Fuel loading succession following fuel treatments in California

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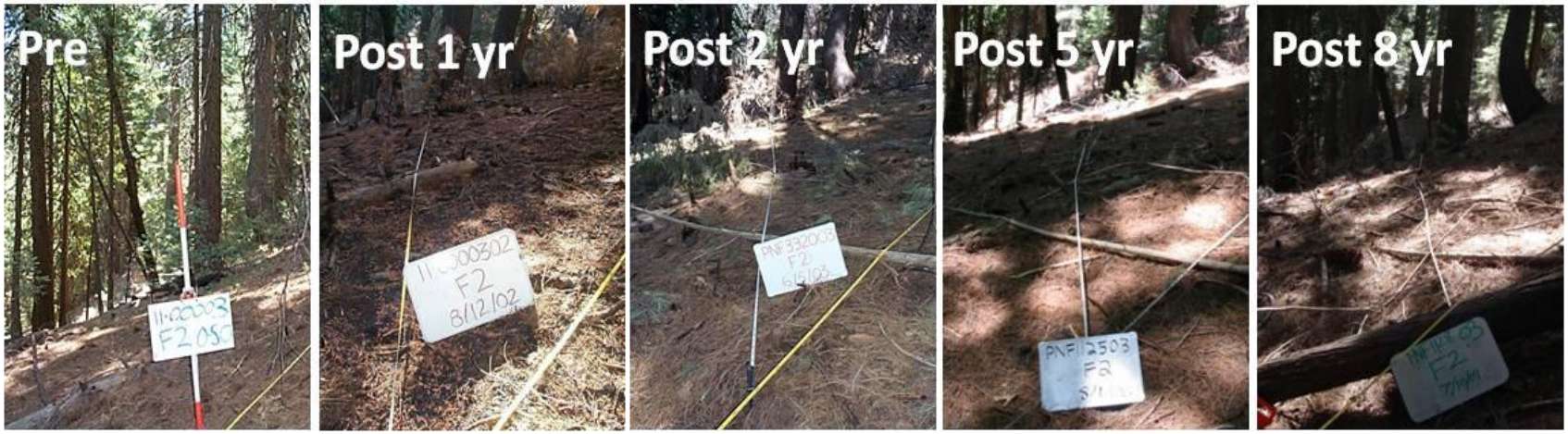
Background

- To date most of research only considers time immediately after treatment
- Fuel treatment longevity is likely to depend on vegetation &/or treatment type
- Need for more monitoring data for both



Background

- Fuel treatment effects & effectiveness monitoring project in R5 started in 2001
- Solicit projects from all NF in CA for all vegetation types
- Initially just Rx fire, then mechanical as well
- Goal was pre, 1, 2, 5, 10 & 20 yrs post
- Pre-treatment data collected on 50 fuel projects on all NF in CA in many vegetation types
- Funded by R5 FAM until 2006

Background

- Pre- and 1-year post data
- Mechanical trts sig change all stand metrics Rx fire only CBH

Table 4. Pre- and post- treatment average (standard error) stand characteristics for the five forest-treatment combinations. Due to changes in sampling procedure, not all plots had tree data collected. Sample size (number of plots) for each forest-treatment combination is noted in the table.

Forest-treatment[1]	Status	Tree density (ha^{-1})	Canopy cover (%)	Canopy base height (m)	Canopy bulk density ($kg\ m^{-3}$)	Quadratic mean diameter[2] (cm)
SN-MT $n = 6$	Pre	1201 (183)[a]	71 (11)[a]	1.2 (1.8)[a]	0.104 (0.006)[a]	17.8 (7.6)[a]
	Post	578 (141)[a]	54 (11)[a]	3.4 (3.0)[a]	0.066 (0.014)[a]	25.4 (7.6)[a]
LN-MT $n = 14$	Pre	427 (126)[a]	60 (7)[a]	4.0 (1.2)[a]	0.054 (0.005)[a]	38.1 (5.1)[a]
	Post	183 (96)[a]	34 (8)[a]	7.6 (2.1)[a]	0.039 (0.007)[a]	45.7 (5.1)[a]
RF-MT $n = 6$	Pre	893 (198)[a]	38 (13)[a]	1.2 (2.1)[a]	0.178 (0.0035)[a]	33.0 (7.6)[a]
	Post	561 (151)[a]	28 (12)[a]	4.3 (3.4)[a]	0.122 (0.036)[a]	43.2 (7.6)[a]
SN-PF $n = 10$	Pre	462 (141)	74 (7)	4.3 (1.2)[a]	0.063 (0.009)[b]	35.6 (5.1)[b]
	Post	351 (106)	74 (10)	7.3 (2.4)[a]	0.049 (0.009)[b]	38.1 (5.1)[b]
LN-PF $n = 27$	Pre	408 (86)	49 (5)	3.7 (0.3)[a]	0.084 (0.008)	35.6 (2.5)
	Post	356 (69)	46 (6)	6.1 (1.5)[a]	0.074 (0.007)	38.1 (2.5)

[1] SN, short-needle; LN, long-needle; RF, red fir; MT, mechanical treatment; PF, prescribed fire
[2] 75th percentile quadratic mean diameter
[a] denotes a significant difference ($p < 0.01$) and [b] denotes a significant difference ($p < 0.05$) before and after treatment for the given forest-treatment combination for the specific metric

(Vaillant et al.2009)

Background

- Pre- and 1-year post data
- Rx fire more effective at reducing surface fuels

Table 5. Pre- and post- treatment average (standard error) surface and ground fuel loads for the five forest-treatment combinations. Number of plots for each forest-treatment combination is noted in the table. SN, short-needle; LN, long-needle; RF, red fir; MT, mechanical treatment; PF, prescribed fire.

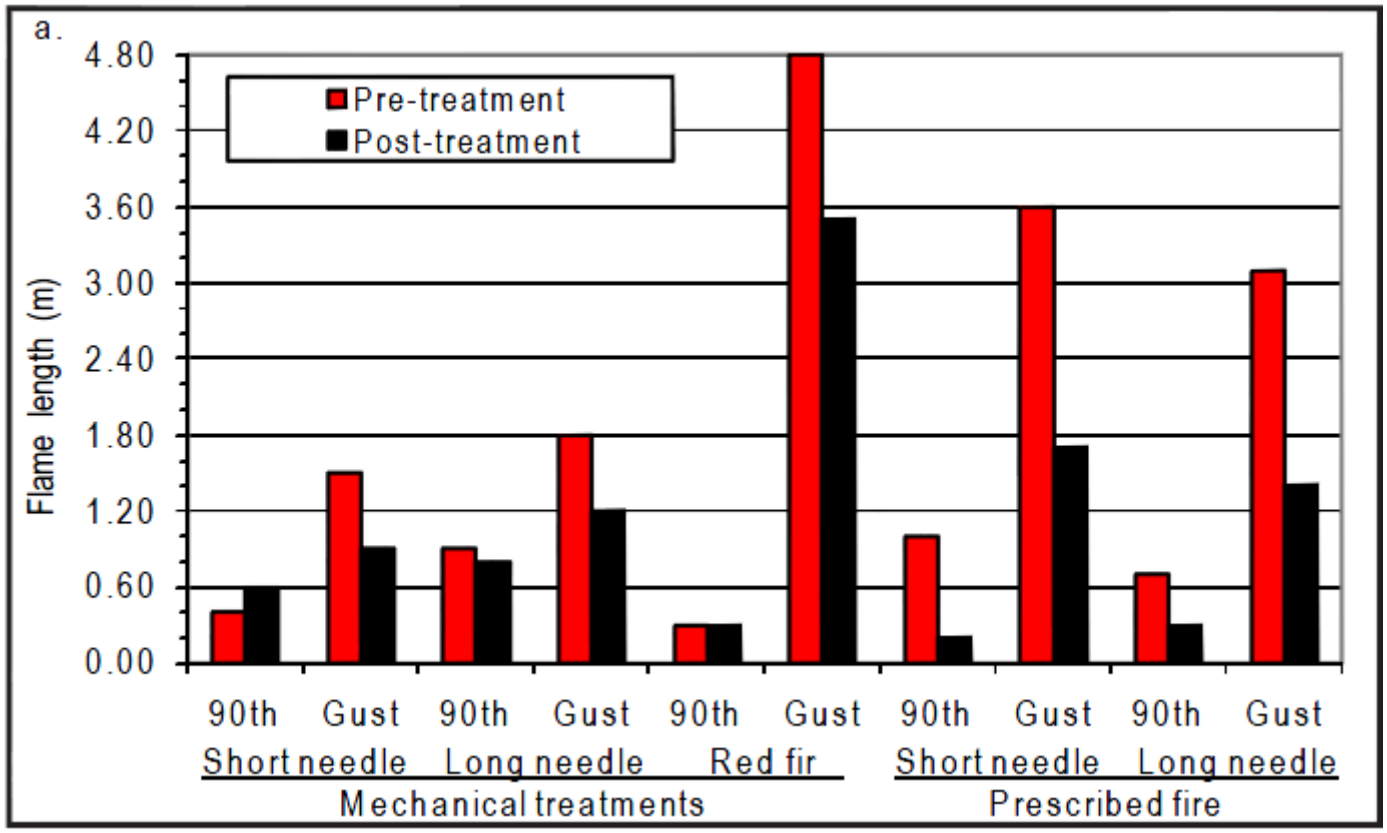
Forest-treatment	Status	Duff	Litter	1 h	10 h	100 h	1000 h	Fuel bed depth cm
		t ha^{-1}						
SN-MT $n = 11$	Pre	58.3 (22.4)	39.7 (4.0)	1.1 (0.2)	2.5 (1.6)[b]	3.4 (2.2)	33.6 (40.4)[a]	18.3 (9.1)
	Post	56.0 (13.5)	67.3 (2.2)	1.6 (0.3)	4.7 (1.3)[b]	6.5 (2.2)	47.1 (0.2)[a]	18.3 (2.7)
LN-MT $n = 18$	Pre	121.1 (15.7)	185.2 (2.7)	0.2 (0.2)	2.9 (1.1)[a]	3.6 (1.6)[a]	42.6 (29.1)	15.2 (6.1)
	Post	103.1 (11.2)	141.2 (17.9)	0.7 (0.2)	7.4 (1.1)[a]	10.3 (1.8)[a]	17.9 (0.2)	21.3 (2.1)
RF-MT $n = 11$	Pre	87.4 (26.9)	26.2 (4.7)	1.3 (0.4)	5.6 (2.0)	4.7 (2.5)	42.6 (49.3)	15.2 (9.1)
	Post	89.7 (15.7)	25.1 (2.5)	1.8 (0.4)	6.5 (1.3)	5.4 (2.5)	24.7 (0.4)	12.2 (2.7)
SN-PF $n = 12$	Pre	130.0 (13.5)[a]	116.3 (2.5)[a]	1.3 (0.2)[a]	9.0 (1.1)[a]	9.6(1.3)	98.6 (26.9)[a]	18.3 (6.1)[a]
	Post	44.8 (11.2)[a]	9.6 (2.0)[a]	0.2 (0.2)[a]	2.5 (1.1)[a]	4.9(2.0)	4.5 (0.2)[a]	9.1 (2.4)[a]
LN-PF $n = 30$	Pre	94.2 (9.0)[a]	133.2 (1.8)[a]	0.7 (0.1)	3.6 (0.7)[b]	3.8 (0.9)	29.1 (17.9)	24.4 (3.0)[a]
	Post	40.4 (9.0)[a]	14.6 (1.3)[a]	0.2 (0.2)	1.8 (0.7)[b]	3.4 (1.3)	15.7 (0.2)	6.1 (1.5)[a]

[a] denotes a significant difference ($p < 0.01$)
[b] denotes a significant difference ($p < 0.05$) before and after treatment for the given forest-treatment combination for the specific metric

(Vaillant et al.2009)

Background

- Pre- and 1-year post data
- Both reduce flame length/intensity except SN-MT



(Vaillant et al.2009)

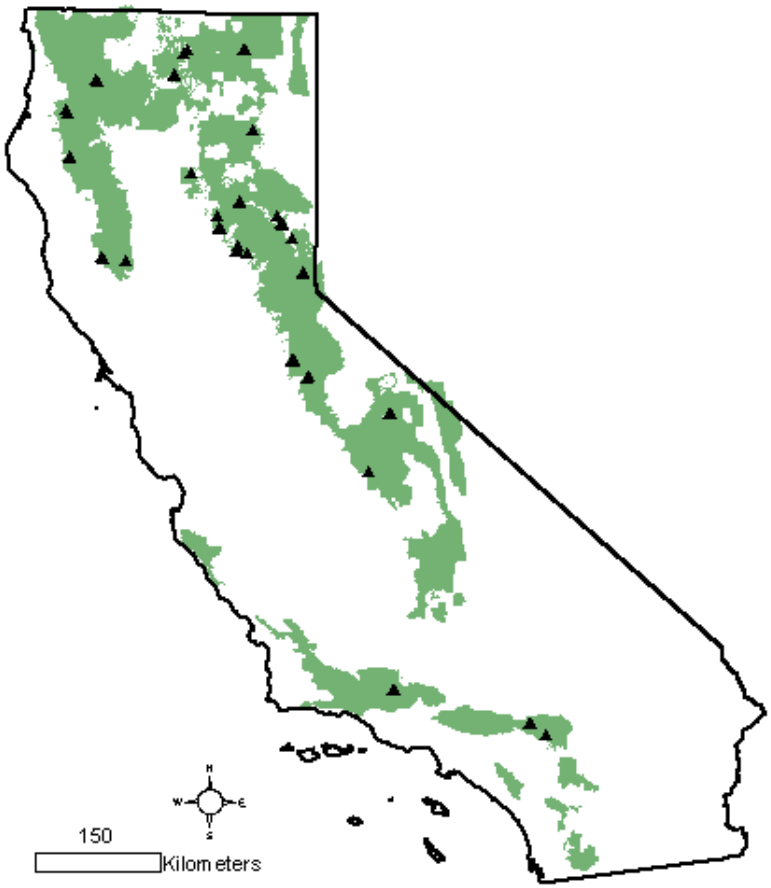
2008 JFSP RFA

Task 1A – Lifecycle fuels treatment

- What is the length of time that fuel treatments are effective in reducing undesired fire effects and fire behavior, and how does treatment effectiveness change over time and by treatment type?
- What re-treatment intervals are needed for various treatment types to maintain desired fire behavior?
- What are the costs associated with different treatment types and re-treatment intervals, and what are the least-cost re-treatment intervals to ensure fire behavior remains within a desired range?
- What are the key uncertainties associated with analyses of treatment effectiveness, longevity, and maintenance?

Background

- Continued with published data set
- 14 National Forests
- 28 fuel treatment projects
- 89 plots sampled at multiple time periods
  - Total of 356 data points



Methods

The plots have been stratified by:

Dominant forest type

- Douglas-fir (53)
- Yellow pine (106)
- Mixed conifer (161)
- Red fir (36)

Treatment type

- Fire only (167)
- Overstory only (14)
- Overstory + fire (12)
- Overstory + non fire (128)
- Mastication (35)

Methods

- Random plot location within treatment
- 3-6 plots depending on year
- 2 types of plots – detailed & fuels
  - Detailed includes overstory tree sampling (n=277)
  - Fuels do not (n=79)
- Actual fuel loading
  - Live & dead
- FVS for canopy calcs.

Research Question

Objective – Determine length of time fuel treatments are effective at reducing undesirable fire behavior.

1) Measuring changes in fuel accumulation

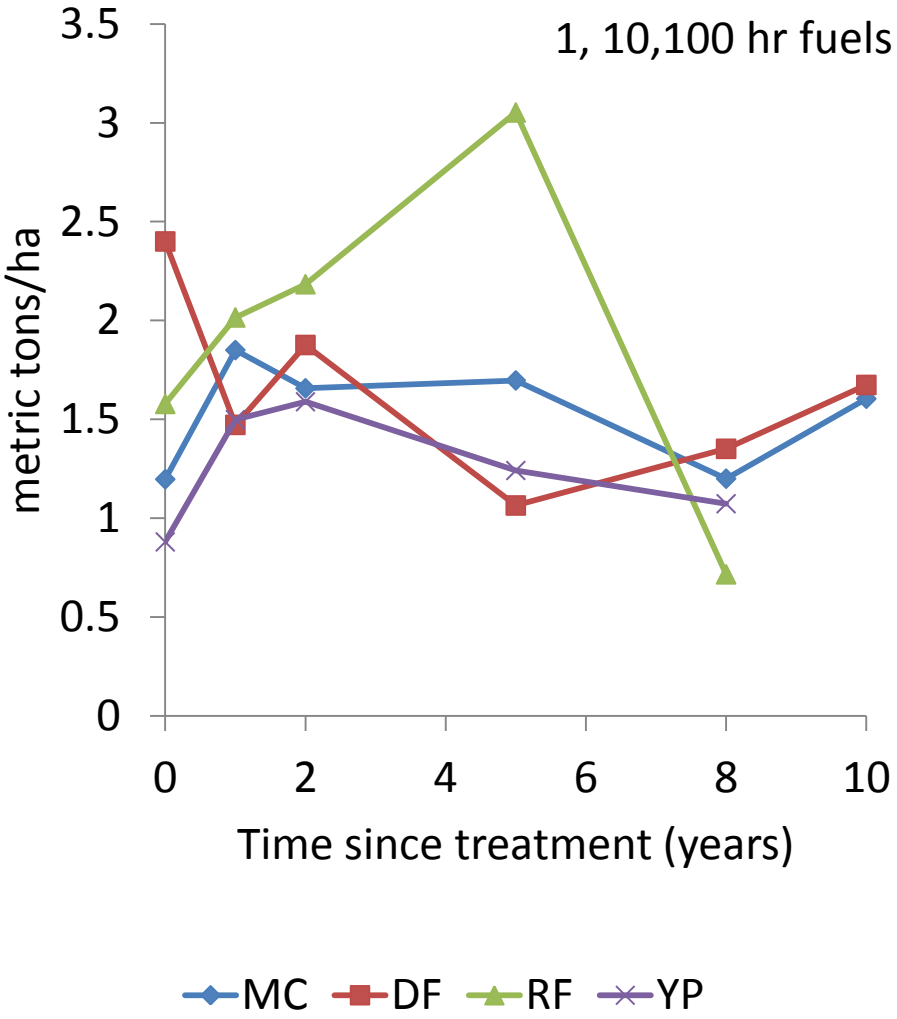
-Forest structure, live fuels, & downed fuels

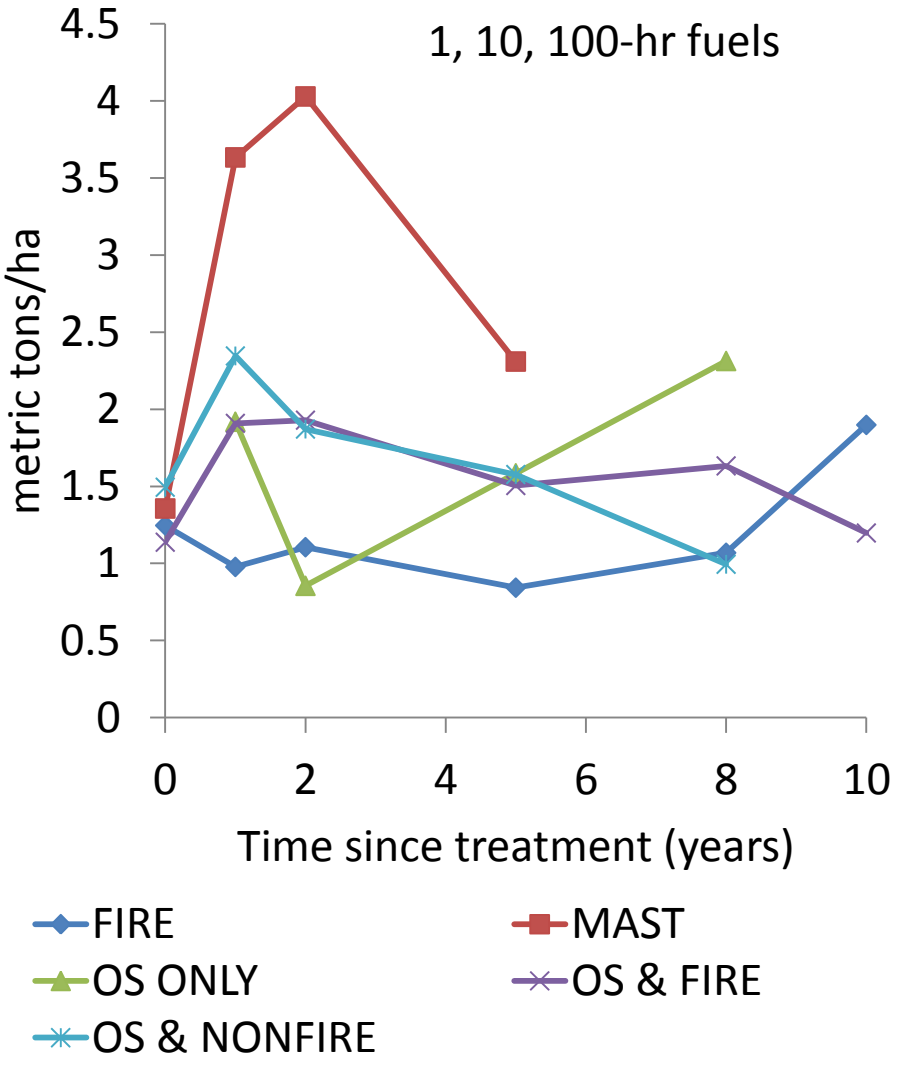
2) Modeling potential fire behavior

-Using standard & custom fuel models

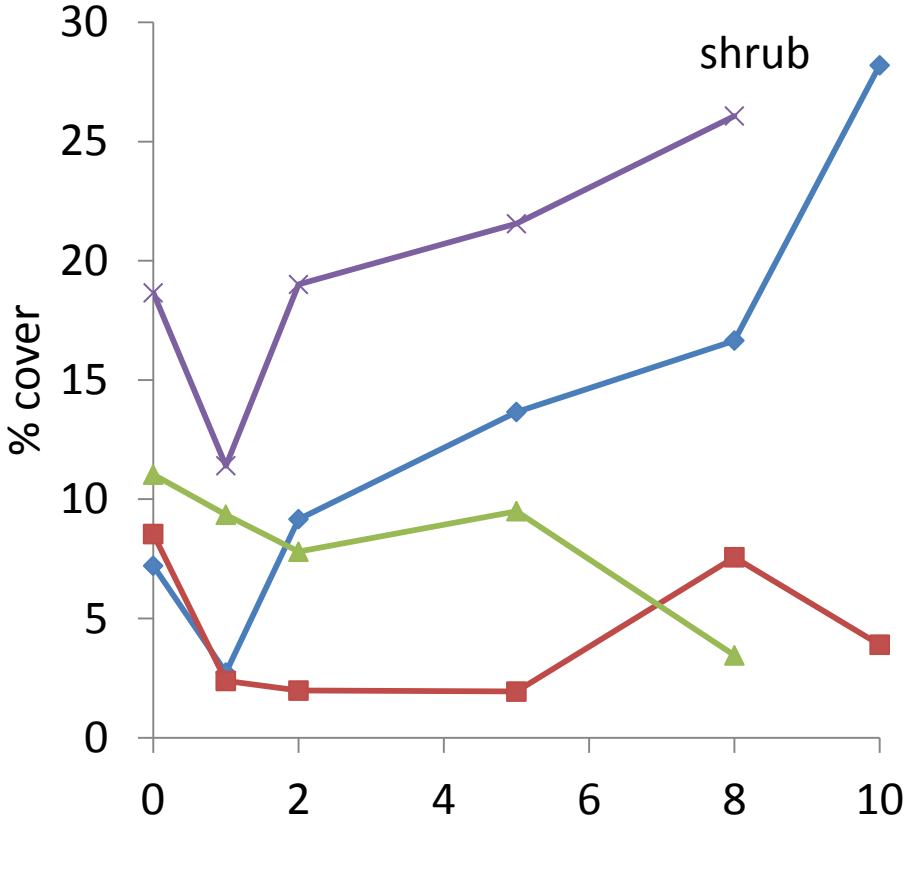
Comparisons between veg types, trt types & veg-trt types

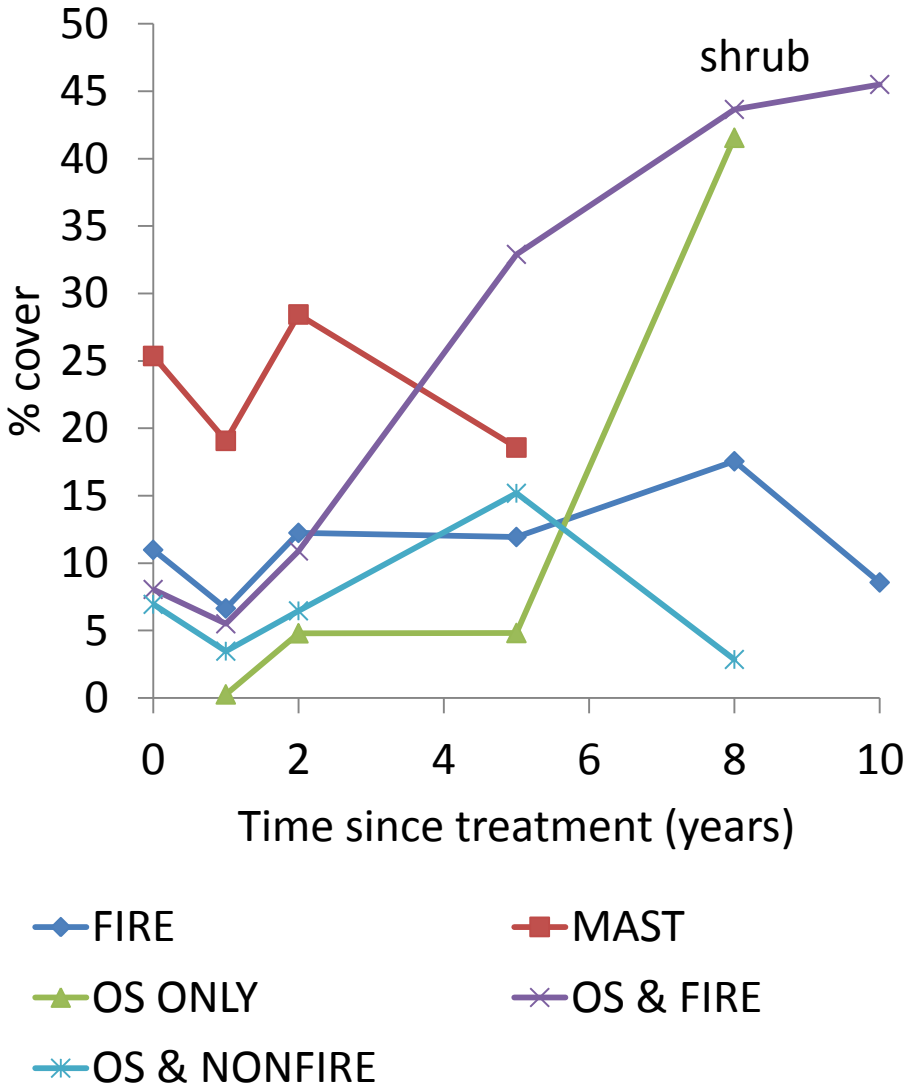
Surface fuel loads



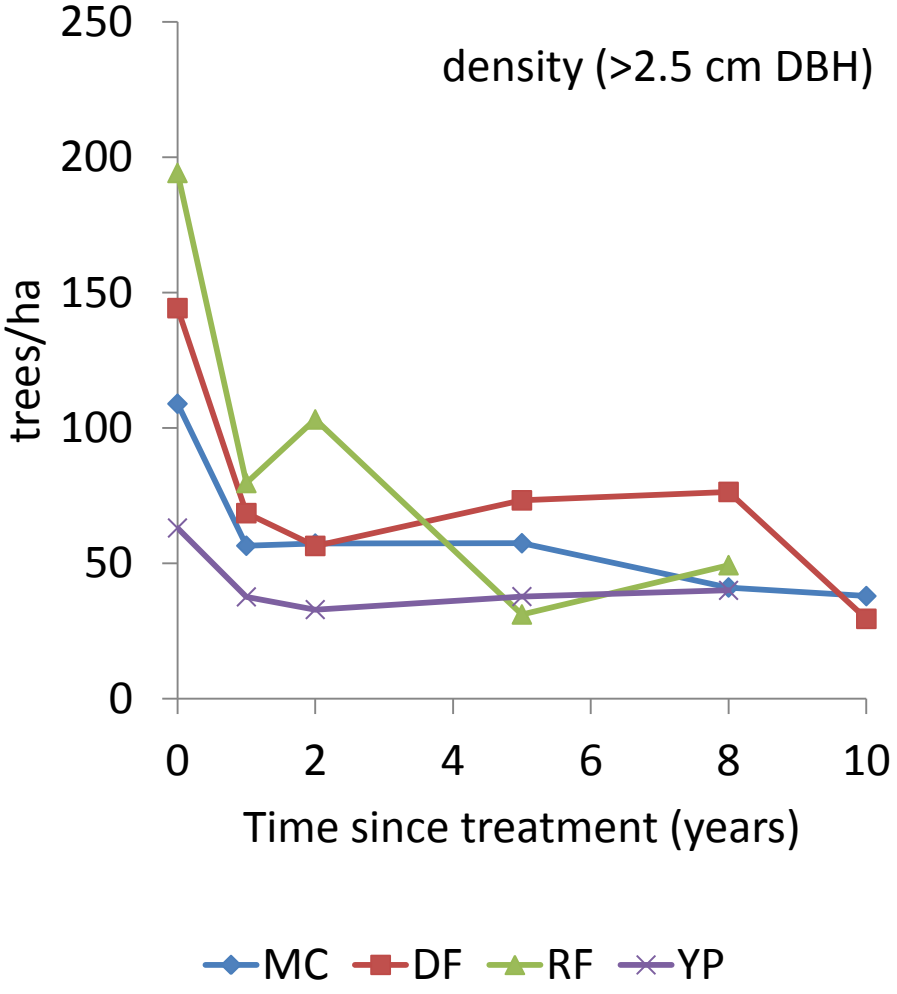


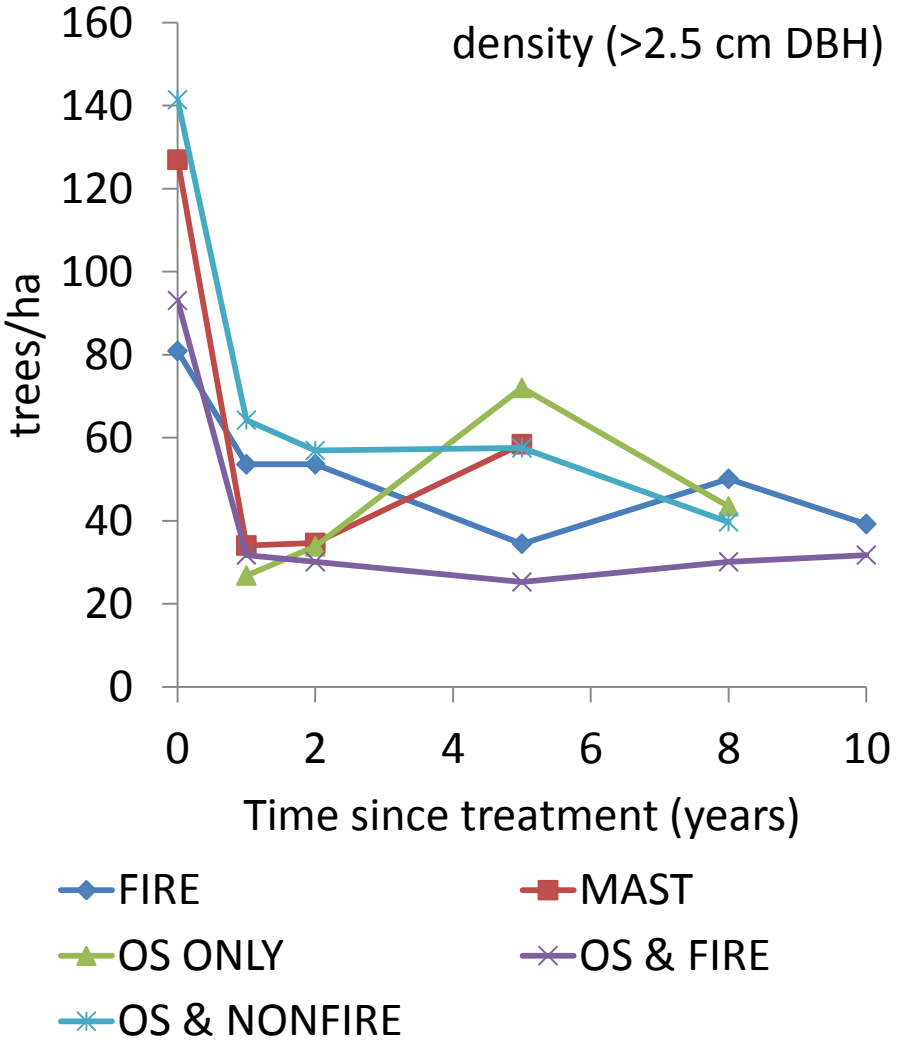
Shrub cover


shrub
% cover
30
25
20
15
10
5
0
0
2
4
6
8
10
Time since treatment (years)
MC
DF
RF
YP

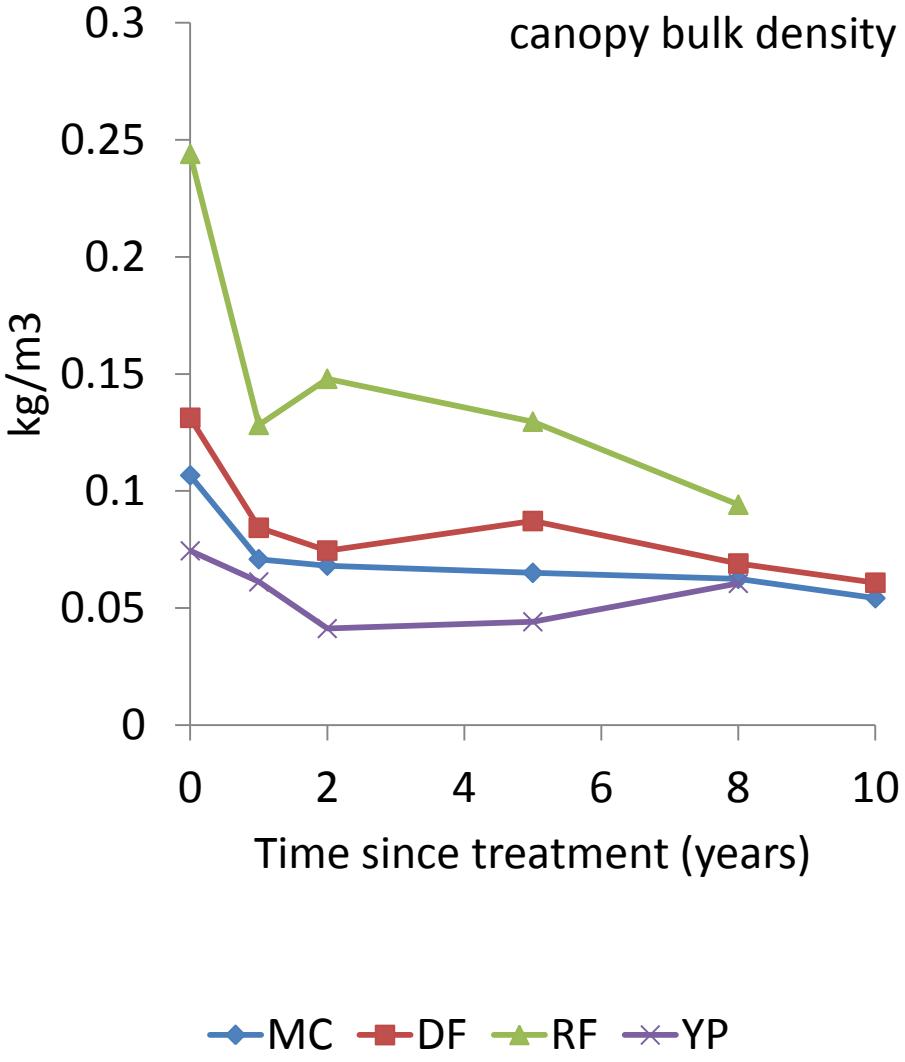

shrub
% cover
50
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
Time since treatment (years)
FIRE
MAST
OS ONLY
OS & FIRE
OS & NONFIRE

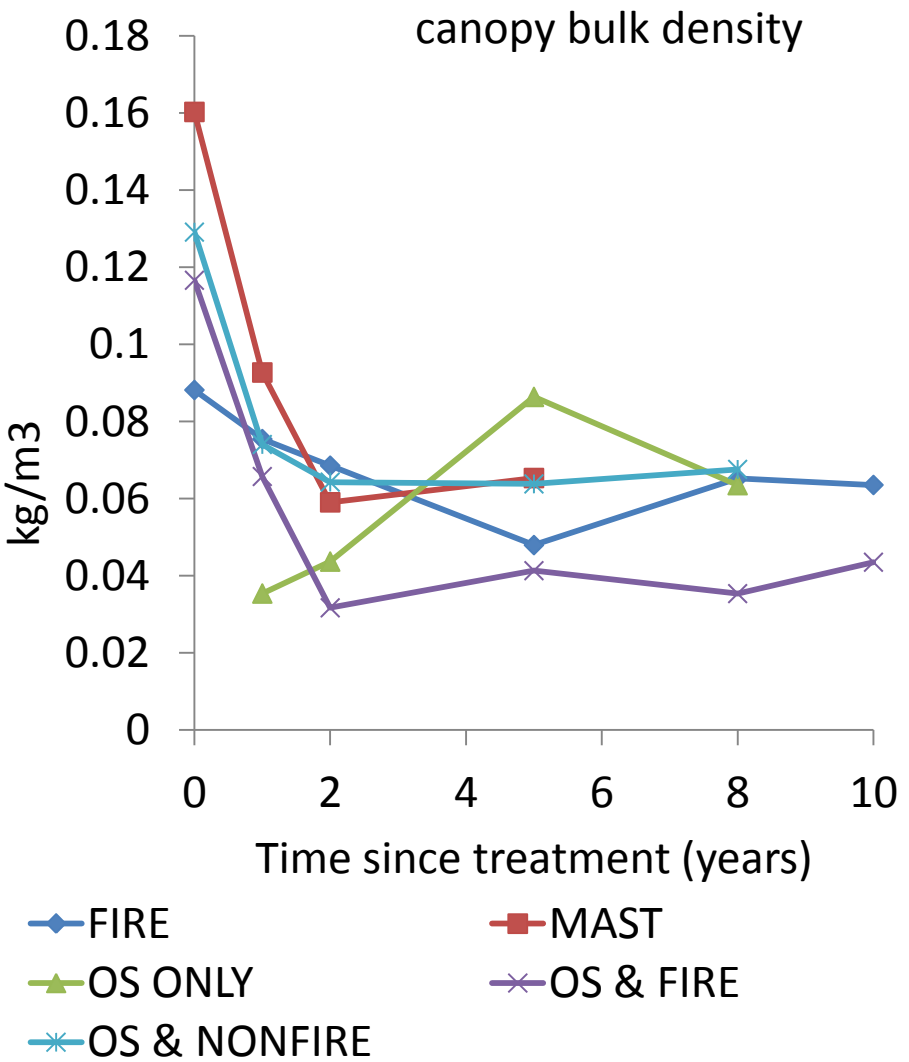
Tree density





Canopy bulk density





Challenges

- Re-treatment – great for the forests, not so great for the research
- Many of the plots were retreated – not a very "long term" look

Sample size by years since treatment				
1	**2**	**5**	**8**	**10**
97	95	57	42	5

Acknowledgements

- Join Fire Science JFSP-09-1-01-1
- Region 5 FAM
- JoAnn Fites-Kaufman, retired AMSET
- Forest fuels, fire, GIS, silviculture staff
- Field crews