



KLAMATH FIRE ECOLOGY PROGRAM

2012 ANNUAL REPORT



A. Summary

The 2012 season was a year of change for the Klamath Network Fire Ecology program, as it included the hiring of new fire ecologist, Eamon Engber, after a season of vacancy in fire ecology and fire effects. Eamon spent considerable time becoming familiar with KLMN parks and the vegetation types, plot networks, and past fire ecology work completed by former fire ecologists, leads, and seasonals. Jen Beck (former fire ecologist) and Becky Smith (former lead fire effects monitor) left a legacy in the network, punctuated by attention to detail, organization, a staggering amount of collected data, and a commitment to fire effects monitoring.

The 2012 season was the first in which there was a fire ecologist but no fire effects crew at REDW, necessitating creative measures to accomplish high priority monitoring needs in the network. The SFBAN fire effects crew, with Kristin Shive (acting fire ecologist) leading seasonals Monica Delmartini and Jenny Cribbs, helped complete post-fire sampling needs at REDW June 18 – 25 (6 FMH forest plots, 4 grass plots, multiple rainy days), and battled poison oak and rattlesnakes sampling post-fire and post-thinning plots at WHIS May 29 – June 1 (4 FMH forest plots and 11 photo points). Sampling efforts at REDW were further supplemented by the venerable plant ecologist, S. Samuels, along with seasonals from Veg. and Fire. The Southern Cascades fire effects crew, consisting of seasoned veterans Todd Erdody and Christy Frenzen, assisted the fire ecologist with fieldwork at WHIS and also sampled three post-fire forest plots at ORCA July 26 – 28. Data entry couldn't have been completed without assistance from Wende Rehlaender from SFBAN, who managed to enter most of the 2012 data as well as those lingering from 2011.

The fire ecologist assisted with planning and support needs in the network, making progress on READ guides and kits for REDW and WHIS, monitoring plan updates for WHIS (ORCA still in progress), scientific integrity and peer review standards planning at REDW, and fire behavior modeling for REDW burn plans. Attention was also focused on fire ecology outreach and education in the network, with two weekend field trips to WHIS (with ecologist J. Gibson), hosting students from San Francisco State University and Humboldt State University; one fieldtrip at REDW with Humboldt State students; and one fire ecology presentation for a College of the Redwoods environmental science class. The fire ecologist maintained collaboration with the larger fire ecology and management community by joining the steering committee of the Northern California Prescribed Fire Council and attending the fall meeting in South Lake Tahoe, CA Nov. 8 – 9, and also attending the AFE 5th International Fire Ecology and Management Congress Dec. 3 – 7 in Portland, OR. Fire community support was further provided by serving on a review panel for the JFSP Graduate Research and Innovation (GRIN) program.

The fire ecologist attended multiple trainings in 2012; Resource Advisor training was a highlight, and newly developed skills were put to use as a READ on the Reading Fire in LAVO as well as the Chips Fire on the Plumas and Lassen national forests. After serving as a READ on the Reading fire, he transitioned to the BAER team and assisted with the development of the vegetation portion of the BAER plan. In late October, the fire ecologist had an opportunity to travel to GRCA with REDW fire staff to participate in the 2,278 acre Range prescribed fire as a FEMO; this turned out to be a great assignment with many learning opportunities.

Over the course of the 2012 season, the fire ecologist became familiar with past monitoring data collected in the network and with past research projects, and worked to identify future monitoring and research needs as well as future funding sources. Collaborations with Dr. Jeff Kane at Humboldt State University and Dr. Phil van Mantgem with USGS resulted in the submittal of three Reserve Fund fire research proposals (girdling effectiveness on invading conifers and hardwoods; fire effects in second growth redwood forests; climate change and fire severity in the KLMN). The fire ecologist also worked with the vegetation ecologist at REDW to develop a restoration thinning proposal for 150 acres of Jeffrey pine savanna occurring on serpentine soils (submitted in the SCC under *ONPS*, and still in the running!), and worked with the forester at REDW to develop an experimental oak thinning proposal (SCC *rotating resource base*; not funded). Additionally, a previously submitted fuels and LiDAR proposal for WHIS was re-submitted by J. Gibson with assistance from the fire ecologist.

In addition to proposal development, the fire ecologist established new research and monitoring protocols at REDW. The first was a 1000-hr fuel moisture monitoring protocol for second growth redwood/Douglas-fir/tanoak forests, a vegetation type in which REDW Fire Management would like to apply more prescribed fire. Briefly, seasoned 4 – 8 inch diameter Douglas-fir poles were placed at key locations in second growth burn units, and will be sampled in conjunction with duff moisture (using a Campbell Sci. Duff Moisture Meter) throughout the 2013 fire season. A second research project entailed a continuation and modification of small Douglas-fir mortality monitoring at REDW, to more appropriately address drivers of post-fire tree mortality (e.g., crown scorch and consumption; figure 1). This project builds on a small study by Engber and Varner that was published in 2012. Lastly, the fire ecologist worked to finalize a California oak flammability study with Humboldt State University, also published in 2012 (Engber and Varner).



Figure 1. Post-fire scorch on invading conifers in the 2012 Williams Ridge Rx burn, REDW.

Table 1. Fire Effects Plot Workload (2012) and Total Plots Installed⁺

Park	Monitoring Unit	Type of Plot	Pre-burn 2012	Immed. Post 2012	Postburn (1-20 yrs) 2012	Annual total (2012)	Total Plots
Redwood National Park	Mixed Prairie (GMIPR1D03)	FMH Grass plot	0	1	7	8	38
Redwood National Park	Oregon Oak Woodland (FQUGA1D09)	FMH Forest plot	0	0	6	6	26
Redwood National Park	Old Growth Redwood (FSESE1D08)	FMH Forest plot	0	0	0	0	4
Redwood National Park	Fir Plots	Rapid Assessment**	11	7	0	18	60**
Redwood National Park	Wildcat Second Growth	Rapid Assessment	0	0	0	0	10
Whiskeytown National Recreation Area	Whiteleaf Manzanita (BARVIG04)	FMH Brush Plot	0	0	0	0	10
Whiskeytown National Recreation Area	Whiteleaf Manzanita (FARVI1D04)	FMH Forest Plot	0	0	0	0	4
Whiskeytown National Recreation Area	Oak Woodland (FQUKE1D09)	FMH Forest Plot	0	0	0	0	11
Whiskeytown National Recreation Area	Oak Woodland (FQUCH1D09)	FMH Forest Plot	0	0	0	0	2
Whiskeytown National Recreation Area	Ponderosa Pine Forest (FPIPO1D09)	FMH Forest Plot	0	0	2	2	6
Whiskeytown National Recreation Area	Mixed Conifer Forest (FMICO1D08)	FMH Forest Plot (post-thin)	0	0	2	2	18
Whiskeytown National Recreation Area	Knobcone Pine Woodland (FPIAT1D10)	FMH Forest Plot	0	0	0	0	5
Whiskeytown National Recreation Area	East Boundary Mixed oak & conifer	Photo-Point	0	0	11	11	20
Oregon Caves National Monument	Douglas-fir Forest (FPSME1D10)	FMH Forest Plot	0	0	3	3	8
Oregon Caves National Monument	CC-9 Thinning	Rapid Assessment	0	0	0	0	4
Oregon Caves National Monument	Horseshoe Shaded Fuel Break	Rapid Assessment	0	0	0	0	4
Total			11	8	31	50	231

* Pilot sampling plots

**Denotes short-term monitoring (preburn through two years postburn only)

+ FMH plots sampled at REDW and WHIS by SFBAN were included here, but are redundant with SFBAN annual report.

Table 2. Fire Ecology Staffing 2012

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified (Yes or No)	Training and Development
Fire Ecologist	1/1/12	12/31/12	26	Yes	READ, FFI, S-131, S-133, S-290; retirement seminar, NPS-Introduction to PEPC; completed FEMO taskbook, opened FF1 taskbook; AFE Fire Congress, Northern CA Rx Fire Council meeting; MTBS webinar, NPLCC climate change webex meeting

Redwood National Park

The Fire Effects Monitoring program at Redwood contains six monitoring types: Oak Woodland, Mixed Prairie, Old-Growth (inactive), Little Bald Hills (inactive), Fir Plots (short-term monitoring), and Wildcat second growth (inactive). Results are available for Mixed Prairie, Oak Woodland, and Fir Plots. Objectives analyzed prior to 2012 by the former fire ecologist (J. Beck) have been included below (taken from the 2010 Annual Report), along with new analyses. All results shown in Table 3 include 80% confidence intervals of the mean. Minimum sample size has been attained for only the Oak Woodland (FQUGA1D09) monitoring type at 01YR02 (in large part due to the relatively small desired *minimum detectable change* of 10% relative native cover).

Table 3. 2012 Management Objectives and Monitoring Results

Monitoring Unit	Management Objective	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Last Analysis Completed
Mixed Prairie (GMIPR1D03)	1 st Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = +8.6% PRE: 24.2 (21.0—27.3) % cover 01YR02: 26.3 (23.2—29.4) % cover (n= 27 plots, 12 burn units)	Yes	2010 (1991-1999)
	2 nd Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = -1.3% PRE: 26.7 (22.7—30.7) % cover 02YR02: 26.4 (20.9—31.8) % cover (n= 16 plots, 10 burn units)	Yes	2010 (1990-2007)
	3 rd Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = +18.3% PRE: 27.5 (22.7—32.3) % cover 03YR02: 32.5 (27.7—37.4) % cover (n= 13 plots, 6 burn units)	Yes	2010 (1990-2000)
	4 th Burn: Do not reduce	Change in native plant relative	No	2010

Monitoring Unit	Management Objective	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Last Analysis Completed
	native plant relative cover by >10% from preburn levels within two years of the burn.	cover = -10.1% PRE: 34.4 (27.2—41.7) % cover 04YR02: 31.0 (27.0—34.9) % cover (<i>n</i> = 6 plots, 5 burn units)		(1990-2010)
	5 th Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = -6.9% PRE: 26.4 (21.0—31.8) % cover 05YR02: 24.6 (19.9—29.2) % cover (<i>n</i> = 7 plots, 4 burn units)	Yes	2010 (1991-2010)
	6 th Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = -12.2% PRE: 29.3 (23.9—34.7) % cover 06YR02: 25.8 (23.7—27.8) % cover (<i>n</i> = 7 plots, 4 burn units)	No (but close)	2012 (1991-2012)
Oregon Oak Woodland (FQUGA1D09)	1 st Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = -7.8% PRE: 49.8 (45.3—54.2) % cover 01YR02: 45.9 (40.8—51.0) % cover (<i>n</i> = 22 plots, 8 burn units)	Yes	2010 (1991-1999)
	2 nd Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = -7.1% PRE: 48.2 (40.0—56.3) % cover 02YR02: 44.8 (38.8—50.7) % cover (<i>n</i> = 9 plots, 5 burn units)	Yes	2010 (1992-2004)
	3 rd Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = -13.2% PRE: 52.5 (45.8—59.2) % cover 03YR02: 45.6 (40.5—50.6) % cover (<i>n</i> = 13 plots, 5 burn units)	No	2010 (1991-2010)
	4 th Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = -23.4% PRE: 49.6 (40.0—59.1) % cover 04YR02: 38.0 (33.8—42.2) % cover (<i>n</i> = 4 plots, 2 burn units)	No	2010 (1991-2004)
	5 th Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = -23.7% PRE: 42.7 (33.6—51.8) % cover 05YR02: 32.6 (27.2—38.0) % cover (<i>n</i> = 6 plots, 3 burn units)	No	2012 (1992-2012)
	6 th Burn: Do not reduce native plant relative cover by >10% from preburn levels within two years of the burn.	Change in native plant relative cover = -30.9% PRE: 47.4 (40.2—54.6) 06YR02: 32.7 (26.2—39.3) (<i>n</i> = 6 plots, 1 burn unit)	No	2010 (1991-2010)

Redwood – GMIPR1D03 Native Cover

In the 2010 annual report, monitoring data from grasslands that had burned up to 6 times suggested a reduction in relative native plant cover from the pre-burn condition (-29.3%, 3 plots, 2 burn units). In 2012, four more plots that had burned six times were sampled and included in the analysis (total of 7 plots, 4 burn units), and results, though lacking in statistical power, suggest a more modest decrease in relative native cover (-12.2%). Plots below depict absolute native and non-native cover, as well as relative native cover. The decrease in relative native cover in units that have been repeatedly burned (both oak woodland and grassland) warrants further monitoring and will be prioritized in the future.

Figure 2. Absolute native (LEFT) and non-native (RIGHT) plant cover in the GMIPR1D03 monitoring type, pre-burn and 2 years after the 6th burn (n = 7 plots, 4 burn units).

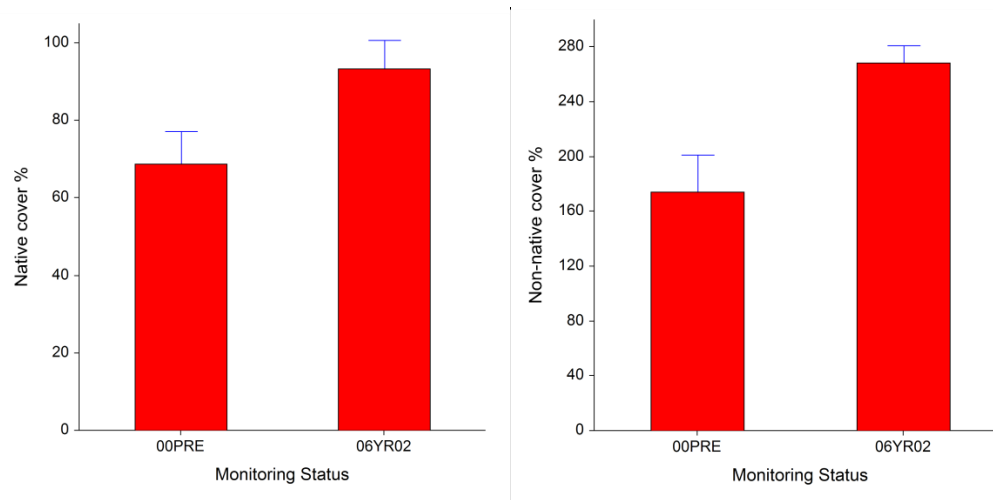
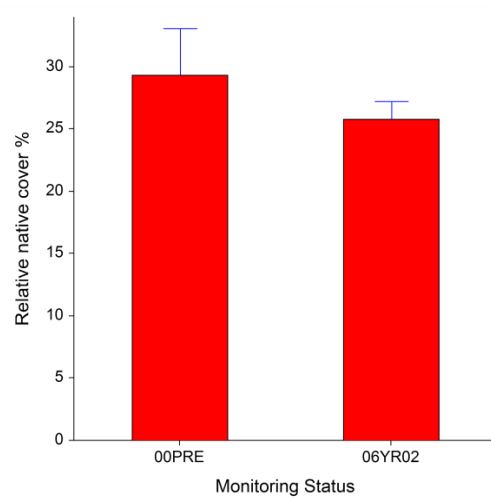


Figure 3. Relative native plant cover in the GMIPR1D03 monitoring type, pre-burn and 2 years after the 6th burn (n = 7 plots, 4 burn units).



Redwood – Fir Plots



Figure 4. Douglas-fir encroachment and scorch in the 2012 Williams Ridge Rx burn in the Bald Hills of REDW.

Douglas-fir (≤ 3 ft tall) density was monitored pre- and 2 years post-burn on 23 plots (0.01 ha in size) in the GMIPR1D03 and FQUGA1D09 monitoring types. Plots were opportunistically installed at random locations in 2008 and 2009 burn units; data are presented for units that burned and were sampled at the 01YR02 event ($n = 9$ burn units). Of the 23 plots, approximately half ($n=12$) were in grassland, the remainder ($n=11$) in Oregon white oak woodland.

Results suggested greater mortality in grasslands and early season (before rain) burns (Table 4 and Figure 5), an intuitive finding given observed differences in fuels (lower live and dead fuel moisture in early burns; more complete fuel consumption in grasslands). The stated objective of 80% reduction in Douglas-fir density was achieved in only the early season grassland burns (-92%). Over the course of the 2 year monitoring period, ingrowth (new recruitment) occurred but was difficult to differentiate from survival since individuals were not tracked at the PRE sample (i.e., trees were not tagged). The high seedling densities observed at 01YR02 in late season burns are driven in part by greater survival, but primarily by ingrowth during the 2 year sampling period. There is also a chance that the visiting monitoring crew at the 01YR02 sample event included more first-year seedlings (i.e., very small seedlings) than the 00PRE event, thereby inflating counts. Current Douglas-fir monitoring protocols are in the process of being modified to include the tagging of a portion of seedlings on plots, assessing crown injury (scorch and consumption) for tagged trees, expanding the sampling frame to include larger seedlings/saplings (> 3 ft tall), and classifying trees by height class.

Table 4. Change in Douglas-fir seedling (<3 ft tall) density (TPA: trees per acre) in oak woodlands and grasslands following fire (N=23 plots, 9 burn units). “Early” and “Late” refer to before- and after-rain burns, respectively.

FQUGA	00PRE tpa	01YR02 tpa	Change %	Objective achieved?
Early n=7 plots	908	613	-32%	NO
SE	161.8	213.3		
80% CI	908 ± 233	613 ± 307		
Late n=4 plots	1679	2276	+36%	NO
SE	687.1	1036.3		
80% CI	1679 ± 1125	2276 ± 1697		
GMIPR				
Early n=5 plots	939	73	-92%	YES
SE	369.2	37.1		
80% CI	939 ± 566	73 ± 57		
Late n=7 plots	642	1185	+85%	NO
SE	129.9	539.7		
80% CI	642 ± 187	1185 ± 777		

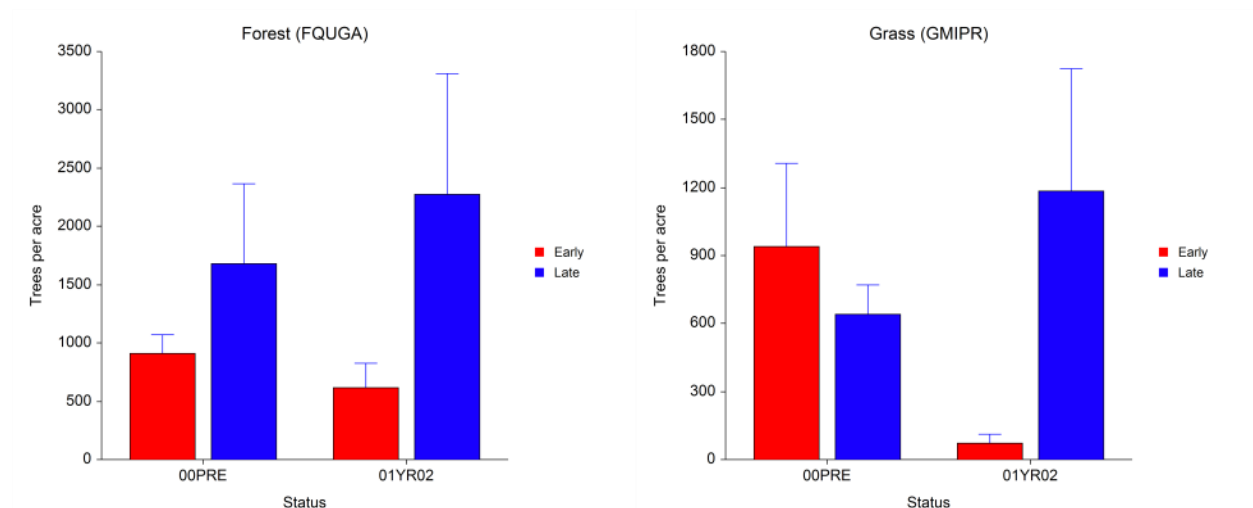


Figure 5. Douglas-fir seedling density in oak woodlands and grasslands, following early (before rain) and late-season (after rain) fall burns.

To assess the drivers of mortality on small Douglas-fir trees, 7 rapid assessment plots were installed in the FQUGA1D09 monitoring type within the Williams Ridge prescribed burn that occurred in October, 2012. Tree size, crown scorch, and crown consumption were recorded and the mortality status of these trees will be tracked until 2 years post-burn. Based on a mortality model for small Douglas-fir (Engber and Varner 2012), about 27% mortality is predicted to occur in the Williams Ridge burn (fig. 6 below), less than the desired objective of $\geq 50\%$ Douglas-fir density reduction in the monitoring type.

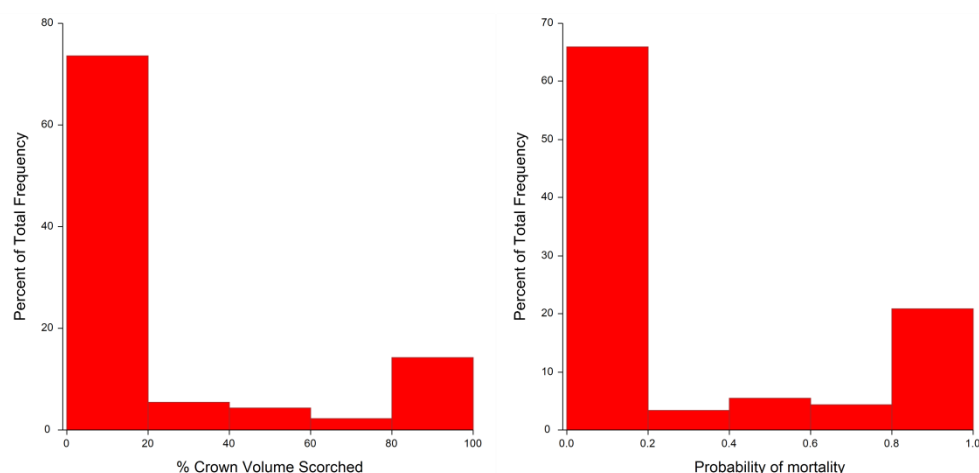


Figure 6. Frequency distribution of crown scorch (LEFT) and predicted mortality (RIGHT) for small Douglas-fir in the Williams Ridge Rx burn. Only about 27% of the small Douglas-fir trees are predicted to die (i.e., 27% of the trees have a mortality probability > 50%). Predictions based on an existing mortality model developed for small Douglas-fir in the Bald Hills area (Engber and Varner 2012).

Whiskeytown National Recreation Area

Whiskeytown contains 6 monitoring types: Black Oak Woodland, Live Oak Woodland, Mixed Conifer, Ponderosa Pine, Chaparral, and Knobcone Pine. Objectives were analyzed in the 2010 annual report by former fire ecologist (J. Beck) and have been included below. The minimal sampling in 2012 did not warrant new analyses of fire management objectives (e.g., there were no new YR02 or YR05 reads). However, initial results from a mixed-conifer thinning project are displayed below, as well as new photo-points and a 10 year post-fire read for two plots sampled in 2012. All results shown in Table 9 include 80% confidence intervals of the mean. Minimum sample size has not been attained for any monitoring type at Whiskeytown.

Table 5. 2012 Management Objectives and Monitoring Results (from 2010 report)

Monitoring Unit	Management Objective	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Last Analysis Completed
Chaparral	Maintain dead surface fuel loading between 2-10 tons/acre	00PRE: 16.2 (11.2—21.3) tons/acre 01POST: 6.2 (0.2—12.1) tons/acre 01YR01: 7.5 (1.1—13.8) tons/acre (n= 4 plots, 2 fires)	Yes	2009
Oak Woodland	Maintain average overstory* tree densities of 5-50 trees/acre *live trees >10" DBH	00PRE: 55 (47—63) trees/acre 01YR01: 42 (33—51) trees/acre 01YR02: 33 (23—42) trees/acre (n= 9 plots, 4 fires)	Yes	2010
	Maintain average overstory* tree densities of 5-50 trees/acre *live trees >10" DBH	00PRE: 59 (46—72) trees/acre 01YR01: 45 (29—62) trees/acre 01YR02: 38 (23—53) trees/acre 01YR05: 41 (31—52) trees/acre	Yes	2010

Monitoring Unit	Management Objective	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Last Analysis Completed
		01YR15: 49 (33—65) trees/acre (<i>n</i> = 5 plots, 1 fire)		
	Maintain average pole-sized* tree densities between 20-100 trees/acre <i>*live trees <10" DBH</i>	00PRE: 318 (240—396) trees/acre 01YR01: 168 (87—249) trees/acre 01YR02: 148 (73—223) trees/acre (<i>n</i> = 9 plots, 4 fires)	No	2010
	Maintain average pole-sized* tree densities between 20-100 trees/acre <i>*live trees <10" DBH</i>	00PRE: 350 (199—501) trees/acre 01YR01: 272 (107—437) trees/acre 01YR02: 239 (85—392) trees/acre 01YR05: 216 (78—353) trees/acre 01YR15: 183 (97—269) trees/acre (<i>n</i> = 4 plots, 1 fire)	No	2010
	Maintain average total dead surface fuel loads between 5-15 tons/acre	00PRE: 20.6 (19.3—21.9) tons/acre 01POST: 3.8 (2.9—4.7) tons/acre 01YR01: 7.6 (4.0—11.2) tons/acre 01YR02: 8.7 (5.6—11.8) tons/acre (<i>n</i> = 9 plots, 4 fires)	Yes	2010
	Maintain average total dead surface fuel loads between 5-15 tons/acre	00PRE: 20.2 (18.0—22.4) tons/acre 01POST: 3.4 (2.3—4.5) tons/acre 01YR01: 10.1 (3.1—16.9) tons/acre 01YR02: 10.3 (5.0—15.6) tons/acre 01YR05: 23.7 (13.9—33.5) tons/acre 01YR15: 19.2 (15.8—22.6) tons/acre (<i>n</i> = 5 plots, 1 fire)	Yes, then no	2010
Knobcone Pine Woodland	Maintain total dead surface fuel loads between 8-35 tons/acre	00PRE: 13.7 (10.8—16.6) tons/acre 02POST: 27.3 (15.5—39.0) tons/acre 02YR02: 42.4 (33.2—51.6) tons/acre 02YR05: 44.4 (31.9—56.9) tons/acre (<i>n</i> = 5 plots, 2 fires)	Not really	2009
Mixed Conifer Forest	Maintain 10-65 overstory* trees/acre <i>*live trees >10" DBH</i>	00PRE: 49 (39—59) trees/acre 01YR01: 49 (41—58) trees/acre 01YR02: 49 (40—57) trees/acre 01YR05: 49 (39—59) trees/acre (<i>n</i> = 9 plots, 2 fires)	Yes	2009
	Maintain 10-65 overstory* trees/acre <i>*live trees >10" DBH</i>	00PRE: 44 (34—54) trees/acre 01YR01: 47 (38—56) trees/acre 01YR02: 49 (41—57) trees/acre 01YR05: 52 (43—60) trees/acre 01YR15: 66 (50—83) trees/acre (<i>n</i> = 5 plots, 1 fire)	Yes, then no	2009
	Maintain average pole-sized* tree density between 10-80 trees/acre <i>*live trees <10" DBH</i>	00PRE: 234 (125—342) trees/acre 01YR01: 124 (48—200) trees/acre 01YR02: 104 (45—163) trees/acre 01YR05: 100 (47—152) trees/acre (<i>n</i> = 9 plots, 2 fires)	No	2009
	Maintain average pole-sized* tree density between 10-80	00PRE: 312 (131—493) trees/acre 01YR01: 170 (39—301) trees/acre	No	2009

Monitoring Unit	Management Objective	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Last Analysis Completed
	trees/acre <i>*live trees <10" DBH</i>	01YR02: 130 (39—222) trees/acre 01YR05: 131 (49—214) trees/acre 01YR15: 142 (41—242) trees/acre (<i>n</i> = 5 plots, 1 fire)		
	Maintain basal area of 75-200 ft ² /acre	00PRE: 160.4 (105.9—214.9) ft ² /acre 01YR01: 160.0 (107.2—212.8) ft ² /acre 01YR02: 143.2 (95.0—191.4) ft ² /acre 01YR05: 133.2 (83.7—182.7) ft ² /acre (<i>n</i> = 9 plots, 2 fires)	Yes	2009
	Maintain basal area of 75-200 ft ² /acre	00PRE: 75.1 (43.1—107.1) ft ² /acre 01YR01: 81.2 (49.6—112.8) ft ² /acre 01YR02: 83.2 (51.8—114.6) ft ² /acre 01YR05: 80.5 (56.7—104.3) ft ² /acre 01YR15: 109.9 (79.4—140.4) ft ² /acre (<i>n</i> = 5 plots, 1 fire)	Yes	2009
	Maintain dead surface fuel load between 10-35 tons/acre	00PRE: 35.9 (24.1—47.4) tons/acre 01YR01: 16.7 (10.7—22.7) tons/acre 01YR02: 18.3 (12.4—24.2) tons/acre 01YR05: 35.3 (21.2—49.4) tons/acre (<i>n</i> = 9 plots, 2 fires)	Yes, then no	2009
	Maintain dead surface fuel load between 10-35 tons/acre	00PRE: 19.7 (15.5—23.9) tons/acre 01YR01: 8.5 (4.9—12.2) tons/acre 01YR02: 13.1 (4.9—21.2) tons/acre 01YR05: 17.9 (15.1—20.7) tons/acre 01YR15: 15.4 (13.8—17.0) tons/acre (<i>n</i> = 5 plots, 1 fire)	Yes	2009
Ponderosa Pine Forest	Maintain average overstory* tree densities between 15-45 trees/acre <i>*live trees >10" DBH</i>	00PRE: 92 (69—115) trees/acre 01YR01: 87 (67—106) trees/acre (<i>n</i> = 5 plots, 3 fires)	No	2009
	Maintain average overstory* tree densities between 15-45 trees/acre <i>*live trees >10" DBH</i>	00PRE: 105 (71—140) trees/acre 01YR01: 94 (64—124) trees/acre 01YR02: 85 (67—103) trees/acre 02YR02: 81 (69—93) trees/acre 02YR05: 74 (61—88) trees/acre 02YR10: 77 (59—95) trees/acre 03YR01: 76 (53—98) trees/acre 03YR02: 63 (34—93) trees/acre (<i>n</i> = 3 plots, 4 fires)	No	2010
	Maintain 10-75 pole-sized* trees/acre <i>*live trees <10" DBH</i>	00PRE: 424 (299—549) trees/acre 01YR01: 262 (88—436) trees/acre (<i>n</i> = 5 plots, 3 fires)	No	2009
	Maintain 10-75 pole-sized* trees/acre <i>*live trees <10" DBH</i>	00PRE: 301 (197—404) trees/acre 01YR01: 80 (11—148) trees/acre 01YR02: 63 (0—146) trees/acre 02YR02: 45 (0—94) trees/acre 02YR05: 32 (0—73) trees/acre 02YR10: 36 (5—68) trees/acre	Yes	2010

Monitoring Unit	Management Objective	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Last Analysis Completed
		03YR01: 14 (1—26) trees/acre 03YR02: 12 (1—24) trees/acre (n= 3 plots, 4 fires)		
	Maintain average dead surface fuel load of 5-28 tons/acre	00PRE: 32.3 (26.3—38.3) tons/acre 01YR01: 23.7 (0.0—47.4) tons/acre (n = 5 plots, 3 fires)	Yes	2009
	Maintain average dead surface fuel load of 5-28 tons/acre	00PRE: 29.7 (24.7—34.6) tons/acre 01POST: 5.3 (2.1—8.5) tons/acre 01YR01: 10.1 (6.2—14.0) tons/acre 02POST: 5.6 (4.9—6.2) tons/acre 02YR02: 16.4 (5.2—27.5) tons/acre 02YR05: 29.3 (14.0—44.5) tons/acre 02YR10: 30.8 (23.5—38.1) tons/acre 03POST: 12.2 (10.3—14.0) tons/acre 03YR01: 12.9 (11.4—14.5) tons/acre 03YR02: 15.8 (9.0—22.6) tons/acre (n= 3 plots, 4 fires)	Generally yes	2010

Coggins Park Thin (FMICO1D08)

In 2011, Whiskeytown fire management completed a thinning in mixed conifer forest in the Coggins Park area. Two FMICO1D08 control plots existed in the project area and were sampled pre-thin in 2011 (00PRE), and overstory density was sampled post-thin in 2012 (01YR01). Diameter distributions are shown below for each plot, before and after treatment. Thinning treatments were focused on smaller size classes (< 15 inches dbh), and successfully reduced small tree (< 6 inches dbh) density on the control plots by 87 to 99 %.

Figure 7. Diameter distribution pre- and post-thin in control plot FMICO1D08-03.

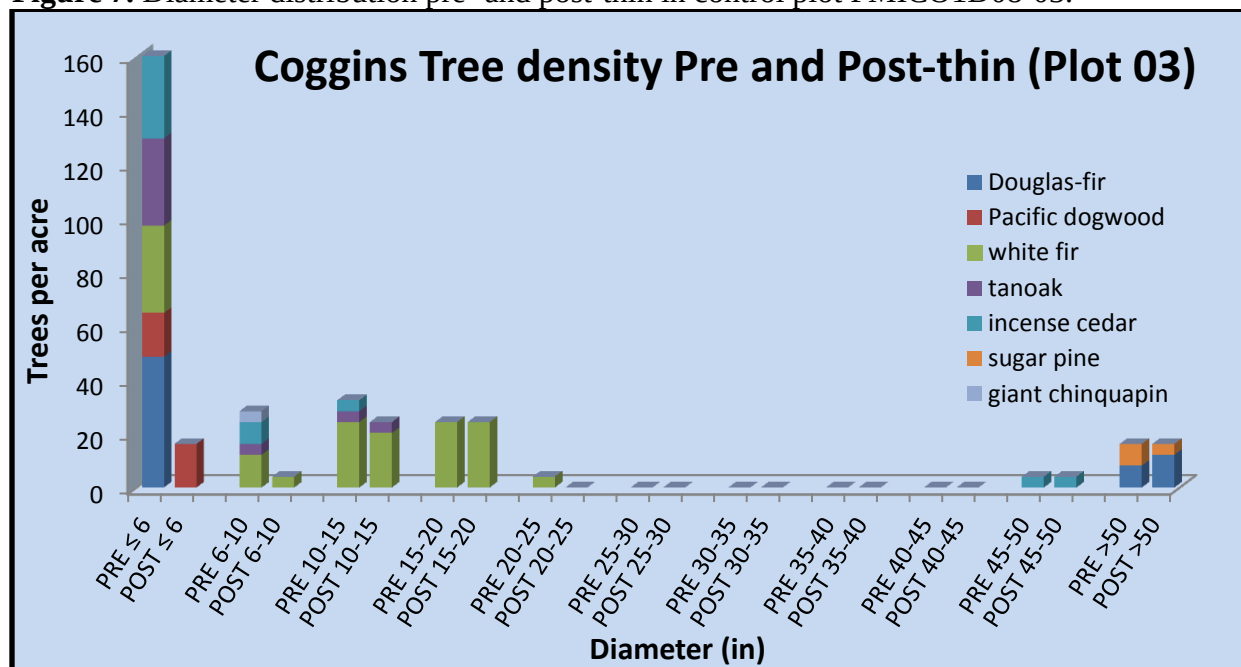
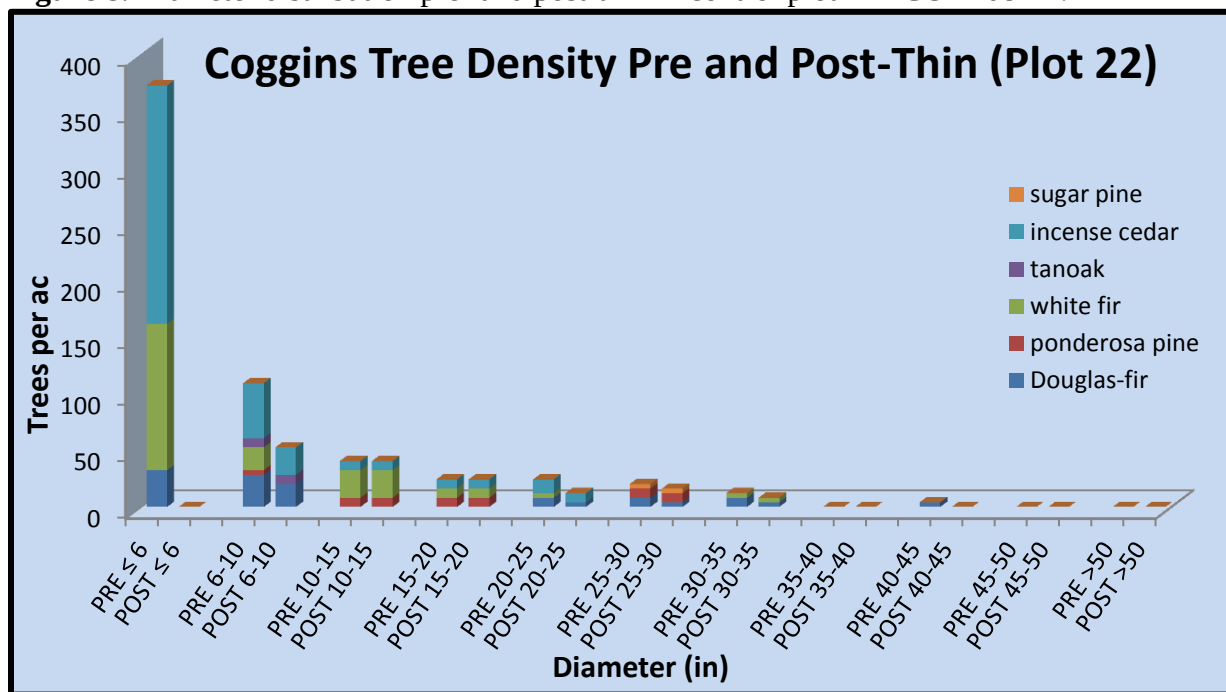


Figure 8. Diameter distribution pre- and post-thin in control plot FMICO1D08-22.



Ponderosa pine: long-term change

Two ponderosa pine (FPIPO1D09) FMH plots were sampled 1, 5, and 10 years after a prescribed fire; stand density for poles (<10" dbh) and overstory (>10" dbh) over time are shown below.

Figure 9. Live pole (<10 inch dbh) density over time, following a single prescribed fire.

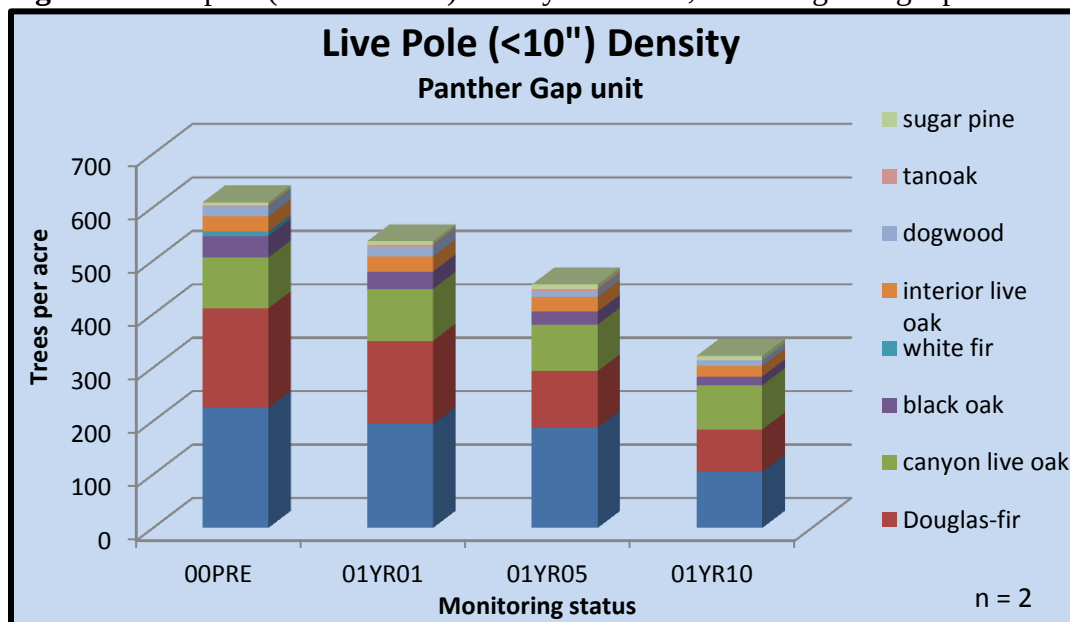
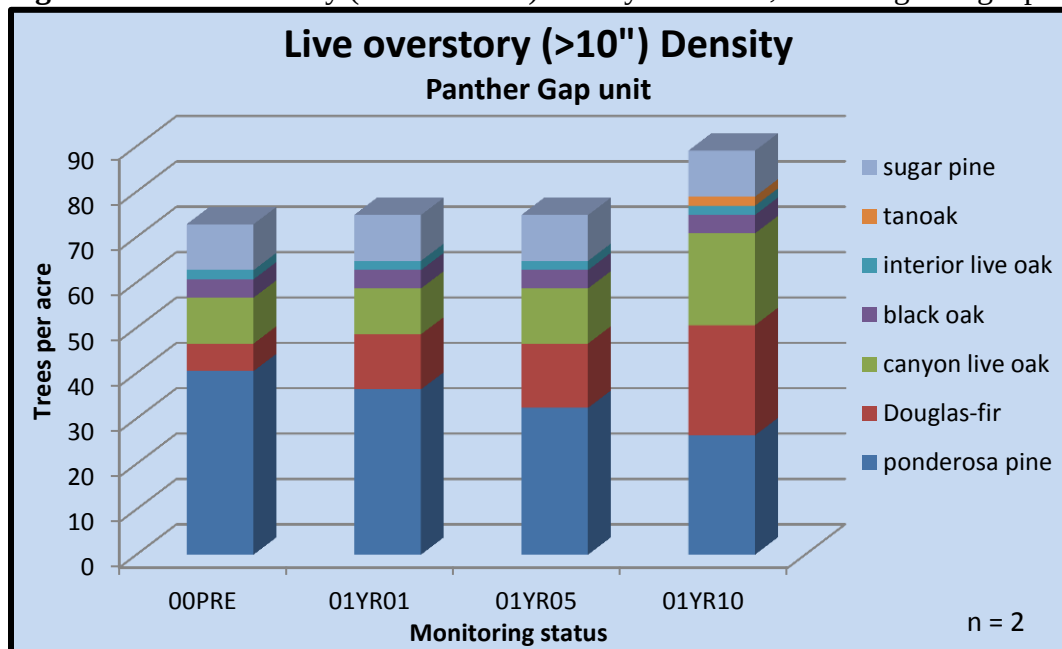


Figure 10. Live overstory (>10 inch dbh) density over time, following a single prescribed fire.



While only limited inference can be obtained from the two plots, the trend in overstory species composition shows a decrease in the proportion of ponderosa pine in comparison to Douglas-fir, over time. The shift toward more shade tolerant species (i.e., Douglas-fir) as time since fire accumulates has been noted at WHIS in recent research (Leonzo and Keyes, 2010), and will continue to be assessed as more long-term monitoring data become available for the ponderosa pine monitoring type.

East boundary photo-points

Photo-points have been installed in the East Boundary burn units (primarily mixed oak, pine, & shrub vegetation) as a minimum level of fire effects monitoring. Subunits are treated with prescribed fire in both the growing and dormant seasons; photos depict one season post-burn and highlight rapid re-sprouting of shrubs and hardwoods.

Photo point 15, Subunit 1 (Left: 01POST, Right: 01YR01)



Photo point 20, Subunit 2 (Left: 01POST, Right: 01YR01)



Photo point 20, Subunit 2 (Left: 01POST, Right: 01YR01)



Photo Point 19, Subunit 2 (Left: 01POST, Right: 01YR01)



Photo Point 18, Subunit 2 (Left: 01POST, Right: 01YR01)



Photo point 3, Subunit 8 (Left: 00PRE, Right: 01YR01)



Photo point 7, Subunit 8 (Left: 00PRE, Right: 01YR01)



Oregon Caves National Monument

Oregon Caves contains three monitoring types: Douglas-Fir (FMH) – 8 plots, CC9 (Rapid Assessment) – 4 plots, and Horseshoe Shaded Fuelbreak - HSFB (Rapid Assessment) – 4 plots. HSFB has been thinned, and some of the piles burned, but has yet to have post-sampling at the time of this report. Monitoring objectives for ORCA are in review, as the focus of fuels management has shifted from prescribed fire to thinning and pile burning. Table 6 below is from the 2010 annual report, and depicts original objectives that will be updated in a future report. Minimum sample size has not been achieved for any monitoring type at Oregon Caves.

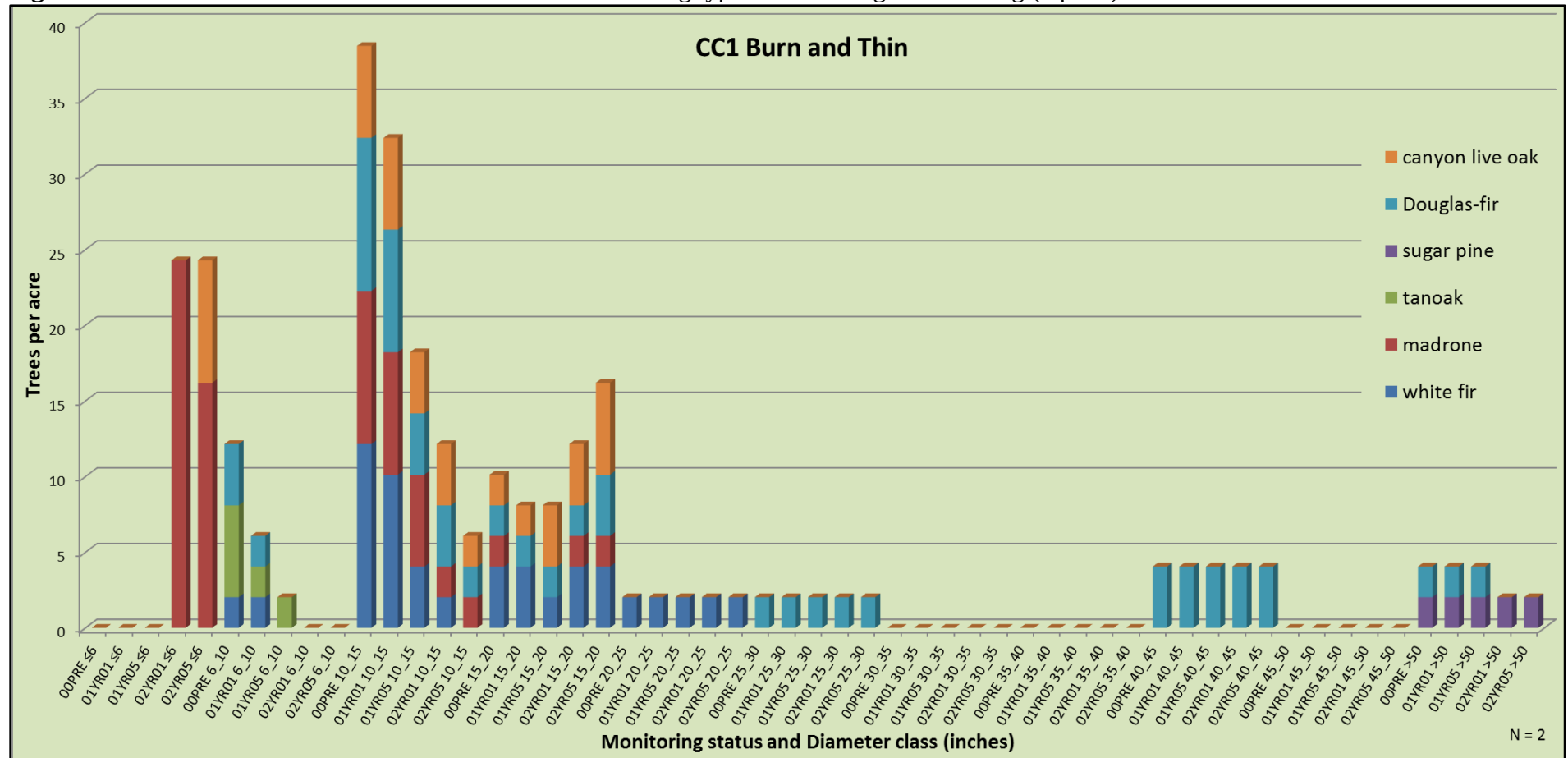
Table 6. Management Objectives and Monitoring Results for Oregon Caves.

Monitoring Unit	Management Objective	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Last Analysis Completed
Douglas-fir (FPSME1D10)	At immediate postburn: Reduce total fuel load by 20-50% from preburn levels	Reduction in total dead surface fuel load: -71.5% PRE: 115.5 (0 – 235) tons/acre YR01: 32.9 (11.3 – 54.5) tons/acre (<i>n</i> = 3 plots, 2 fires)	No	2008
	At three years postburn: Limit mortality of large overstory trees, >60 cm DBH, to <10% of preburn levels	0% change from preburn (<i>n</i> = 3 plots, 2 fires)	Yes	2008

CC1 burn unit: Trees

Two FPSME1D10 plots were treated with prescribed fire (broadcast-burned) and hand-thinned in 1997, and then hand-thinned again in 2007. *Note: Plots were installed post-thinning, so no “true” pre-treatment data exist.* The large chart below shows the diameter distribution pre-burn (00PRE), one and five years after the first burn/thin (01YR01, 01YR05), and one and five years after the second thin (02YR01, 02YR05). After the second thin the “pole” tree (<10” DBH) size class was dominated by madrone at 02YR01 (madrone was spared in the thinning treatment), but by 02YR05, re-sprouting canyon live oak constituted about 33% of the density. In the 10-15” class, overstory density was reduced by 84% between PRE and 02YR05 sampling events, partly due to outgrowth into the 15-20” class, where there was a 60% increase in density. The larger size classes (>20”) remained relatively unchanged.

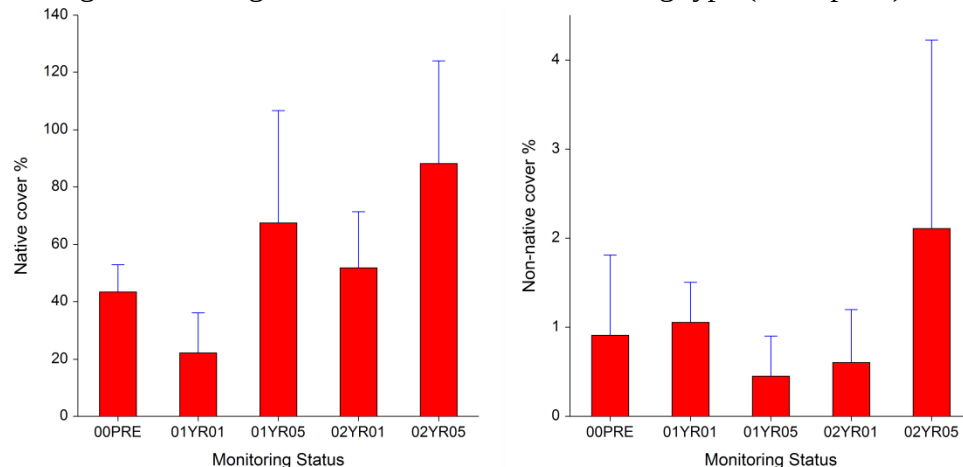
Figure 11. Diameter distribution in the FPSME1D10 monitoring type after burning and thinning (2 plots).



CC1 understory species cover

Following a single burn and two thinning treatments, native understory cover has steadily increased over time based on two FPSME1D10 plots in the CC1 burn unit. Non-native cover has remained quite low over time, with scattered individuals of St John's wort (*Hypericum perforatum*), non-natives grasses (*Vulpia myuros*; *Agrostis capillaris*), and bull thistle (*Cirsium vulgare*) comprising most of the non-native cover.

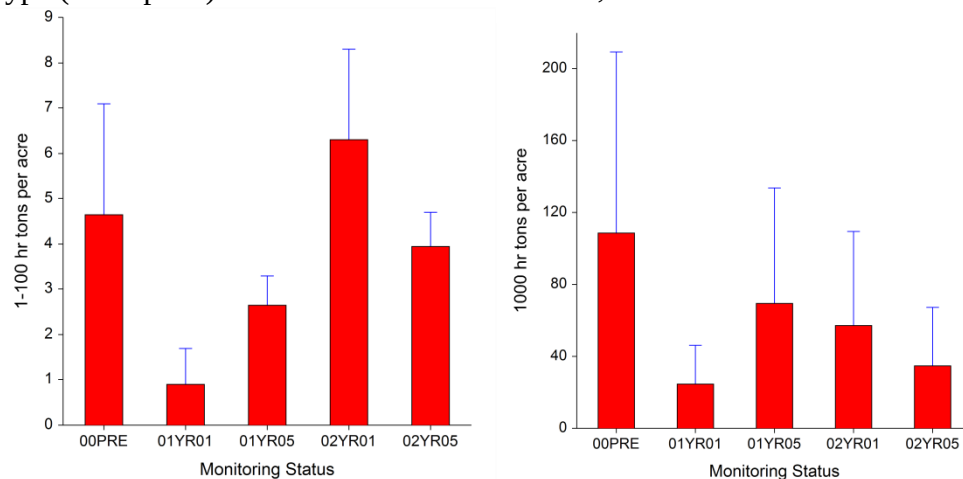
Figure 12. Native (LEFT) and non-native (RIGHT) understory cover (absolute) following burning and thinning in the FPSME1D10 monitoring type (n = 2 plots).



CC1 fuels

Surface fuel loading is quite variable in the CC1 burn unit, but generally shows an initial reduction in fine fuels, then a stable 15% reduction from 00PRE conditions by 02YR05. One thousand-hour fuel loads are even more variable but show an overall decreasing trend, with a 68% reduction by 02YR05 (figure 13).

Figure 13. Surface fuel loading following burning and thinning in the FPSME1D10 monitoring type (n = 2 plots). Below LEFT: 1-100 hr fuels; Below RIGHT: 1000 S+R fuels.



References

Engber, E.A. and J. Morgan Varner. 2012. Predicting Douglas-fir sapling mortality following prescribed fire in an encroached grassland. *Restoration Ecology* 20: 665-668.

Engber, E.A. and J. Morgan Varner. 2012. Patterns of flammability of the California oaks: the role of leaf traits. *Canadian Journal of Forest Research* 42: 1965-1975.

Leonzo, C.M. and C. R. Keyes. 2010. Fire-excluded relict forests in the southeastern Klamath Mountains, California, USA. *Fire Ecology* 6: 62-76.

Table 7. Fire Ecologist 2012 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	18	• Progress on READ guides for REDW & WHIS • WHIS FMP revisions • REDW burn plan review and fire behavior modeling • ORCA monitoring plan (in progress) • Invasive plant EA meetings at REDW • Pre-season planning for fire effects sampling • Research needs planning
Presentations	4	• 3 weekend field trips for SF State and HSU (at WHIS & REDW) • Fire ecology lecture for College of the Redwoods class • READ presentation at REDW • Fuels and fire effects project updates for Inside Redwood
NPS Meetings/ task groups	8	• Pre-fire season: REDW, WHIS, ORCA • Regional fire ecology meeting GOGA • READ meetings REDW • Scientific integrity and peer review meeting, REDW
Interagency work	8	• JFSP Graduate Research & Innovation review panel • Fire training exchange REDW (Northern CA Rx Fire Council, FLN) • Northern Ca Rx Fire Council steering committee calls
Wildfire assignments	6	• READ for 2 wildland fires
Prescribed fire projects	3	• FEMO on Williams Ridge Rx, REDW • FEMO on Range RX, GRCA
Non-fire fuels projects	2	• Fuels work at REDW
Research	8	• 3 reserve fund proposals • 2 papers revised & resubmitted
Data collection	10	• fieldwork

Data entry	10	• FFI database (entry, patches) • Data backup and archival
Data analysis	5	• FFI database – summaries • NCSS – analyses and plots
Supervision/Admin	1	• Visiting monitoring crews; volunteers; interns
Training	5	• FFI Ecological Monitoring Utilities • Resource Advisor Training • S-131, S-133, S-290 • NPS-Introduction to PEPC • Retirement seminar • Refresher • PT
Travel out-of-park for plot or project work	2	Include <u>travel time only</u> for distant, multi-day plot/project work requiring a travel authorization (Note: include data collection or project time associated with these trips in the plot or project categories above)
Miscellaneous	10	• Reading fire BAER plan • 2 SCC proposals (Jeffrey pine savanna restoration thinning; oak woodland experimental thinning) • Weather station set-up • AFE fire congress

D. Additional Program Information

Please complete the new tables below which contain the information from the supplement that we feel is valuable to compile on an annual basis to help assess the fire ecology program workload. Everglades National Park is used as a fictitious example in the table.

Table 8. Planning - 2012

Park	Does Park have written DFCs? (yes or no)	Date Park-level Monitoring Plan completed (or revised)	Total # of Project- or Community-level Monitoring Plans (not just 2012)	Assisted with how many BAER plans in 2012?
Redwood National Park	YES	2010	3 (FMH program; Fir plots; second growth RA)	0
Whiskeytown National Recreation Area	YES	2012 (<i>in progress</i>)	4 (FMH program; Brandy Cr. Mechanical RA; shaded fuelbreak; photo-point)	0
Oregon Caves National Monument	NO	2012 (<i>in progress</i>)	2(FMH; Fuelbreak RA)	0
Lassen Volcanic				1

Table 9. Monitoring - 2012

Park	% 2012 Data Entered	% 2012 Data Quality Checked	# Prescribed Fires Monitored*	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored*	# BAER Treatments Monitored*
Redwood National Park	100%	95%	6	0	0	0
Whiskeytown National Recreation Area	100%	100%	4	1	0	0
Oregon Caves National Monument	100%	90%	2	1	0	0

* Number of treatment units with treatment effects monitoring conducted. Include pre-burn and post-burn monitoring but not burn-day monitoring.

Table 10. Communicating Results – 2012**

Park	# of Project Monitoring Reports completed in 2012	# of Annual meeting(s) with Park staff	# of Formal presentations of results	Do you use Minitab?*
Redwood National Park	1	2	0	n
Whiskeytown National Recreation Area	1	2	0	n
Oregon Caves National Monument	1	1	0	n

* This information will help to assess Minitab multi-user license needs.

**Table does not include informal discussion of monitoring results with park staff (including emails with graphs/summaries etc.).

Table 11. Research - 2012

Park	Are research needs identified in FMP or Monitoring Plan? (yes or no)	# of Proposals Submitted in 2012	# of Proposals Funded in 2012	# of Research Projects Supported in 2012*	Additional Comments
Redwood National Park	Not really	2	0	1	
Whiskeytown National Recreation Area	Yes (but needs to be updated)	2	0	0	
Oregon Caves National Monument	No	0	0	0	

*Number of funded research projects, new or ongoing, supported by the fire ecology program including logistical info or support, staffing, etc.

E. 2013 Direction

The Klamath fire ecology program has historically focused on tending ca. 200 monitoring plots across its three management units. Most of these are long-term FMH vegetation plots but about 35 percent are rapid assessment plots that are more short term in nature and with a more pointed intent. Most of the 200 plots have been repeatedly sampled over the years following a modified FMH monitoring cycle; the database is voluminous. Given current declining trends in

funding and field crew support, it may not be practical or possible to maintain the current number of active monitoring plots. Moving forward in a way that maintains the integrity of these plots for future use, while prioritizing critical monitoring needs, will be imperative. I see the Klamath fire ecology program focusing on 2 primary areas in the near future, including:

1. Revisiting the database: Substantial effort will be focused on the assessment of existing monitoring data as they pertain to management objectives. The fire ecologist will determine the relevance of all monitoring variables in regard to present management objectives, and prioritize monitoring of the most relevant variables. Monitoring objectives that have been met, or that have sufficient replication to be conclusive, will not be prioritized. Data trends that suggest detrimental effects of management activities (e.g., decreases in native plant cover in frequently burned areas) but that are limited in replication, will be prioritized for future monitoring contingent upon crew availability and overall feasibility.
2. Specific Research/Monitoring Questions: During the past 5 years the Klamath fire ecologist has directed some resources toward the investigation of specific research objectives in addition to long-term monitoring. These investigations have employed more efficient sampling schemes that address specific research questions. The fire ecologist would like to continue the use of shorter-term research projects focused on directed research and/or management questions as they arise. Engagement with the scientific community, local universities, and novel funding sources will be promoted.

F. Optional Information

To help in the ongoing effort to improve FFI, please include any feedback or suggestions here based on your experiences using FFI.

It would be nice if there were an option to move a sample event from one plot to another using export/import. As an example, I have a plot name that was incorrectly changed and entered as a new plot, and data from a sampled event were entered into this new plot. Currently there is no way using import/export to move the sample event to the correct, original plot, except to manually re-enter the data.

See blurb below about a fire training exchange facilitated in part by the Klamath fire ecologist:

Redwood National Park Hosts Fire Training Exchange

Fire managers from Spain visit Northern California

Sixteen fire managers from Spain visited Redwood National Park last week as part of a Fire Training Exchange. The event was co-hosted by The Nature Conservancy's [Fire Learning Network](#) (FLN), [California Klamath-Siskiyou Fire Learning Network](#), [Northern California Prescribed Fire Council](#), [The Watershed Research and Training Center](#), [California Fire Science Consortium](#), [UC Cooperative Extension](#), [Redwood National and State Parks](#), and [Orleans/Somes Bar Fire Safe Council](#), among others. The program will take trainees to three different sub-regions in northern California, including the North Coast, Mid-Klamath and Trinity Mountains regions, to learn about and participate in local prescribed fire management efforts. On Friday, October 19th, the group was hosted by Redwood National Park, where they were able to participate in a very successful prescribed burn.

This program is an opportunity for fire managers from around the world to learn from one another as they work to reintroduce and advance the responsible use of prescribed fire as a management tool in fire-adapted ecosystems. It also showcases projects that each of the hosting organizations plan to implement with the help of the visiting trainees. Redwood National Park fire management staff was fortunate to have good conditions for burning during their visit (just in time before season-ending storms rolled in), and were able to fully incorporate the Spanish crew into the Williams Ridge Rx burn on Friday. The trainees were mostly experienced fire managers who work in similar Mediterranean-type climates, although some were less experienced with prescribed fire. During the after action review (AAR) following the burn, the Spanish crew made it clear how much they appreciated the opportunity to work with NPS fire managers, and in turn, we reiterated that we couldn't have done it without their assistance.

INSTRUCTIONS FOR UPLOADING 2012 ANNUAL REPORT

1. Save your report as a PDF file using the following file naming convention “2012 *Park/Network Name* Annual Report.pdf”.
2. Go to the NPS Fire Ecology Sharepoint site (<http://npsfamshare.nps.doi.net/wildlandfire/firescience/fireecology/default.aspx>). In Fire Ecology Documents, upload your report to the 2012 Park and Network Fire Ecology Program Annual Reports folder.
3. Please e-mail your regional ecologist, Nate Benson, and MaryBeth Keifer to let us know when you get your report uploaded.

Call MaryBeth Keifer (603-795-2333) or Nate Benson (208-387-5219) if you have any questions or problems.