



Yosemite National Park Fire Ecology Annual Report Calendar Year 2012

A. Summary

The fire ecology program at Yosemite National Park had a productive and safe year in 2012. Most notable was the hiring of Karen Palmer as the Lead of the Fire Effects crew. Karen started work in March and the crew of 1 (returning monitor, Tim Martel) started in June. Tim's season was short this year because fewer projects were funded this year and because his wife gave birth to a baby girl in September. Despite the short season and a small crew size, the crew made efficient use of their time by completing all the FMH plot reads that were scheduled for the 2012 season as well as 20 additional Retro fuels plots that were not read during the 2011 field season.

Despite the extensive period of warm, dry weather and fuel moisture conditions we experienced this year, Yosemite successfully managed a fire in red fir, western white pine and Jeffrey pine. The Cascade Fire was a lightning-ignited fire that burned from 16 July to 19 November for a total of 1,705 acres. The Cascade Fire tested our beta version of a "fire decision matrix" we developed to determine what fires to successfully manage and which should be suppressed. The Cascade proved that the matrix can pick successful fires even in record drought years. In addition, the Cascade Fire was a success story all in itself. Fire crews were able to monitor the fire for the majority of the burning period, and employed minimal impact suppression tactics to only a small portion of the active edge of the fire when necessary. According to fire crews on the fire, the fire produced good fire effects. Good air quality was maintained throughout the duration of the fire. The management strategy employed on the Cascade is a good example of what makes the fire program at Yosemite noteworthy, by allowing fire its historical role in an ecosystem adapted to fire while minimizing risk to firefighters and impacts to resources.

Two more segments in Hodgdon (Segments D & E, totaling 234 acres) were burned this year. The fire effects appeared good overall based on our initial observations. A portion of this parkwide burn unit along the south fork of the Tuolumne River is a "cold air drainage" where cool air pools in a basin and cannot exit because of a topographic constriction. There are many cold air drainages throughout the park but this one in particular supports a plant community similar to those found in the northern Cascades. Therefore, burning in this unit has been controversial; because if this truly is a relic forest from prior to the last period of glaciation it

probably should not burn in decadal return intervals but more on the scale of centuries. We burned for the second year in a row in the Hodgdon cold air drainage.

We also initiated an 870 acre prescribed burn in Wawona NW in May. After prepping the unit for the second year in a row, plumbing it and conducting a test burn; the burn boss, holding boss and hand crew foremen decided that risks were too high and could not be mitigated.

Publication of our forest structural assessment using LiDAR, funded through Fuels Reserve in 2009 was a highlight for our program as well. Lastly, this work was recently presented at the 5th International Fire Ecology and Management Congress in Portland, Oregon. Both the fire ecologist and the lead fire effects monitor attended the conference, and both gained a lot through this opportunity.

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

Park	Monitoring Unit	Plot Type (FMH Forest/Brush/Grass plot, photo point, Rapid Assessment, CBI, etc.)	Pre-burn 2012	Immed. Post 2012	Postburn (1-20 yrs) 2012	Annual Total (2012)	Total Plots
YOSE	White fir – mixed conifer	FMH Forest plot	1	1	6	8	25
YOSE	Ponderosa pine – bear clover	FMH Forest plot	-	-	6	6	18
YOSE	Giant Sequoia	FMH Forest plot	-	-	-	0	13
YOSE	Meadow – YOSE valley	FMH Grass plot	-	-	8	8	8
YOSE	Ponderosa pine – mixed conifer	FMH Forest plot	-	-	-	0	7
YOSE	Incense cedar – mixed conifer	FMH Forest plot	-	-	-	0	3
YOSE	Red fir – mixed conifer	FMH Forest plot	-	-	2	2	2
YOSE	Mixed conifer	Retro fuels	-	-	20	20	41
YOSE	Mixed conifer (YOSE valley)	Retro fuels	-	-	-	0	41
YOSE	Mixed conifer – red fir	Retro fuels	-	-	-	0	20
Total			1	1	42	44	178

Table 2. Fire Ecology Staffing 2012

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified (Yes or No)	Training and Development
Gus Smith	1/1/12	12/31/12	26	Yes	Refresher, NPS Operational Leadership, presented a paper at AFE Congress.
Karen Palmer	3/25/12	12/15/12	19	Yes	Refresher, Yosemite READ training, NPS Operational Leadership, NPS/BLM/FWS Supervisory Skills workshop, presented a poster at AFE Congress, FFI database workshop, and initiated FFT1 taskbook.
Tim Martel	5/20/12	9/22/12	9	Yes	Refresher, Yosemite READ training, completed FALB taskbook, and initiated FFT1 and FEMO taskbooks.

Table 3. 2012 Management Objectives and Monitoring Results

Monitoring Unit	Management Objective (Restoration)	Monitoring Results Mean (80% confidence intervals of the mean)	Objective Achieved?	Year Analysis Completed (Range of Data [Yrs] Included in Analysis)
White fir – mixed conifer forest (n = 9 plots; Re02Year10)	Density: 20-89 trees/acre < 31.5” dbh 4-20 trees/acre > 31.5” dbh	98 trees/acre < 31.5” (+/- 85.5) 11 trees/acre > 31.5” (+/- 6.6) (n = 8, removed an outlier plot): 53 trees/acre < 31.5” (+/- 44.7) 12 trees/acre > 31.5” (+/- 6.5)	(n = 9) NO for trees < 31.5” YES for trees > 31.5” (n = 8) YES	2012 (2007-2012)
	Species composition: 40 – 65% fir, 15 – 50% pine, 0 – 10% cedar	<u>a) trees < 31.5” and 9 plots</u> = 75% fir, 18% pine, 7% cedar <u>b) trees > 31.5” and 9 plots</u> = 48% fir, 40% pine, 12% cedar <u>c) trees < 31.5” and 8 plots</u> = 75% fir, 14% pine, 11% cedar <u>d) trees > 31.5” and 8 plots</u> = 48% fir, 39% pine, 13% cedar	a) NO, fir is too high b) NO, cedar is a bit high c) NO d) NO	2012 (2007-2012)
Ponderosa pine – bear clover forest (n = 13 plots; Re02Year05)	No density or species composition objectives identified in FMP	88 trees/acre < 31.5” (+/- 85.2) 8 trees/acre > 31.5” (+/- 11.5)	N/A	2012 (2007-2010)
		<u>a) trees < 31.5”</u> = 42% pine, 41% cedar, 17% black oak <u>b) trees > 31.5”</u> = 80% pine, 16% cedar, 4% black oak	N/A	2012 (2007-2010)
Giant Sequoia – mixed conifer forest (n = 2 plots; Re01Year02)	Density: 20-101 trees/acre < 31.5” dbh 4-26 trees/acre > 31.5” dbh	53 trees/acre < 31.5” (+/- 34.5) 10 trees/acre > 31.5” (+/- 4.5)	YES *but sample size too small	2012 (1998-2010)
	Species composition: 35-65% fir, 0-20% sequoia, 40-55% pine	<u>a) trees < 31.5”</u> = 85% fir, 8% cedar, 4% sequoia, 4% pine <u>b) trees > 31.5”</u> = 63% fir, 21% cedar, 16% sequoia, 0% pine	NO	2012 (1998-2010)
Red fir – mixed conifer forest (n = 2 plots; Re01Year10)	Density: 20-202 trees/acre < 31.5” dbh 4-30 trees/acre > 31.5” dbh	30 trees/acre < 31.5” (+/- 16.8) 20 trees/acre > 31.5” (+/- 12.9)	YES *but sample size too small	2012 (2012)
	Species composition: 70-100% fir, 0-30% pine	a) <u>trees < 31.5”</u> = 100% fir, 0% pine b) <u>trees > 31.5”</u> = 100% fir, 0% pine	YES	2012 (2012)

Monitoring Unit	Management Objective (Restoration)	Monitoring Results Mean (80% confidence intervals of the mean)	Objective Achieved?	Year Analysis Completed (Range of Data [Yrs] Included in Analysis)
Ponderosa pine – mixed conifer forest (n = 2 plots; Re02Year01)	Density: 4-91 trees/acre < 31.5” dbh 4-30 trees/acre > 31.5” dbh	16 trees/acre < 31.5” (+/- 12.3) 20 trees/acre > 31.5” (+/- 7.6)	YES *but sample size too small	2012 (2006-2010)
	Species composition: 60-95% pine, 15-40% cedar, 1-10% oak	<u>a) trees < 31.5”</u> = 87.5% fir, 12.5% pine, 0% cedar, 0% oak <u>b) trees > 31.5”</u> = 70% pine, 30% cedar, 0% oak	a) NO, fir is present in high % b) YES, but no oak	2012 (2006-2010)
Incense cedar – mixed conifer forest (n = 3 plots; Re01Year10)	No density or species composition objectives identified in FMP	94 trees/acre < 31.5” (+/- 47.8) 7 trees/acre > 31.5” (+/- 4.8)	N/A	2012 (2009)
		<u>a) trees < 31.5”</u> = 54% cedar, 36% fir, 10% pine <u>b) trees > 31.5”</u> = 100% pine, 0% fir, 0% cedar,	N/A	

B. Fire ecologist accomplishments and areas of focus

Table 4. Fire Ecologist 2012 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	20%	FMP, CE to remove « suppression zone » from the FMP and replace it with a « structure protection strategy « in the WUIs, burn plan development & review. Subject matter expert on Mariposa Grove Restoration Plan EIS, authored all WFDSS decisions
Presentations	05%	Scientific meetings, park staff, public, etc.
NPS Meetings/ task groups	10%	CA Fire Science Delivery Consortium Advisory Committee, AFE Board of Directors, AFE Education Committee, Southern Sierra Fire Science Working Group
Interagency work	0%	LANDFIRE, FPA, FLN, etc.
Wildfire assignments	0%	None
Prescribed fire projects	< 5%	Reading burn plans, READ on Wawona Northwest prescribed burn project
Non-fire fuels projects	1%	Walk around and consulting on El Portal and Foresta thinning to develop ways to encourage clumps and gaps in the distribution of trees left after thinning
Research	20%	Wrote two proposals for Fuels Reserve Funding Request, reviewed 2 others, completed Forest Ecology and Management publication on LiDAR fire severity project, completed 3 rd year of NPS Climate Change proposal on carbon emissions project
Data collection	0%	Estimated amount of time spent in the field collecting data; include time spent preparing for field work and travel time to local plot locations
Data entry	0%	Estimated amount of time spent entering data from paper to PC
Data analysis	5%	Estimated amount of time spent performing analyses, including data summaries and statistical tests.
Supervision/Admin	25%	Hiring, supervision, payroll, travel authorization/vouchers, purchasing, etc.
Training	5%	Estimated amount of time spent in training (include time for all training courses attended including in-park, NPS/interagency, and non-government)
Travel out-of-park for plot or project work	0%	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	5%	Reviewing BAR reports.

C. Fire effects crew accomplishments and areas of focus

The fire effects crew had a productive and safe field season in 2012. The fire ecology program welcomed the new fire effects lead, Karen Palmer, at the end of March. Karen had just finished her Master's thesis in forestry and then later graduated from Northern Arizona University in May. She has since become familiar with the extensive fire effects monitoring program we have here at Yosemite. Our seasonal crewmember, Tim Martel, returned for his 3rd season. Tim left slightly early this season to spend time with his wife and their new baby girl. The two crewmembers finished all the plots that were scheduled to be read for 2012, plus read 20 Retro fuels plots that the crew didn't get to during the 2011 field season. In addition, nearly all data from these plots was entered into the FFI database and quality checking had begun before Tim left for the season in late September. The crew also worked on two prescribed burns in the park: the Wawona NW prescribed burn and the Hodgdon PW-03 prescribed burn. In addition, Tim Martel went out on one out-of-park assignment for almost three weeks to gain more experience and work on his fire qualifications.

Table 5. Fire Effects Crew 2012 Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	35%	
WUI plots	0%	
CBI plots	0%	
Retro fuels plots	8%	
Fire Assignments	5%	Seasonal crew member, Tim Martel, went out on assignment with the park fuels crews (Crew 6 and Crew 7) for nearly 3 weeks to work primarily on the Reading Fire in Lassen National Park. He worked on HECM, FALB, and FFT2 duties.
Prescribed fire projects	5%	Lead served as FEMO/FFT2/HECM-t between two prescribed fires. Seasonal served as FFT2 (lighting) on one prescribed fire.
Non-fire fuels projects	0%	
Travel out-of-park for plot or project work	0%	No out-of-park plot or project work scheduled in 2012
Data entry	25%	Completed data entry of all plot data for 2012, plus entered in plot data that was not entered from 2011 and 2007
Data analysis	12%	Lead performed the data analysis for this year's annual report. Lead has also begun work on additional winter projects which require FFI data analysis of various protocols.
Supervision/Admin	3%	Travel and payroll paperwork, purchasing crew field equipment, etc.
Training	5%	Both crew members had refresher training and completed the Yosemite READ class. The Lead also completed additional training such as NPS Operational Leadership, a Supervisory Skills Workshop, and an FFI database workshop.
Miscellaneous	2%	Lead presented a poster at the AFE Congress in Portland, OR, and also gave a presentation in the "Croaking Toad" lecture series for Yosemite National Park natural resource staff.

D. Additional Program Information

Table 6. 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?
Yosemite National Park	no	no	none	none

Table 7. Monitoring - 2012

Park	% 2012 Data Entered	% 2012 Data Quality Checked	# Prescribed Fires Monitored*	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored*	# BAER Treatments Monitored*
Yosemite National Park	100%	100%	1	0	1	0

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

Table 8. 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?*
Yosemite National Park	1	12	4	Yes

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

Table 9. 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
Yosemite National Park	yes	3	1	4 ¹	

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

¹ Jackson: Impact of fire severity on river geomorphology and ecological function, Collins and Stevens JFSP work in Illilouette Basin, Tarnay, Smith, Lutz, and Brooks Carbon pools, Lutz, Kane, Roberts, Smith, Brooks LiDAR investigation of forest structure by fire severity class and vegetation type.

Reserve Fund Research:

- 1) Static carbon pools: J.R. Matchett completed database structure and loaded all plot data into database and ran allometry algorithms, Tarnay mapping carbon pools by vegetation classes, Smith providing plot data, accuracy checking, managing cooperative agreements. Smith and Tarnay present paper at AFE International Congress. Complete 12/31/2013
- 2) LiDAR assessment of forest canopy gaps – complete and attached!

E. 2013 Direction

This winter and into the spring of 2013, we will begin analyzing more protocols from the FFI database in order to answer a wider variety of interesting questions for fire management and natural resource staff at Yosemite National Park. In fact, a temporary general shift from data collection to data analysis and database stewardship will begin next year. We will shift from being focused on collecting more data, to utilizing and analyzing data to inform fire management in the future. With the park performing less prescribed burning over the last 3 years, we have a relatively light plot workload in 2013 (see below). Therefore, in conjunction with the lighter plot workload and the smaller crew size, we see an opportunity to shift to work that can be done with fewer people and still produce results for fire management.

There are several large, long-term projects that the fire ecologist has been interested in completing. Yosemite needs to have a coherent fuel moisture database that can support queries, long-term analysis capabilities, and comparisons from year to year. Thus, creating this type of fuel moisture database for the 2013 season will be a primary focus this winter. Also, up until recently, plot photos were typically accessed by looking directly in the plot folders, were rarely backed up onto network drives, and were not searchable digitally. We have started populating a ‘database’ of the plot photos by loading digital photos that are being re-named to a standard protocol into a digital file storage system. Now, we will have easier access to these photos and comparisons over time can be made more readily. Other projects include:

- 1) Updating the fuels constants in the FFI database to utilize the park-specific fuels constants developed by Jan van Wagendonk.
- 2) Input the rapid assessment data into the FFI database from the many separate Excel spreadsheets that they are stored in now; so that this data can be analyzed with the FMH plot data.
- 3) A review of the Retro fuels data and protocols.
- 4) Develop a bank of “6 Minutes for Science” topics to be presented throughout the fire season.
- 5) Other related research projects may be developed on the side.

Workload and plots scheduled to be read in 2013:

- 3 white fir – mixed conifer forest plots (Re03Year05)
- 6 ponderosa pine – mixed conifer forest plots (4 of these are Re01Year20 and 2 are Re02Year10)
- 1 giant sequoia forest plot (Re01Year05)
- 2 mechanical fuels treatments plots (Re01Year10)
- 32 rapid assessment plots (Kibbie and Whiskey Fires, all Re01Year10)
- 28 Retro fuels plots, pending their review next spring (8 of these are Re02Year10 and 20 are Re02Year15)

F. Optional Information

Prescribed fire restores native plant richness without greatly increasing non-native plants (initial insights)

We examined how number of prescribed fires and time since last fire impact native plant richness. We categorized plants as either native to the park or non-native and observed the changes post treatment and through time. The vegetation data was collected on FMH plots using the point-intercept method (USDI National Park Service 2003). All analyses excluded substrate hits, trees, unknown plants, and plants only keyed out to the genus.

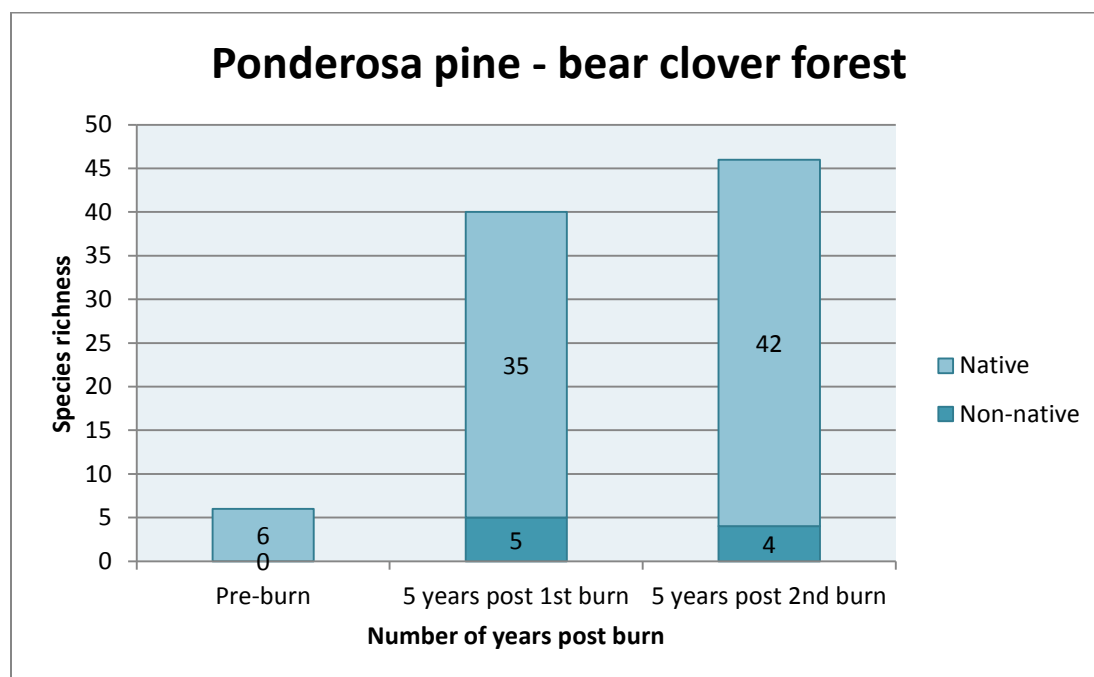


Figure 1. Species richness and time since prescribed burn in the ponderosa pine – bear clover forest type (n = 13 plots).

There was 100% nativity prior to the first burn. Then 5 years after the first burn, five non-native species had invaded. Five years after the second burn, species richness had increased 7 fold compared to the Pre-read and 91% were native species. Thus, we see an increase in herbaceous vegetation diversity with repeated prescribed burning in this forest type without substantial

introduction of non-native species. We will continue to monitor nativity to determine if native species richness is maintained and if non-native species richness declines with time.

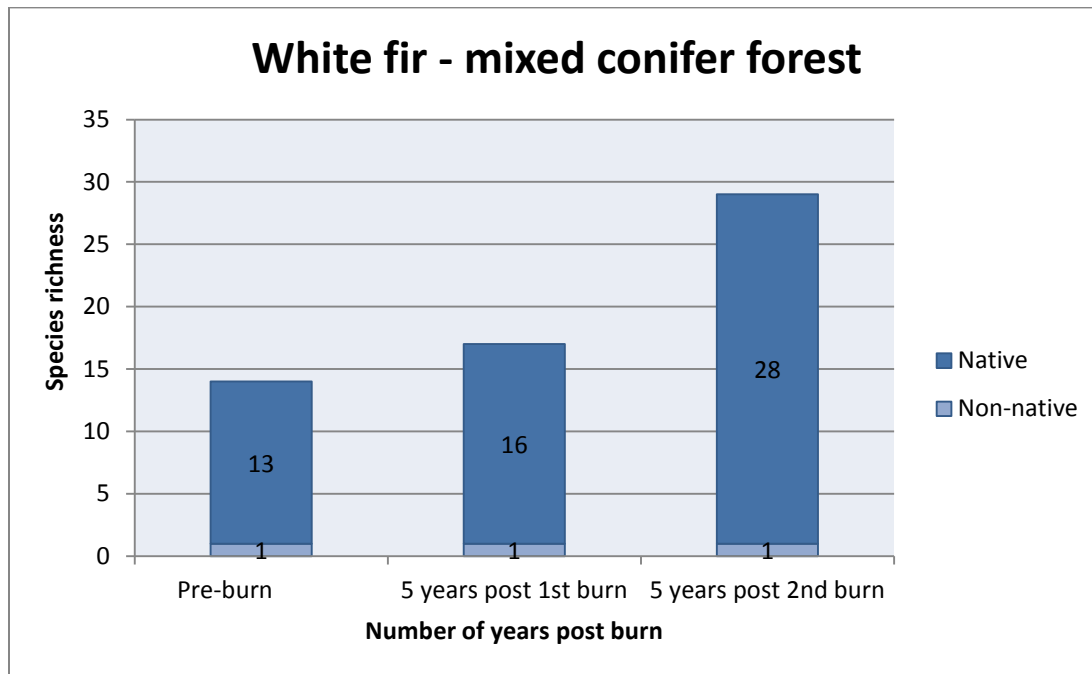


Figure 2. Species richness and time since prescribed burn in the white fir – mixed conifer forest type (n = 15 plots).

In the white fir – mixed conifer forest type, there is only one non-native species present at each point in time from the Pre-read on. Species richness of the native species is simultaneously increasing over time to more than double what was recorded on the Pre-read. Again, we are seeing an increase in overall diversity with repeated prescribed burning without compromising nativity.

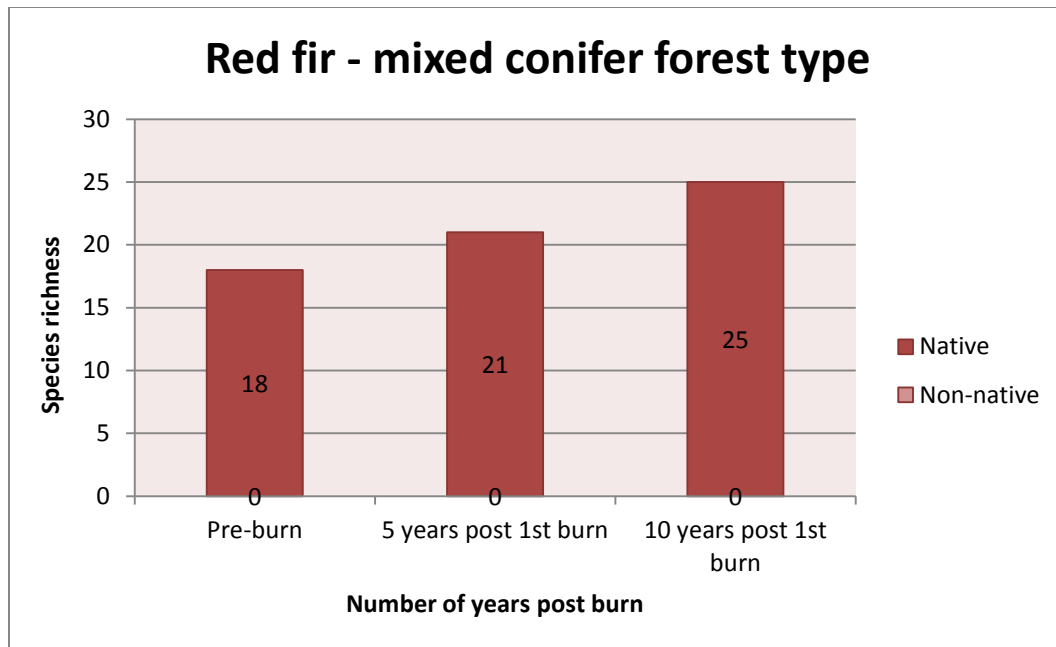


Figure 3. Species richness and time since prescribed burn in the red fir – mixed conifer forest type (n = 2 plots).

In the red fir – mixed conifer forest type, the data shows 100% nativity in species on these plots. Prescribed burning did not introduce non-natives. These results also show a moderate increase in species richness over time after the fire. However, being that the sample size is so small (n = 2 plots), we have little confidence that this represents the impact of burning on red fir stands in the park.

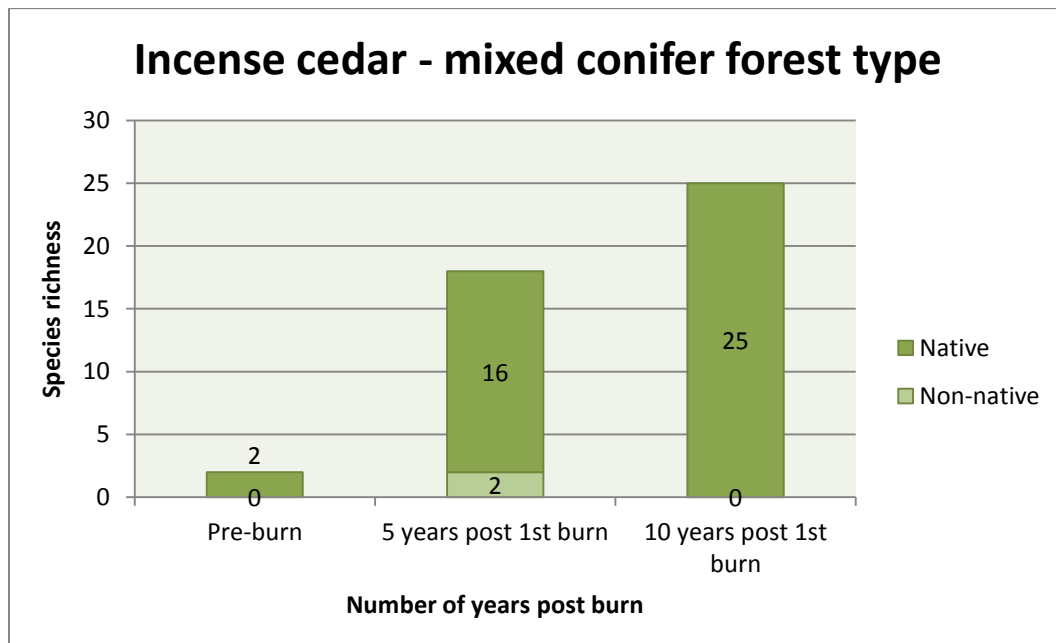


Figure 4. Species richness and time since prescribed burn in the incense cedar – mixed conifer forest type (n = 3 plots).

The incense cedar – mixed conifer forest type is 100% native prior to the first burn but also very low in species richness. Five years after the first prescribed burn native species richness increased by a factor of 8 and two non-native species invaded. This resulted in a more diverse plant community and yet with this increase in species richness, 11% of all species were non-native. Ten years after the burn there are no non-native plants present and a further increase in the species richness of the native species. Similar to the previous analysis, results should be taken with a grain of salt as there are only 3 plots.

Conclusions

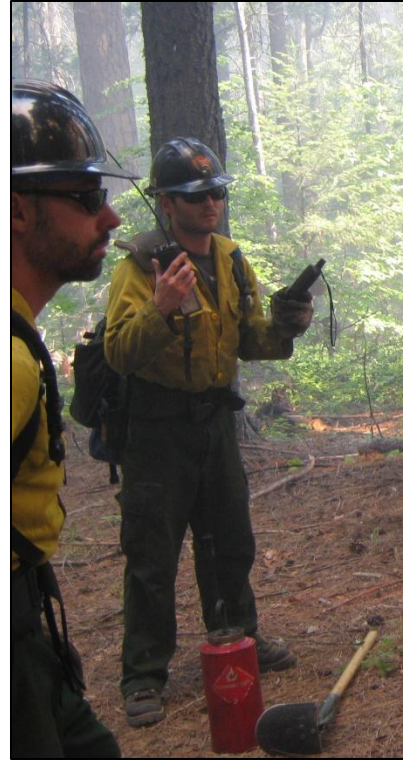
The nativity analysis results for the ponderosa pine – bear clover and the white fir – mixed conifer forest types proved to be the most interesting at this point. These results provide support for Yosemite’s prescribed burn program by highlighting positive effects to the herbaceous plant community post-fire in these forest types. The negative implication of introducing many non-native species to areas post-fire remains a concern for resource managers throughout the park. Thus we are attempting to address these concerns by looking at the data from our FMH plots. Although these initial results are obviously just part of the picture, we plan to also look at the frequency data (i.e. the number of hits of natives vs. non-natives per each transect) to get an idea of relative cover of non-natives across the plots. We also are interested in understanding more about the biology of “who” these non-native species are. Are they all the same type of non-native species, or do they vary by forest/vegetation type? Which species go away quickly versus ones that may persist longer? This brief analysis has brought to light several new questions which we will begin focusing on now.

Literature Cited

USDI National Park Service. 2003. Fire Monitoring Handbook. Boise (ID): Fire Management Program Center, National Interagency Fire Center. 274p.



Another day at the office! Tim and Karen reading FMH grass plots in Leidig Meadow.



The crew monitored fire effects and also assisted with lighting operations on the Hodgdon prescribed burn (234 acres) in June, 2012.



Hodgdon prescribed burn – burning in a mixed conifer forest.



Some of the rare plants found in the area of the Hodgdon burn unit. *Cypripedium montanum* pictured on the left and *Clintonia uniflora* pictured on the right. Initial effects looked positive for both these species.