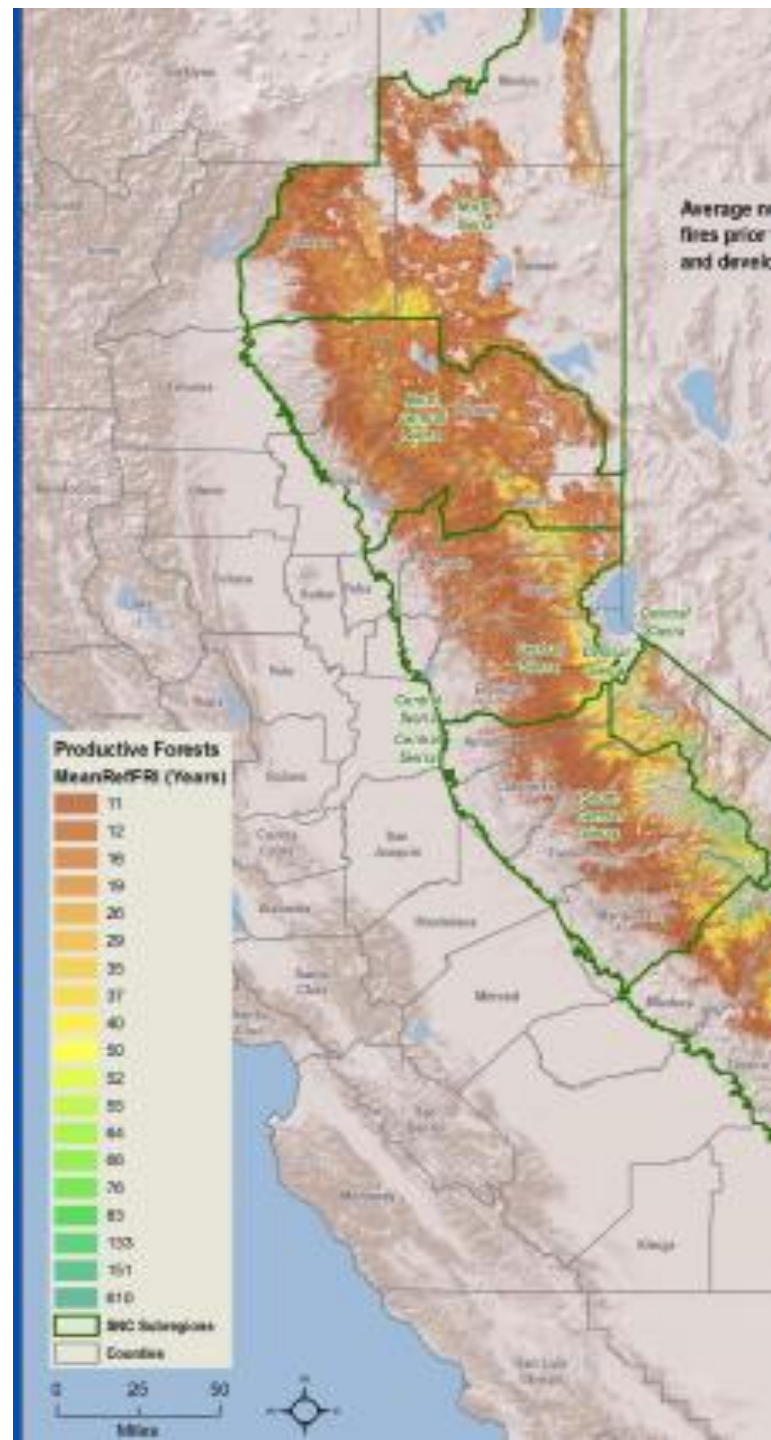
1797



Pocket of shade tolerant white fir being torched in prescribed burn

# Fire return interval

- Ponderosa pine type 5 – 12 years
- Mixed conifer forest 8 - 20 years
- Combination of lightning and native management
- 4.4 – 11.9 million acres (5% - 12% of California's lands) burned annually before settlement, most at low severity



# Suppression has led to overcrowded & unhealthy forests

- Increased competition and mortality
- Increased susceptibility to native bark beetle outbreaks
- Fires now more likely to be high severity meaning most or all trees are killed
- Conifer encroachment in oak woodlands, meadows, aspen, shrub habitat



# Consequences of Fire Suppression



Spaulding Lake in Nevada County, 1919 and 1993.  
Source: Gruel 2001

# Consequences of Fire Suppression



- Long Ravine railroad trestle near Colfax, Placer County.
  - Source: Gruel 2001

# Full time fire suppression

- Began 1905 with formation of the US Forest Service
- 1910 Big Blow Up burned 5 million acres (Montana & Idaho), killed 79 firefighters - USFS decides to stress fire prevention and control fires as quickly as possible.
  - Light burning continues in CA, Red River Lumber company near Lake Almanor used fire on 800k acre property
- 1924 USFS researchers concluded light burning was ineffective, impractical, economically indefensible, CA State Board of Forestry agreed, outlawed til mid 1950's

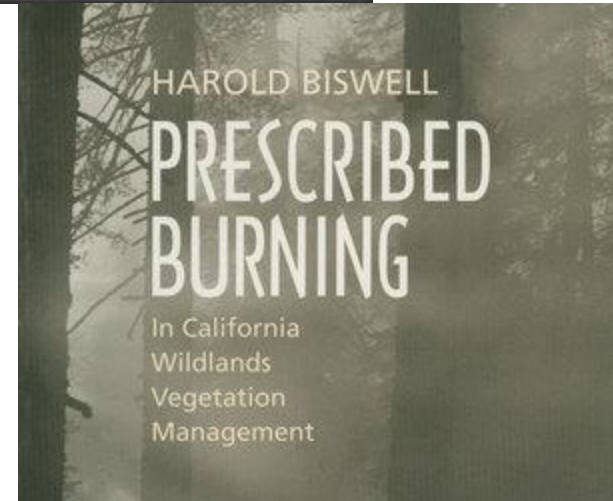


Ponderosa pine, sugar pine, black oak type, with manzanita and grass as associated dominants – “poorly stocked”.  
Mariposa County

**UC Library, Digital Collections**

# Experimentation with Rx fire

- 1943, USFS allows exception in SE for longleaf pine
- Dr. Harold Biswell arrived in California 1947 from Southeast
- Professor of forestry UC Berkeley - experience with Rx in long leaf pine
- Worked with CA ranchers to develop techniques for Rx fire to kill woody vegetation and promote grasses to increase grazing capacity



# Use of Rx fire fizzles with time

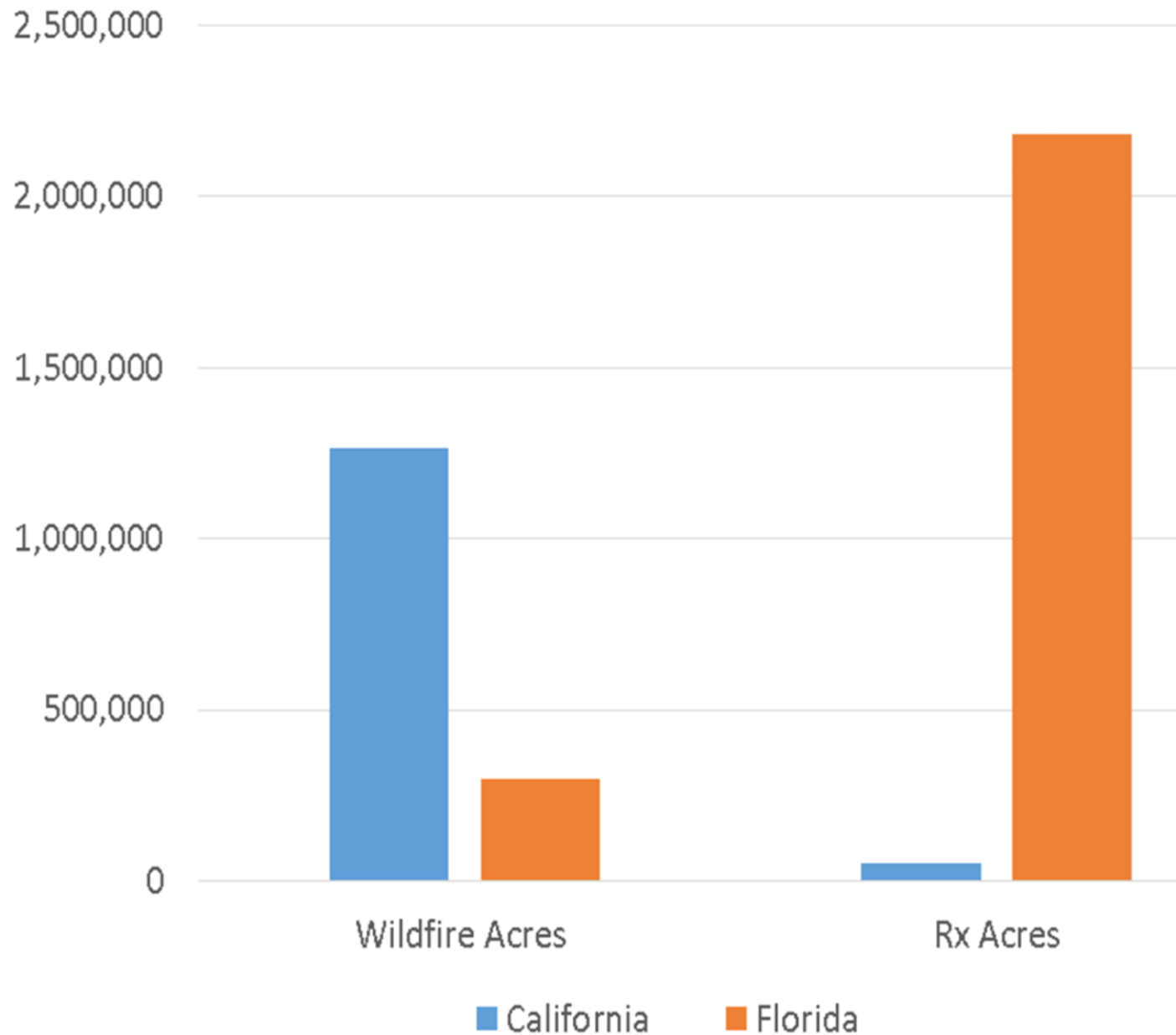
- 1945 first permits to conduct Rx fire for range improvement
- Range burning reached peak in 1955  
> 200,000 acres burned
- Then declined
  - more homes were built on adjacent wildlands
  - ranchers held liable for escape damage
- Still going strong in SE

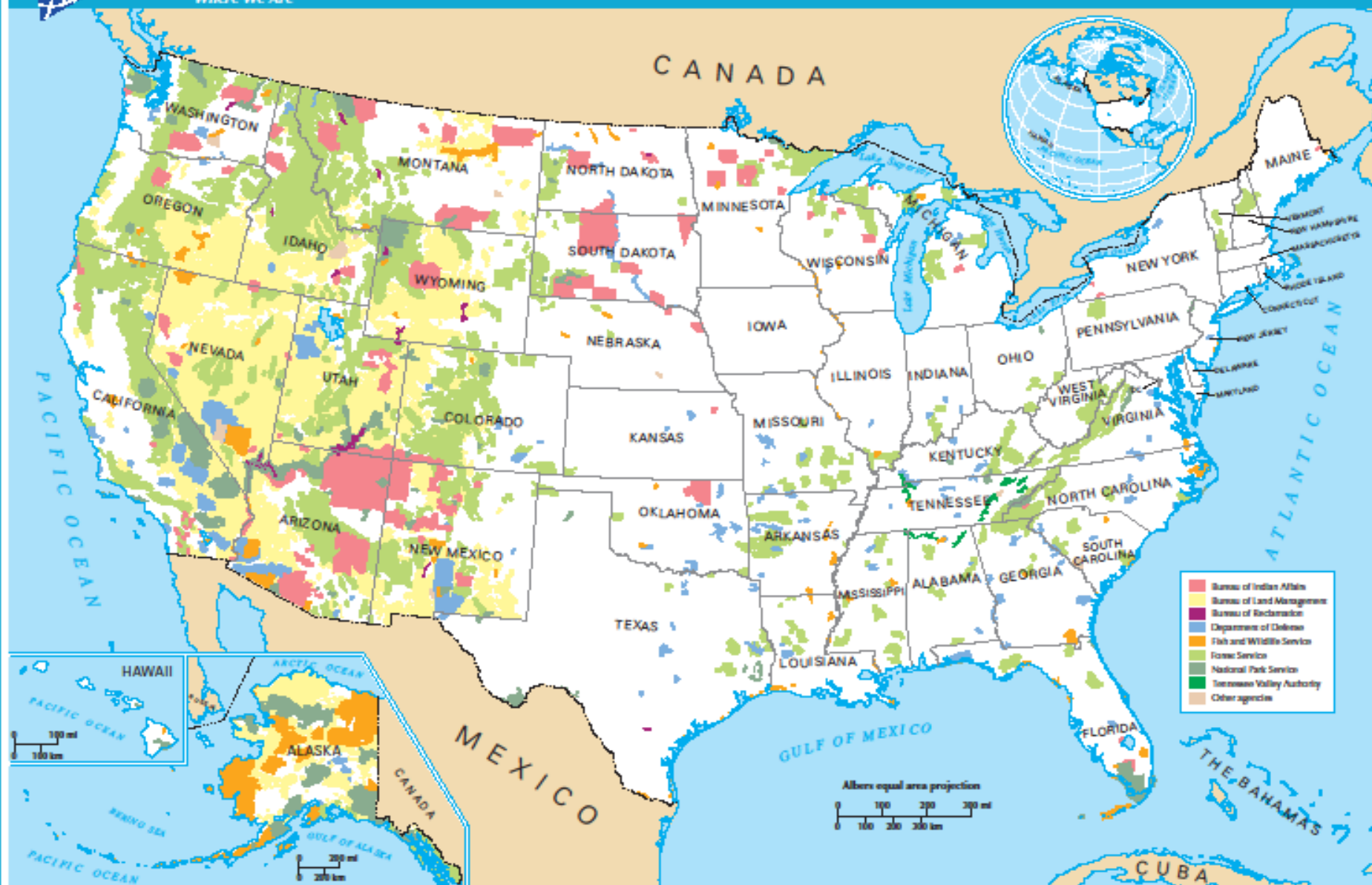


van Wagtendonk, J. 1995. *Dr. Biswell's Influence on the Development of Prescribed Burning in California*. USDA

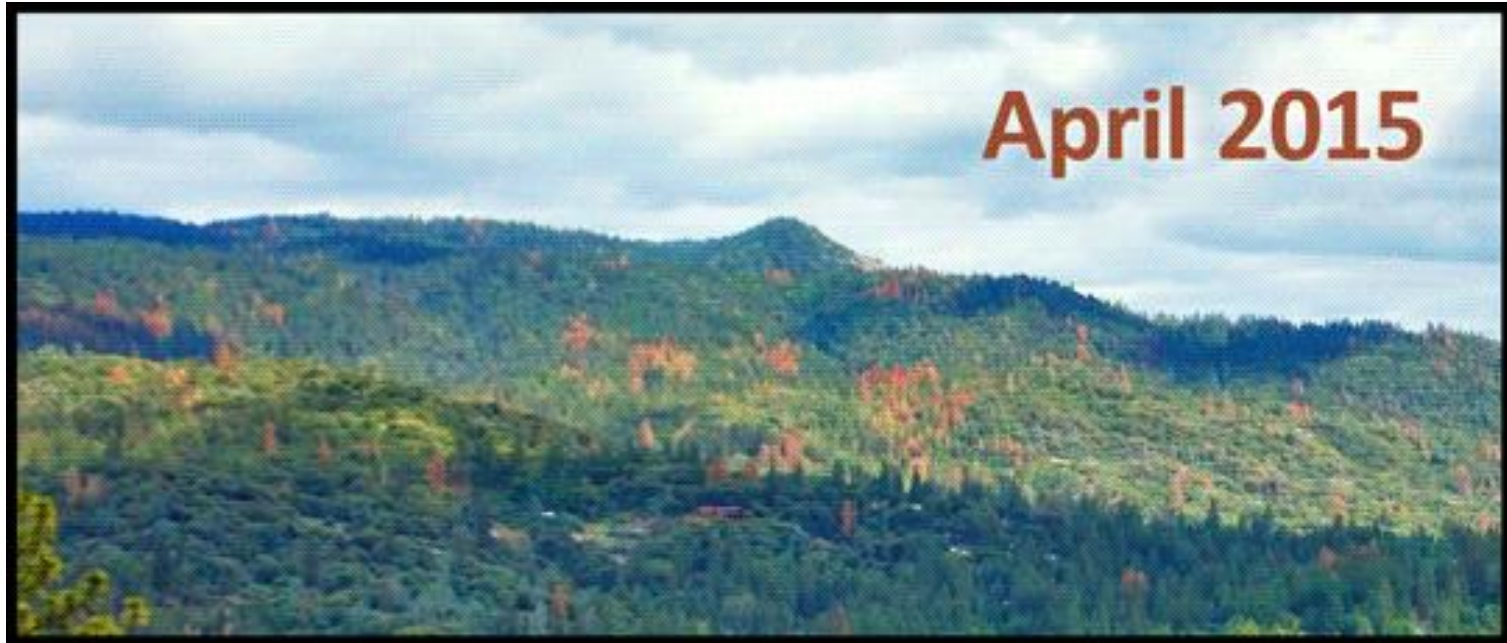
FS Gen. Tech. Rep. PSW-GTR-158.

## Wildfire vs. Rx fire in California and Florida 2017





# Add in climate change



*Location in Madera County before and after tree mortality began spreading.*

*Photos: Margarita Gordus, CA Department of Fish and Wildlife*

Dead trees have increased fuels on the ground and increased fire severity

# Add in climate change

- 2021 hottest summer on record
  - Average temperature in CA reached 77.4° F from June to August. Broke record of 76.5° F from 2017.

The Palmer Drought Severity Index estimates dryness based on temperature and precipitation data. Higher numbers indicate less dryness.

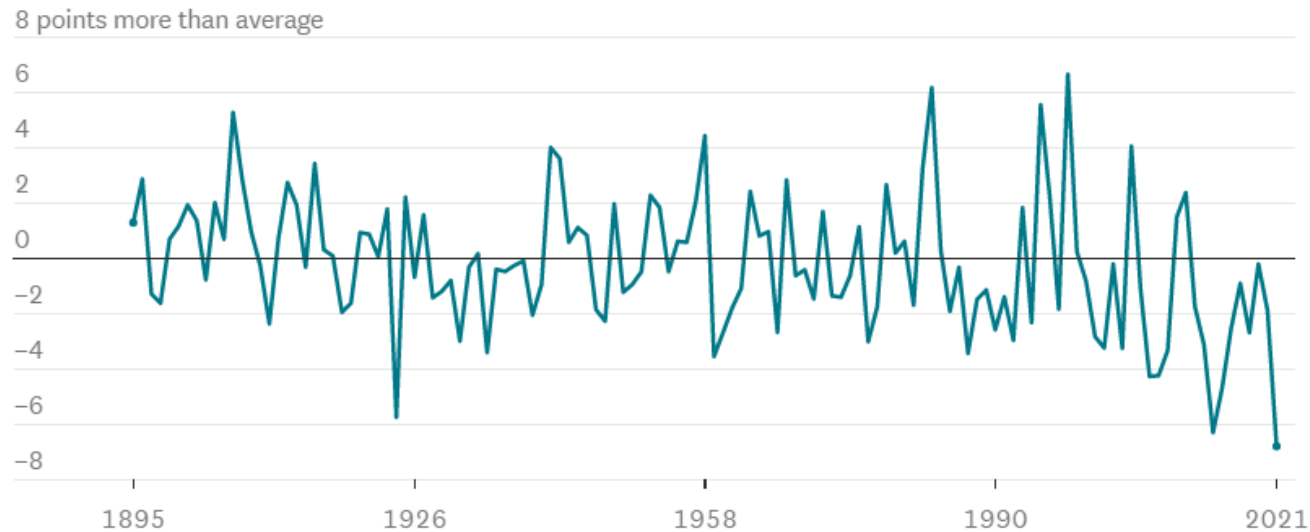
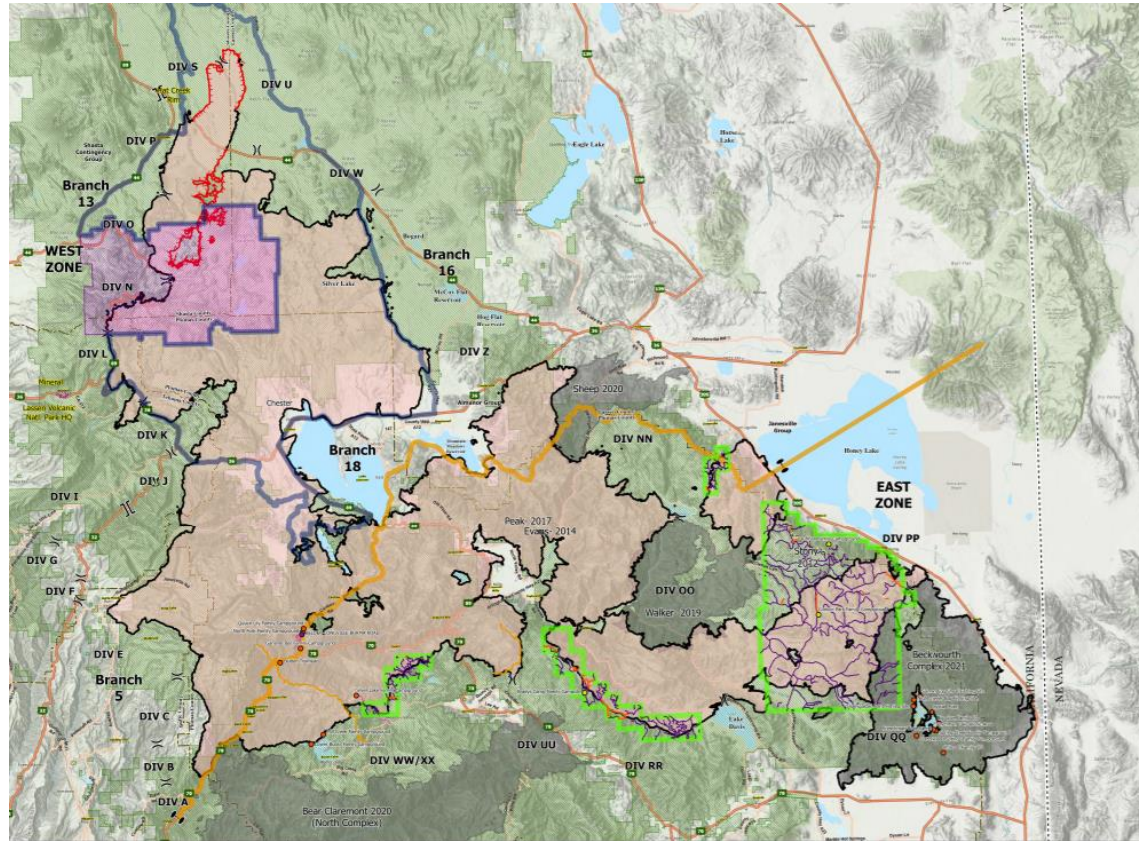


Chart: Yoohyun Jung / The Chronicle · Source: [NOAA National Centers for Climate Information](#)

- 2021 driest year on record
  - “The future is already here – it’s just not evenly distributed.” William Gibson, maybe

# Wildfires becoming impossible to contain

- Fires showing extreme behavior
  - Fires 8 largest wildfires in CA have all burned since 2017.
  - 1 of every 8 acres in CA has burned in the last 10 years – 12 mil of 100 mil acres



- 2020 fire season
  - 4.4 mil acres, 4% of state
- 2021 fire season
  - 2.5 mil acres, Dixie fire 1 mil acres, destruction of Greenville,
  - Caldor fire 220,000 acres, destruction of Grizzly Flats



# What can a forest landowner do?

Reduce fuels, reduce density

Hand thinning

Mastication

Skidding

Grazing

Mechanical thinning

Biomass chipping

Hand piling and burning

Broadcast burning

# Forest management constraints

- Size of ownerships makes some of these activities uneconomical
  - Cost-share funding available, but planning and permitting knowledge curve steep
  - Shortage of registered professional foresters
  - Shortage of contractors
  - Shortage of woods products facilities
- Lack of prescribed fire capacity
  - ‘professionalization’ of prescribed fire
    - Laws outlawing/discouraging private burning – this is changing
    - Lack of clarity in permitting – still an issue
    - Lack of opportunities for experience – probably the biggest issue

75,000 private forest landowners in CA w/ > 10 acres



# 1<sup>st</sup> California Prescribed Burn Association

- The Humboldt County Prescribed Burn Association formed and conducted its first burns in 2017, and was the first PBA formed in the western United States. It is supported through membership dues, grants, and the volunteer efforts of the members.
- CalPBA.org



# Options for private lands burning



## Pros

- Liability covered
- Low cost

## Cons

- Limited agency capacity
- Environmental compliance
- Not guaranteed
- Overall timeline



## Pros

- Contractor provides some insurance
- Experienced crews/resources
- Landowner can set expectations and timeframes

## Cons

- For profit firm: Cost
- Limited capacity



## Pros

- Low cost
- You're in charge—do it when and how you want

## Cons

- Liability
- Manpower/resources



PRIVATE  
PROPERTY

# Prescribed Burn Association (PBA)

## Pros

- You're in charge—do it when and how you want
- Low cost—volunteer based
- Environmental compliance
- Equipment/labor pooled through PBA
- PBA can apply for grants/funding
- Every burn is a training opportunity



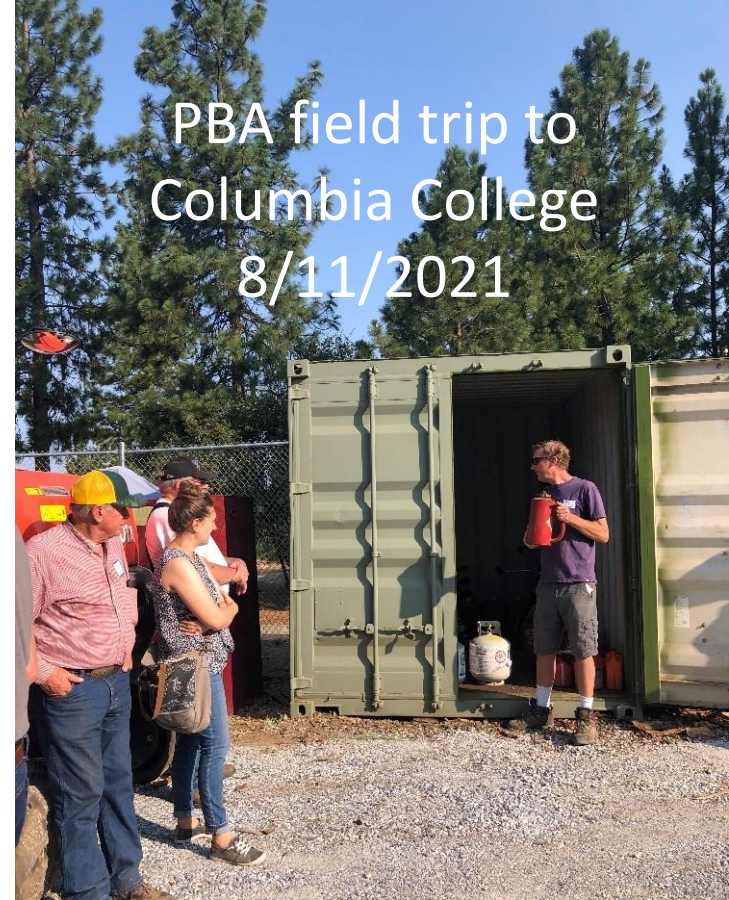
## Cons

- Liability (though you can hire a burn boss with insurance)
- Permits/air quality
- Someone has to coordinate

# Formation of the Motherlode PBA

- 7/2021 - Held a zoom meeting – 40
  - Id'd a steering committee
- 8/2021 - Held a field trip to Columbia College - 30
- 11/2021 – Pile burn (non-burn day) - 15
- 12/2021 – 1<sup>st</sup> broadcast burn! – 20
- 5/2022 – Coordinator funding awarded!

PBA field trip to  
Columbia College  
8/11/2021



# Planning for burn took about 2 weeks

## 3. Prescription

Element	Minimum (cool)	Desired	Maximum (hot)
Temperature (F)	40	70	80
Relative Humidity (%)	80%	20%	15%
Mid-Flame Wind Speed (mph)	0	3	5
Fine Dead Fuel Moisture (%)	15	5	2
Probability of Ignition (%)	10	60	90

*\*The burn boss may make a go/no-go ignition decision based on a combination of these prescription elements.*

**Wind direction** (acceptable range and optimal): N-E-S. West winds are acceptable if smoke impacts to residence can be mitigated.

**Seasonality of burn** (if applicable; in many cases, implementation will be appropriate at any time that prescription parameters are met): Summer burning will be avoided. Fall and winter are preferred and spring is acceptable.

## 4. Smoke Management Plan

(to be prepared according to local air district rules; refer to SMP for detailed plan):

- ☐ Submitted through PFIRS
- ☐ Submitted in hard copy to air district
- ☐ Not required by air district based on project size/emissions

Wrote a burn plan / map

STATE OF CALIFORNIA  
DEPARTMENT OF FORESTRY AND FIRE PROTECTION  
**PROJECT TYPE BURING PERMIT**

(PUB. RES. CODE, ARTICLE 3, SECTIONS 4491, 4492, 4493 AND 4494)  
LE-7 (REV. 11/04)

## APPLICATION FOR PERMIT TO BURN

Dated 11-24-2021

San Andre

## CalFire visit for LE 7 permit Calls to air quality district

located in SW Corner of Sec. 15, TWP. 3N

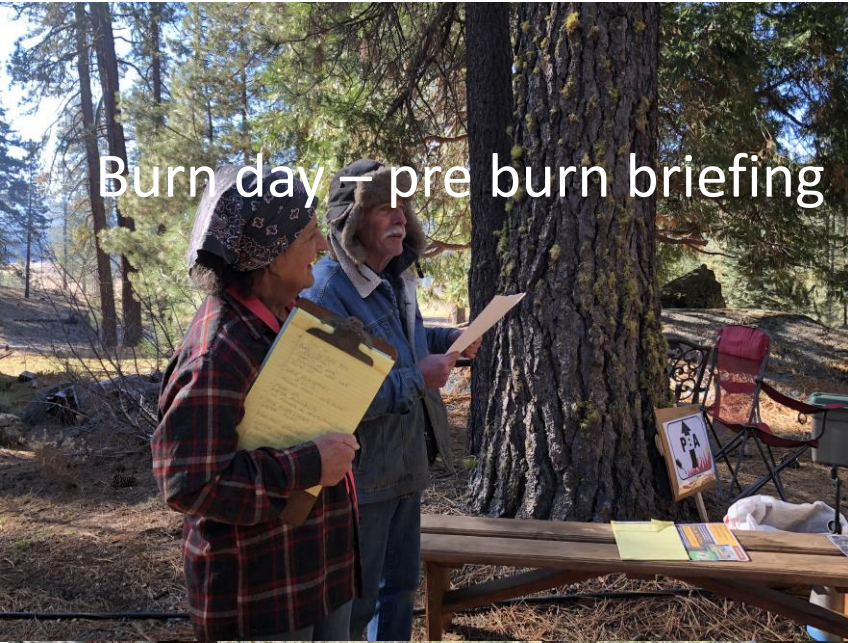
During the period 12-02-2021 to 12-06-2021

1. The PERMITTEE shall comply with all fire laws, ordinances, and regulations.
2. The PERMITTEE shall notify the adjoining property owners and occupants of his/her intentions to burn and the date such burning will take place. This notice must be given not less than 2 days prior to the start of such burning, except that co-tenants having rights or facilities on or adjoining the PERMITTEE's property shall be notified not less than 15 days prior to the start of burning.
3. This permit is valid only on those days which are not prohibited by the State Air Resources Board pursuant to Section 41855 of the Health and Safety Code or by the Local Air Pollution Control District. Prior to burning PERMITTEE will contact Local Air Pollution Control District at telephone number 209-533-5598.
4. This permit does not relieve the PERMITTEE from using reasonable and prudent care to prevent damage to the property of others or injury to persons as prescribed by law. In the event of negligence on the part of the holder of this permit, which results in escape of the fire that requires suppression action, the permit holder will be held liable for suppression costs.

**NOTE TO PERMITTEE: PLEASE READ THE R  
INFORMATION ON THE LAWS A**

# Burn Day! 12-4-2021

Burn day – pre burn briefing



Test fire



Ignition



Holding


# After the burn




Just before the pizza and beer



Landowners monitored for a few days



Patchy burn of pine needles (1 hr fuel) and sticks (10 hr fuel)  
Very happy with outcome – burned 3 Xs as much with help



# Formation of El Dorado/Amador PBA

- 8/2021 - Held a zoom meeting – 40
  - Id'd a steering committee
- 11/2021 - Field trip to large ranch in Pilot Hill with burn boss to look at burn planning/ grazing – 35
- 1/2022 – Field trip to forested property in Omo Ranch with burn boss to look at burn planning - 25
- 1/2022 – Burned blackberries - 15
- 5/2022 – 1<sup>st</sup> broadcast burn! – 10
- 5/2022 – Coordinator funding!



Overall project goals: Private land management to reduce fuels and fire hazard, reduce invasives, and expand potential area for grazing. Long term management with consideration to adjacent properties and wildfire hazard. Goal is to utilize prescribed fire throughout property and other masticated areas to reduce fuels and regen at lower cost than herbicide.

Project objectives:

- 1) Primary objective is to reduce surface fuels and mid-story to reduce fire hazard.
- 2) Limit tree mortality to <10%.
- 3) Provide training opportunity and introduction to broadcast burning for PBA members.

2. Pre-burn Considerations

**Plan for unit preparation** (describe line type/construction, pre-treatment of fuels, pre-burn land management considerations (e.g., grazing deferment), etc.):

Line construction using tractor along eastern and southern borders, improved by hand as needed. Upper western side of unit bordered by rocky area with sparse fuel (no surface fuels, few spaced out manzanita bushes) and gravel road. On northern side burn unit is bordered by 300' clearcut powerline corridor with very limited fuel. Dirt road along this border, will be improved by hand as needed.

Unit was masticated three years prior and thinned (mostly incense cedar removed). Downed trees removed from unit. Many remaining conifers were limbed. Much of the activity fuel has decomposed.

**Water supply** (describe quantity, location, and other considerations):

Access to standpipe adjacent to unit near southeast corner. Will have 5 bladder bags staged with holding and a UTV with 60-gallon tank if available.



Wrote a burn plan / map

# Burn Planning

## CalFire visit for LE 7 permit Calls to air quality district

These precautions are to be considered the minimum necessary to be taken by the **PERMITTEE** on his/her land to prevent damage to the property of others under average weather conditions or the period during which burning operation is scheduled to take place. The **PERMITTEE** is cautioned that it is his/her responsibility to take any additional precautions that the judgment of a prudent person would dictate under the specific circumstances and conditions that exist at the exact time of the burning operation.

In addition to the terms of the permit when issued, the following precautions will be taken before, during, and after burning:

- Advance preparation of areas, firebreaks, snag removal etc.
  - Dozer line w/ check lines in place
  - Green ground cover, minimal heavy fuels
  - S shaded east aspect < 5:1 slope
- Fire fighting equipment and personnel to be on hand at time of starting fire, patrol, mop-up, etc.
  - Drip torches, handtools, back pumps, light tractor
  - 8-15 non-fire personnel
  - Patrol status x 3 days

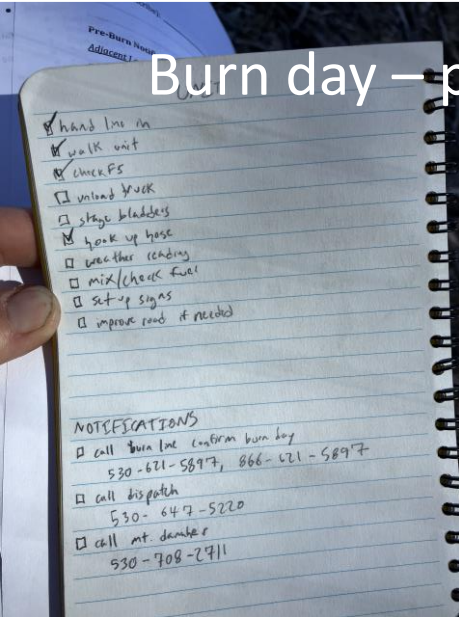
These precautions are made a part of Project Type: \_\_\_\_\_ BY Josh Vickers, AGENT

Burn Permit No.   J   Title Battalion Chief

Dated 5/7/22 Date of Inspection 5/7/22

ORIGINAL TO PERMITTEE, DUPLICATE TO UNIT, TRIPLPLICATE TO LOCAL FILE

## Burn day – pre burn briefing



## Burn Day! 5-15-22



## Assembling tools



## Lighting



## Signage



Landowner monitored for  
a week because of smoke



**After the burn**

Landowner happy with  
outcome, prepping  
adjacent acres



After action review/ PBA planning

*Let's rebuild a  
culture of  
**burning!***

Questions: Contact  
Susie Kocher  
[sdkocher@ucanr.edu](mailto:sdkocher@ucanr.edu)

Find your PBA at  
<http://calpba.org/>

