



Yosemite National Park Fire Ecology Annual Report Calendar Year 2009

Summary

Two thousand and nine will be remembered as a big year of change for Yosemite Fire Management. Several employees in key positions left Yosemite for lateral moves or promotions to other agencies. The National Fire Policy changed to allow us to better implement multiple objectives under one fire code and fully implement the Wildland Fire Decision Support System on “unplanned” ignitions. We lost a prescribed fire into the 1990 Arch Rock fire scar just above the community of Foresta on 26 August and we lost Isaiah Hirschfield to the BLM in October. Isaiah is now a Fire Intelligence Officer in Portland, OR at the Northwest GACC. The Fire Ecologist hopes to have that position filled by February 2010.

It was a very active fire season this year in Yosemite. The first fire of the season was lightning caused and started just after 1700 above the store in El Portal as all the Fire Management staff were heading back to their duty stations from a long day of orientation. We managed fires (Grouse, Harden, Wildcat Fires) throughout the season culminating with the Big Meadow Fire.

In contrast with unplanned ignitions, planned ignitions were few this year. We burned 34 acres above El Portal in a mostly grass fuel type. We also burned 33 acres in Big Meadow in Foresta. The Big Meadow burn was an 89 acre ~~poison-oak~~ grass fuel type burn that escaped in the first hour of ignition so the project was not completed. We treated 155 acres with pile burning in June, and 120 acres of mechanical thinning and mowing.

Twenty-three FMH plots were visited and read this year. Eighteen of the visits were re-reads post prescribed burn (Re) and five were immediate post-burn reads (Post). Eighty-two “Retro” or Sydoriak plots were read this year in Yosemite Valley, Big Creek, and Aspen Valley; seven post-wildfire Rapid Assessment plots were read in the Frog Fire, and forty-two CBI plots were read in the North Mountain Fire. In addition to plot reads, the fire effects crew participated on prescribed burns and wildfires and spent a total of four weeks on research projects.

Yosemite had an excellent Fire Effects crew with three new crew members and 2008 crew member Athene Eisenhardt returning as an Assistant Lead. Despite having a very late announcement for the crew positions (March) all but one crew member started work on 9 May.

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Fire Ecology Program of Work

The Fire Effects crew read 156 plots this season (Table 1). We read 25 FMH plots, 82 “Retro” or Sydoriak plots, 7 Post-wildfire Rapid Assessment plots, and 42 CBI plots. We also finished the second year of work with Alan Taylor sampling fuel loading and stand density and size in “Valley Visualization plots” in Yosemite Valley. This work was funded by Fuels Reserve Research Fund money. In addition the crew and fire ecologist worked with Peter Brown and Tony Caprio and the SEKI Fire Effects crew on a lodgepole pine fire history research project in Yosemite and Sequoia National Parks. The combined crews sampled fuel loading, tree density, dbh, and height, as well as cored trees and saplings in variable sized plots. Additionally, we collected fire scars in and between plots. The combined crew sampled 24 plots in Hockett Plateau in SEKI, 22 plots in Bridalveil creek area, and 24 plots in upper Tuolumne Meadow in YOSE. Lodgepole Fire History research was funded by the Fuels Reserve Research Fund.

Table 1. Fire Effects plot workload in 2009.

Park	Monitoring unit	Plot type	Pre-burn	Post	Post-burn	Park total
YOSE	Incense cedar-mixed conifer	FMH – forest			3	3
YOSE	Ponderosa pine-mixed conifer	FMH – forest		5		7
YOSE	White fir – mixed conifer	FMH – forest			6	24
YOSE	Sequoia	FMH – forest			1	13
YOSE	Meadow –Yose valley	FMH – grass			8	8
YOSE	Red fir – mixed conifer	FMH – forest		2		2
YOSE	Mixed conifer	Retro			21	41
YOSE	Mixed conifer (Yose valley)	Retro			41	41
YOSE	Mixed conifer – red fir	Retro			20	20
YOSE	Upper mixed conifer	Wild fire Rapid assessment			7	37
YOSE	Mixed conifer	CBI		42		280
YOSE	<i>Total</i>		0	49	107	476

The Fire Effects crew entered nearly all the data collected in 2009 and earlier into FFI. Retro plot fuels data were entered into FFI and tree, shrub and herb data were entered into spreadsheets. The crew also entered all the fuels data from the lodgepole pine fire history study in YOSE as well as the data from Hockett Plateau in SEKI.

The Fire Ecologist spent a great deal of time this year checking and correcting errors in the FFI database. Although I was able to catch a lot of obvious data entry errors, incorrect monitoring status names, etc., there are likely many more to work on in the future. Although this is nearly invisible work it is one of my highest priorities to get the database in good shape during my tenure at YOSE.

In November, the FFI database was converted to version v1.03. The new version offers many new features that make data entry, naming, and data export easier.

Table 2. Fire Ecology staffing in 2009.

Staff member	Start date	End date	# pay periods	READ qualified Yes or No	Training and development ¹
Gus Smith	01/01/2009	12/31/2009	26	Yes	Rx-310, AFE meeting, ATR training,
Isaiah Hirschfield	01/20/2009	10/22/2009	20	Yes	S-490, Rx-510
Athene Eisenhardt	05/11/2009	11/06/2009	13	Yes	READ training
Justin Romanowitz	05/11/2009	10/23/2009	12	No	Basic 32
Catherine Airey	06/08/2009	11/20/2009	12	No	None ²
Gerald Joest	5/11/2009	11/06/2009	13	Yes (t)	READ training

¹All employees received charge card, whistle-blower, computer security and harassment training.

²Catherine Airey started 3 payperiods late and missed all fire training opportunities.

Table 3. Fire Ecologist's accomplishments and areas of focus.

Category	Percent Time	Accomplishments and/or areas of activities
Planning	5%	FMP review meetings, Monitoring Plan initial information gathering
Presentations	1%	UC-Merced Ecology Field Trips x2, FORE Science Teachers Workshop x2, RM&S presentation of Fire Effects results
NPS Meetings/ task groups	15%	RM&S meetings, standing meeting on Research permits, FMO command staff meetings, SEIN Forest Protocol meetings.
Interagency work	0%	
Fire Assignments	8%	FEMO – Rx and Grouse Fire, READ – Harden and Grouse Fire, WFDSS author/editor responsibilities – Grouse, Harden, Smith, Indian, Mono, Wildcat, Big Meadow Fires
Research	16%	Field work: 1. Valley Visualization, 2. Lodgepole fire history, Support: 1911 project Proposal development: 1. Using LiDAR to determine canopy gap size and distribution, 2. Public perceptions of smoke (JFSP) 3. American Indian burning practices (JFSP) 4. Adaptive Management preproposal (JFSP)
Data Collection	5%	
Data entry/data integrity	15%	Researching data errors in FFI and Excel spreadsheets.
Data analysis	10%	Estimated amount of time spent performing analyses, including data summaries and statistical tests.
Supervision/Admin	21%	Hiring, supervision, travel, budget!, ATR, etc.
Training	2%	Rx-310, READ, ATR
Miscellaneous	2%	BAER and BAR coordination and their budgets

Table 4. Fire Effects Lead and crew accomplishments and focus areas.

Category	Percent Time	Notes
FMH plots	50%	All re-reads and post reads.
WUI plots	<5%	Valley “Retro” plots
CBI plots	<5%	North Mountain Fire
Research projects	15%	Lodgepole fire history (YOSE and SEKI), Valley Visualization of fuels treatments (Alan Taylor)
Fire Assignments	5%	Lead: CRWB assignments, FEMO on El Portal Rx Assistant: 13 days Backbone fire FEMO/FFT1, Grouse Fire FEMO, and Wildcat FFT2. Crew: FFT2 assignments on Harden, Wildcat, Smith, Cottonwood, El Portal Rx.
Fuels Project work	< 1%	Assist with Wawona Meadow conifer encroachment
Data entry	10%	
Data analysis	0%	This is expected to be very low number or zero for fire effects crew/lead monitor
Supervision/Admin	6%	Travel, payroll, etc.
Training	1%	Rx510, S490, READ, FFT2

Fire Monitoring Handbook Protocol (FMH)

Fire Monitoring Handbook (FMH) protocol plots are the most common and widely distributed plots in Yosemite. They are also the most widely used in other parks and other agency units and are thus somewhat comparable across Agency Units and geographic areas. In this report I use only data from the FMP plots to determine whether our projects (prescribed fire, mechanical thinning, and a combination of both) are meeting the ecological objectives in our Fire Management Plan.

We visited 5 ponderosa pine (FPIPO1T09) plots largely for post second burn reads (Post02) because the Big Meadow fire burned over plots established in the Arch Rock Fire (1990) footprint. One of the 5 plots was “masticated” in the 2008-2009 Foresta Rd mastication fuels treatment but this plot did not burn in the Big Meadow Fire. The plot was rehabbed and read after the masticator scattered the rebar during the winter. Two of the four plots that burned in the Big Meadow Fire did not burn in the Arch Rock fire (Post01) and compare nicely to those burned twice.

We visited 8 grass plots (BAGAL1D01) in Yosemite Valley in Leidig and Sentinel Meadows. Both meadows were burned twice and this visit was a second year read (Re02Year02). Six white fir plots (FABCO1T08) were visited as either five years post second burn (Re02Year05) or 1 year post third burn (Re03year01). These plots are primarily in the Mariposa grove.

We hiked to and camped in Lost Valley above Little Yosemite Valley to read three incense cedar plots (FCADE1D10) that were burned ten years ago (Re01Year10). We also visited one giant sequoia plot (FSEGI1T08) in the Mariposa Grove one year after its first burn (Re01Year01). Unfortunately, this is the only SEGI plot that has burned and so we have little data to determine how this monitoring type is responding to fire. Sequoia and Kings Canyon National Parks has a large number of SEGI FMH plots so we could combine our plots to answer whether prescribed fire is moving this forest type towards our objectives.

We also visited two red fir monitoring type plots (FABMA1T08) because they were within the perimeter of the Harden Fire but they did not burn so we left them unread.

Below are the tables I created last year from all years up to 2008. I did not repeat the analysis because we only had two, small Rx fires in burn units that do not have FMH plots. Instead, I analyzed how we're moving towards the tree density and species composition ecological objectives. I did not analyze the fuel loading data (1 hr., 10 hr., 100 hr., 1000 hr., litter and duff) because I first need to enter the Yosemite fuel constants into FFI and do a lot more error-checking of these data.

Table 5a. Restoration target conditions and monitoring results of tree density, YNP, 2008.

Monitoring Unit	Management Objective (Restoration)	Monitoring Results $\bar{X}$ (+/- 90% CI)	Objective Achieved Yes or No
Red Fir Forest FABMA1T08 (n = 2 plots)	20-202 trees/ac <31.5in dbh	38.4 trees/ac <31.5in dbh (+/-36.6)	Perhaps
	4-30 trees/ac >31.5in dbh	20.2 trees/acre > 31.5in dbh (+/- 6.7)	Yes
Giant Sequoia/mixed conifer Forest FSEG11T08 (n = 13 plots, 1 fire)	20-101 trees/ac <31.5in dbh	116 trees/ac <31.5in dbh (+/- 43.0)	No confidence
	4-26 trees/ac >31.5in dbh	10.4 trees/ac >31.5in dbh (+/- 2.6)	Yes
White fir/mixed Conifer forest FABCO1T08 (n = 24 plots)	20-89 trees/ac <31.5 in dbh	<31.5 in – 97.1 trees/ac (+/- 25.0)	No confidence
	4-20 trees/ac >31.5 in dbh	>31.5 in – 13 trees/ac (+/- 2.9)	Yes
Ponderosa pine/mixed conifer forest FPIPO1T09 (n = 4 plots)	4-91 trees/ac <31.5 dbh	<31.5 in – 409.8 trees/ac (+/- 311.0)	No confidence
	4-30 trees/ac >31.5 dbh	>31.5 in – 15.2 trees/ac ¹ (+/- 5.7)	Yes
Ponderosa pine/bear clover FPIPO1T02 (n = 18 plots)	No management objectives at time of FMP	<31.5in – 165.4 trees/ac (+/- 79.3) >31.5 in – 8.8 trees/ac (+/- 2.4)	

¹Total of 15 mature trees in four plots.



The tranquil Grouse Fire on July 1st creeping into a hanging meadow (above) contrasted with the roaring Big Meadow Fire racing up towards Big Oak Flat Rd on August 26th.



Table 5b. Restoration target conditions and monitoring results for species composition, YNP, 2008.

Monitoring Unit	Management Objective (Restoration)	Monitoring Results $\bar{X}$ (+/- 95% CI)	Objective Achieved Yes or No
Red Fir Forest FABMA1T08 (n = 2 plots)	70-100% fir, 0-30% pine	Trees < 31.5 in dbh 56% ABMA, 44% ABCO Trees > 31.5 in dbh 70% ABMA, 30% ABCO	Yes Yes
Giant Sequoia/mixed conifer Forest FSEGI1T08 (n = 13 plots)	35-65% fir, 0-20% SEGI, 40-55% pine	Trees < 31.5 in dbh 73% ABCO, 11% PILA, 11% CADE, 2% SEGI, 2% CONU, <1% PSME & PIPO Trees > 31.5 in dbh 55% PILA, 23% SEGI, 20% ABCO, 3% CADE	No No, but very close
White fir/mixed Conifer forest FABCO1T08 (n = 24 plots)	40 – 60% fir, 15 – 50% pine, 0 – 10% cedar	Trees < 31.5 in dbh 69% ABCO, 20% CADE, 5% PILA, <5% ABMA, PIJE, PIPO, < 1% Quercus & CONU4 Trees > 31.5 in dbh 49% ABCO, 24% PILA, 16% CADE, 7% PIJE, 4% PIPO	No Yes
Ponderosa pine/mixed conifer forest FPIPO1T09 (n = 4 plots)	60-95% pine, 15-40% cedar, 1- 10% oak	Trees < 31.5 in dbh 62% ABCO, 16% CADE, 17% pine, 3% oak, 2% PSME Trees > 31.5 in dbh 74% pine, 20% CADE, 7% oak	No Yes
Ponderosa pine/bear clover FPIPO1T02 (n = 18 plots)	No management objectives at time of FMP	Trees < 31.5 in dbh 41% CADE, 29% PIPO, 19% QUKE, 5% PILA, 5% ABCO, 1% PSME, < 1% CUCH2 Trees > 31.5 in dbh 65% PIPO, 30% CADE, 3% PILA, 3% QUKE	

White fir Monitoring Type

The white fir monitoring type is a common vegetation type in the lower mixed conifer, contains the majority of our plots and thus we have the most confidence in monitoring results. Figures 1 – 3 illustrate the changes that occur in tree species composition pre-prescribed burn, 10 years post burn and 10 years post second burn. Note that white fir stands that have not seen fire in roughly 100 years have greater tree species diversity than those stands that have burned once or twice. White fir becomes more dominant (exceeds target proportion) as other species (red fir, oaks and Jeffrey pine) decline with prescribed burns and time. Additionally, pines slowly increase in dominance and just meet our objective proportion but because there are only three plots that have 10 years history post second burn, I have little confidence in where the population mean is. Also it is important to note that if the canopy is closed or nearly so, the only chance for an increase in pines to pre-settlement conditions is for them to regenerate in canopy caps. Figures 4 – 6 illustrate the change in age classes of trees post prescribed fires and through time. Poles are trees ≤ 6 in, Second growth trees are > 6 in but < 31.5 in. You should also note that there are no more poles present 10 years after the second burn. In future analyses I'll analyze size class by species to determine which species are represented in each size class.

Management Implications (white fir)

By ten years after the second prescribed burn we've lost 50% of the trees >80cm dbh. Clearly this is not a sustainable trajectory unless mortality of the larger class has hit an asymptote after the second burn. The fire ecologist will investigate whether this is too much mortality for our large tree class. We can't attribute all the mortality of trees to prescribed fire but we can compare these results to recently published studies of tree mortality from plots that have not burned in the past. Lutz et al. (2009) report a 24% "ambient" decline of large diameter trees in Yosemite. However, most of the pines as well as white fir decrease by ~50%, perhaps suggesting that our results are just a snapshot of what is happening on longer time scales. Van Mantgem et al. (2009) also report increasing mortality rates among trees in the Sierra Nevada, pines, firs, and at all elevations. Mortality rates are increasing 0.03%/yr in CA, increasing 0.044%/yr for pines, and 0.031%/yr for Abies. Again, we should be concerned but the cause of mortality in our plots might be larger than a management influence.

Second, though we should be concerned with large diameter tree mortality we should also be concerned with the lack of pines in these stands. Pines are shade intolerant and thus need large (enough) canopy gaps to grow into. They do not grow in a closed canopied forest, so the only way we will have pines persisting in this forest type will be to create canopy gaps for pines to grow into. Ideally canopy gaps would be large enough for pines to have access to sunlight but small enough minimize distance to seed source. Fires that scorch canopy fir trees or linger around the root crown long enough to kill the tree might provide gaps that will allow pines to regenerate back into the forest.

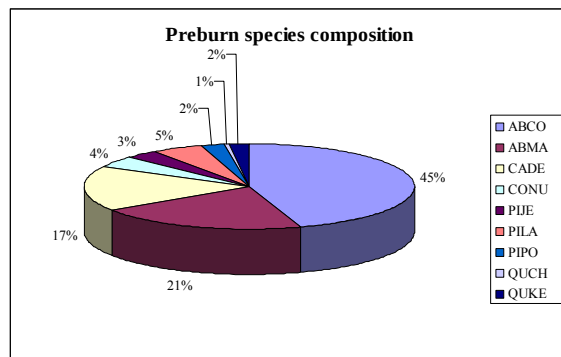


Fig. 1. Live tree species composition in white fir plots prior to first burn, YNP, 2009.

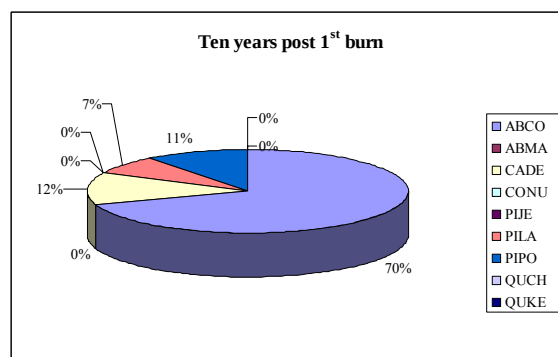


Fig. 2. Live tree species composition in white fir plots 10 years post first burn, YNP, 2009.

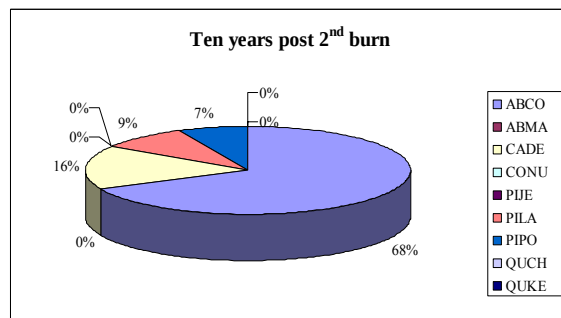


Fig. 3. Live tree species composition in white fir plots 10 years post 2nd burn, YNP, 2009.

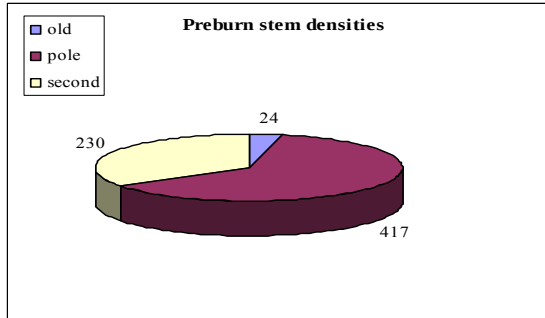


Fig. 4. Stem density (trees/ac) of live trees prior to first burn in white fir forest plots, YNP, 2009.

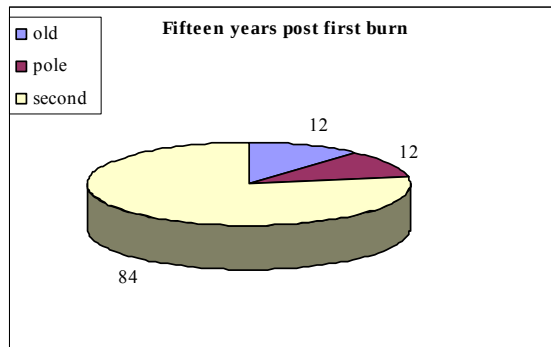


Fig. 5. Stem density (trees/ac) of live trees 15 years post First burn in white fir forest plots, YNP, 2009.

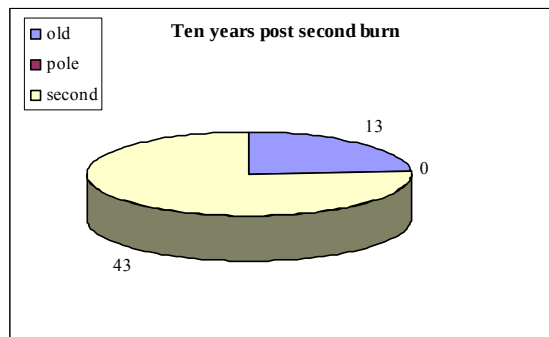


Fig. 6. Stem density (trees/ac) of live trees 10 years post second burn in white fir forest plots, YNP, 2009.

Ponderosa pine/bear clover Monitoring Type

This monitoring type is common in the park particularly in the southern part of the park where we have some of our longest plot histories. This forest type occurs on hot and dry southerly aspects, with a short fire return interval and lacking the vertical structural heterogeneity of other forest types.

Forests with short fire return intervals rarely had time to build up surface and ladder fuels, so historic fires would have been low to moderate severity. Low fire return interval departure (FRID) stands are more open than other mixed conifer types with ponderosa pine dominating the canopy.

With over 100 years of fire suppression these forests have changed dramatically in species composition, structure and fuel loading. Figure 7 illustrates the diversity of tree species that have colonized this forest type in the absence of fire. Eight to twelve years after the first burn (Figure 8) the species composition is similar, however, by five years after the second burn (Figure 9) the forest is composed of species typical of a short fire return interval forest.

The structure of the forest changes dramatically with the introduction of fire. Preburn forests are dominated by poles (< 6 in dbh; Fig. 10) whereas postburn and post second burn forests are dominated by second growth trees (6 in < second > 31.5 in; Figure 11).

We don't lose as many large diameter trees in this forest type after fires. Stands start with an average of 11 large (>31.5 in) pre-settlement trees/ac and five years after their second burn there are still 7 trees/ac, or a 36% reduction.

Management Implications (Ponderosa pine/bear clover)

Though we don't have target conditions for this forest type in our Fire Management Plan I think we could use the composition of the "old" trees for historic conditions. If we accept large tree composition as our target conditions, I think that prescribed fire is moving this forest type on a trajectory of restoration. However, forests that haven't burned in the past 100 years have a lot of fuel built up over time and have the potential to create a lot of intensity that could lead to a lot of large tree mortality. Also, as demonstrated in the above results, we don't really start seeing this forest change until after the second entry burn.

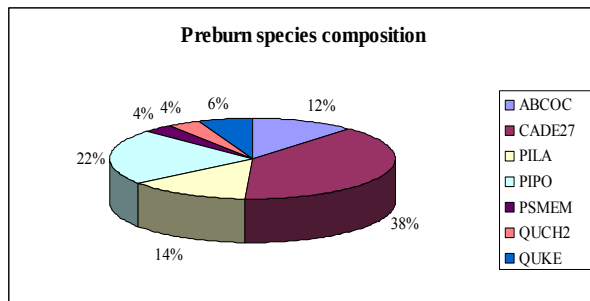


Fig. 7. Live tree species composition prior to prescribed burn in ponderosa pine plots, YNP, 2009.

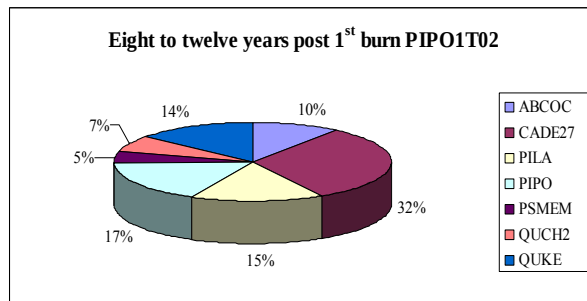


Fig. 8. Live tree species composition 8 – 12 years post first burn in ponderosa pine plots, YNP, 2009.

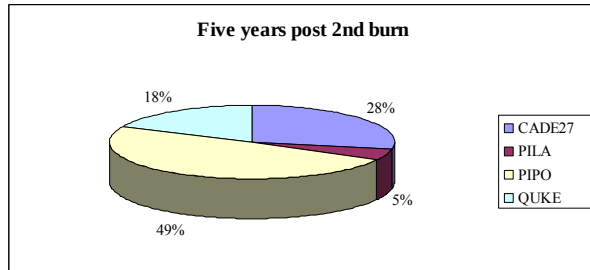


Fig. 9. Live tree species composition 5 years post 2nd burn in Ponderosa pine plots, YNP, 2009.

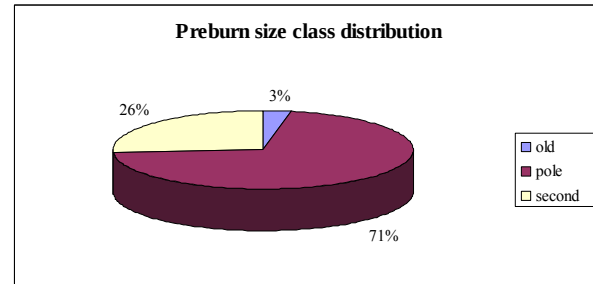


Fig. 10. Preburn size class distribution in ponderosa pine plots, YNP, 2009.

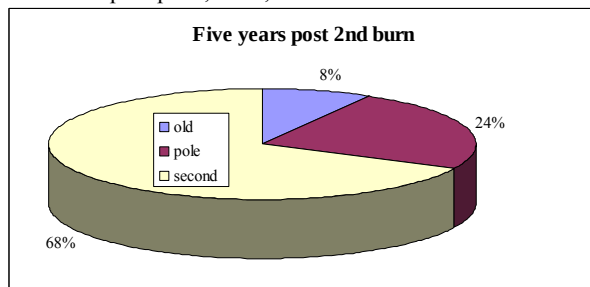


Fig. 11. Size class distribution of live trees 5 years post 2nd burn in ponderosa pine plots, YNP, 2009.

Incense cedar monitoring type (case study of prescribed fire)

Lost Valley is a mid elevation (~6,200 ft) valley above Little Yosemite Valley that was treated with prescribed fire on 5 – 7 November 1999. The objectives of the 40 ac burn were to reduce understory < 5cm dbh tree density by 30% without killing more than 20% of the overstory Jeffrey and sugar pines. Additionally they wanted to reduce 1000hr fuels by 30%, 100hr fuels by 40%, 10hr fuels by 60% and 1hr fuels by 70%. The prescriptions for meeting these objectives were ambient temperatures between 30 – 80° F, relative humidity of 20 – 50%, wind speeds between 1 – 5 mph, 10hr fuel moisture 6 – 13%, and 1000hr fuel moisture between 10 – 20%.

The weather conditions during the burn varied by day and time of day. High and low temperatures were 39°F and 70° F, high and low relative humidities were 66% and 9% and winds varied from 1 – 5 mph with estimated tree tops wind speeds of 10 – 20 mph at their maximum. One thousand hour fuel moisture at Crane Flat on 25 October 1999 was 4.5 – 5% and 10 hr fuel sticks at the burn site were 4.5 – 6%. Seven days prior to the burn Yosemite Valley recorded 0.65 in of rain.

The recorded fire behavior varied by day and time of day with the greatest intensity around 1200 on 6 November at a time when relative humidity hit a minimum (9%). At that time, the rate of

spread of the burn was 10 chains/hr with a flame height of 17 ft, and flame depth of 15 ft. Group torching of trees was witnessed and spot fires began to appear outside the canyon to the north of the burn. The burn escaped out of Lost Valley and was extinguished the following day with the season ending rain and snow storm.

Three FMH plots were established prior to the burn for monitoring fire effects. The plots that were established in Lost Valley were originally designated as an incense cedar monitoring type because of their dominance in the canopy (Figure 12). However, despite losing 67% of the cedars in ten years, the plots are still dominated by incense cedar and white fir (Figure 13). White fir and incense cedar were most common in 12" and 24" classes prior to the 1999 prescribed fire, but most of these were dead in the 10 year post burn read (Figures 14 & 15). We lost 42% of the > 31.5 in trees and all the poles ten years post prescribed burn (Figures 16 & 17).

To investigate the role of the prescribe fire in changing the species composition and structure of the Lost Valley burn unit, I compared indices of fire intensity on trees that lived 10 years post burn and those that died within 10 years post burn. First, there are no live poles (≤ 6 in) 10 years after the Lost Valley Rx (Table 6). Second, char height, or the highest point on trees with black char on the bark, differs little between trees that lived and those that died. Scorch height is the highest point on the tree with scorched leaves or needles. Scorch height also differs little between live and dead trees. However, the amount of scorch differs greatly between trees that lived and those that died, suggesting that trees scorched > 50% are most unlikely to live post fire (Table 6).

Tables 7 – 9 illustrate post burn metrics (char and scorch height, and % scorch) by species. None of the species listed appear to show lower tolerance to fire, though further analyses with more plots will help answer this question. Lodgepole pine and trembling aspen were present in the plots but their numbers too few to include in these tables.

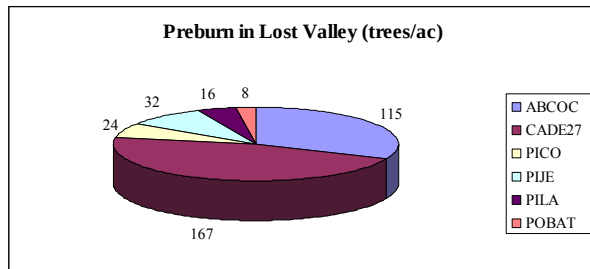


Fig. 12. Preburn live tree species distribution in Lost Valley burn unit, YNP, 2009.

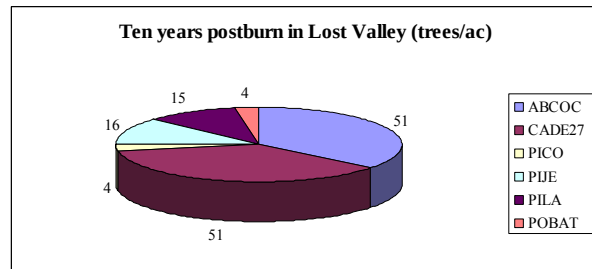


Fig. 13. Ten years post burn species distribution in Lost valley burn unit, YNP, 2009.

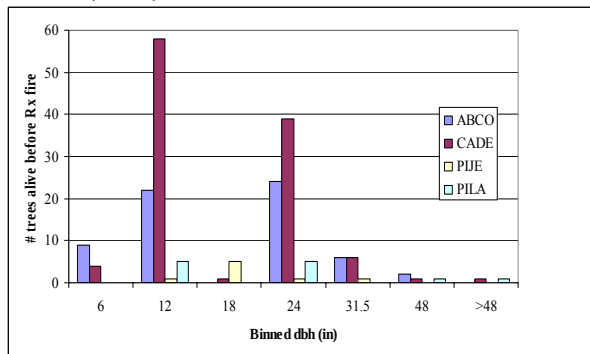


Fig. 14. Preburn size class distribution by species in Lost Valley burn unit, YNP, 2009.

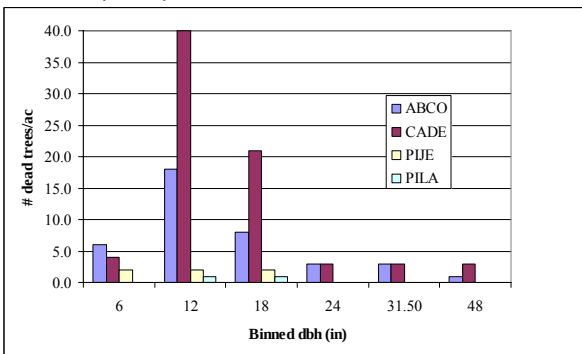


Fig. 15. Ten year post burn size class distribution by species in Lost Valley burn unit, YNP, 2009.

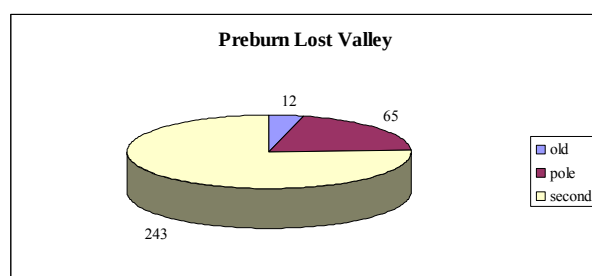


Fig. 16. Size class distribution of live trees pre-burn in Lost Valley incense cedar plots, YNP, 2009.

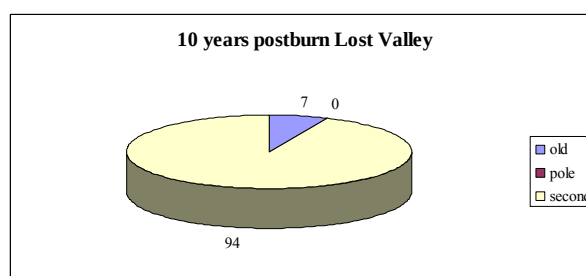


Fig. 17. Size class distribution 10 yr post-burn in Lost Valley incense cedar plots, YNP, 2009.

Table 6. Averaged fire effects characteristics of trees that lived 10 years after and those that died within 10 years of the Lost Valley Rx burn.

Size class (in)	Trees/ac		Char height		Scorch height		% canopy scorched	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead
6	0.0	64.8	-	2.9	-	22.0	-	0.18
12	28.3	89.0	5.8	6.8	11.2	13.1	0.24	0.74
18	41.8	43.2	5.0	7.3	15.5	20.5	0.19	0.66
24	16.2	8.1	9.0	4.8	13.7	23.2	0.21	0.61
31.5	9.4	8.1	5.0	11.0	16.7	25.0	0.17	0.55
48	6.7	5.4	6.9	14.8	33.4	31.4	0.20	0.38

Table 7. Averaged fire effects characteristics of white fir (ABCO) trees that lived 10 years after and those that died within 10 of the Lost Valley Rx burn.

Size class (in)	Char height		Scorch height		% canopy scorched	
	Live	Dead	Live	Dead	Live	Dead
6	-	2.9	-	22.0	-	0.18
12	6.5	6.9	10.2	14.8	0.24	0.61
18	4.5	2.7	15.9	19.1	0.07	0.53
24	7.6	5.0	12.4	26.7	0.08	0.61
31.5	4.4	10.5	19.0	32.8	0.06	0.65
48	6.3	14.0	25.0	18.0	0.02	0.01

Table 8. Averaged fire effects characteristics of incense cedar (CADE) trees that lived 10 years after and those that died within 10 of the Lost Valley Rx burn.

Size class (in)	Char height		Scorch height		% canopy scorched	
	Live	Dead	Live	Dead	Live	Dead
6	-	-	-	-	-	-
12	5.1	5.8	13.1	12.4	0.36	0.78
18	6.0	9.8	15.6	21.3	0.21	0.69
24	10.0	4.5	14.6	19.7	0.31	0.60
31.5	6.3	11.3	20.0	19.8	0.33	0.49
48	-	15	-	35.8	-	0.51

Table 9. Averaged fire effects characteristics of Jeffrey (PIJE) and sugar (PILA) pine trees that lived 10 years after and those that died within 10 of the Lost Valley Rx burn.

Size class (in)	Char height		Scorch height		% canopy scorched	
	Live	Dead	Live	Dead	Live	Dead
PIJE 12"	-	32.3	-	10.0	-	0.60
PIJE 18"	4.7	4.1	10.5	20.5	0.03	1.0
PILA 12"	-	2.7	-	10.8	-	0.83
PILA 18"	-	6.0	-	16.0	-	0.60
PILA 31.5"	3.0	-	0.0	-	0.0	-
PILA 48"	8.7	-	35.3	-	0.19	-

Table 10. Fuel loading (T/ac) and % change in surface fuels from the 1999 prescribed fire in Lost Valley.

Fuel	Pre-burn ¹	1yr post-burn ¹	% Δ	10yrpost ¹	% Δ
1hr	0.3	0.2	-0.33	0.4	0.33
10hr	3.1	0.7	-0.77	3.7	0.19
100hr	3.1	1.3	-0.58	3.5	0.13
1000hr	87.5	58.2	-0.33	101	0.15
Litter	7.1	2.6	-0.63	4.8	-0.32
Duff	25.7	0.6	-0.98	6.5	-0.75
Total	126.8	63.6	-0.50	119.9	-0.05

¹units = tons/acre

Management Implications (incense cedar)

The most obvious point to make is that we were burning out of prescription. Both fuel moisture and relative humidity were below the range in the prescription and with the help of the winds associated with the approaching season-ending storm probably helped the burn escape. However, the fire effects associated with this burn were positive.

Although the objectives of this burn were not met, I would argue they were too specific and should include a broader range of acceptable effects. For example, the burn was to reduce small diameter trees by 30% but the burn reduced the 65 poles/ac to zero, which is probably acceptable for a first entry burn. A 30% reduction in poles would have left 45 trees/ac; a density that would probably exceed our EIS objectives given this is a small portion of the < 31.5 in tree class.

It is harder to evaluate whether we met the objective of killing less than 20% of the > 40 in dbh Jeffrey and sugar pines. First, we did not have any large Jeffrey pines in our plots. Second, although we had 3 large sugar pines in our pre-burn plot read, they are not relocated after the post burn read. This could mean that they died but typically we'd record the tree as dead until it is dead and down. If the tag was lost, we typically retag the tree and record that a tag was lost. So given the data, I can not answer the question. However, for those trees > 40 in dbh (all were incense cedar) that we have continuous data on, we didn't kill a single tree.

We did not meet any of our surface fuel reduction objectives (Table 10). We reduced surface fuels more than we intended but again I would argue that our burn objectives were too specific.

In this higher elevation mixed conifer forest, prescribed fire appears to be the appropriate tool for restoration. Though we have no target conditions for this forest type, we could assume that both density and species composition should be similar to the white fir type. Like in other forest types, prescribed fire seems to be very effective at reducing the ladder fuels in the 6, 12, and 18 in classes. Although composition of this stand has not changed greatly, the number of white firs and incense cedars has been reduced significantly. Lower stem density increases a forest's resilience to fire but also reduces competition for water, nutrients and sunlight.

All of the surface fuels except litter and duff have increased above their preburn condition (Table 10). This burn unit should be reburned to consume much of the dead and downed fuel at a time of year or when fuel moisture is such that we continue to reduce ladder fuels without killing overstory trees.

Fire Ecology Research in Yosemite

The Fire Ecologist and Fire Effects crew contributed significantly to two research projects funded by Research Reserve Fuels money. Dr. Alan Taylor from Pennsylvania State University completed his second year of a "valley visualization" project in Yosemite Valley. We completed all the plot work (trees, fuels transects, photos) in one week, pulled rebar from 2008 and 2009 plots, and Alan took overstory photos during a mid September visit. Alan's work will help Fire and Park managers visualize the impacts of different fuels treatments to visitor's views of iconic landmarks.

We assisted Dr. Peter Brown from the Rocky Mountain Tree Ring Research lab as well as Dr. Tony Caprio, Fire Ecologist and his SEKI Fire Effects crew. Our combined crews sampled 24 plots in upper Tuolumne Meadows and 22 plots in the Bridalveil Creek area during a two week period. We also sampled 22 plots in Hockett Meadow down in Sequoia National Park. We spent a total of 19 days on the project. Results from this research will be included in the 2010 report.

The other Fuels Research project that was funded this year is a study by Dr. Jim Lutz et al. from the University of Washington and USGS Yosemite Field Station staff. I have been working with Jim Lutz to get him FFI data to be able to model the carbon in our forests treated with prescribed burning and forests that have not burned.

The Fire Ecologist also worked with two Research Experience for Undergraduates (REU) students at the Sierra Nevada Research Institute this summer. One of the REU students also spent time with the Fire Effects crew in the field.

The 1911 project should be completed this year by Dr. Scott Stevens and Dr. Rick Everett. I have been working with these investigators to get their report to us by the end of January 2010.

Prescribed fires

We had two prescribed burns this year in Yosemite (Table 11). The first in El Portal was a 34 grass burn for community protection. The burn boss was Deron Mills and resources from outside of Yosemite assisted with the burn. The burn was pretty low intensity for areas with oak overstory but grass residual vegetation in areas without canopy cover were consumed well. There were several large islands of fuel that remained at the end of the burn but overall relatively

successful. The burn unit is a very difficult one to burn because the residents' homes back up to the burn on the lower side and Foresta is above the unit. Much of the southwest portion of the unit is very steep and a two track road provides the only break in fuels at the top of the unit. READs flagged and weed wacked around all the elderberry shrubs prior to the burn as well as the cultural resources.

The Big Meadow prescribed burn occurred on 26 August and escaped within an hour of lighting the test fire. There was an Escaped Prescribed Fire Review Team at the park following the fire and they wrote a report documenting causes for the escape. I will not elaborate on the burn or escape because all the details can be found in the Team's final report. For all of us who support prescribed fire, this was a difficult couple of weeks and we feel humbled by the experience.

Yosemite Crew 7 as well as crews from other agencies helped with other projects in June after we received snow and rain on the Grouse Fire. Yosemite crews, hot shot crews and the Whiskeytown Fire Use Module helped with pile burning during a short window of opportunity. Table 11 & 12 list all other fuels projects completed in 2009.

Table 11. Prescribed fires and pile burning in Yosemite, 2009.

Project	Acres	Month
Pile burning: Wawona/Wawona Rd	118	June
Pile burning: El Portal	9	June
Pile burning: Yosemite Valley	4	June
Pile burning: Foresta	22	June
Pile burning: Yosemite West/Henness Ridge	1	June
Pile burning: Garnet Ridge	1	June
El Portal Rx	34	June
Big Meadow Rx	33	August

Table 12. Mechanical thinning projects completed in Yosemite in 2009.

Project	Acres	Month
Foresta Fuels break thinning	15	June
El Portal mowing	15	June
Parkwide Structure clearing	25	July
Wawona Meadow thinning ¹	30	July – October
Wawona Meadow mowing	35	August

¹Funded through Yosemite Fund Grant with Monica Buhler as project manager.

Wildfires

We had twenty-three wildfires this summer that burned a total of 13,559 acres (Table 13). Most were either suppressed or extinguished on their own at < an acre. The Grouse Fire was a highlight of the summer for many reasons. It was the first to be managed in a way that minimized negative impacts to resources, wilderness, air quality, but was also managed for fire fighter and public safety and minimal cost. Because of logistical insufficiencies, we had to order Alan Johnson's team to manage the fire for the last week. Alan brought a "short" Type II team and was able to provide full logistical support where we could not. The Grouse Fire burned through Memorial Day weekend and the 4th of July, and though it did impact visitors with smoke

and delays on highway 41 and Glacier Point Rd., we all view it as a successful fire with good fire effects in the old Steamboat Fire (1990) footprint.

The Harden Fire was managed similarly by Corky Conover through much of the duration of the fire. Alan's team provided support to Corky with time keepers and planning. The Harden burned in the footprint of the Ackerson Fire as well as in more recent fire scars. The Harden burned with little impact to visitors' experience and burned with good fire effects. Lastly, the Wildcat fire started at the end of July and burned largely on the canyon wall and above the Tuolumne River. The Wildcat Fire only impacted visitors travelling through the Tuolumne Canyon and many who visited the park during the time it was burning might not have even noticed it.

Table 13. Wildfires by size and cause and start date in Yosemite, 2009.

Fire name	Acreage	Cause	Start date
Thirteen	0.1	Lightning	11/14/09
Buena Vista	0.1	Unknown	10/11/09
Merced	0.25	Human	10/04/09
Hetchy	0.1	Lightning	09/12/09
Big Meadow	7500	Human	08/26/09
Ridge	0.1	Unknown	08/16/09
Stump	0.1	Human	08/15/09
Note	0.1	Unknown	08/13/09
Shoulder	0.1	Human	08/09/09
Swinging	0.1	Human	08/06/09
Falls	0.1	Unknown	07/31/09
Wildcat	1293	Lightning	07/29/09
White thorn	0.1	Lightning	06/15/09
Harden	1654	Lightning	06/08/09
Indian	0.1	Lightning	05/30/09
Smith	0.1	Lightning	05/30/09
Grouse	3007	Lightning	05/30/09
Foresta	0.1	Lightning	05/30/09
Pit	0.1	Lightning	05/27/09
Dark Hole	0.1	Lightning	05/27/09
Mono	7.0	Lightning	05/18/09
Cottonwood	96.0	Lightning	05/18/09
West	0.1	Lightning	05/18/09
Total Acreage	~13,559		

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