Red Mountain Mastication Study

Adaptive Management Services Enterprise Team

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Sequoia National Forest

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What is mastication?

- Shreds fuels into small chunks
- Some ladder and canopy fuels are displaced to the surface layer


Mastication

Treatment Objectives

- Reduce risk of crown fire
- Improve suppression effectiveness

Why mastication?

- Applicable to non-merchantable timber
- More cost effective than hand-treatments
- No air quality issues associated with prescribed burning
- No need to wait for narrow prescribed burn windows
- No risk of prescribed fire escape

Downsides to mastication?

- Fuels are not removed
- Surface fuel loads increase
  - surface fire heat output
  - residence time

Higher residence time affects:

- Fire suppression personnel
- Tree mortality

Research project objectives

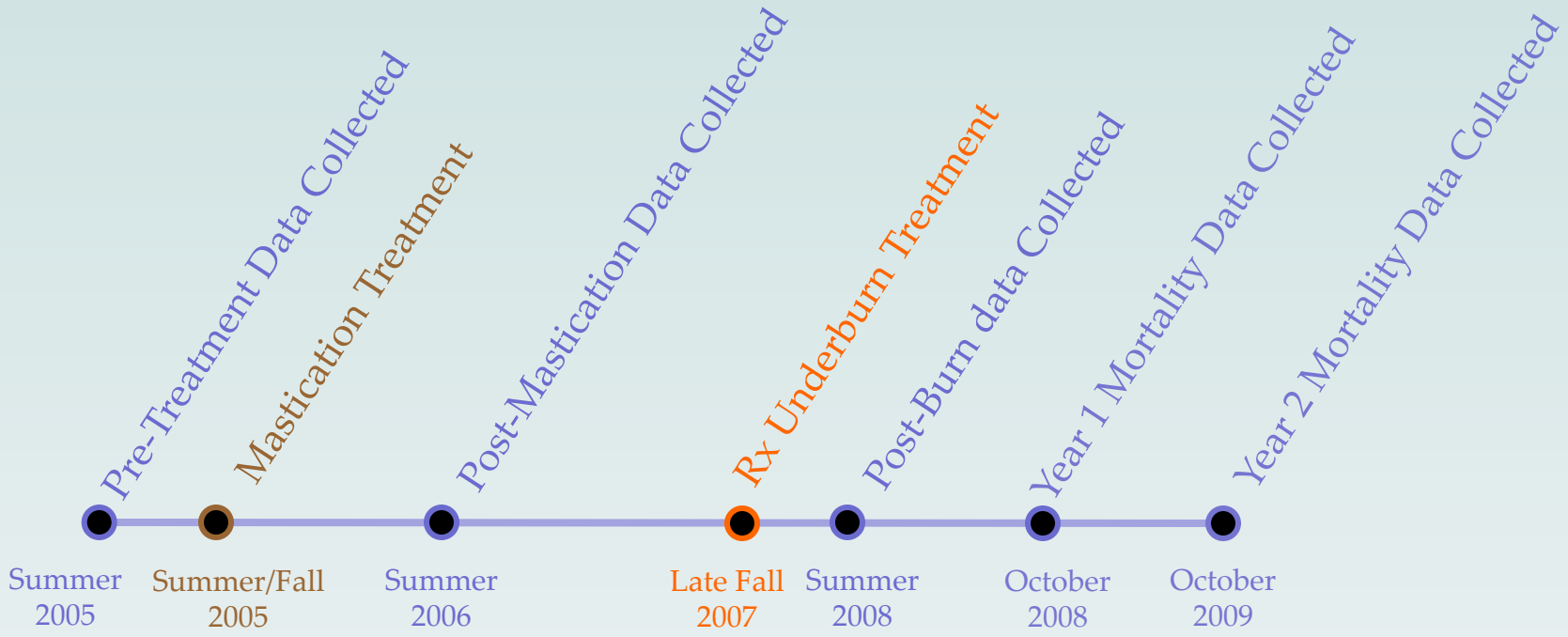
1. Determine the effectiveness of using mastication alone or mastication in combination with prescribed burning
   a. Fuels
   b. Potential fire behavior
2. Quantify effects of mastication and mastication with prescribed burn treatments on tree mortality

Study design

- Random block design
- 4 blocks randomly divided into 1 control + 3 treatments , with 4 plots each
- Total 16 plots/treatment

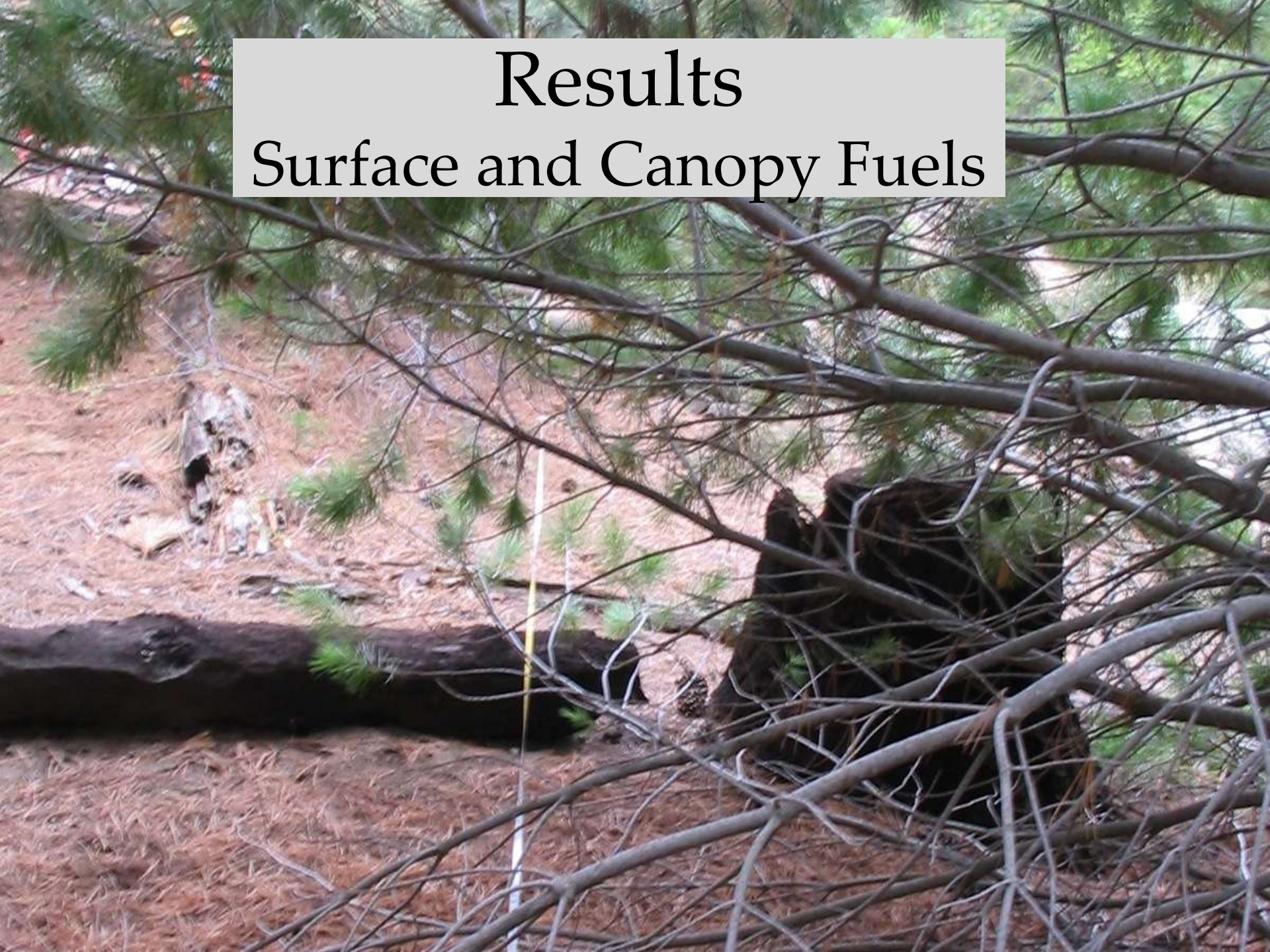
1) Control (no treatment)
2) Masticate
3) Masticate + burn
4) Masticate w/pull back + burn

Timeline


Pre-Treatment Data Collected
Mastication Treatment
Post-Mastication Data Collected
Rx Underburn Treatment
Post-Burn data Collected
Year 1 Mortality Data Collected
Year 2 Mortality Data Collected
Summer 2005
Summer/Fall 2005
Summer 2006
Late Fall 2007
Summer 2008
October 2008
October 2009


Prescribed burn
Dec 5 and 6, 2007

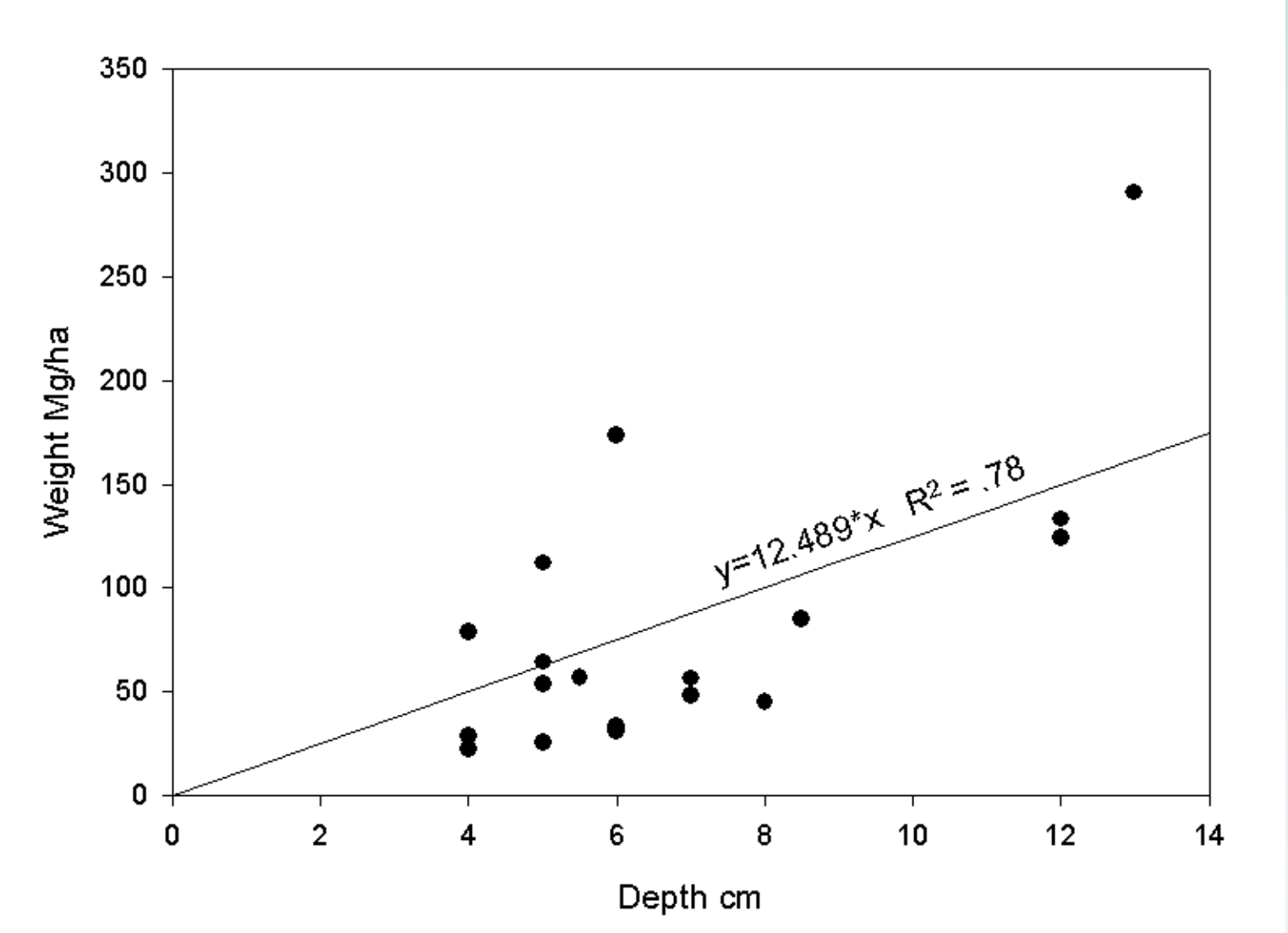

Fire behavior plot
camera & anemometer



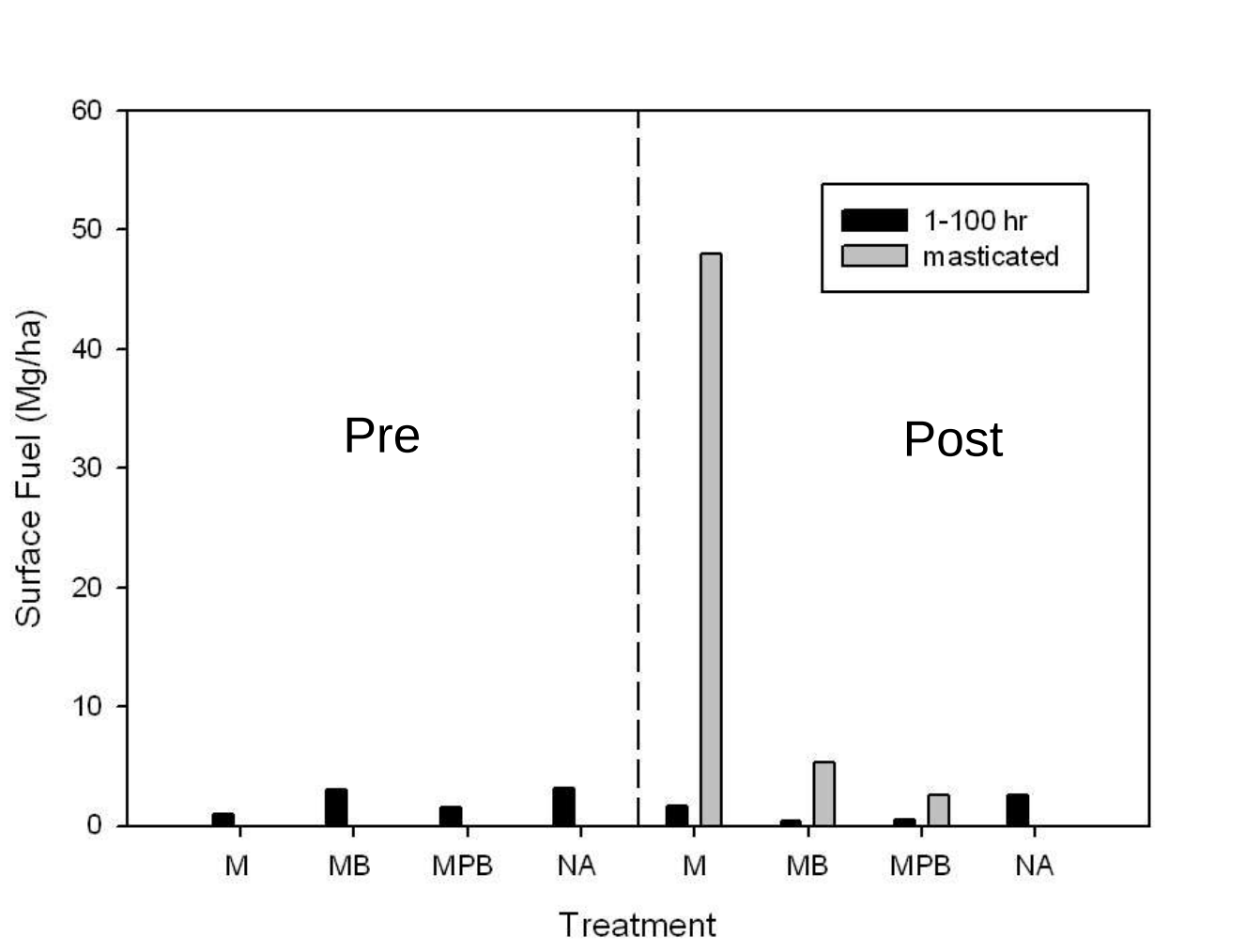
Results

Surface and Canopy Fuels

Depth to weight relationship of masticated fuel bed



Pre and post-treatment surface fuels



Tree height and density

Year	Treatment	Average height (m)	Trees (ha^{-1})
Pre-treatment (2005)	Masticated	7.9 (0.7)c	956 (20)a
	Masticated/fire	8 (0.3)c	937 (9)a
	Masticated/pull-back/fire	9.2 (0.5)abc	911 (12)a
	Control	8.7 (0.6)bc	833 (11)a
Post-treatment (2008)	Masticated	12.7 (0.8)a	270 (32)b
	Masticated/fire	11.6 (0.5)ab	208 (71)b
	Masticated/pull-back/fire	12.1 (0.5)a	229 (84)b
	Control	9.7 (0.6)abc	828 (108)a
	Year*treatment p-value	0.007	<0.001

Photos

Pre-treatment (2005)

Post-mastication (2006)

Post-burn (2008)

Photos

Pre-treatment
(2005)

Post-mastication
(2006)

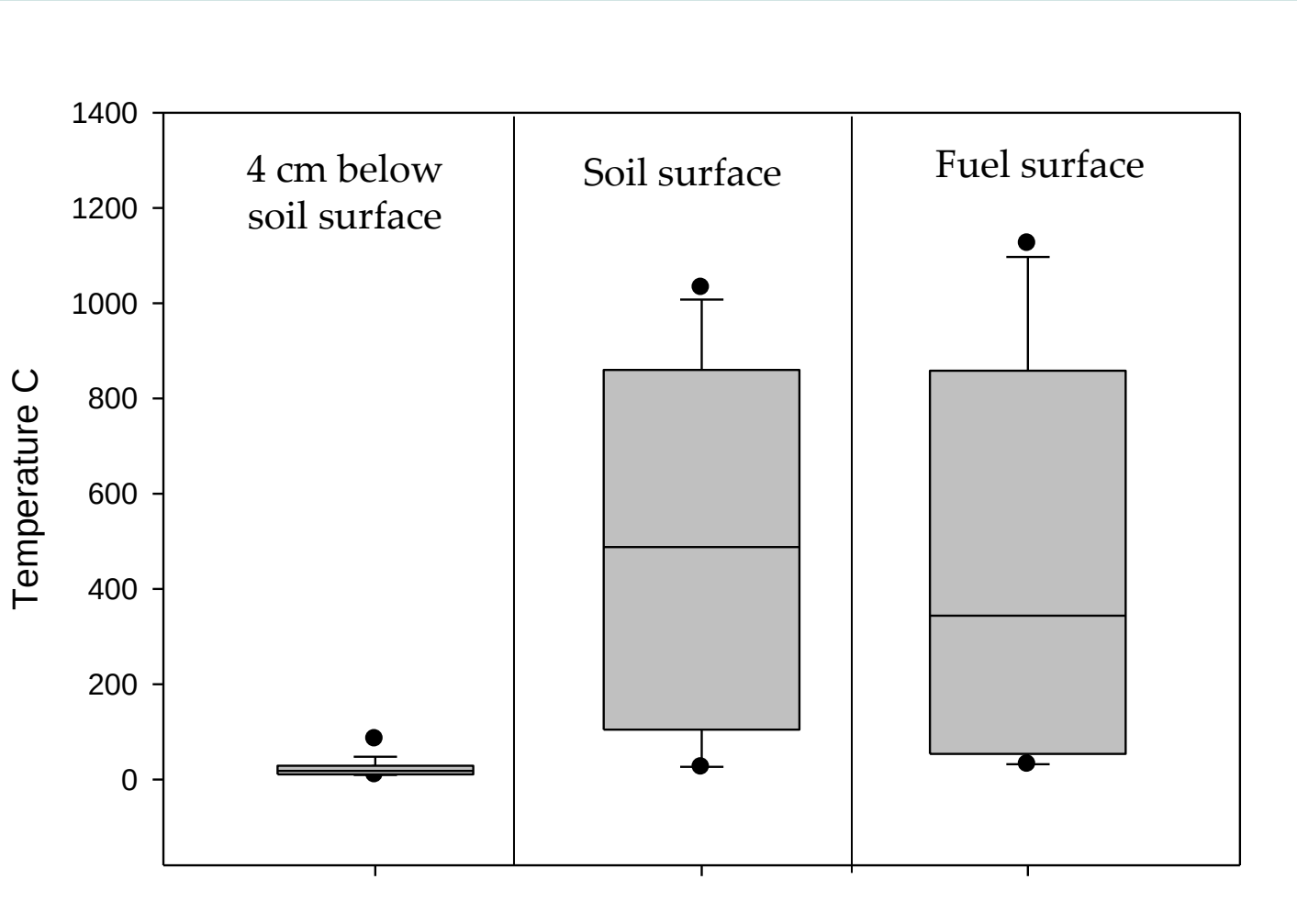
Post-burn
(2008)

Results
Prescribed Fire Behavior Measurements

Results

Prescribed Fire Behavior Measurements

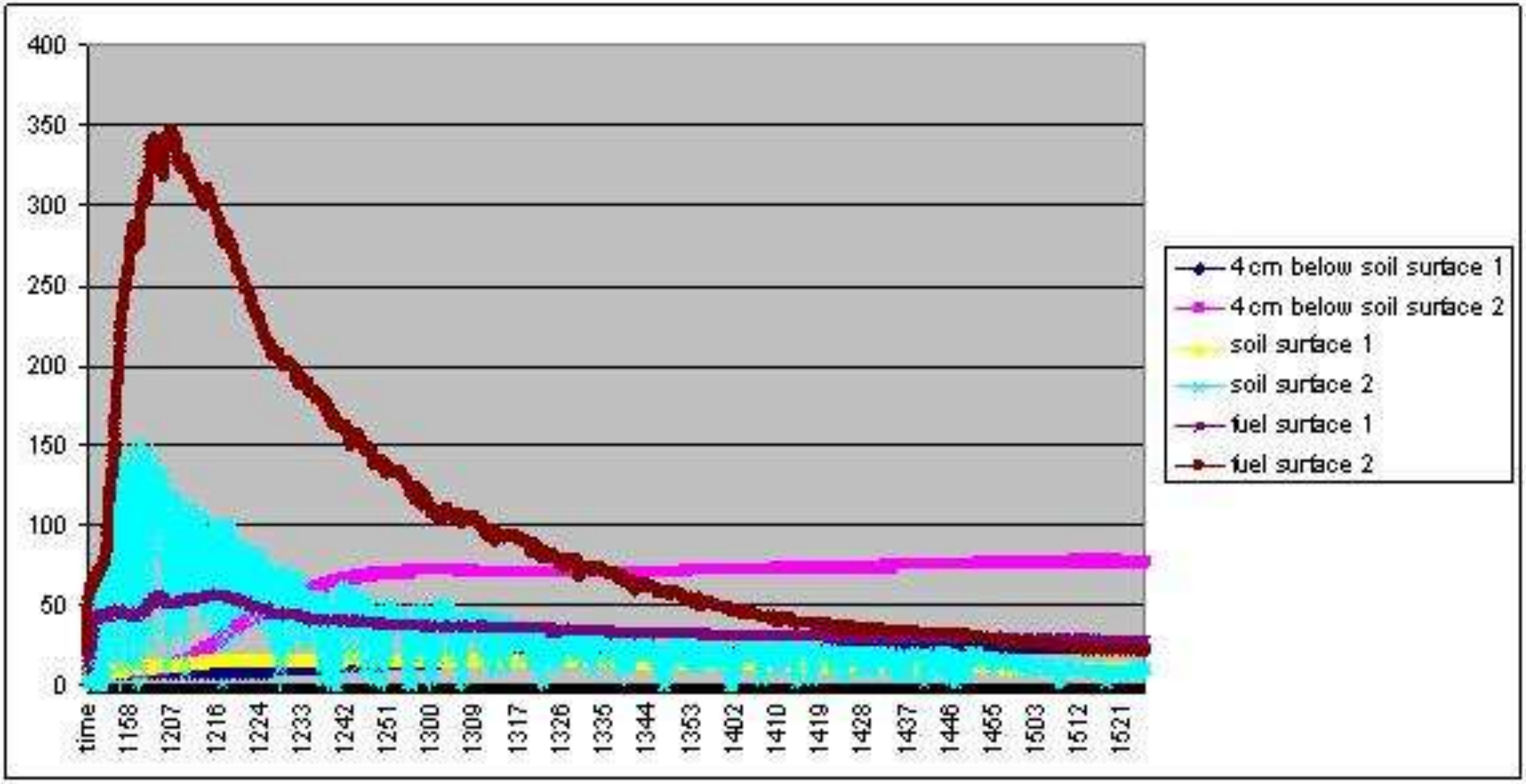
Maximum Temperature



Results

Prescribed Fire Behavior Measurements

Temperature change over time



Results

Potential Wildfire Fire Behavior

Results

Potential Fire Behavior

Flame length and rate of spread, predicted for post-treatment fuel conditions and extreme weather

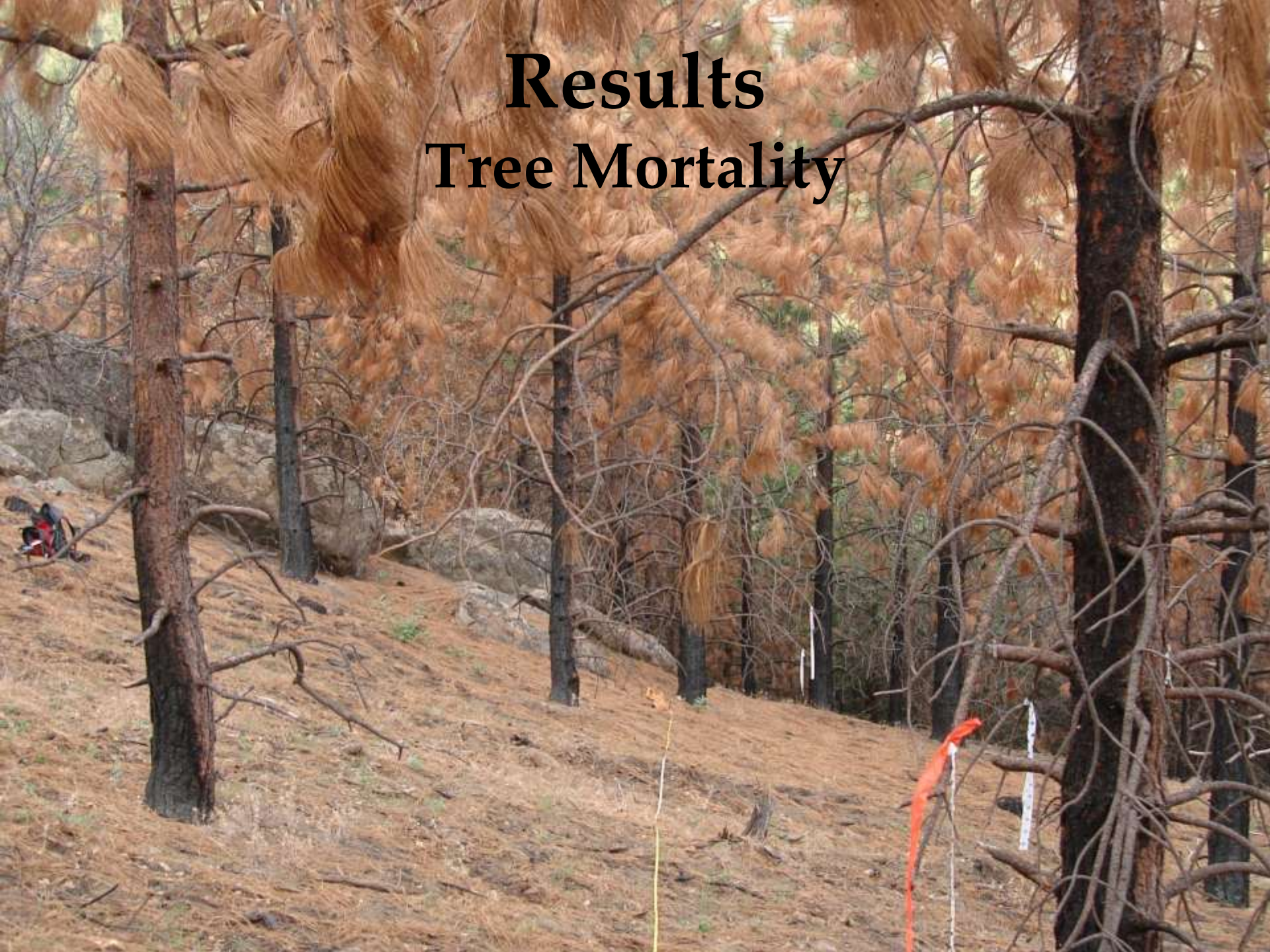
Treatment	Weather scenario	Flame length (m)	Rate of spread (ch/h)
Masticated	90	1.3 (0.2)	10.2 (2.1)
Masticated	97	1.6 (0.3)	16.1 (3.4)
Masticated/burned	90	0.4 (0.2)	2.5 (1.6)
Masticated/burned	97	0.5 (0.2)	4.2 (2.8)
Masticated/pull-back/burned	90	0.2 (0)	0.9 (0)
Masticated/pull-back/burned	97	0.2 (0)	1.3 (0.1)
Control	90	0.5 (0)	3.1 (0.4)
Control	97	0.6 (0.1)	4.7 (0.6)

Results
Potential Fire Behavior

Torching and crowning indices predicted for post-treatment fuel conditions and extreme weather

Treatment	Torching index Mean (SE)	Crowning index Mean (SE)
Masticated	22 (10)	34 (2)
Masticated/burned	73 (7)	38 (4)
Masticated/pull-back/burned	80 (0)	36 (7)
Control	31 (8)	22 (2)

Results
Tree Mortality



Results

Percent standing dead trees

	Masticated	Masticated/ burned	Masticated/ pull-back/ burned	Control
Post-mastication/ pre-burn	2.2(2.2)b	2.4(1)b	1.6(1.3)b	1.9(0.5)b
1-year post-burn	2.2(2.2)b	37.5(7.3)a	28.6(9.5)a	1.4(0.4)b
2-years post-burn	2.2(2.2)b	50.5(8.8)a	37(9.1)a	1.6(0.4)b

Acknowledgements

- **Joint Fire Science**
- **Sequoia National Forest**
- **Thanks to all the field crew members, and Jo Ann Fites-Kaufman, Scott Dailey, Carol Ewell, Todd Decker, Sylvia Mori, Carol Henson, Sid Beckman**

Mastication and prescribed fire impacts on fuels in a 25-year old ponderosa pine plantation, southern Sierra Nevada. Alicia L. Reiner, Nicole M. Vaillant, JoAnn Fites-Kaufman and Scott N. Dailey. 2009. Forest Ecology and Management, Volume 258, Issue 11, Pages 2365-2372.


Questions?
http://www.fs.fed.us/adaptivemanagement/projects/