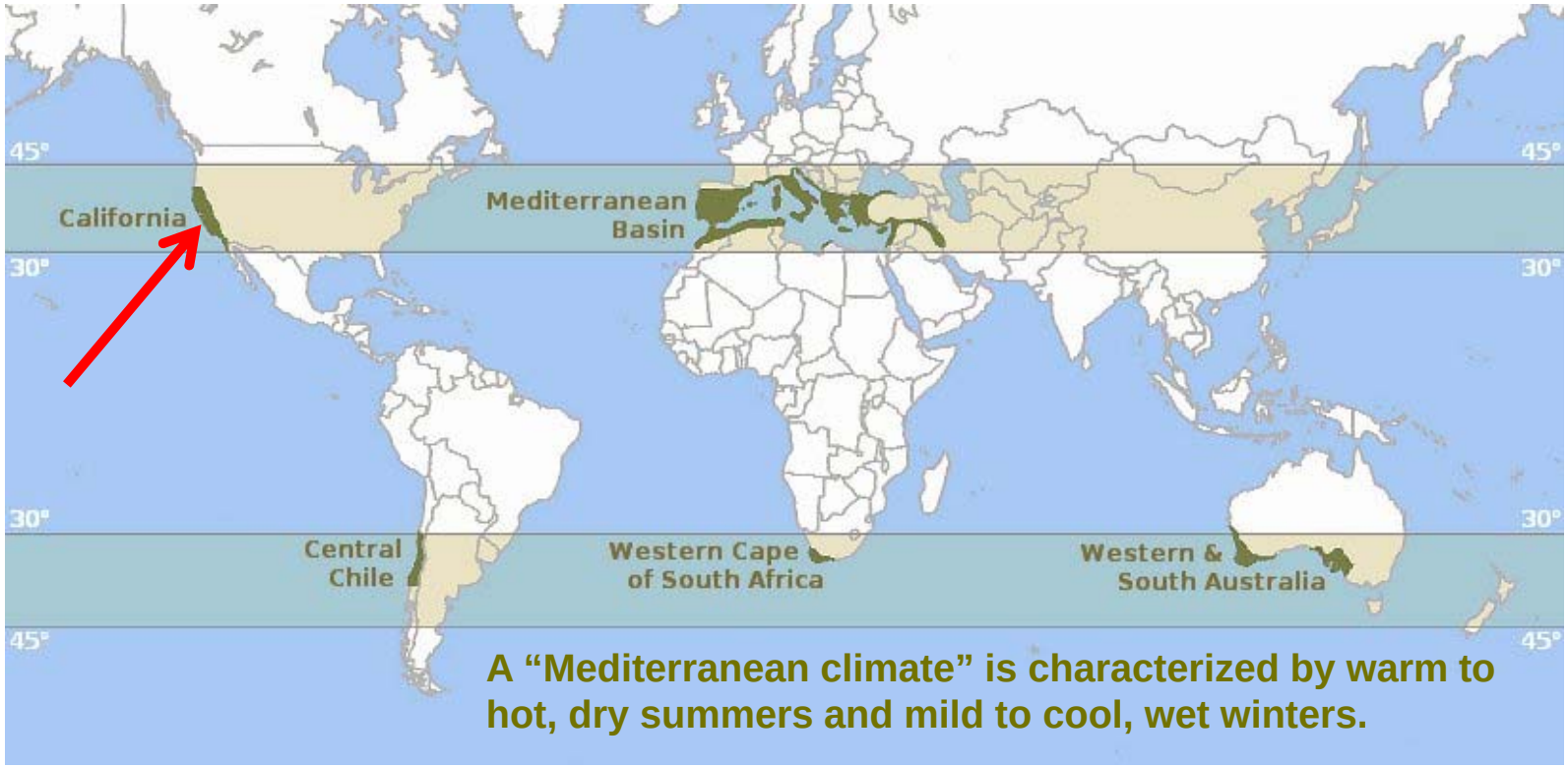
Managing for a Healthy Forest Ecosystem in the Sierras & Cascades of California

1. PSW & UC Research:
   - Carl Skinner, PSW Fire & Fuels
   - Scott Stephens, UC Fire Science
   - Bill Oliver, PSW Silviculture
   - Jianwei Zhang, PSW Silviculture
2. Beaty management examples

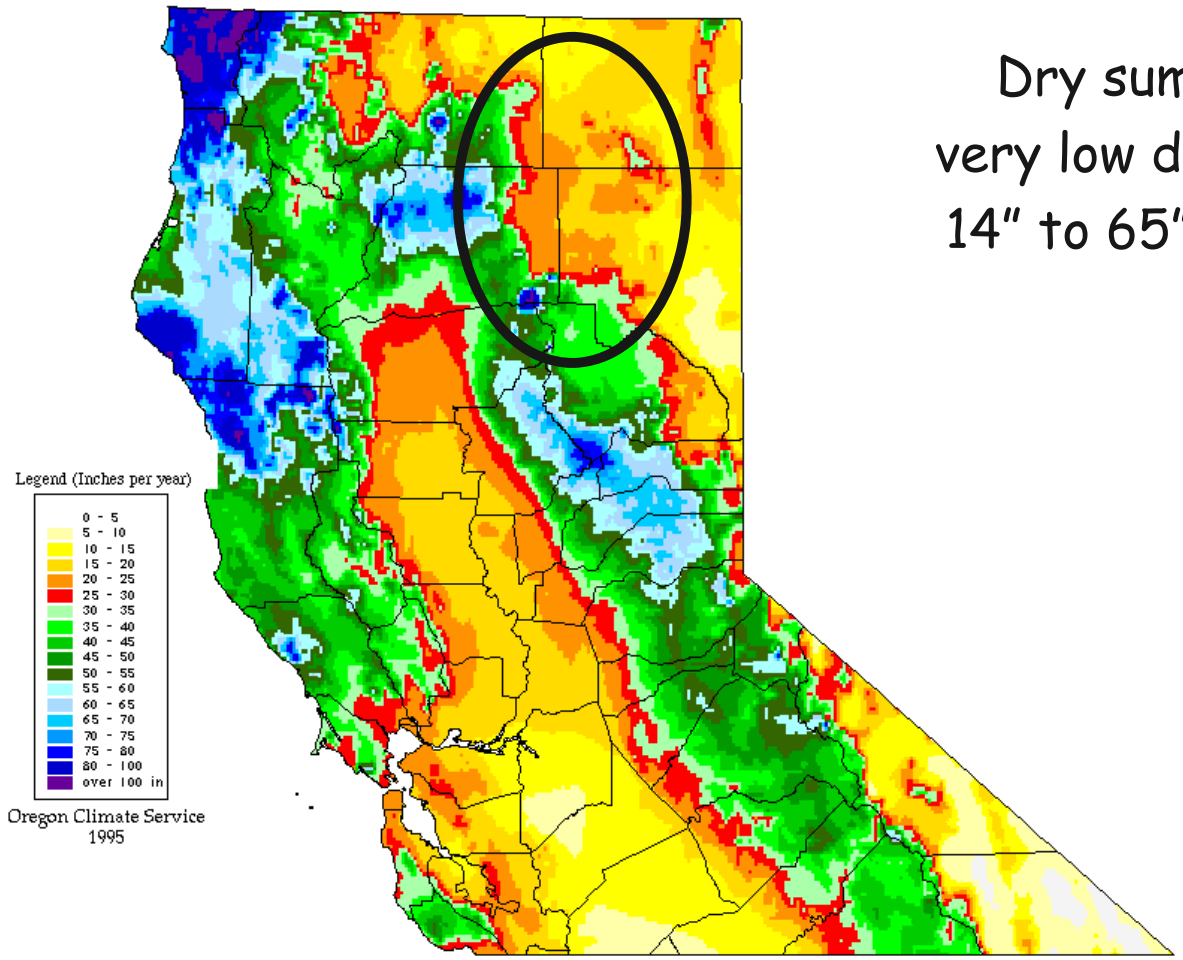
Bob Rynearson
W.M. Beaty and Associates, Inc.

Beaty managed mixed conifer forest in Shasta County



"drought" every summer in Mediterranean Climate:

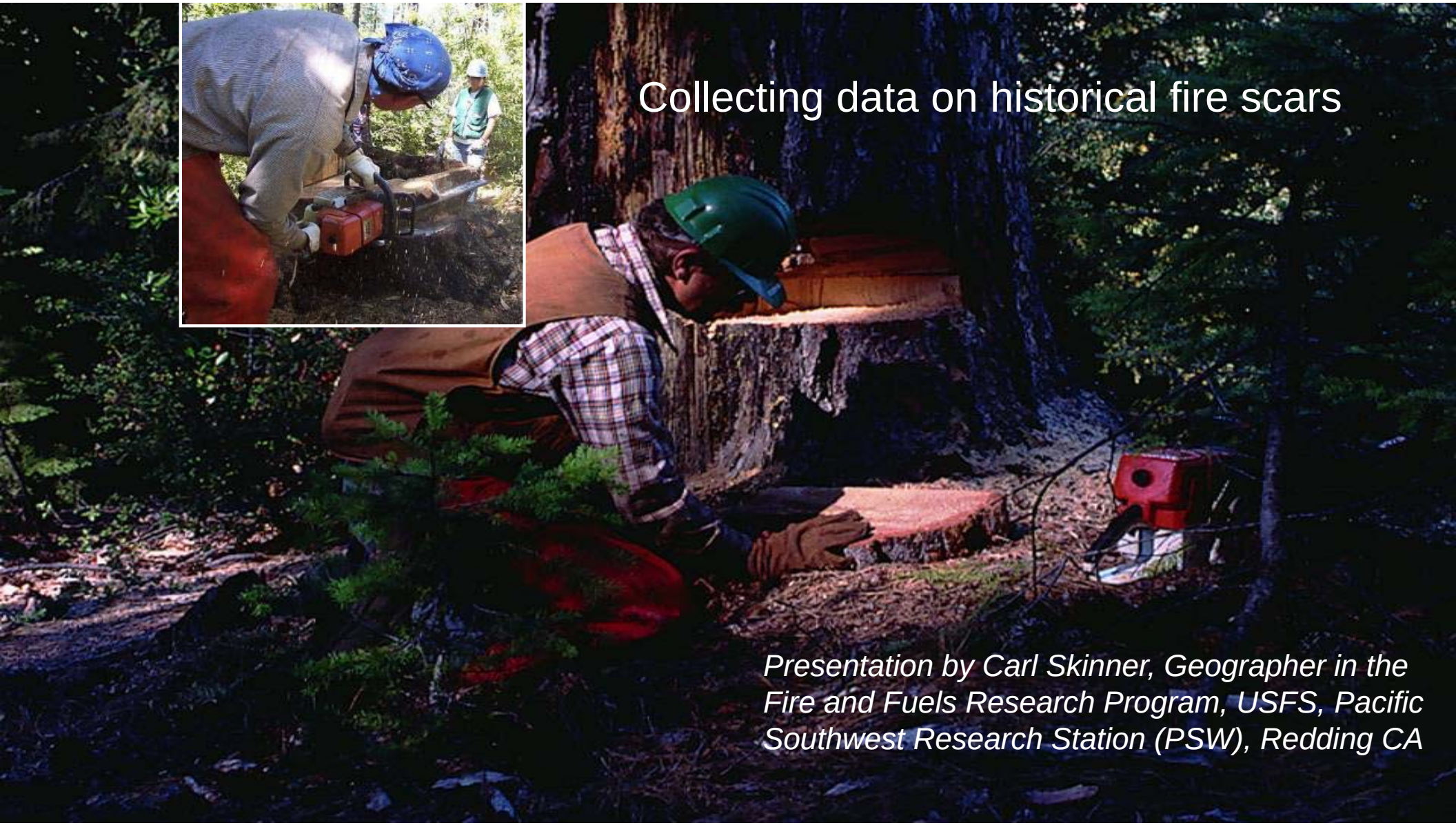
- There is a fire season every year & wildfires historically shaped forest structure and composition
- Limiting factor for seedling establishment: Soil moisture – veg. control
- Tree spacing is critical to healthy forests



Annual Average Precipitation (Inches),
Northern California

Period: 1961-1990

Dry summers +
very low daytime RH
14" to 65" PPT / yr



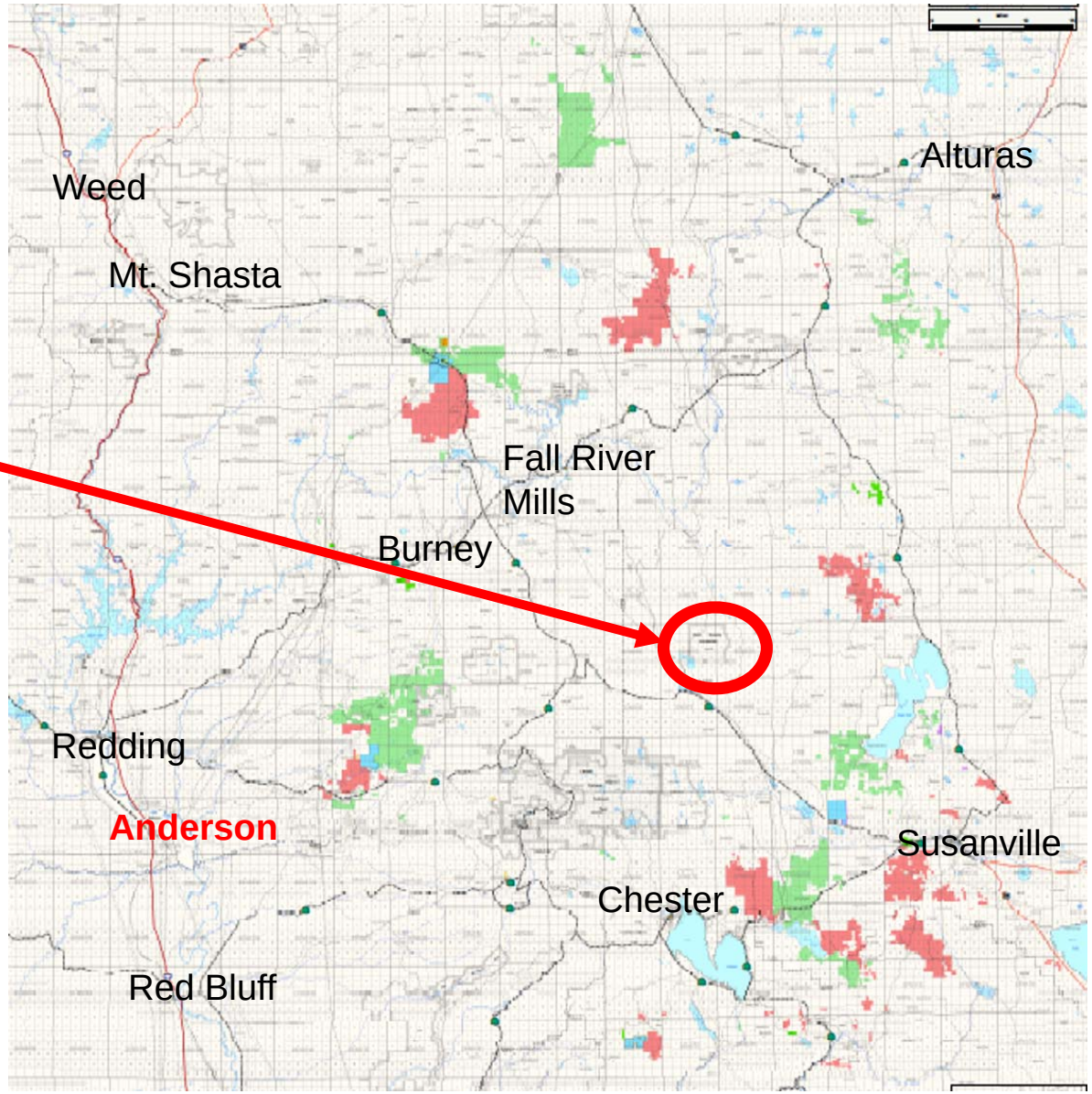
Collecting data on historical fire scars

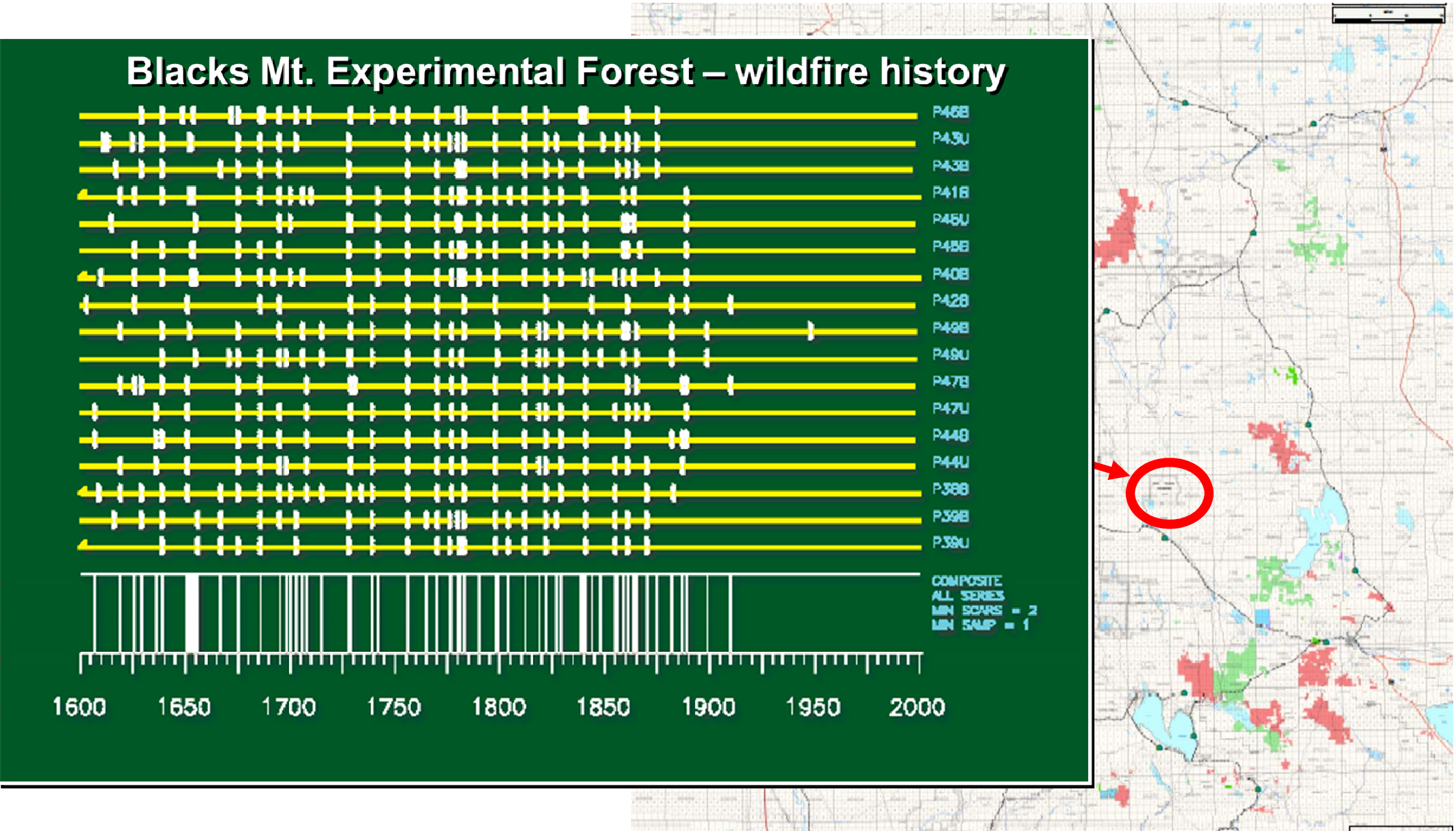
Presentation by Carl Skinner, Geographer in the Fire and Fuels Research Program, USFS, Pacific Southwest Research Station (PSW), Redding CA

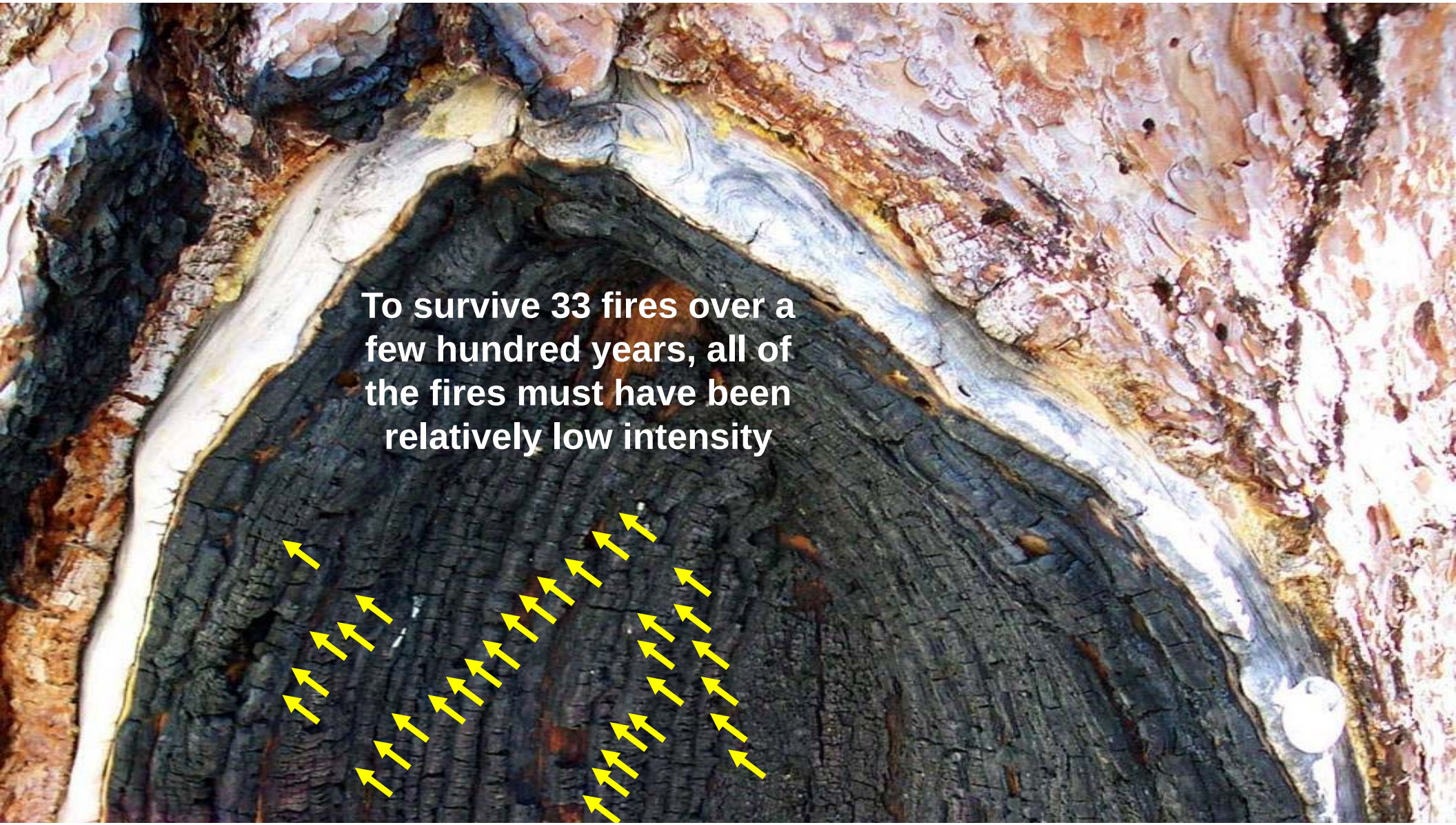
California prior to 1900:
~ 4.5 to 12 million acres/yr. burned by wildfires

Stephens et al. 2007 FEM

USDA Forest Service
Blacks Mt. Experimental Forest




Blacks Mt. Experimental Forest – wildfire history
P46B
P43U
P43B
P41B
P45U
P45B
P40B
P42B
P49B
P49U
P47B
P47U
P44B
P44U
P39B
P39B
P39U
COMPOSITE
ALL SERIES
MIN SCARS = 2
MIN SAMP = 1
1600
1650
1700
1750
1800
1850
1900
1950
2000


To survive 33 fires over a few hundred years, all of the fires must have been relatively low intensity

"Of the hundreds of persons who visit the Pacific slope in California every summer to see the mountains, few see more then the immediate foreground and a haze of smoke which even the strongest glass is unable to penetrate."

C. Hart Merriam

1898 Visit to Siskiyou County

Chief, Division of Biological Survey

From: Morford 1984

"Fires … have been ground fires, and easily controlled. A trail will sometimes stop them."
R.B. Wilson 1904

Township descriptions of the lands examined for the proposed Trinity Forest Reserve, California. 1904 US Department of Agriculture, Bureau of Forestry, Washington, D.C.

"The most potent factor in shaping the forest of the region has been, and still is, fire. The general character of the forest, ... in fact almost every phase of its condition has been determined by ... fire."

J. B. Leiberg

1902

Forest conditions in the northern Sierra Nevada, California.

Professional Paper 8, Series H, Forestry, 5.

US Geological Survey, GPO, Washington, D.C.

Stand Structure & Species Composition

Changes over 20th Century

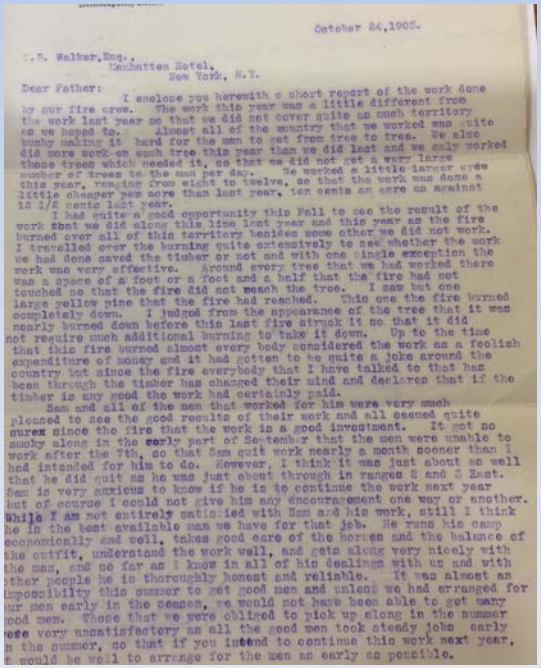
Original Stand Structure

Fire exclusion has helped lead to increasing stand density.

Early Private Forest Management in CA

Clinton Walker Oct 23, 1903 Letter to T. B. Walker reporting on work by "fire crew":

"I travelled over the burning quite extensively to see whether the work we had done saved the timber & with one single exception (i.e. one tree) the work was very effective...."



October 24,1903.

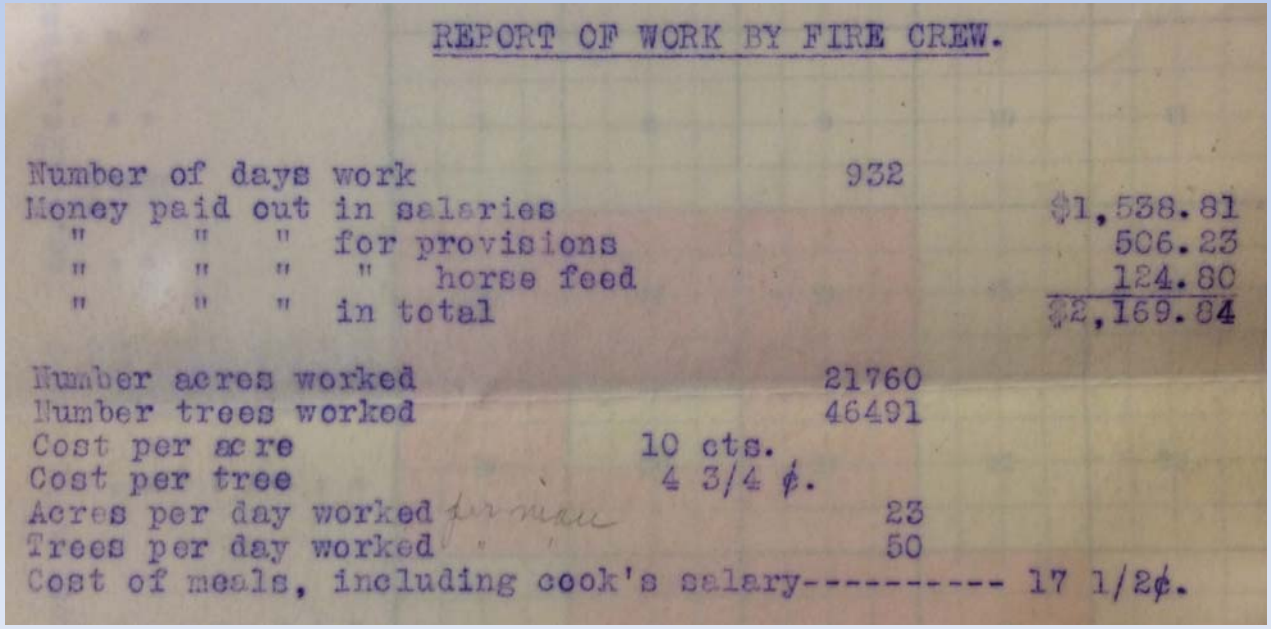
T.B. Walker,Esq.,
Manhatten Hotel,
New York, N.Y.

Dear Father:

I enclose you herewith a short report of the work done by our fire crew. The work this year was a little different from the work last year so that we did not cover quite as much territory as we hoped to. Almost all of the country that we worked was quite bushy making it hard for the men to get from tree to tree. We also did more work on each tree this year than we did last and we only worked those trees which needed it, so that we did not get a very large number of trees to the man per day. We worked a little larger crew this year, ranging from eight to twelve, so that the work was done a little cheaper per acre than last year, ten cents an acre as against 13 1/2 cents last year.

I had quite a good opportunity this Fall to see the result of the work that we did along this line last year and this year as the fire burned over all of this territory besides some other we did not work. I travelled over the burning quite extensively to see whether the work we had done saved the timber or not and with one single exception the work was very effective. Around every tree that we had worked there was a space of a foot or a foot and a half that the fire had not touched so that the fire did not reach the tree. I saw but one large yellow pine that the fire had reached. This one the fire burned completely down. I judged from the appearance of the tree that it was nearly burned down before this last fire struck it so that it did not require much additional burning to take it down. Up to the time that this fire burned almost every body considered the work as a foolish expenditure of money and it had gotten to be quite a joke around the country but since the fire everybody that I have talked to that has been through the timber has changed their mind and declares that if the timber is any good the work had certainly paid.

Sam and all of the men that worked for him were very much pleased to see the good results of their work and all seemed quite curex since the fire that the work is a good investment. It got so smoky along in the early part of September that the men were unable to work after the 7th, so that Sam quit work nearly a month sooner than I had intended for him to do. However, I think it was just about as well that he did quit as he was just about through in ranges 2 and 3 East. Sam is very anxious to know if he is to continue the work next year but of course I could not give him any encouragement one way or another. While I am not entirely satisfied with Sam and his work, still I think he is the best available man we have for that job. He runs his camp economically and well, takes good care of the horses and the balance of the outfit, understand the work well, and gets along very nicely with the men, and so far as I know in all of his dealings with us and with other people he is thoroughly honest and reliable. It was almost an impossibility this summer to get good men and unless we had arranged for our men early in the season, we would not have been able to get many good men. Those that we were oblized to pick up along in the summer were very unsatisfactory as all the good men took steady jobs early in the summer, so that if you intend to continue this work next year, it would be well to arrange for the men as early as possible.



REPORT OF WORK BY FIRE CREW.

Number of days work	932	
Money paid out in salaries		$1,538.81
" " " for provisions		506.23
" " " " horse feed		124.80
" " " in total		$2,169.84
Number acres worked	21760	
Number trees worked	46491	
Cost per acre	10 cts.	
Cost per tree	4 3/4 ¢.	
Acres per day worked	23	
Trees per day worked	50	

Cost of meals, including cook's salary---------- 17 1/2¢.

Clinton Walker Jan 21, 1938 letter

- *'The general condition of the forests when the white man first came into CA was very excellent'*
- *'Then came the foresters from Yale University and put the tourniquet on the forests'*
- *'I would prefer to remove the tourniquet in our timber matters [which] is the lack of fire'*

Meeting of Clinton Walker and Early Leaders circa 1910 - 1920

– '*I requested permission [to burn] from the State Forester and the USFS DuBois.* ***Both refused***'

Meeting of Clinton Walker and Early Leaders circa 1910 - 1920

- *'I requested permission [to burn] from the State Forester and the USFS DuBois. Both refused'*
- *'**We proceeded to burn anyway**, and Chief Forester Graves* came out from Washington and DuBois and many others with cameras and notebooks to get damaging evidence'*

** Co-Founder Yale School of Forestry in 1900 & replaced Gifford Pinchot as Chief of USFS from 1910 to 1920.*

Meeting of Clinton Walker and Early Leaders circa 1910 - 1920

- *'I requested permission [to burn] from the State Forester and the USFS DuBois. Both refused'*
- *'We proceeded to burn anyway, and Chief Forester Graves came out from Washington and DuBois and many others with cameras and notebooks to get damaging evidence'*
- *'They stayed several days and followed the burning, with* ***comment by Graves that the work was excellent'***
- *'DuBois apologized to me for panning me in the newspapers previously '*

But Policy of Fire Suppression Wins

- The earliest federal fire-control policy was written during Graves appointment (DuBois 1914)
- Early suppression justified by new USFS and adopted for federal and state private lands in 1920's

Changes to Forests Adapted to Frequent, Low-Moderate Intensity Fire Regimes

- Mixed conifer, ponderosa, Jeffrey pine forests
  - These conifers do not re-sprout (unlike brush & hardwoods)
  - No serotinous (closed) cones to keep seeds viable after intense fires
  - No fire-stimulated seed germination (unlike brush such as manzanita)

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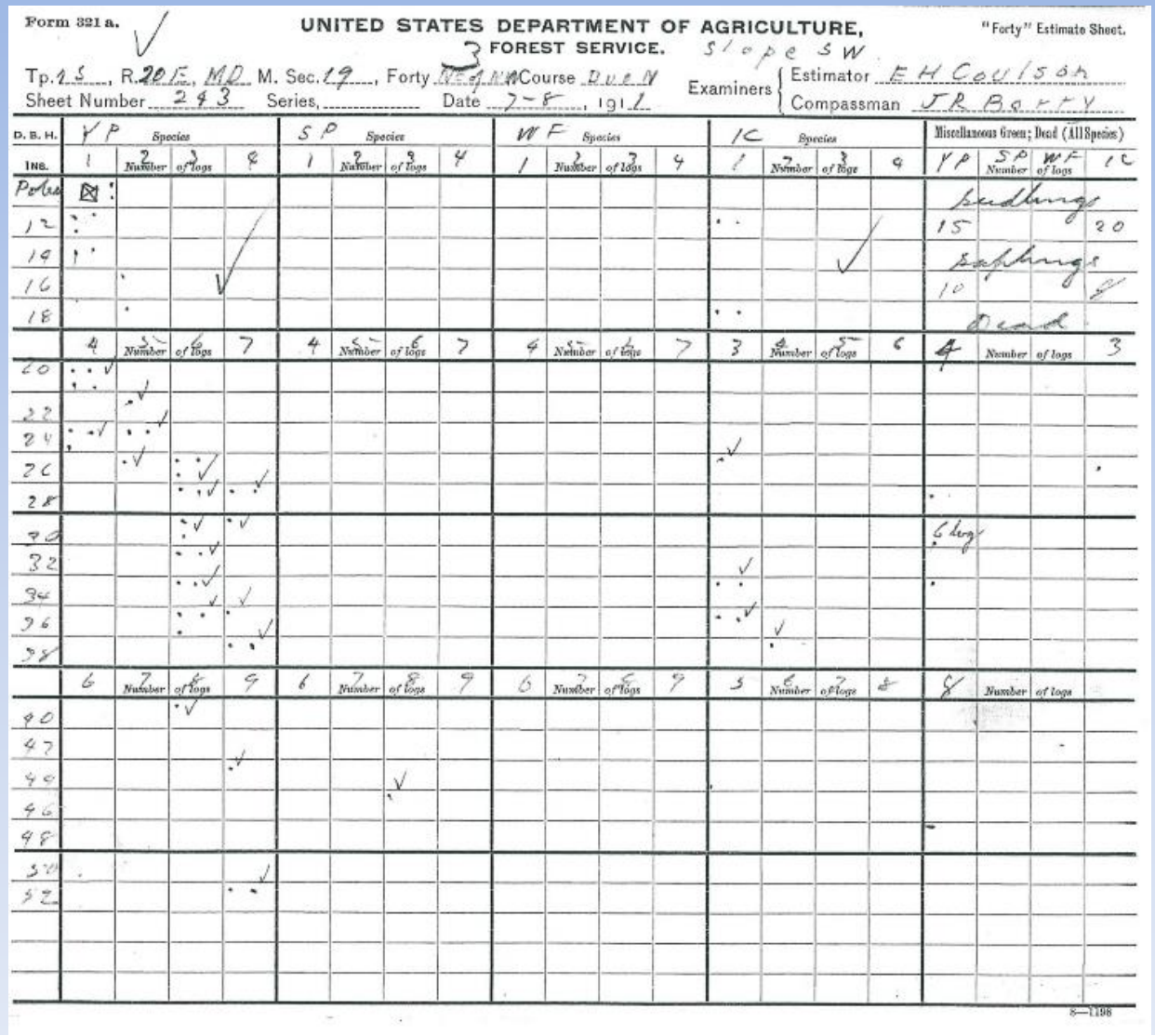
  - No serotinous (closed) cones to keep seeds viable after intense fires
  - No fire-stimulated seed germination (unlike brush such as manzanita)
- Fire every 6-25 years, ends 1870-1920 depending on specific area
  - Fire suppression very effective after WW II

Changes to Forests Adapted to Frequent, Low-Moderate Intensity Fire Regimes

- Removing the fundamental ecosystem process had profound impact on these forests
  - *Almost as important as soil and water* (H. Biswell)
  - **Now look at some early inventory data.....**

Forest Inventory Data from 1911 (321A) from Yosemite and Stanislaus



Form 321 a.

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE.

"Forty" Estimate Sheet.

Slope SW

Tp. 1 S, R. 20 E, MD M. Sec. 19, Forty 3 NE¼ NW¼ Course Due N

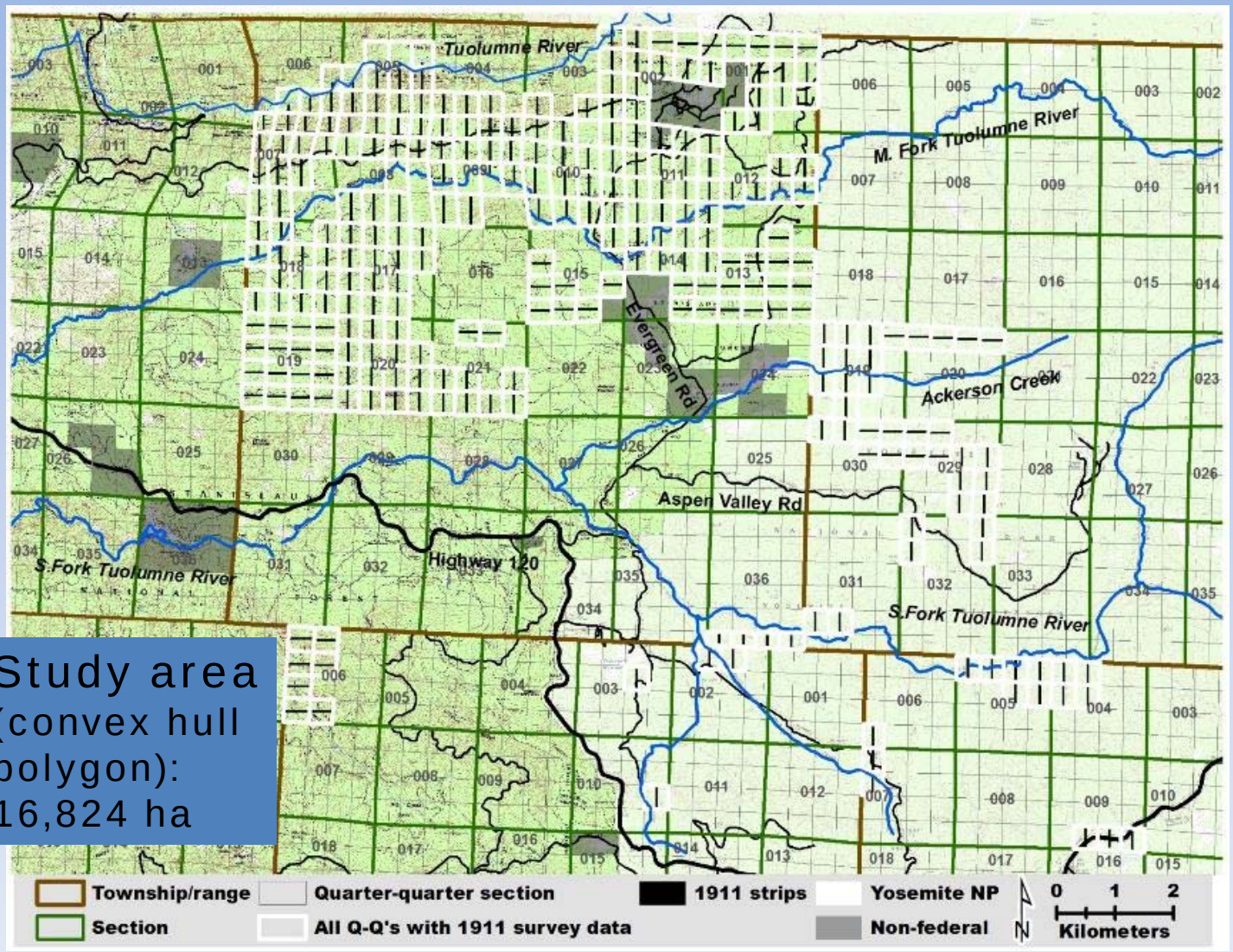
Sheet Number 243 Series, Date 7-8, 1911

Examiners { Estimator E H Coulson
Compassman J R Beatty

D. B. H.	YP Species				SP Species				WF Species				IC Species				Miscellaneous Green; Dead (All Species)			
Ins.	1	2 Number	3 of logs	4	1	2 Number	3 of logs	4	1	2 Number	3 of logs	4	1	2 Number	3 of logs	4	YP	SP Number	WF of logs	IC
Poles	☒																buds			
12																	15			20
14																	saplings			
16																	10			2
18																	Dead			
	4	5 Number	6 of logs	7	4	5 Number	6 of logs	7	4	5 Number	6 of logs	7	3	4 Number	5 of logs	6	4	Number	of logs	3
20																				
22																				
24																				
26																				
28																				
30																	6 large			
32																				
34																				
36																				
38																				
	6	7 Number	8 of logs	9	6	7 Number	8 of logs	9	6	7 Number	8 of logs	9	5	6 Number	7 of logs	8	8	Number	of logs	
40																				
42																				
44																				
46																				
48																				
50																				
52																				

8—1196

Forest Change, 1911 Stanislaus NF, YNP



Study area (convex hull polygon): 16,824 ha

Current versus historical forest conditions: based on re-measurement of timber surveys initially conducted in 1911

Year	Total basal area ($ft^2\ ac^{-1}$)[ha^{-1}]	Number of trees > 6 inches ($acre^{-1}$) [ha^{-1}]
1911	**59 [13]**	**19 [47]**
2013	**248 [57]**	**224 [553]**

[metric values]

Field plot within Rim Fire

Pre-fire (15-Jul-2013)

Field plot within Rim Fire

Post-fire (25-Sep-2013)

Field plot within Rim Fire

Pre-fire (15-Jul-2013)

Dominant trees > 250 years old

Field plot within Rim Fire

Post-fire (25-Sep-2013)

Levels Of Growing Stock ("LOGS") Studies

USFS PSW Redding, CA
William Oliver, PhD

Robert Powers, PhD
Jianwei Zhang, PhD

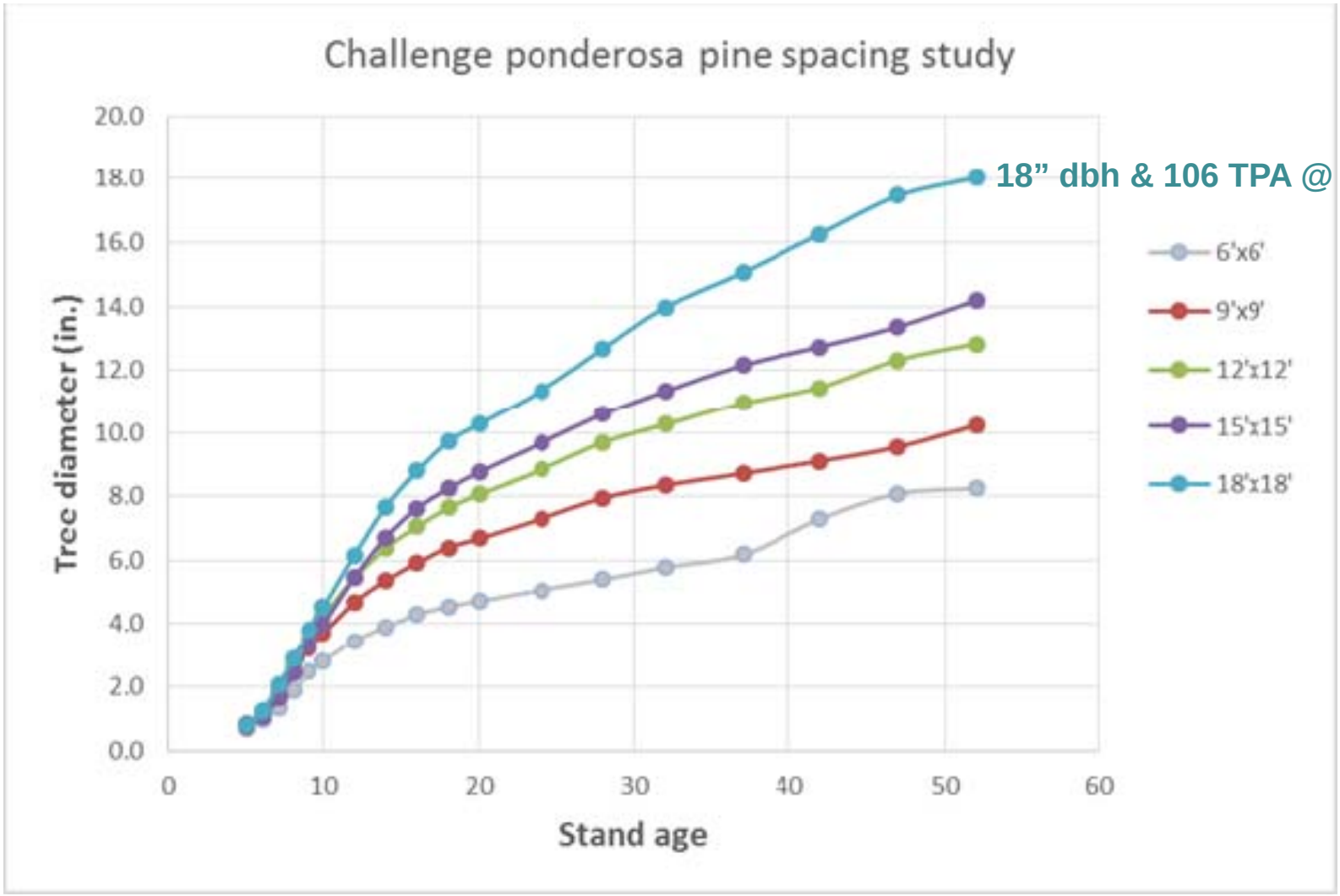
USFS "Elliot Ranch" Study Site

Highest density plots = bark beetle mortality

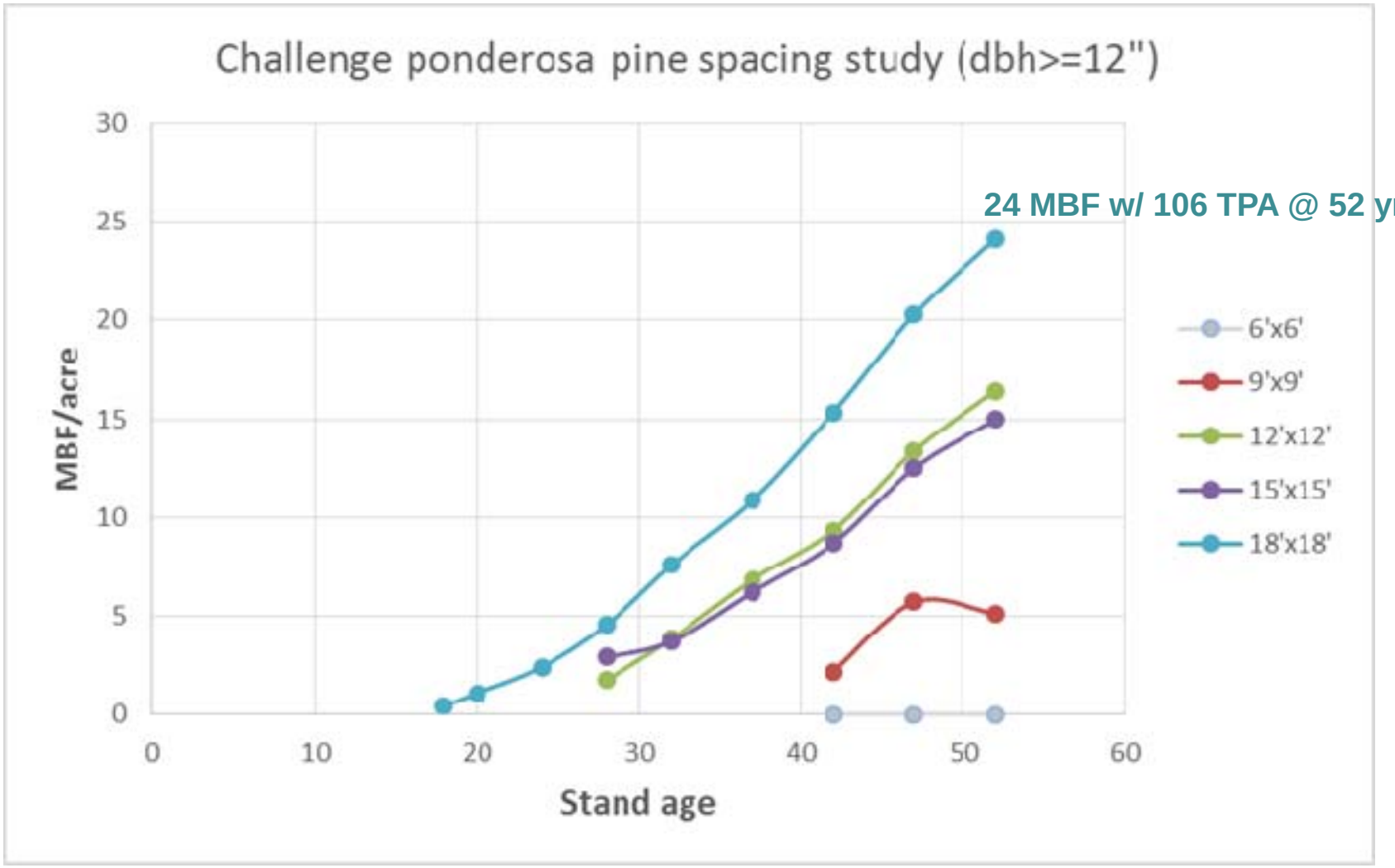
Challenge Experimental Forest

42 year old pond pine planted @ 6’ x 6’ spacing: QMD = 6.5”

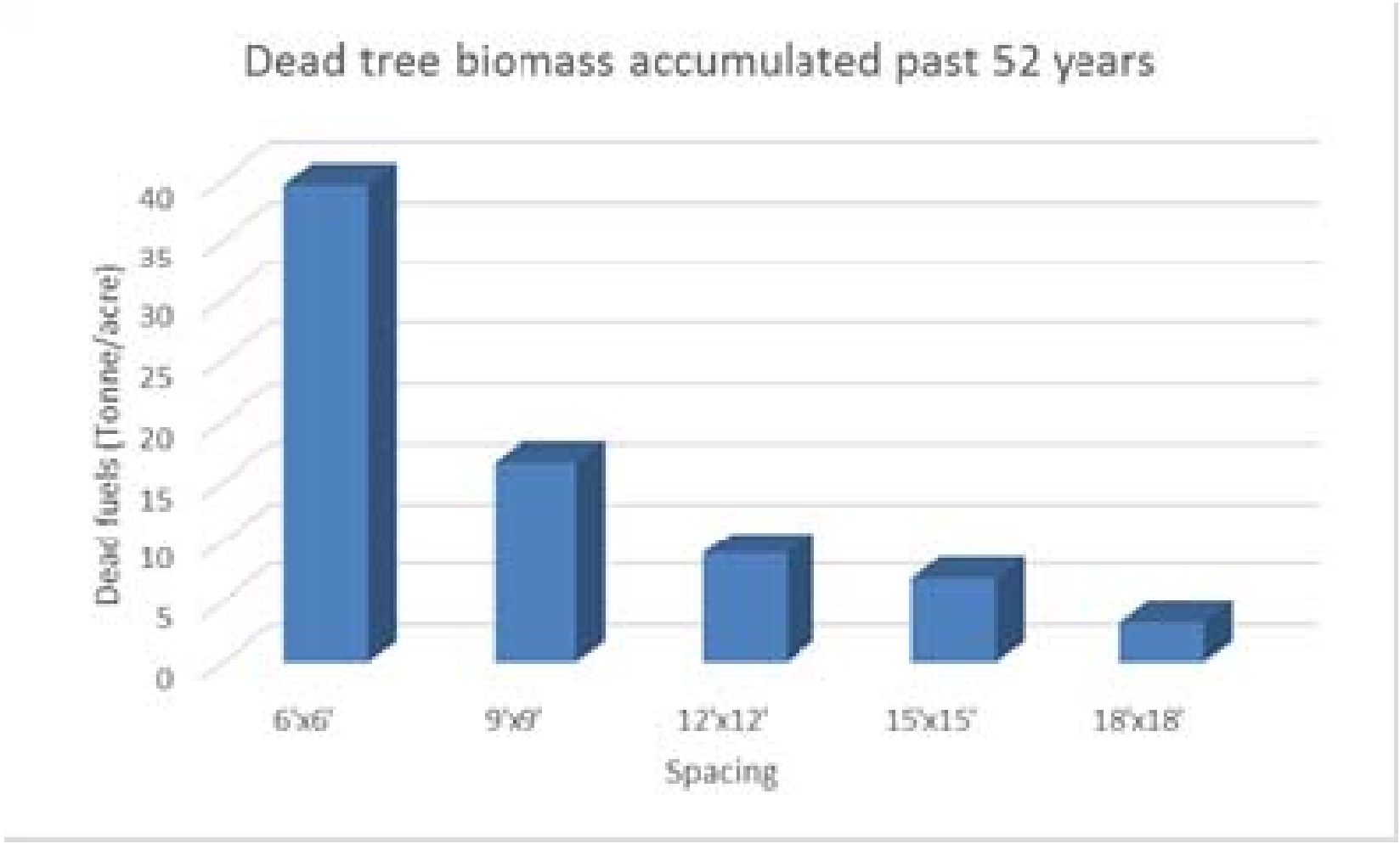
Challenge Experimental Forest
42 year old pond pine planted @ 18’ x 18’ spacing: QMD = 16.0”



18” dbh & 106 TPA @ 52 yrs

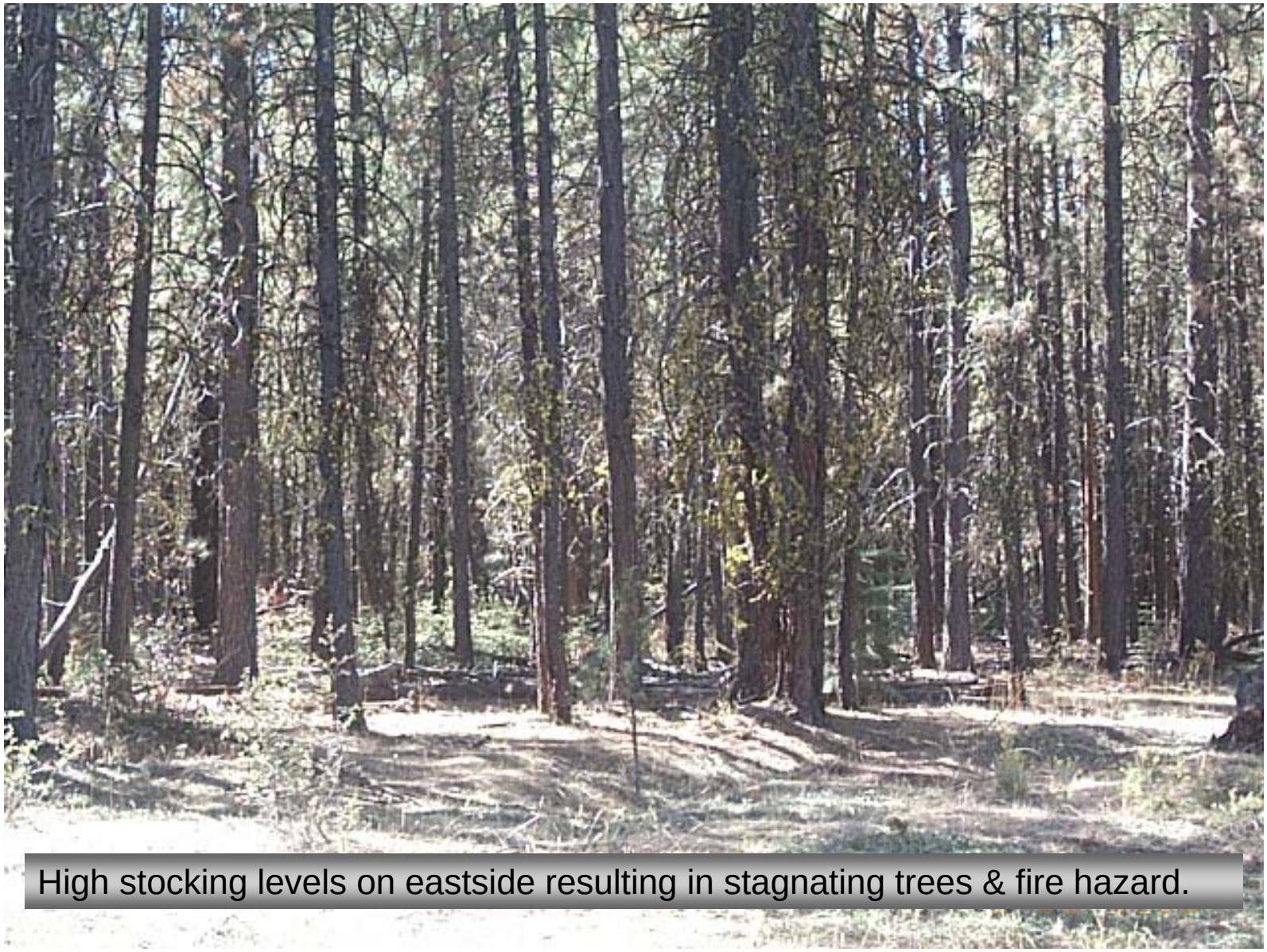


24 MBF w/ 106 TPA @ 52 yrs


Dead tree biomass accumulated past 52 years
Dead fuels (Tonne/acre)
40
35
30
25
20
15
10
5
0
6'x6'
9'x9'
12'x12'
15'x15'
18'x18'
Spacing

Examples of W. M. Beaty Associates, Inc.
Forest Management & Wildfire


Smaller, weaker trees selected for biomass harvest



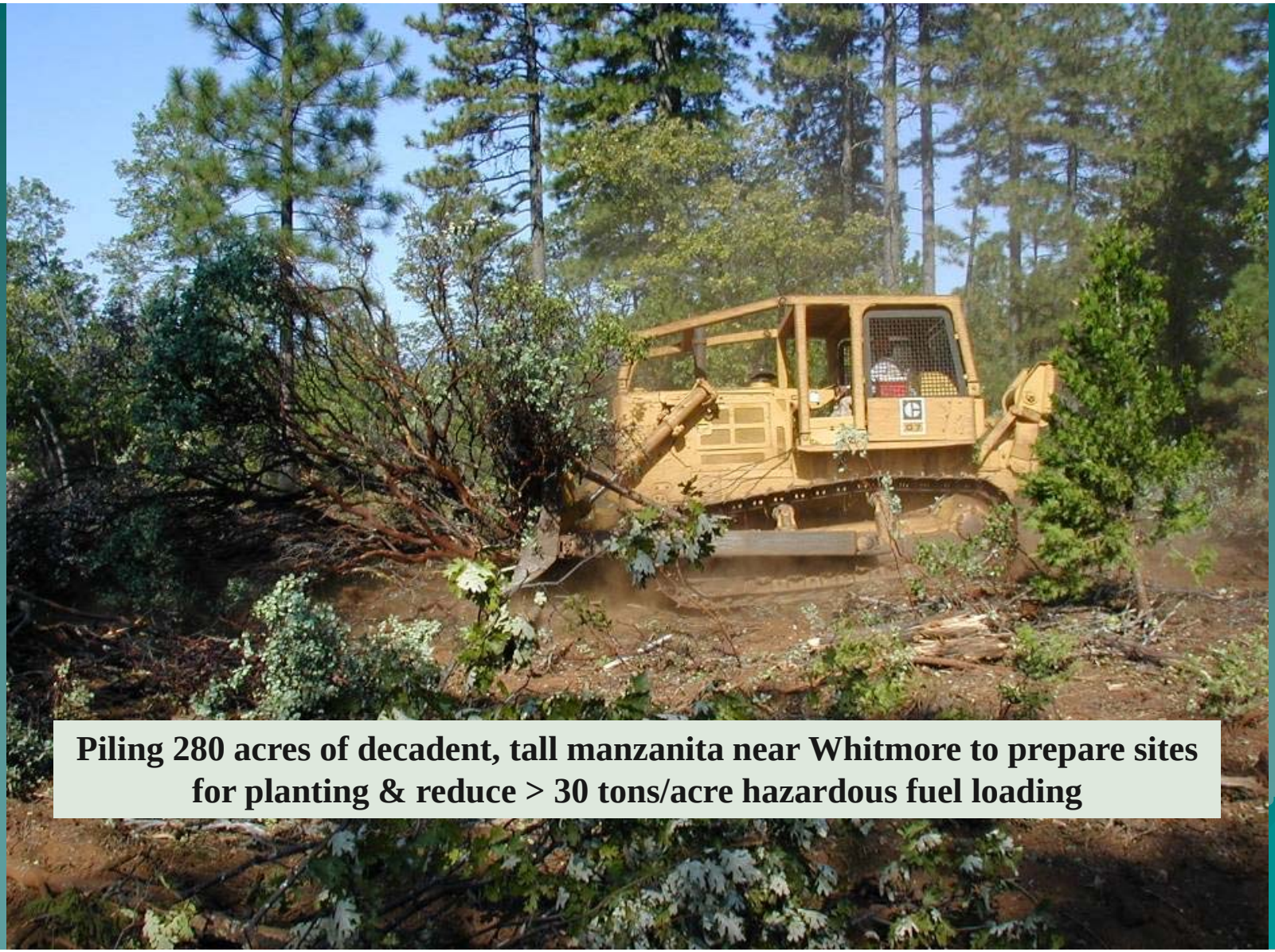
High stocking levels on eastside resulting in stagnating trees & fire hazard.

Thinned eastside stand: increases individual tree vigor & growth & reduced impacts from wildfire

Wildfires where suppression was greatly aided by Beaty thinning projects where crown fires went to ground (some w/ occasional crown flare ups) facilitating direct attack & containment

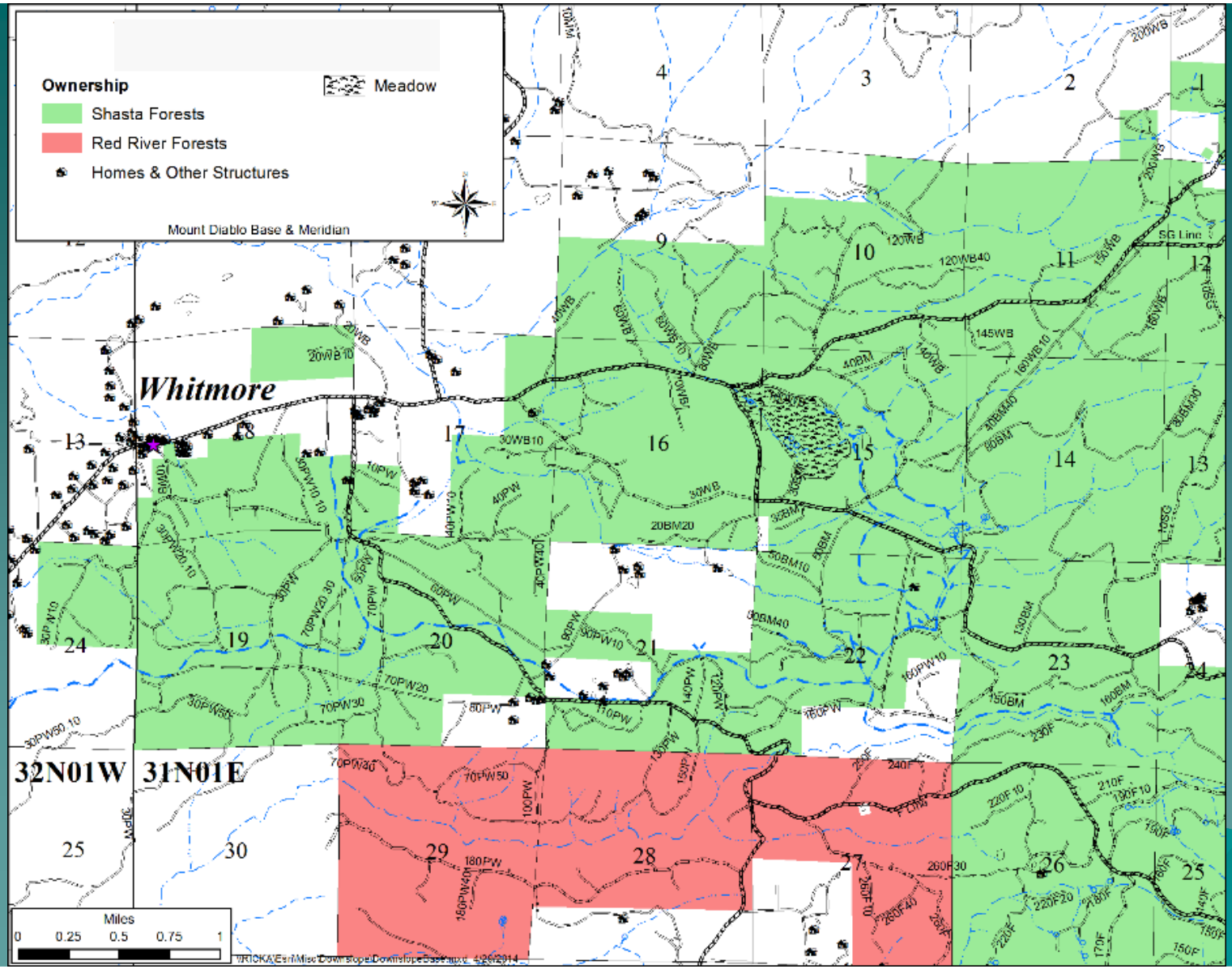
1. 1992 Mud Fire in Lassen County
2. **1994 Widow Fire Incident in Modoc County (Lookout)**
3. 1996 Dixie Fire in Lassen County
4. **2003 Whitmore Fire in Shasta County (Whitmore)**
5. **2008 Sanctuary Fire incident in Shasta County (Shingletown)**
6. Numerous spot fires from lightning strikes in thinned areas that were put out before the fire got into un-thinned timber and became actual wildfire incidents.

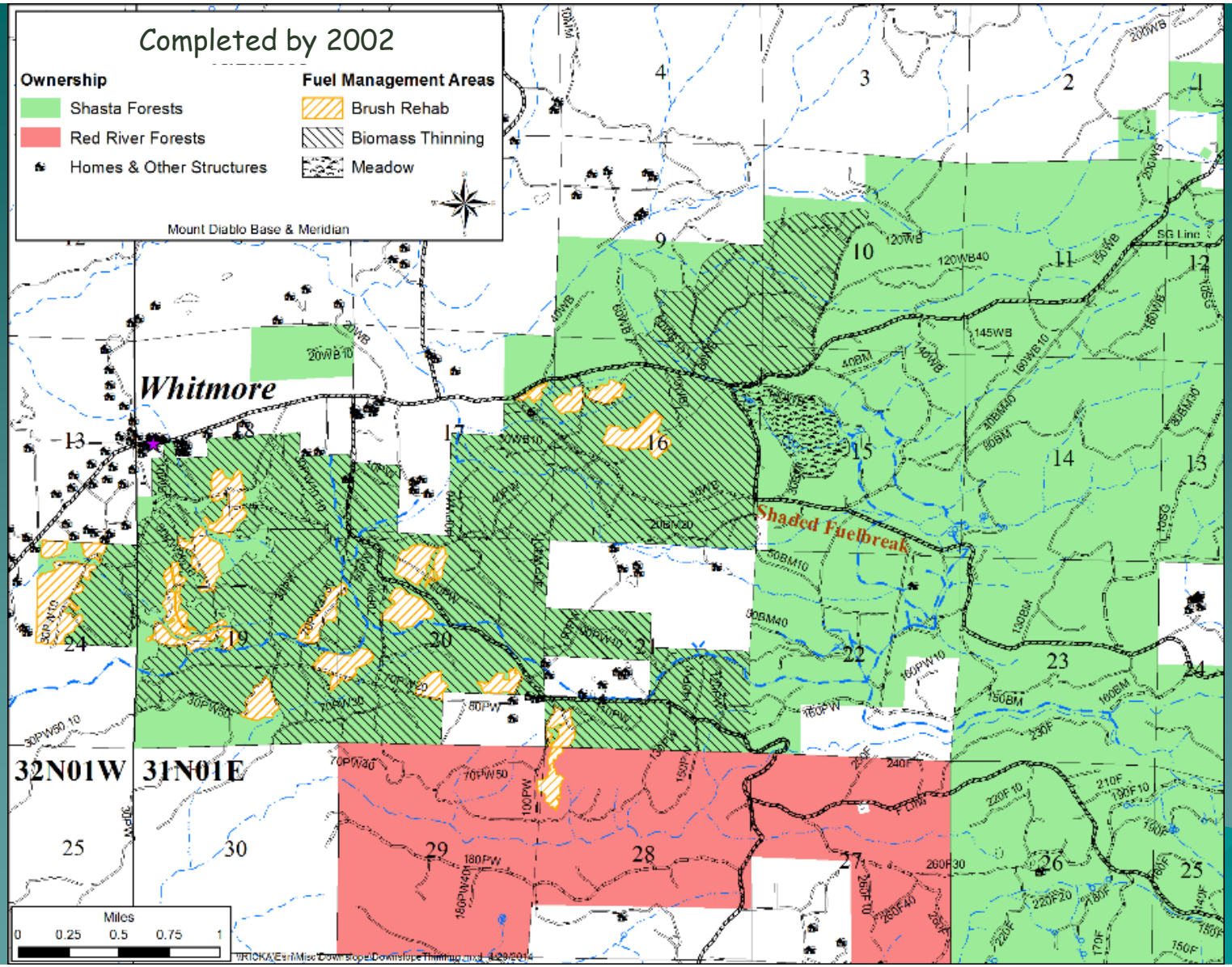

Whitmore
2002 Thinning



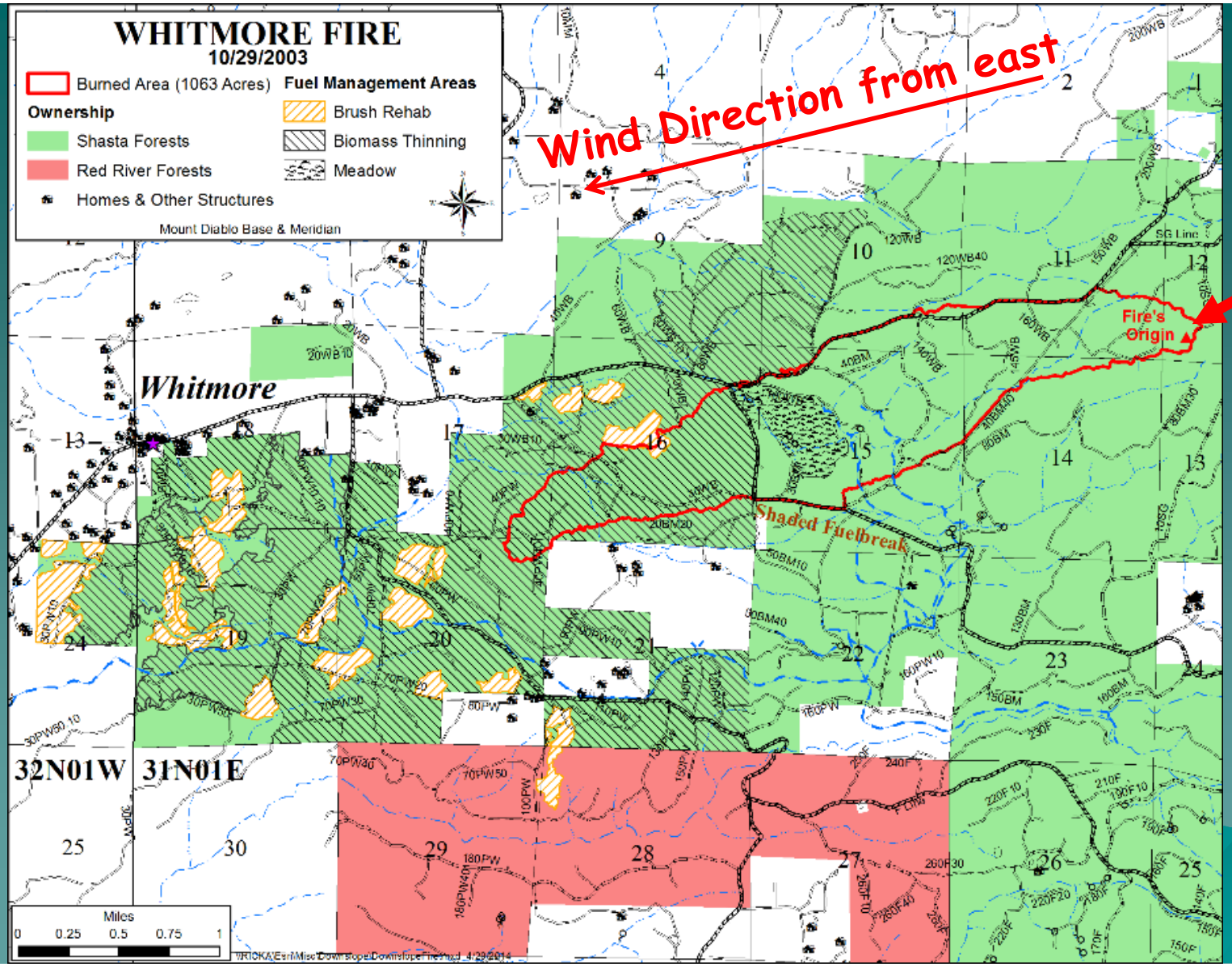
Piling 280 acres of decadent, tall manzanita near Whitmore to prepare sites for planting & reduce > 30 tons/acre hazardous fuel loading


small parcels
with homes
50+ tons fuel/ac
PROPERTY LINE
brush cleared & trees planted
(34 tons brushy fuel/ac removed)


Ownership
Meadow
Shasta Forests
Red River Forests
Homes & Other Structures
Mount Diablo Base & Meridian
Whitmore
32N01W
31N01E
Miles
0 0.25 0.5 0.75 1


Completed by 2002
Ownership
Shasta Forests
Red River Forests
Homes & Other Structures
Fuel Management Areas
Brush Rehab
Biomass Thinning
Meadow
Mount Diablo Base & Meridian
Whitmore
Shaded Fuelbreak
32N01W
31N01E
Miles
0 0.25 0.5 0.75 1

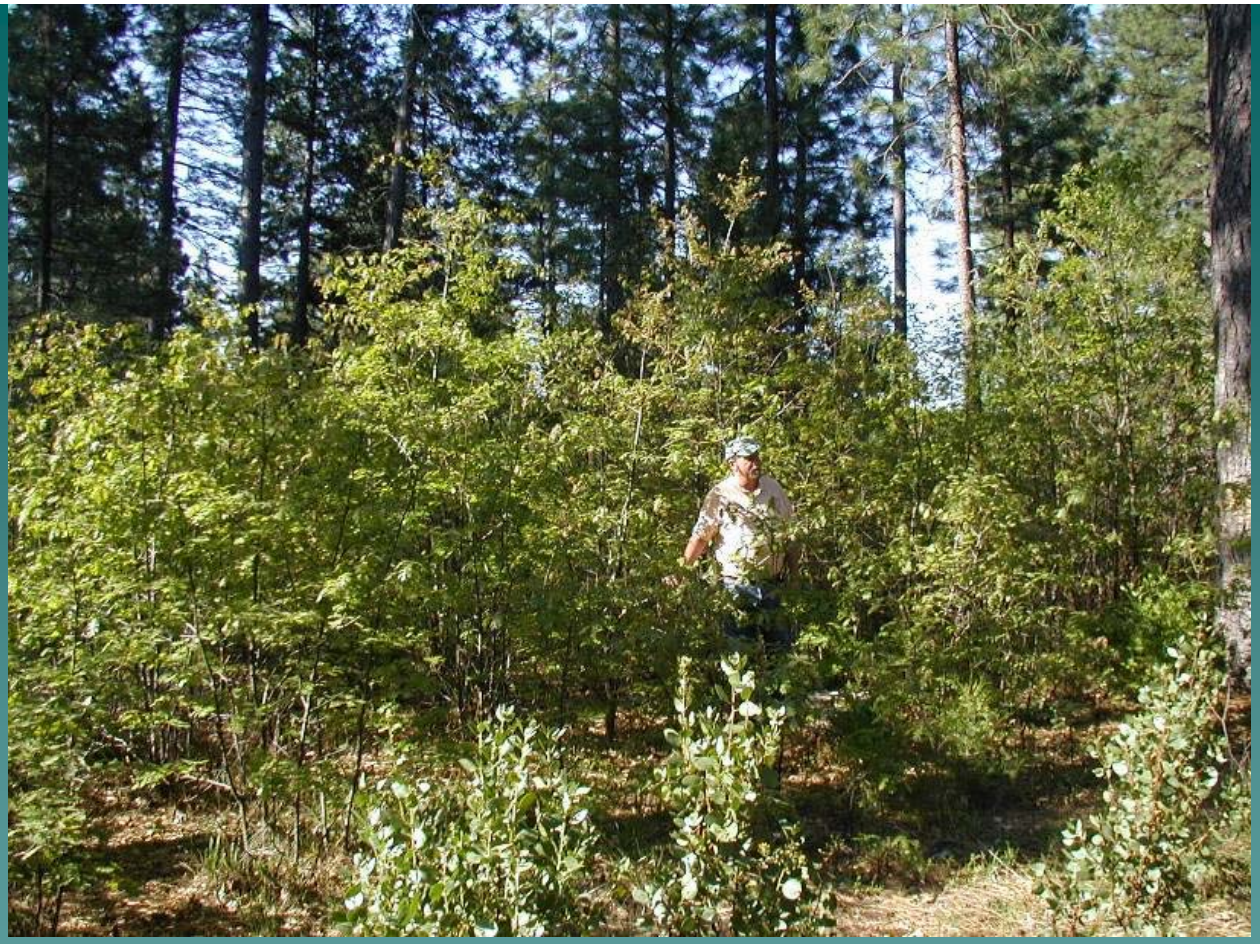

Oct 2003 Whitmore Fire



Fire Started

(illegal campfire)


Oct. 2003
Whitmore Wildfire
Stand thinned in 2002
= ground fire
Un-thinned stand
= crown fire
Wind Direction &
Direction of Fire



Shingletown Ridge Community Shaded Fuel-break **without** follow-up spray treatment to control re-sprouting brush & hardwoods

Shingletown Ridge Shaded Fuelbreak w/ follow-up spray

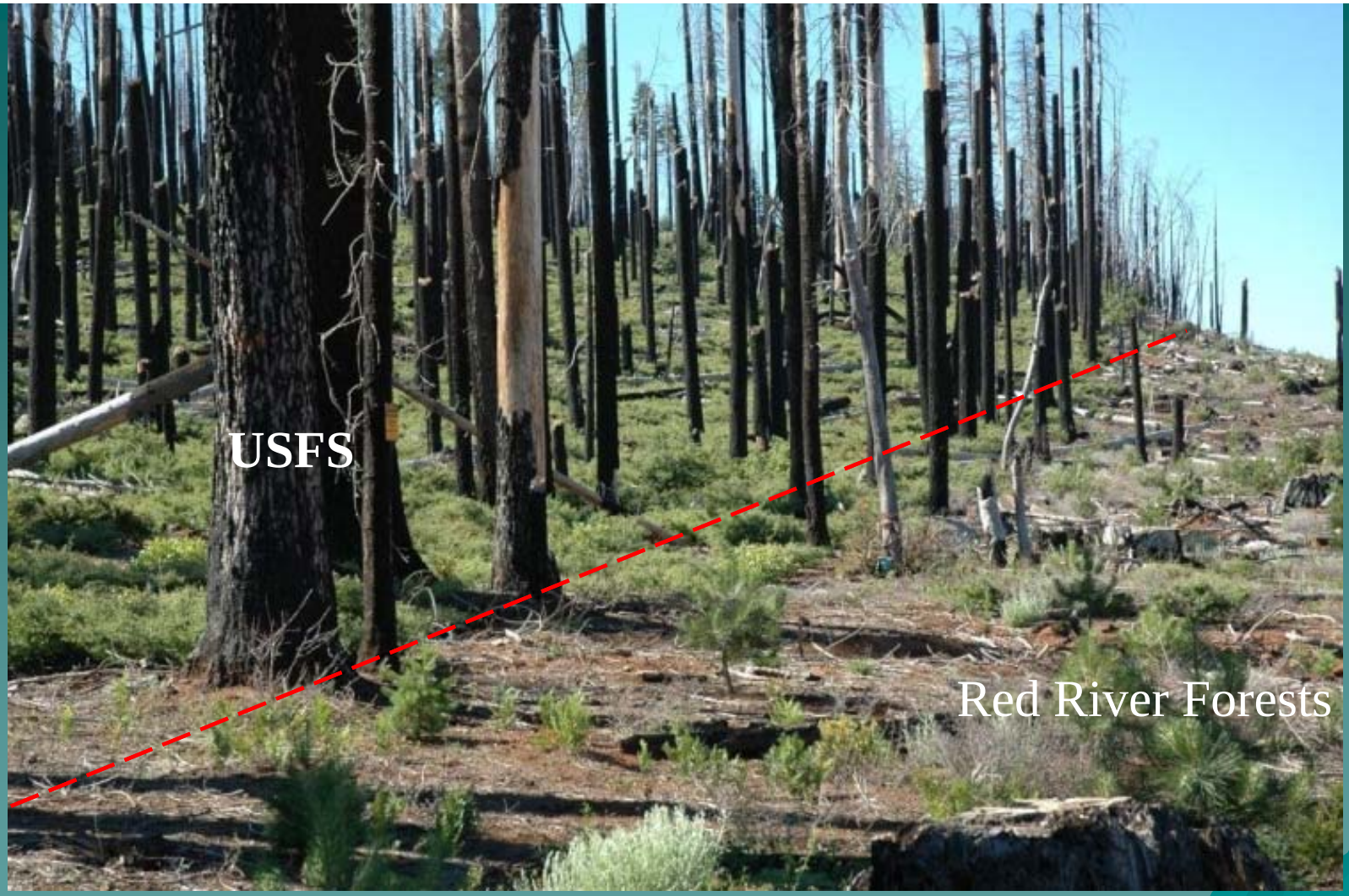
Masticated old manzanita brush

Sprayed young manzanita in Shaded Fuelbreak

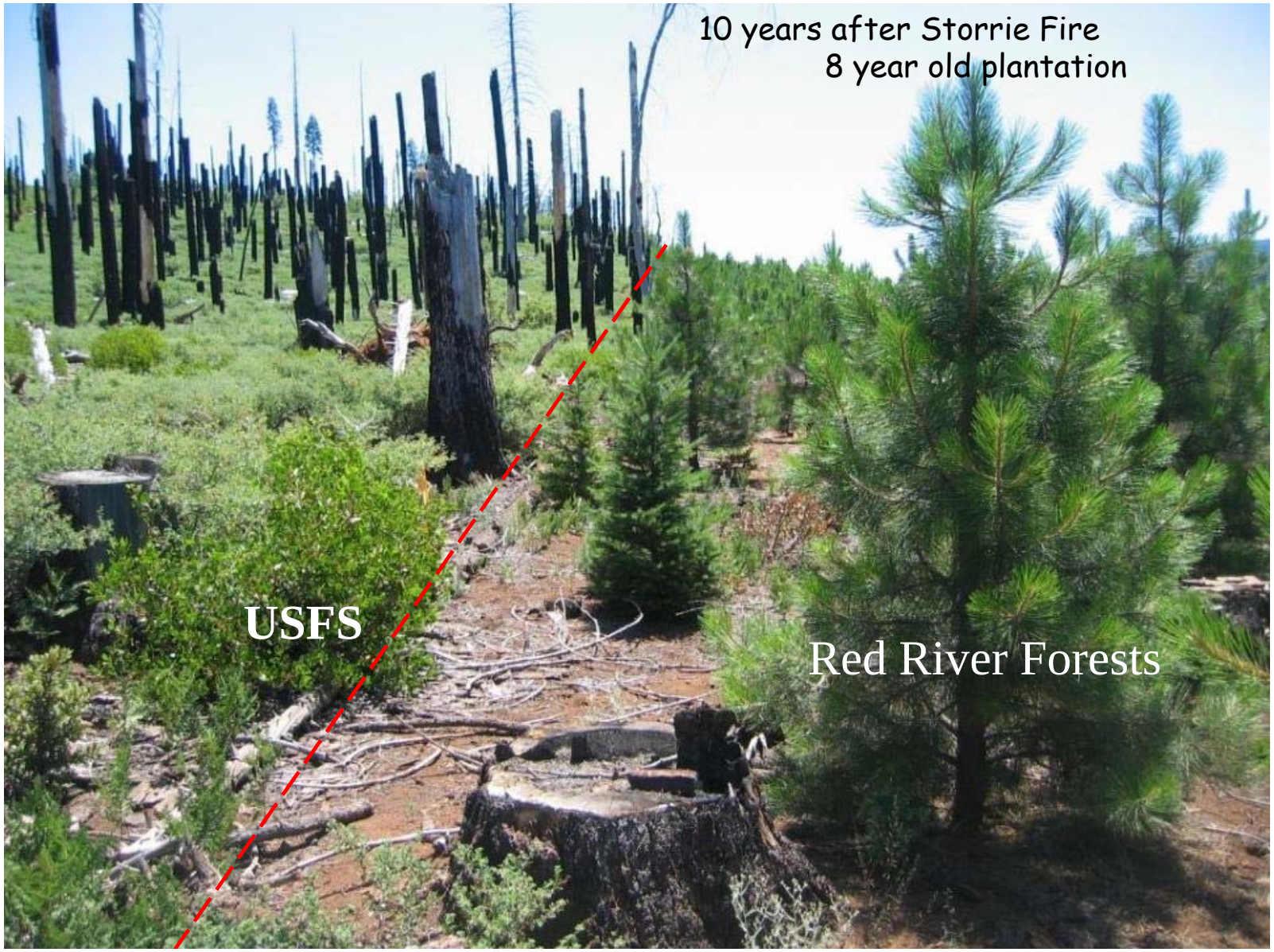
16 yr-old planted native forests after wildfire in Modoc Co., CA

Difference = early weed control

No weed control



A few years after 2000 Storrie Fire


10 years after Storrie Fire
8 year old plantation
USFS
Red River Forests


Storrie Fire 2007
USFS
Red River Forests

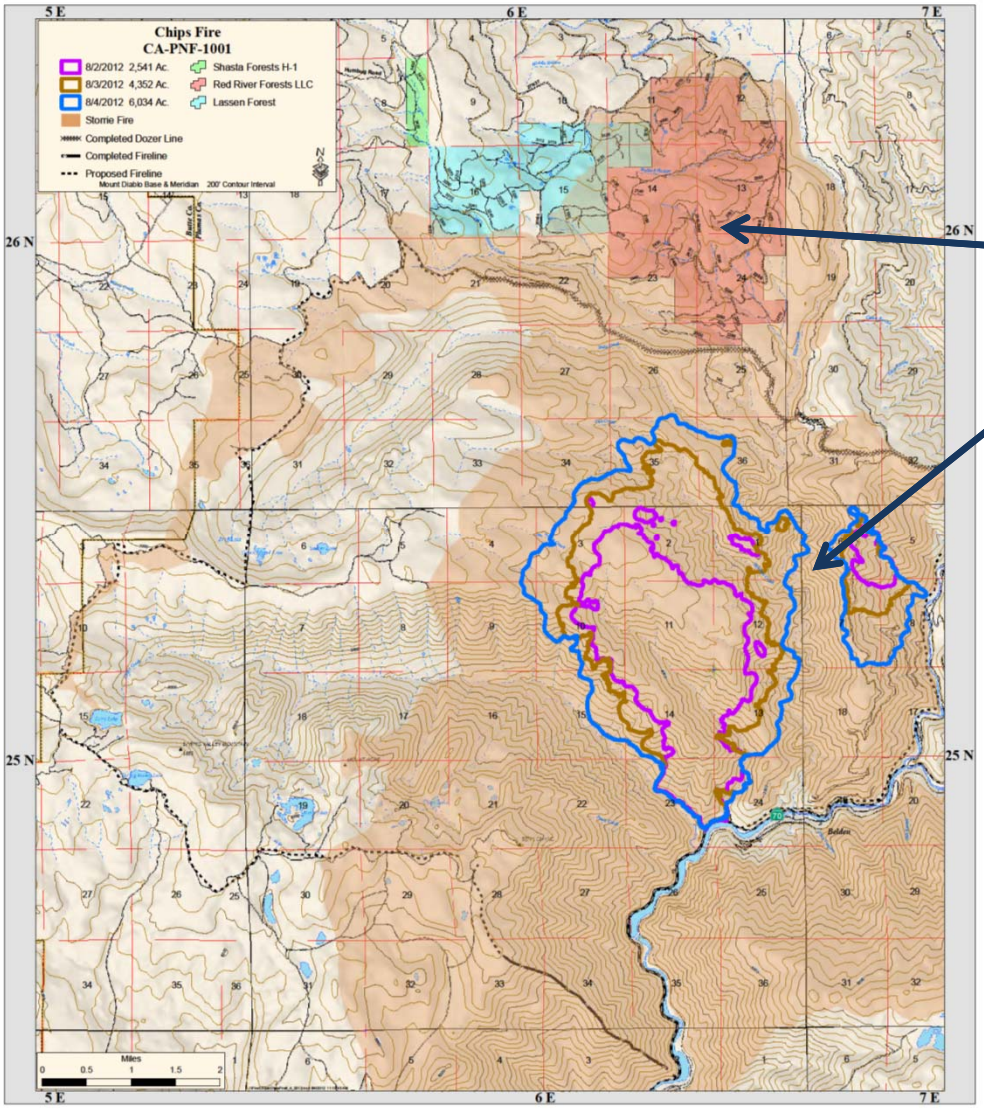

Storrie Fire 2018
Red River Forests
USFS


Additional brush treatment recently completed at this age was not to increase conifer growth but to eliminate brushy fuels near the extremely high dead woody & brushy fuel loading on adjacent lands

200 ft. width “Shaded Fuel Breaks”
Pruning, thinning & spraying
adjacent to main roads


A few years later…


2012 Chips Fire
10 year old Storrie Fire Plantation



2012 Chips Fire burning in footprint of 2000 Storrie Fire shown in brown shading

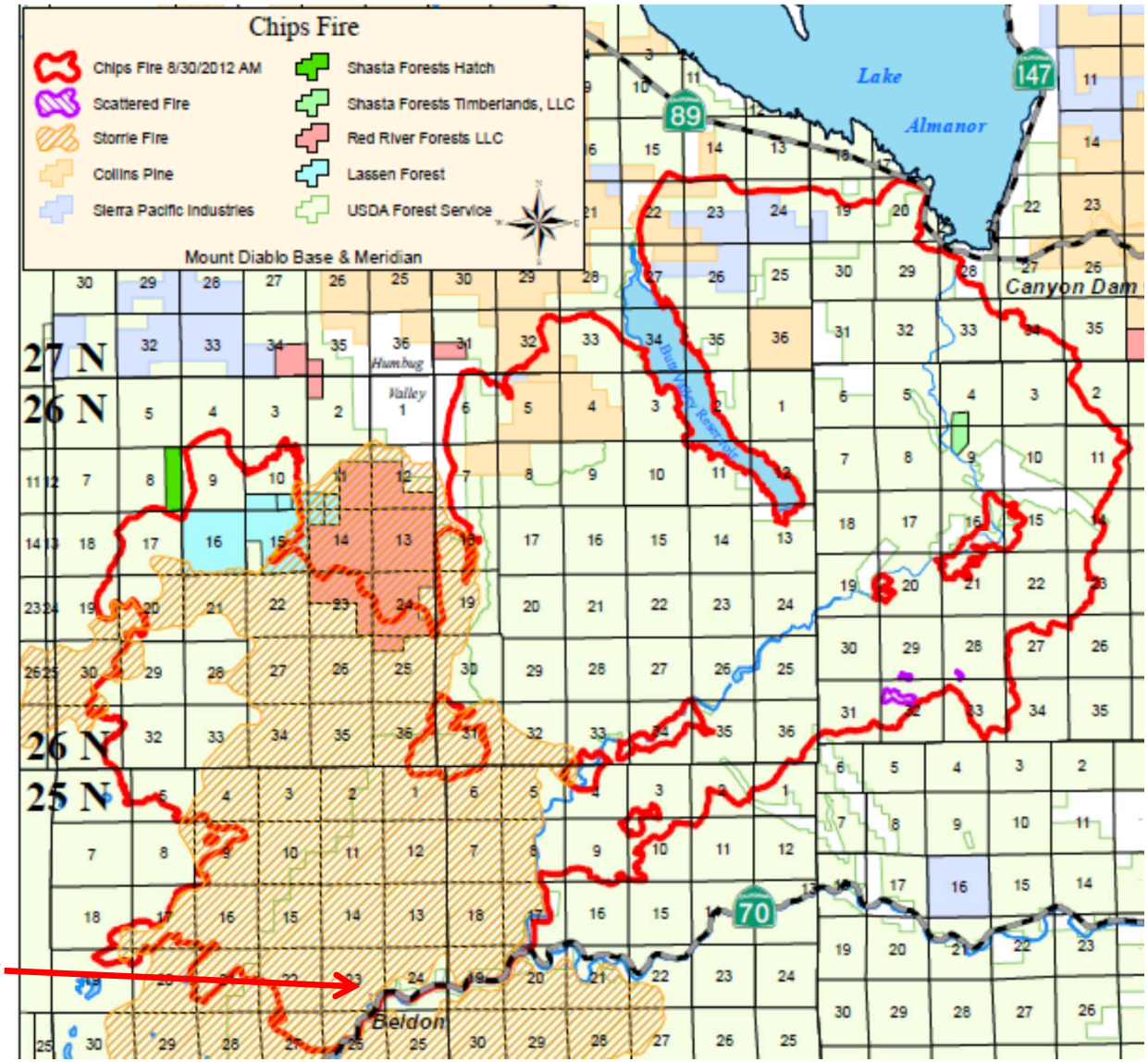
Beaty managed Storrie Fire plantations

USFS No management after Storrie Fire:
>100 tons dead fuels & brush

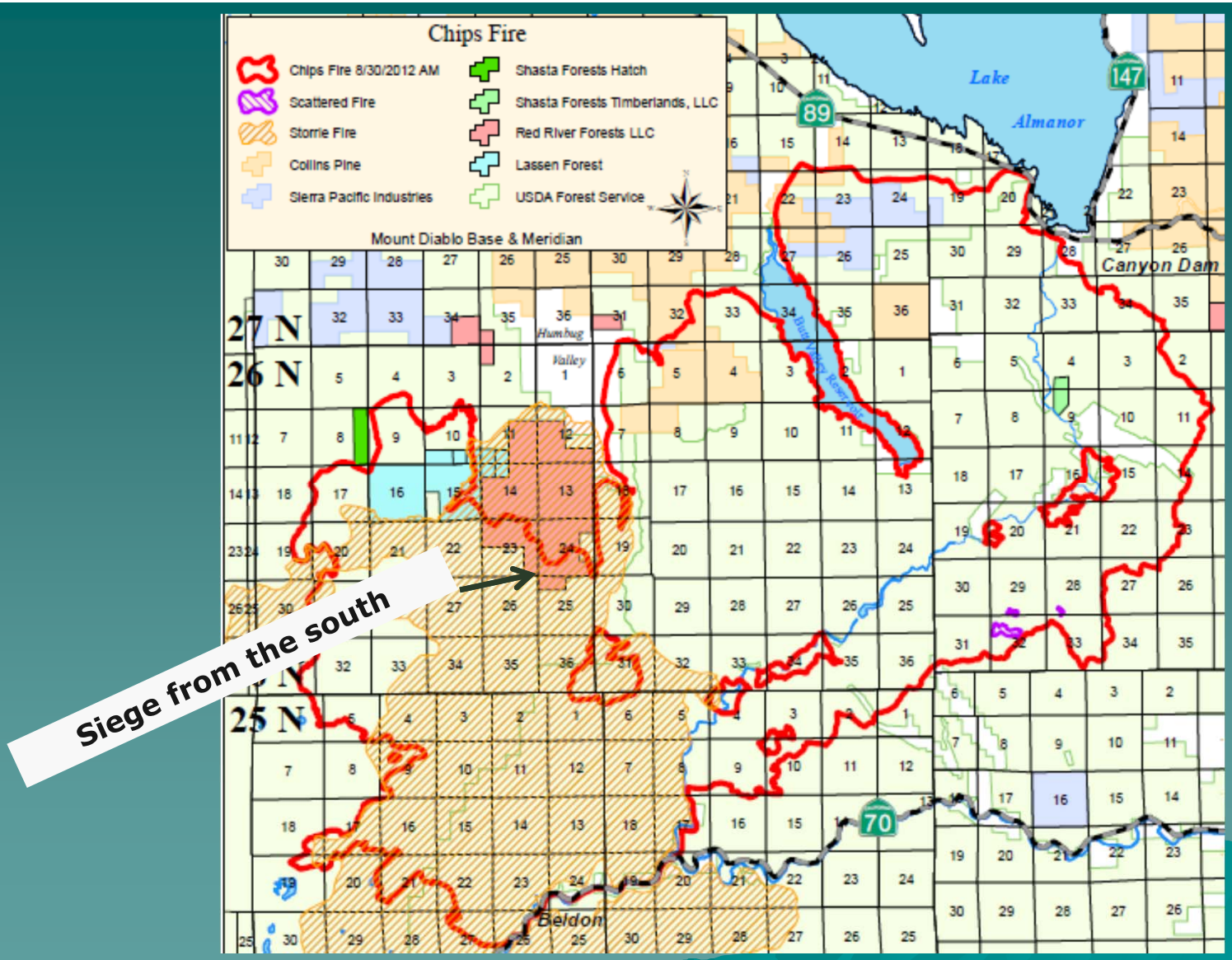
Daily Fire Perimeter:

- 8/2/12 – 2,541 acres
- 8/3/12 – 4,352 acres
- 8/4/12 – 6,034 acres

2012 Chips Fire started in the 2000 Storrie Fire & burned uncontrollably in heavy dead timber & brush through the entire downwind footprint of Storrie Fire except most of Beaty managed plantations. Unfortunately when it reached mature private & public forests it continued to burn many thousands of more acres.



Chips Fire start


Chips Fire
Chips Fire 8/30/2012 AM
Scattered Fire
Storrie Fire
Collins Pine
Sierra Pacific Industries
Shasta Forests Hatch
Shasta Forests Timberlands, LLC
Red River Forests LLC
Lassen Forest
USDA Forest Service
Mount Diablo Base & Meridian
Lake
Almanor
Canyon Dam
Humbug
Valley
Beldon
27 N
26 N
25 N
89
147
70
Siege from the south

After 2001 Storrie Fire:

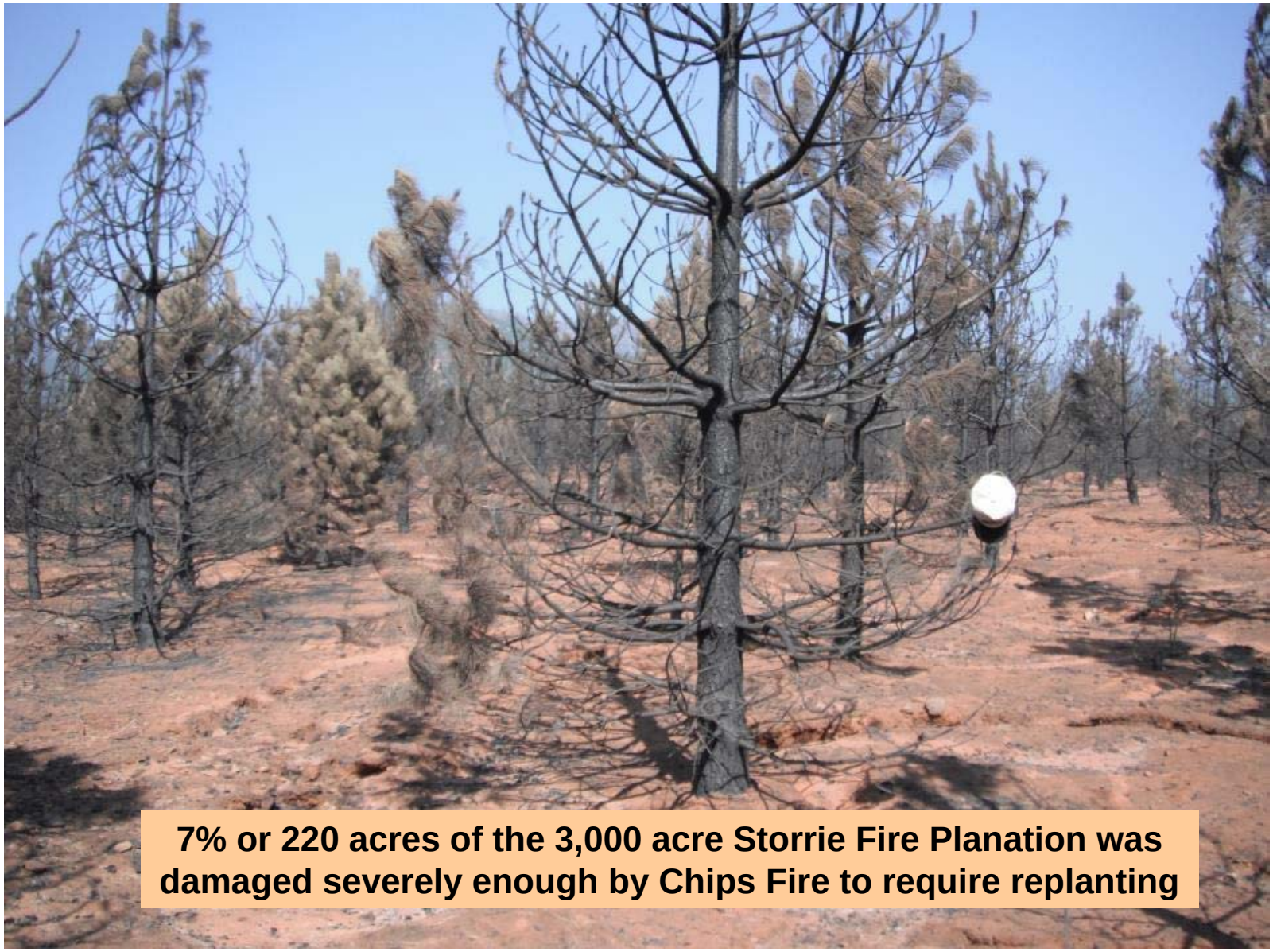
Left: Salvage logged, planted 2002, veg management & 2009 PCT

Lower Right: No salvage, no veg management = >100 tons dead fuels & brush

August 2012 Chips Fire

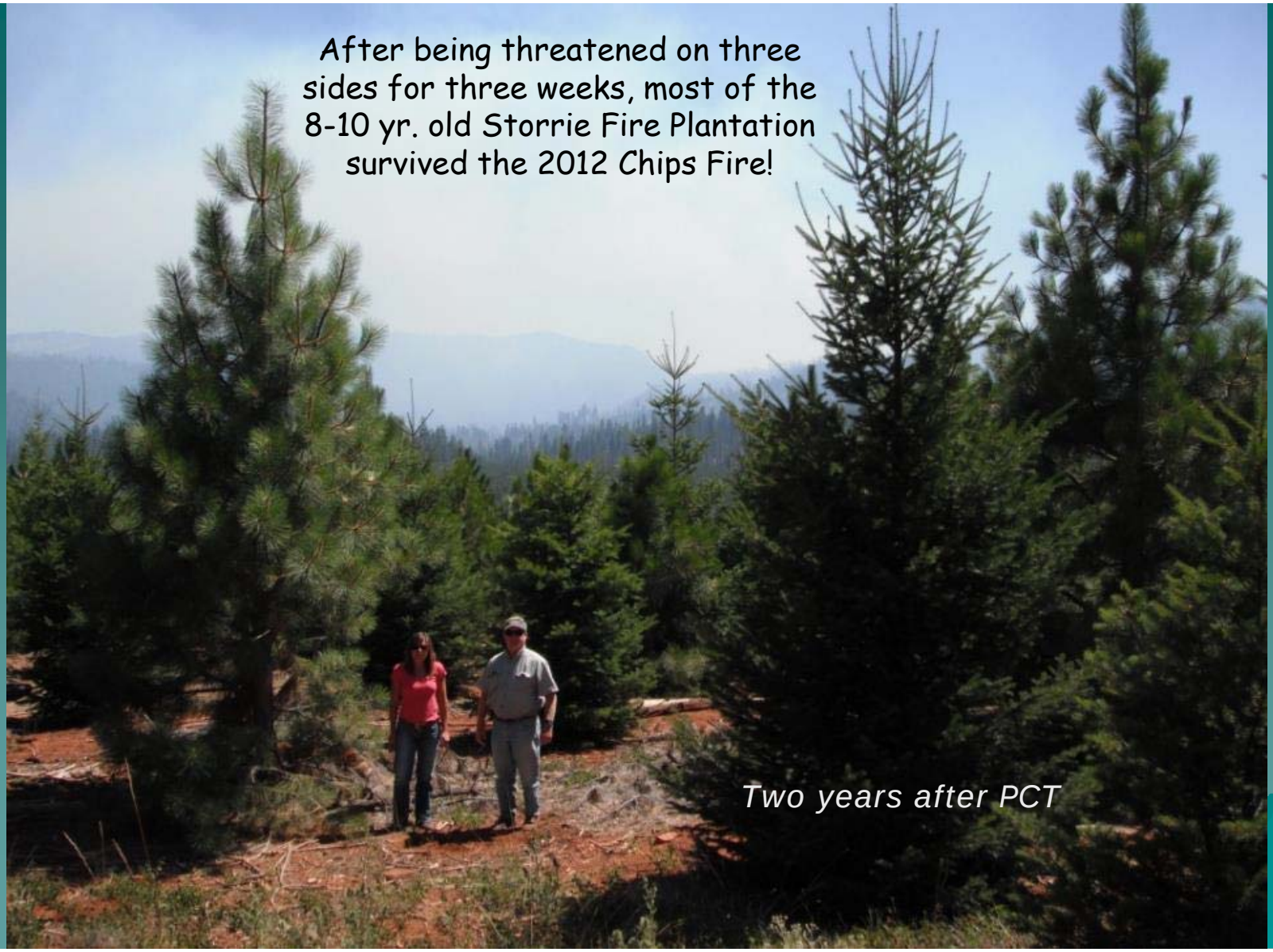
Left: Salvage logged, planted 2002, veg management & 2009 PCT after 2001 Storrie Fire
(note that residual mature trees on left likely survived Chips Fire due to fuel management after Storrie Fire)

Right: No salvage, some planting, no veg management = >100 tons dead fuels & brush


7% or 220 acres of the 3,000 acre Storrie Fire Planation was damaged severely enough by Chips Fire to require replanting


USFS: 12 years of no management after Storrie Fire adjacent to
Storrie Fire Plantation pictured shortly before 2012 Chips Fire


USFS land unmanaged after 2000 Storrie Fire pictured after 2012 Chips Fire


After being threatened on three sides for three weeks, most of the 8-10 yr. old Storrie Fire Plantation survived the 2012 Chips Fire!
Two years after PCT