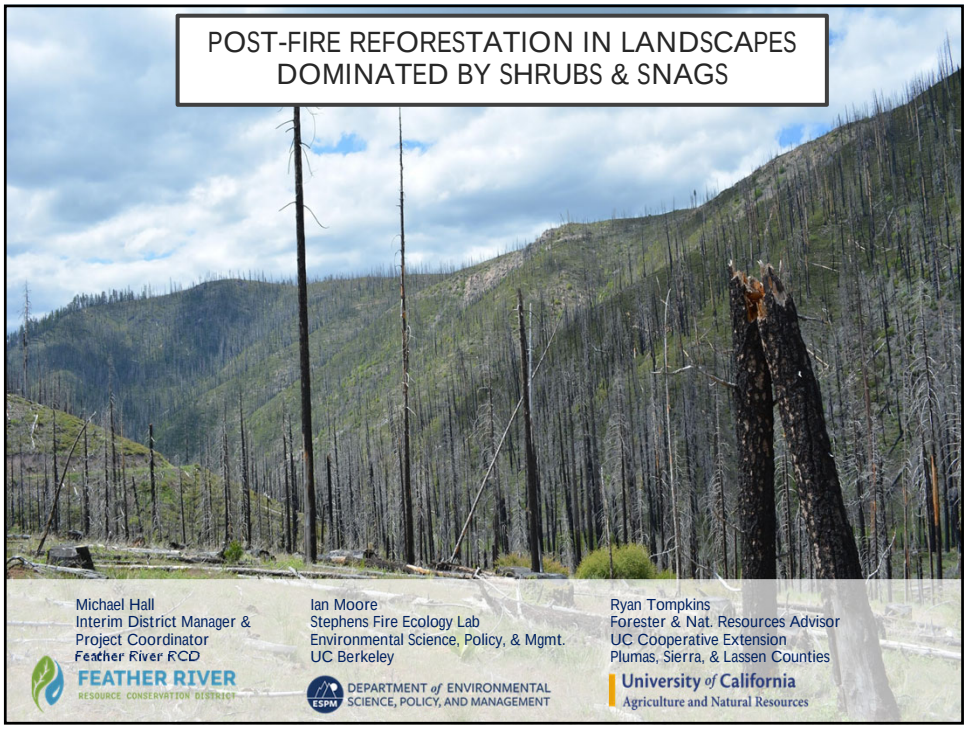
POST-FIRE REFORESTATION IN LANDSCAPES
DOMINATED BY SHRUBS & SNAGS
Michael Hall
Interim District Manager &
Project Coordinator
Feather River RCD
FEATHER RIVER
RESOURCE CONSERVATION DISTRICT
Ian Moore
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Environmental Science, Policy, & Mgmt.
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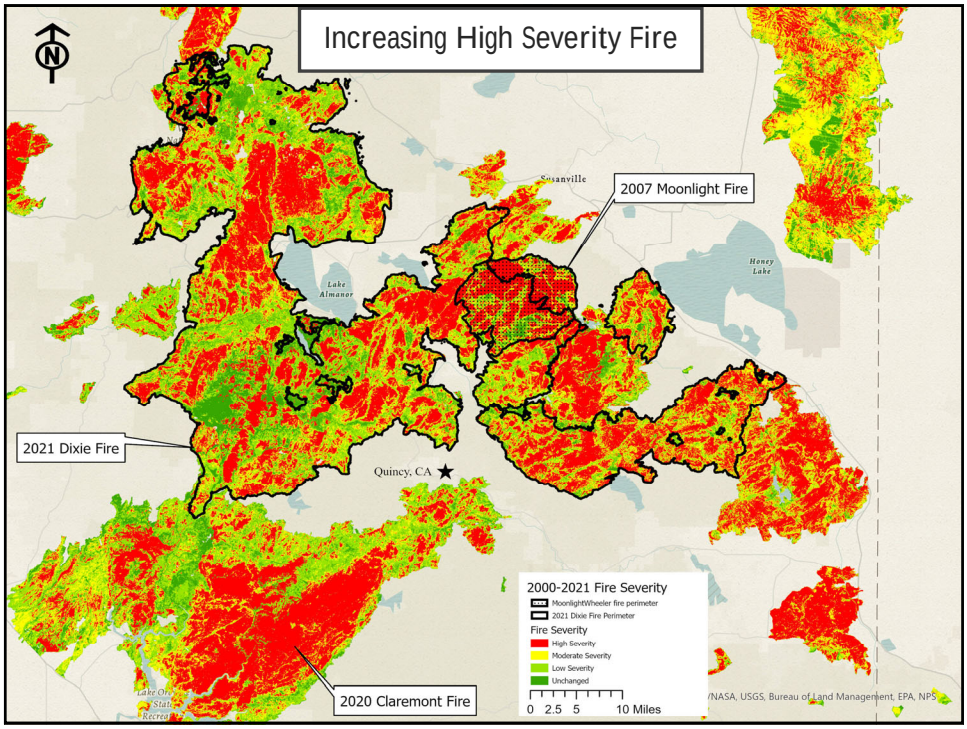
SCIENCE, POLICY, AND MANAGEMENT
Ryan Tompkins
Forester & Nat. Resources Advisor
UC Cooperative Extension
Plumas, Sierra, & Lassen Counties
University of California
Agriculture and Natural Resources

1


Increasing High Severity Fire
2007 Moonlight Fire
2021 Dixie Fire
2020 Claremont Fire
Quincy, CA
Lake Almanor
Honey Lake
2000-2021 Fire Severity
MoonlightWheeler fire perimeter
2021 Dixie Fire Perimeter
Fire Severity
High Severity
Moderate Severity
Low Severity
Unchanged
0 2.5 5 10 Miles

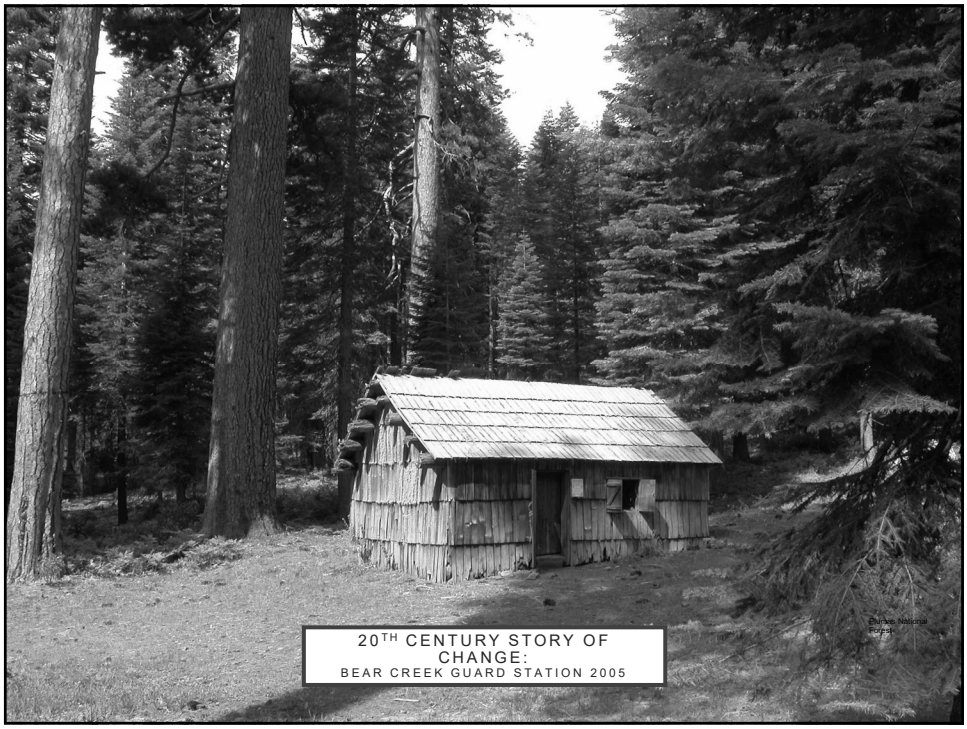
2


Plumas National Forest

3


20TH CENTURY STORY OF CHANGE:
BEAR CREEK GUARD STATION CIRCA 1911
Plumas National Forest

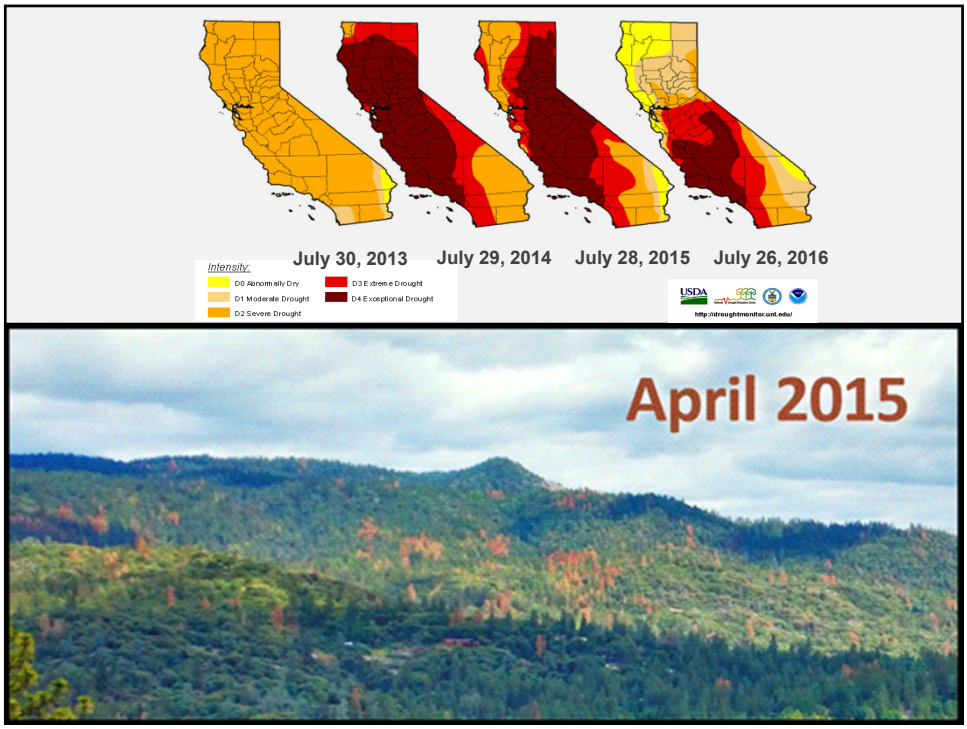
4


20TH CENTURY STORY OF CHANGE:
BEAR CREEK GUARD STATION 2005

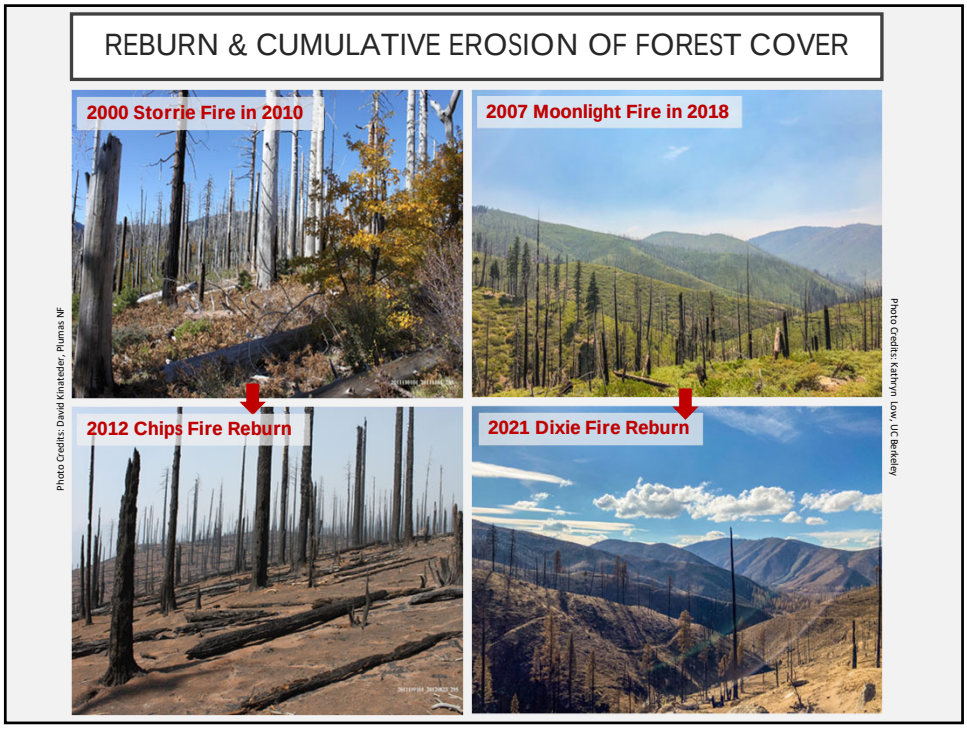
5


TOPOGRAPHY
WEATHER
FUEL
Photo: Plumas County Search and Rescue/KRCR
21st Century shifts in disturbance regimes:
alignment of drought with Landscape level Forest density & Fuels

6

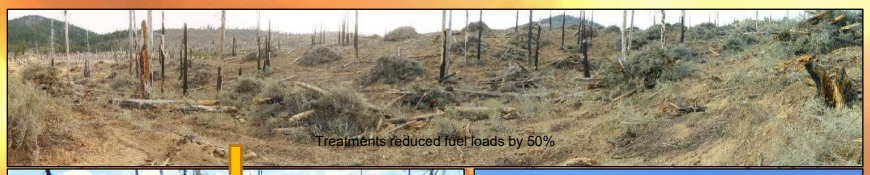

July 30, 2013
July 29, 2014
July 28, 2015
July 26, 2016
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought
http://droughtmonitor.unl.edu/
April 2015

7


REBURN & CUMULATIVE EROSION OF FOREST COVER
2000 Storrie Fire in 2010
2007 Moonlight Fire in 2018
2012 Chips Fire Reburn
2021 Dixie Fire Reburn
Photo Credits: David Knatcher, Plumas NF
Photo Credits: Kathryn Low, UC Berkeley

8

Managing fuel profiles in high severity burns
How do we reforest in a (RE-)burning Climate?



Moore, I.B., Collins, B.M., Foster, D.E., Tompkins, R.E., Stevens, J.T. and Stephens, S.L., 2021. Variability in wildland fuel patches following high-severity fire and post-fire treatments in the northern Sierra Nevada. International Journal of Wildland Fire, 30(12), pp.921-932.

https://www.cafiresci.org/research-publications-source/category/postfirefuels

Photo: Ryan Bair

9

Mechanical Site Preparation

- Mechanical Site Preparation
- Removal of brush and snags to clear ground for planting
- Excavator with Grapple attachment
- Piles are burned

Site Prepped unit (right) vs natural brush regeneration (left)

- Leave 20% Residual Brush
- Leave 5-6 snags/ acre
- Leave 5 largest downed logs/ acre
- Leave habitat species (willow, chokecherry, elderberry, currant)
- Maximum slope 45%

10

Seed Sourcing

- Sowing orders are placed one year in advance of anticipated planting date
- Lift order are placed the winter prior to planting
- Order from USDA Placerville Nursery
- Anticipate needs based on previous years site prep
- Planted at $225/ acre; often plant less
- Cold Storage at Plumas National Forest
- One Tree Planted helps cover seedling costs

11

Planting

- Plant in April - June
- Ideal Conditions:
  - air temps between 32-65 F
  - soil temps 40 F
- 15 person crew accomplishes ~50 acres/day
- Cluster Planting Specifications
  - 3 trees per cluster, trees spaced 5-8 ft. apart
  - Clusters spaced 30 feet apart
- RCD Staff perform:
  - Contract administration
  - Planting Quality Control (e.g. depth, compaction, root configuration, spacing, scalping, etc.
  - Inspection (1/50 acre plots)
  - Monitoring staked rows in 1st & 3rd growing season

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Managing Competing Vegetation: Release

Chemical Release

- Herbicide application following planting
- Can be done in multiple year cycles; ie one year after planting, every other year for three years following
- Must have qualified applicator license
- $200-300/acre

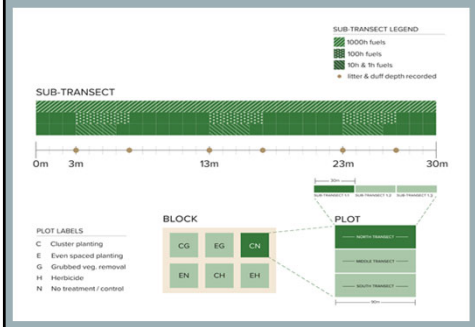
Manual Release (Grubbing)

- Digging out competing vegetation around the tree with hand tools
- Expensive and Difficult
- Used when NEPA/ CEQA will not allow herbicide use
- $600/acre

13

Replicated Treatment Study

Moore, I.B., Collins, B.M., Foster, D.E., Tompkins, R.E., Stevens, J.T., and S.L. Stephens. 2021. **Variability in wildland fuel patches following high-severity fire and post-fire treatments in the northern Sierra Nevada** *International Journal of Wildland Fire* https://doi.org/10.1071/WF20131



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Key Findings: Reducing surface fuels

- Shrub cover reduced by three quarters
  - 84% cover pre-treatment ⟶ 21% cover post-treatment
- Total fuel loads nearly halved
  - 131.4 Mg/ha (58.6 tons/ acre) ⟶ 73.4 Mg/ha (32.7 tons/ acre)
- Fuel continuity significantly reduced
  - Average fuel patch length reduced; proportion of large patches reduced

Table 1. Size class of surface fuel loads before and after shrub removal treatment

Mean, s.d., 75th and 90th percentile fuel loads pre-treatment by type. Values are in megagrams per hectare. Fine surface fuel includes FWD (1-, 10-, and 100-h fuel) and litter. Total down surface fuel includes litter, duff, 1-, 10-, 100- and 1000-h fuel

Fuel type	Mean pre-treatment ($Mg\,ha^{-1}$)	s.d. pre-treatment ($Mg\,ha^{-1}$)	75th percentile ($Mg\,ha^{-1}$)	90th percentile ($Mg\,ha^{-1}$)	Mean post-treatment ($Mg\,ha^{-1}$)	s.d. post-treatment ($Mg\,ha^{-1}$)
Litter	5.20	2.90	7.26	10.89	2.61	2.56
Duff	17.65	22.74	26.25	52.50	1.10	3.31
1-h	0.07	0.09	0.09	0.18	0.91	0.41
10-h	1.16	0.81	1.54	2.76	3.95	1.44
100-h	4.52	4.16	7.27	12.13	6.98	3.93
1000-h	102.83	81.00	135.84	203.63	57.81	69.34
Shrub	5.56	4.53	7.84	12.68	0.66	0.86
Fine surface fuel	10.95	5.88	14.26[A]	18.93[A]	14.45	5.45
Total down surface fuel	131.43	91.98	172.39	243.42	73.36	71.04

[A]Cut-offs used for fuel load component of neighbour analysis.

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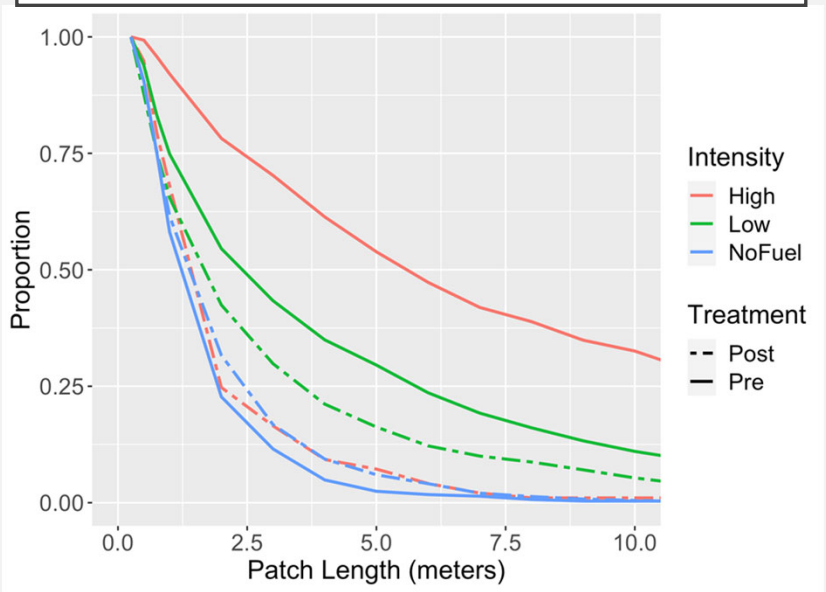
Promoting Heterogeneity: Effects of treatment on shrub continuity



Journal article & Research brief: https://www.cafiresci.org/research-publications-source/category/postfirefuels

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Consider competition and development of live fuel profiles

17

Long-term need for maintenance of reforestation investment:

Not only about survival & growth, but also fuels mgmt. & resistance to reburn

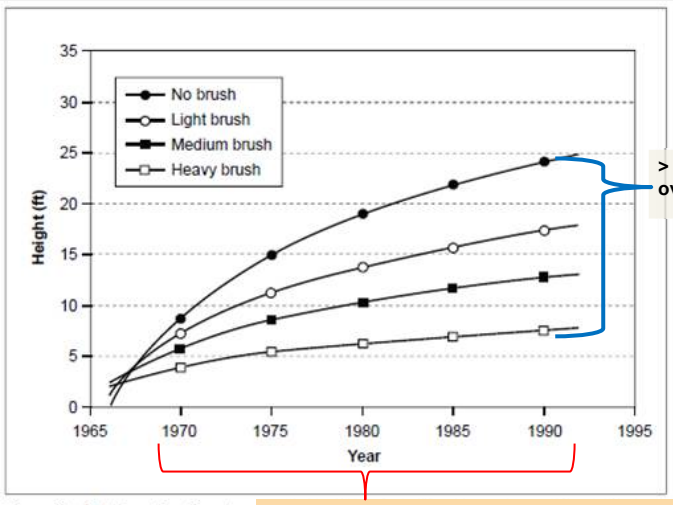
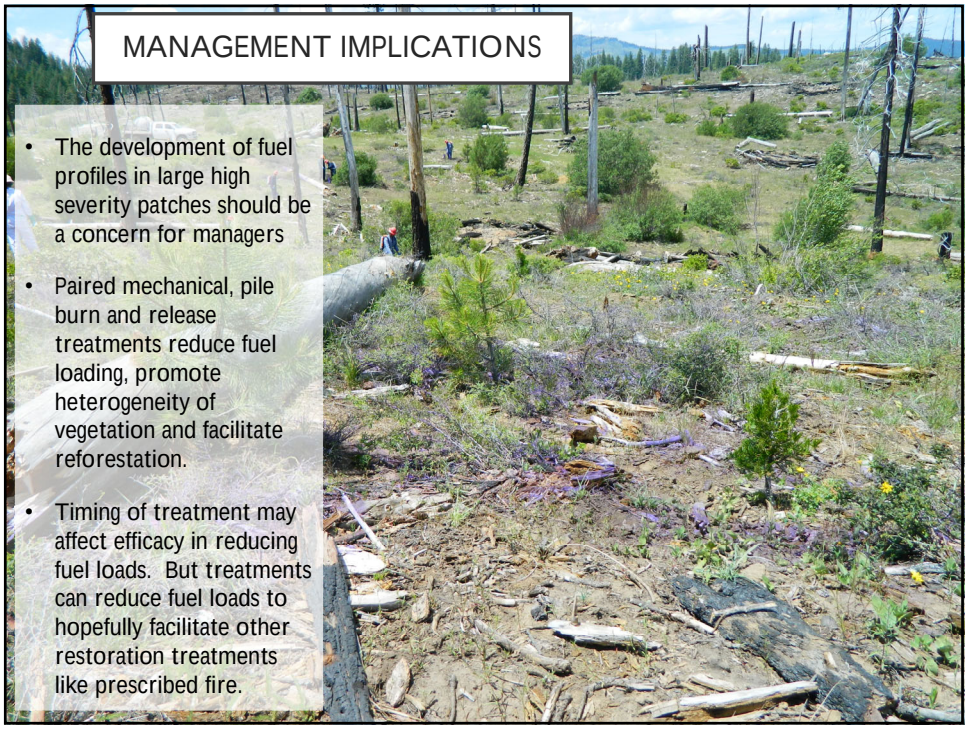


Figure 9—Relationship of pondero
brushfields, 1966–1992.

> 15 ft height difference over 25 yrs

What's the probability the site may re-burn in 25 years?

18


MANAGEMENT IMPLICATIONS
• The development of fuel profiles in large high severity patches should be a concern for managers
• Paired mechanical, pile burn and release treatments reduce fuel loading, promote heterogeneity of vegetation and facilitate reforestation.
• Timing of treatment may affect efficacy in reducing fuel loads. But treatments can reduce fuel loads to hopefully facilitate other restoration treatments like prescribed fire.

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Vegetation Mgmt & Safety Considerations

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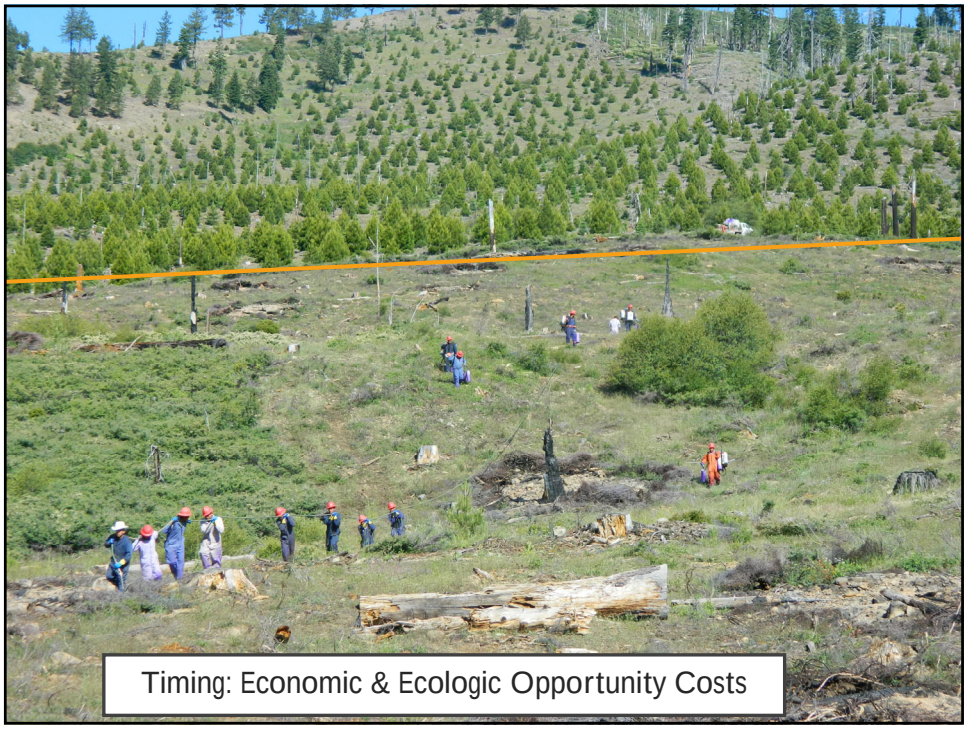
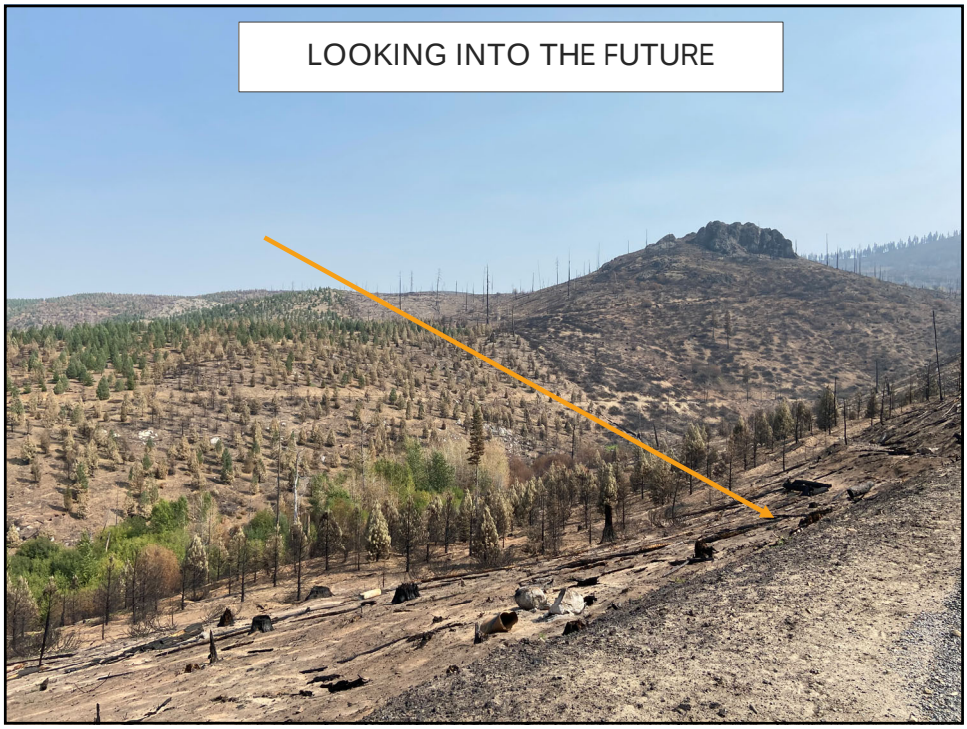

Timing: Economic & Ecologic Opportunity Costs

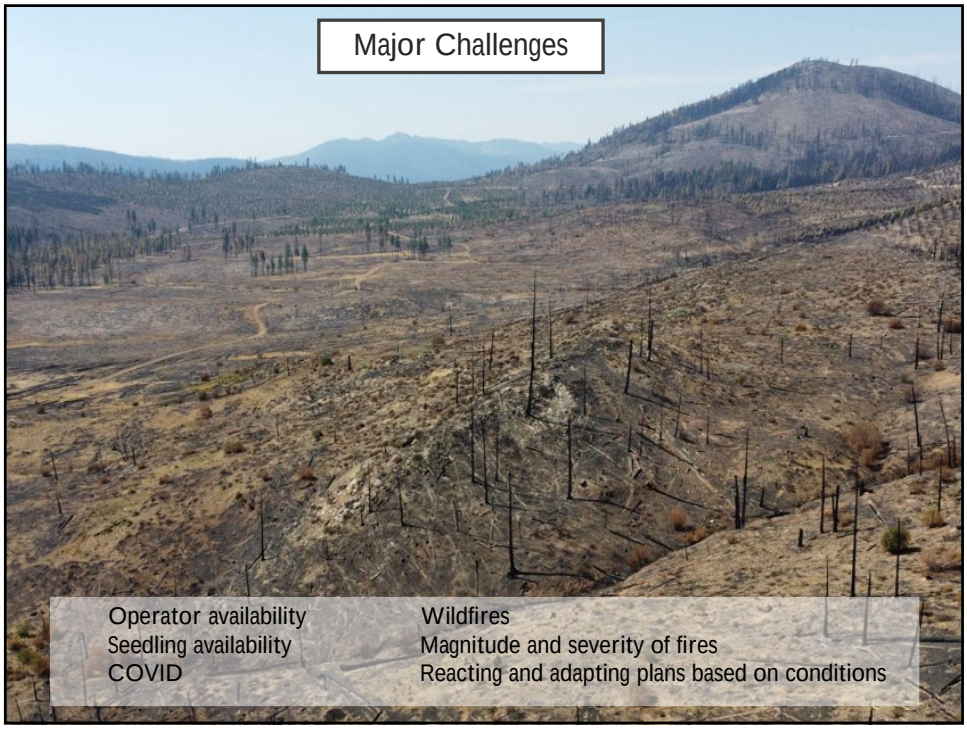
21


LOOKING INTO THE FUTURE

22


LOOKING INTO THE FUTURE

23


Major Challenges
Operator availability
Seedling availability
COVID
Wildfires
Magnitude and severity of fires
Reacting and adapting plans based on conditions

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THANK YOU AND ACKNOWLEDGEMENTS

We'd like to acknowledge our partners:

- Plumas National Forest Funding & Staff (Linda Smith & Maurice Huynh)
- Feather River RCD Staff (Brad Graevs & Brad Underwood) & Field Crews
- Sierra Nevada Conservancy Funding & Staff
- Co-authors: Scott Stephens, Brandon Collins, Danny Foster, Jens Stevens
- Stephens Lab Field Crew @ UC Berkeley
- One Tree Planted
- Many Field Contractors who performed the work

- Additional Questions? Contact:

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Partnerships Through Good Neighbor Agreement

FEATHER RIVER
RESOURCE CONSERVATION DISTRICT

SIERRA NEVADA CONSERVANCY

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

ONE TREE PLANTED

ESPM DEPARTMENT *of* ENVIRONMENTAL SCIENCE, POLICY, AND MANAGEMENT

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