



SUMMARY

The 2007 season was both diverse and productive for the Grand Canyon National Park's (GRCA) Fire Ecology Program. While making 53 FMH plot visits, including a record 20 immediate post-burn reads, all scheduled work was completed while allowing crewmembers wide-ranging training opportunities and contributing to the national firefighting effort. In addition, 91 CBI plots were installed within four fires at GRCA to allow assessment of burn severity. The Fire Ecologist continued to serve as program lead for development of the fire management plan EIS through September.

Newfound learning opportunities became available in 2007 as the Lead Monitor took a 9-month leave of absence to hike the Appalachian and Continental Divide Trails starting in mid-February, and the Fire Ecologist accepted a new position on the Prescott National Forest in mid-September. The Assistant Lead Monitor detailed into the Lead position (April 2007 – present) while continuing

to fulfill the dual role of Assistant, and the Lead detailed into the Ecologist position upon returning from his leave of absence (November 2007 – present). Overall, we had new people filling new or dual positions and taking on many different tasks while effectively being understaffed by one position. Amidst these challenges the Grand Canyon crew was able to step into new roles and successfully perform all field and office work without any major hang-ups.

Data analysis was limited to updating fuel loading totals for the Deputy FMO and Air Quality Specialist, as well as working on the annual report. Conversion of the GRCA database to FEAT v2.4 at the end of the field season continued, while FMH remained the working program used to enter, store, and analyze data. Data entry was severely delayed when the computer containing the main database was one of many park units confiscated for a system-wide virus infection, followed by non-stop burning upon return of the database. One Fire Effects crewmember and a senior engine crewmember assisted into December to complete data entry and error checking.

Crewmembers as usual took part in a wide array of extracurricular activities. We had two first-time firefighters, and used this as an opportunity to acquire a large amount of fire and aviation training. Efforts continued in cross-training Fire Effects crewmembers with all other field disciplines in our fire management program, and personal interest by the crew greatly facilitated the multi-disciplinary learning. To spread the wealth of knowledge further, six other Grand Canyon fire personnel were cross-trained in fire effects plot monitoring protocols. We continued our record of providing the primary fire behavior and weather monitoring support at Grand Canyon with every crewmember assisting fire monitoring in-park on multiple occasions for either prescribed or fire use events. The Acting Lead Monitor was able to provide monitoring for seven of the eight prescribed fires at GRCA this season, with the crew being involved in all eight burns. Despite these additional duties, we were able to accomplish all of our planned plot work.

Out-of-park, the Acting Lead went on one Helicopter Crewmember (HECM) assignment to the Wicked-Hicks Complex in Montana. Continuing the tradition of assisting other Fire Effects programs for a seventh consecutive year, the Acting Lead detailed to Saguaro to assist the Fire Ecologist with data analysis. Unfortunately, we were not able to detail anyone out-of-park with Fire Use Modules, but did get multiple crewmembers experience in-park with the Zion, Bandelier, and Great Plains Modules. The Ecologist spent a total of 5 weeks on fire assignments.

Next season's FMH plot load will be very similar to 2007, barring fire use or suppression events affecting existing plots. CBI plot workload will increase due to over 17,000 acres of prescribed and fire use burning. New rapid assessment-style protocols are also scheduled to be implemented in an effort to give managers more incident-specific data. At present, the workload will be mostly on the North Rim (68%).

STAFF ACCOMPLISHMENTS & AREAS OF FOCUS

TABLE 1. Fire Ecology Staff for 2007 calendar year.

Employee	Starting Date	Ending Date	# Pay Periods	Training	NWGG Task books
Mary Rasmussen, GS-11	1/01/07	9/20/07	20	S403 S420	PIO2
Li Brannfors, GS-7/9	1/01/07 11/25/07	02/17/07 12/31/07	6	-	FFT1-t ICT5-t
Melissa Spandl, GS-6/7	1/29/07	12/31/07	22	S390 L280 S131	ICT5 FFT1
Karen Koenig, GS-5	5/14/07	12/07/07	15	S130/190 S212	FALA-t FFT2
Athene Eisenhardt, GS-5	4/30/07	10/25/07	13	HTA	FALA-t FEMO HECM-t FFT1-t
Benjamin Janes, GS-5	5/29/07	10/11/07	10	S130/190 S212	FALA-t FFT2

TABLE 2. Base-hour Fire Effects crew activities by percent and category. Highlighted areas are where crewmembers spent majority of base-hour time.

Employee	FMH Plots	CBI Plots	Data Entry	Data Analysis	FX Office	Monitoring (Rx or Fire Use)	Rx Fire Ops	Fire Use Ops	Suppression And Helibase Ops.	Training Courses	Other
Li Brannfors,GS-7	1	0	11	1	61	0	0	0	0	0	27
Melissa Spandl,GS-6/7	15	3	1	1	36	8	5	0	7	7	18
Karen Koenig,GS-5	23	0	4	0	20	10	9	1	8	8	17
Athene Eisenhardt,GS-5	21	3	1	0	23	12	2	1	17	3	16
Benjamin Janes, GS-5	14	7	0	0	22	4	3	1	28	10	11

"FX Office" includes miscellaneous plot data preparation and management time, photo filing, paperwork, supervision, PT time, etc.

"Other" includes meetings, paid holidays off, air quality, non-fire duties, leave taken, etc.

TABLE 3. Fire Effects Crew Focus Areas/Accomplishments 2007

Focus Area	Percent Time	Notes
FMH Plots	18%	32 remeasurements, 20 immediate post-burn reads, 1 install
CBI Plots	3%	91 plots across 4 fires
Data Entry	2%	Completed all 2007 FMH & CBI plot data entry by Dec 7
Data Conversion	<1%	- Lead & Assistant converted GRCA FMH data to FEAT in Jan 07 - Acting Ecologist assisted Lake Meredith FMH to FEAT conversion
Data Analysis	2%	2007 Annual Report analysis on all major variables in program - Fuel load numbers for whole program to date <i>Bromus tectorum</i> analysis for fire management plan EIS
General Office/ Supervision/ Admin	30%	- Includes FMH & CBI plot preparation and data filing/organization - Detailed Acting Lead to Saguaro for 2 weeks - Acting Lead hired 3 seasonal crewmembers - Acting Lead supervised 3 seasonals 1 hr PT time/day for each crewmember - Paperwork!
Fire Monitoring (Rx or WFU)	9%	- Lead FEMO & FEMO-trainees on all 8 Rx fires at GRCA, and 1 Rx on the North Kaibab - Lead FEMO & FEMO-trainees on 1 WFU fire at GRCA
Fire Operations/ Assignments (Suppression, Rx, WFU, or Helitack)	19%	- Acting Lead went on 2-week HECM assignment to MT 2 crewmembers detailed for 2 weeks with Coronado Interagency Type-2 Handcrew - Initial attack support on multiple Type 5 fires at GRCA & KNF - Sent one crewmembers to 2-week Helicopter Training Academy at GRCA S Rim 1 crewmember went on 2 week assignment with Engine 6-2 to Idaho 1 crewmember went on 1 week assignment with Engine 6-1 to Zion - Cross-trained crewmembers with GRCA engines, helitack, mechanical fuel reduction projects, fuel sampling - Provided IA coverage on N Rim while Engine 6-2 was out-of-park on assignments
Training	7%	- All attended annual fire refresher - Sent 2 seasonals to S-130/190 in Alamosa, CO - Sent 2 seasonals to S-212 at GRCA, S Rim - Sent Acting Lead to S-131, L-280, S-390 1 seasonal attended GRCA Helicopter Training Academy, S Rim
Other	8%	- Set up and downloaded DataRAM for air quality monitoring on 7 of the 8 Rx burns 2 crew members assisted Veg Mapping crew on North Rim 9% of crew time spent on paid or unpaid leave - Ecologist spent ~120 hrs designing & maintaining GRCA Fire webpages

FIRE EFFECTS PLOT WORKLOAD

The 2007 season started with a relatively light plot load, but with increased prescribed and fire use activity later in the season, turned into a very busy year. A total of 53 visits were made to permanent FMH-style plots, including a record 20 immediate post-burn reads. Five plots burned this year in the Roosevelt WFU, and the remaining 15 burned in an assortment of prescribed burns. In order to supply managers with data from upcoming prescribed burns and provide the crew with plot installation experience, we installed 1 FMH forest plot in South Rim Ponderosa (PIPO) on the Grandview Rx unit. On the CBI front, 91 non-permanent severity plots were installed one year following four prescribed fires from 2006. A higher percentage of time was spent on the South Rim for plot work and prescribed burns than normal.

TABLE 4. Fire Effects Plot Workload 2007

Rim	Monitoring Unit	Plot Type	Install/ Pre-burn	Immed. Post-burn	Year 1	Year 2	Year 5	Year 10	Annual Total	Total FMH Plots
South	Ponderosa Pine PIPO	FMH	2	5	5	8	5	1	26	38
South	Pinyon-Juniper Woodland PIED	FMH							0	17
South	Long Jim II Rx	CBI	24						24	-
South	Shoshone Rx	CBI	28						28	-
South	Grapevine Rx	CBI	23						23	-
South	RX 300 Rx	CBI	16						16	-
North	Ponderosa Pine PIPN	FMH		8		6			14	30
North	Ponderosa Pine w/ White Fir Encroachment PIAB	FMH	1	7				1	9	26
North	Rocky Mountain Subalpine Conifer PIEN	FMH	4						4	17
North	Grassland Interior GRIN	FMH							0	10
North	Grassland Edge GRED	FMH							0	6
Total			98	20	5	14	5	2	144	144

"Total FMH Plots" includes all permanent FMH plots installed to date within a monitoring unit/type

MONITORING OBJECTIVES & RESULTS

FMH

Grand Canyon National Park's Fire Effects monitoring program has installed 144 permanent Fire Monitoring Handbook (FMH)-style plots to date and has burned 110 of these same plots. This large body of data allows us the luxury of being able to report results to our desired level of statistical accuracy for almost all of our major management objectives. Of the 15 objectives listed below, we can confidently say we are achieving 10 of them and the trend is so far very positive on another 5.

Table 5. Management Objectives and Monitoring Results 2007

Monitoring Unit	Management Objectives	Monitoring Results (n = # of plots)	Objectives Achieved?	Minimum Plot #s Achieved?
Ponderosa Pine (PIPO) South Rim	Reduce total fuel load to 0.2-9.3 tons/acre immediate post-burn	7.6 tons/acre (-51.8%) (n=33)	YES	YES n=6
	Limit crown scorch on trees (PIPO) with DBH ≥16" to <30% immediate post-burn	21.6% crown scorch (n=32)	YES – Results are for all trees >6" DBH, so % is likely lower for trees ≥16"	YES n=14
	Reduce poles (PIPO) with DBH of 1-6" to <200 trees/acre 2 years post-burn	109.6 trees/acre (-20.7%) (n=24)	YES	NO n=103
	Achieve overstory (PIPO) density with DBH ≥16" of 19-25 trees/acre 5 years post-burn	19.7 trees/acre (-0%) (n=21)	YES	YES n=12
Pinyon-Juniper Woodland (PIED) South Rim	Reduce total fuel load to <20 tons/acre immediate post-burn	9.0 tons/acre (-24.7%) (n=13)	YES	YES n=5
	Limit overstory tree (all species) mortality to <20% 5 years post-burn	12.4% mortality (n=12)	YES	YES n=4

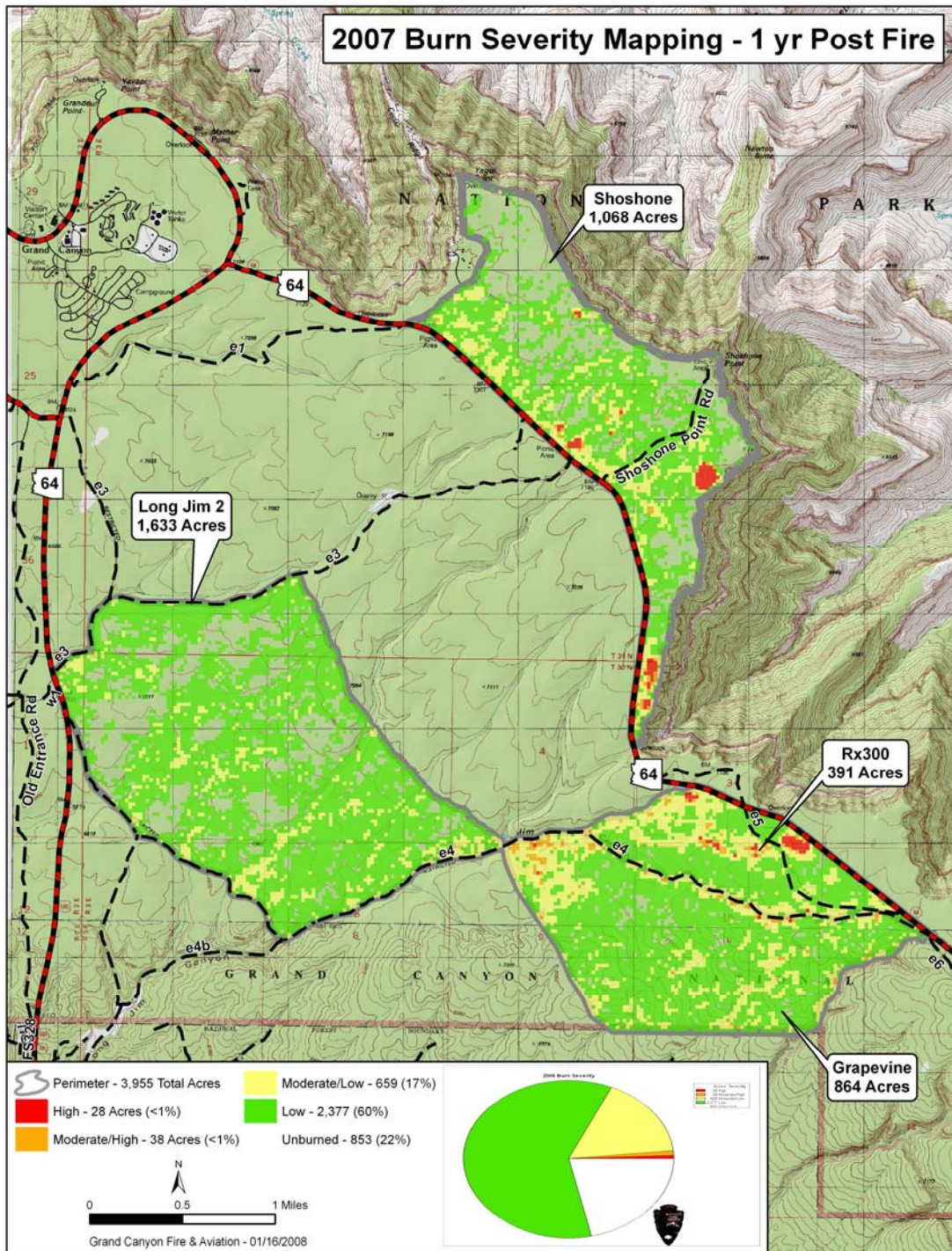
Monitoring Unit	Management Objectives	Monitoring Results (n = # of plots)	Objectives Achieved?	Minimum Plot #s Achieved?
Ponderosa Pine (PIPN) North Rim	Reduce total fuel load to 0.2-9.3 tons/acre immediate post-burn	13.6 tons/acre (-62.6%) (n=29)	NO – Getting close, but second-entry treatment likely needed	YES n=9
	Limit crown scorch on trees (PIPO) with DBH ≥16" to <30% immediate post-burn	18.3% crown scorch (n=29)	YES – Results are for all trees >6" DBH, so % is likely lower for trees ≥16"	YES n=4
	Reduce poles (PIPO) with DBH of 1-6" to <200 trees/acre 2 years post-burn	69.4 trees/acre (-45.6%) (n=26)	YES	NO n=80
	Achieve overstory (PIPO) density with DBH ≥16" of 40-56 trees/acre 5 years post-burn	43.5 trees/acre (-4.9%) (n=20)	YES	YES n=4
Ponderosa Pine w/ White Fir Encroachment (PIAB) North Rim	Reduce total fuel load to 0.2-20 tons/acre immediate post-burn	17.9 tons/acre (-54.7%) (n=19)	YES	YES n=6
	Limit crown scorch on trees (PIPO) with DBH ≥16" to <30% immediate post-burn	11.5% crown scorch (n=19)	YES – Results are for all trees >6" DBH, so % is likely lower for trees ≥16"	YES n=8
	Reduce poles (ABCO) with DBH of 1-6" to <100 trees/acre 2 years post-burn	68.0 trees/acre (-74.0%) (n=15)	YES	NO n=23
	Achieve overstory (PIPO) density with DBH ≥16" of 19-25 trees/acre 5 years post-burn	20.2 trees/acre (-19.8%) (n=13)	YES	YES n=11
Rocky Mountain Subalpine Conifer (PIEN) North Rim	Reduce total fuel load immediate post-burn	Reduction from 62.8 to 30.2 tons/acre (-51.9%) (n=2)	YES - No quantitative goal has been established, but trend is of solid reduction	NO n=6

Assessment of objective success and fulfillment of minimum plot requirements are based on 80% confidence intervals, with R-value of 20.

CBI

Composite Burn Index (CBI) burn severity assessments have been occurring annually at Grand Canyon since 2001. Between 2001-2007, 756 CBI-style plots have been installed in the park, providing Normalized Burn Ratio (NBR) satellite-correlated severity data on 25 fires over 72,000 total acres. This process is designed for field data and satellite imagery gathered one year following a fire; hence, 2007 work was performed on fires which burned in 2006. A total of 91 CBI plots were installed in 2007 to help provide these numbers.

Figure 1. Burn severity by percent and acres for 2006 fires at Grand Canyon



ADDITIONAL ANALYSIS

RX VS. WILDLAND FIRE USE ON THE NORTH RIM

Here at Grand Canyon National Park we are in the incredibly fortunate position of burning equally large acreages with both wildland fire use and prescribed fire treatments. Since 1980, over 60,000 acres have been burned by each treatment type, mostly within designated burn unit boundaries. As permanent FMH plots have been randomized and installed across the landscape of the North Rim, they, too, have burned in both fire use and prescribed events. This combination of management practices and happenstance has produced on the North Rim a perfectly even split of 24 plots burned in first-entry prescribed (Rx) fires and 24 burned in first-entry fire use (WFU) in two of our main monitoring types. We now have five years of post-burn data for many of these 48 plots, and are in a position to present the results comparing prescribed and fire use treatments at Grand Canyon.

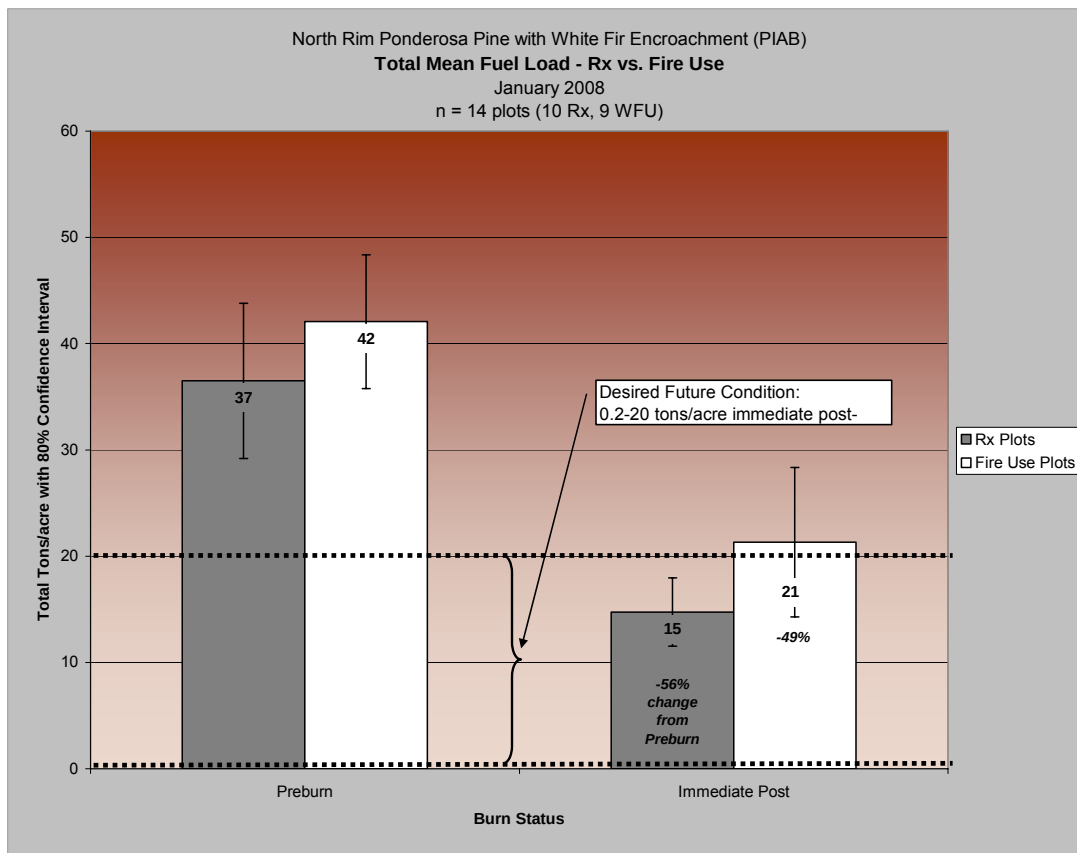
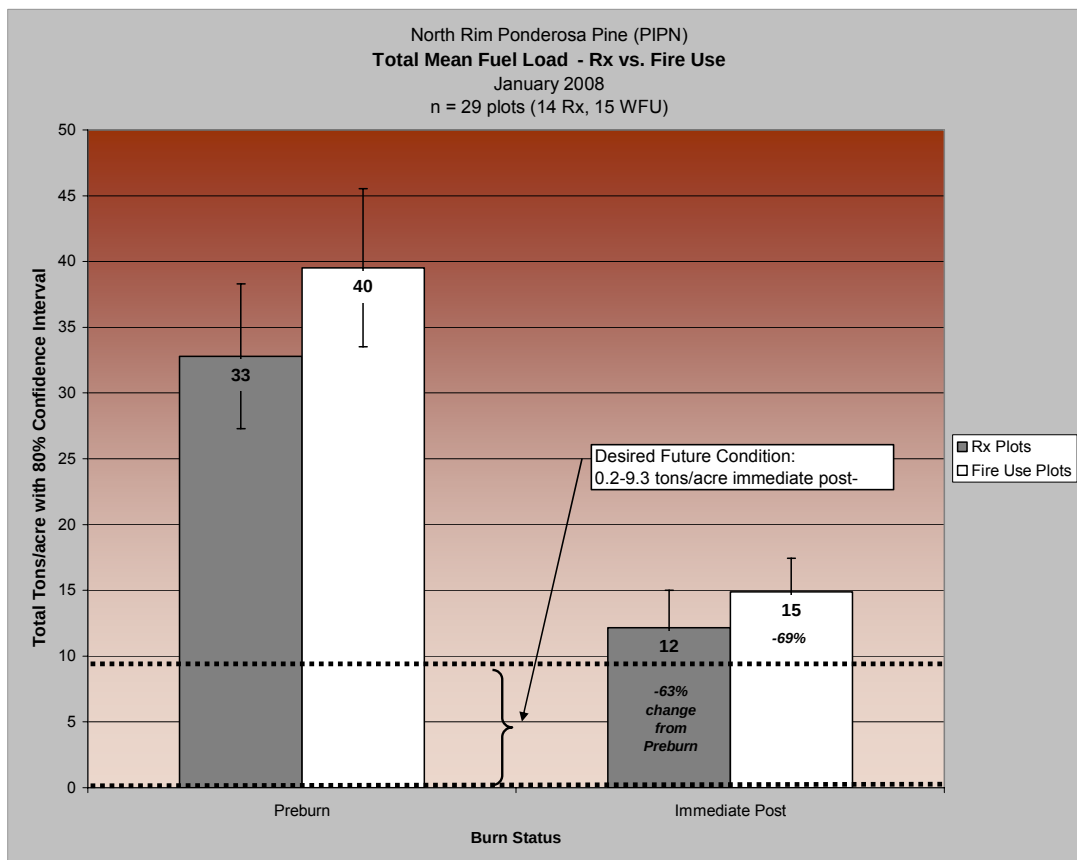
Preceding results in Table 5 reflected prescribed and fire use treatments lumped together for the North Rim Ponderosa Pine and Ponderosa Pine with White Fir Encroachment monitoring types. Here we will break out the results by treatment type for three of our management objectives.

Total Fuel Load

In pure ponderosa, total mean fuel load dropped an average of 63% in 14 Rx plots and 69% in 15 WFU plots immediately post-burn, following a first-entry treatment. While absolute values differ between treatment types, the relative change is nearly identical. Despite the impressive fuel load reduction, we haven't quite reached our desired future condition of less than 9.3 tons/acre. This suggests a second-entry treatment or revisiting our first-entry objectives will be necessary.

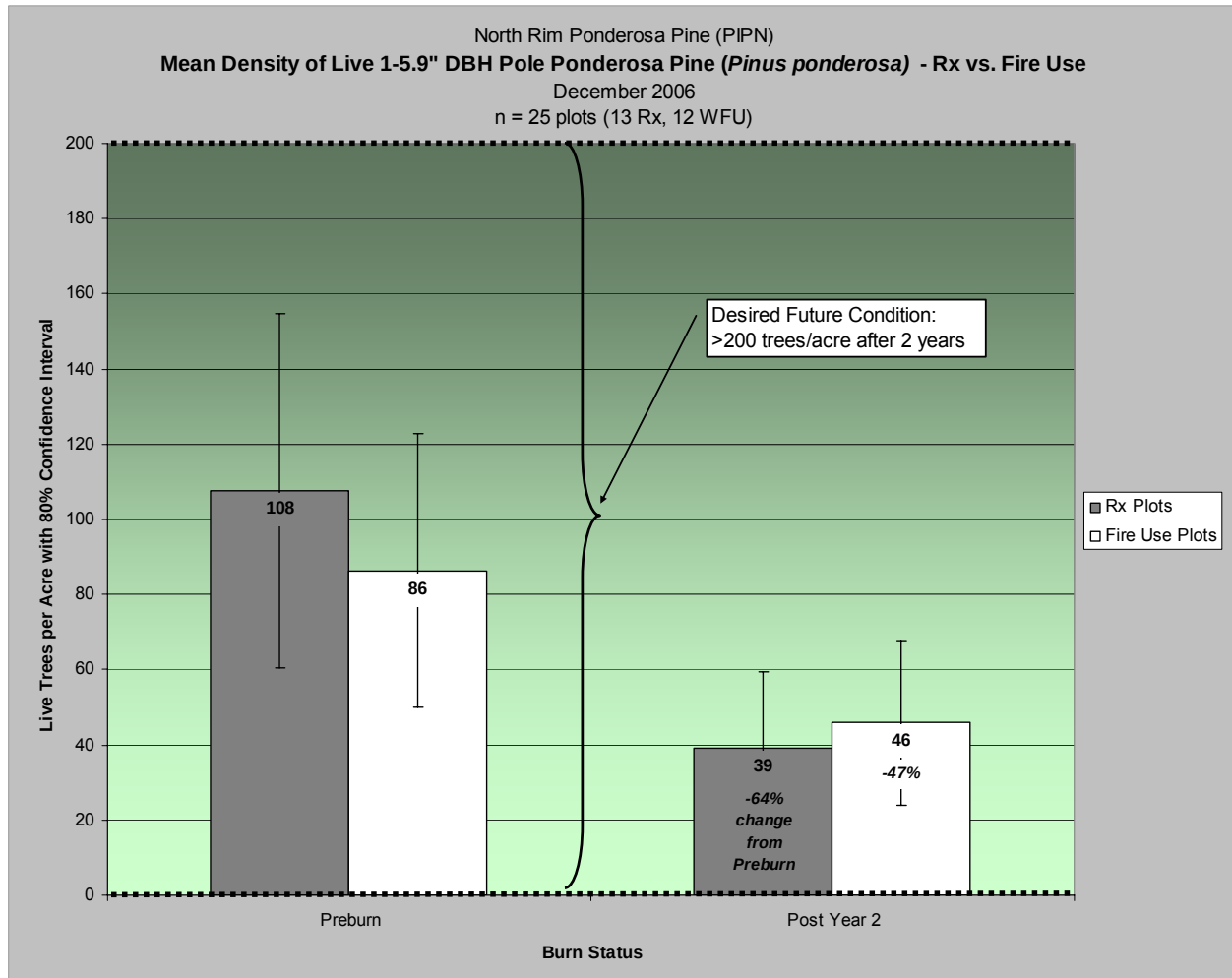
The results for the ponderosa zone where white fir has extensively encroached due to fire suppression and more favorable habitat ("mixed conifer" as bandied about in some circles) are very similar. Reductions of total fuel load are less than in the pure ponderosa, but almost identical for prescribed and fire use treatments. Here our first-entry objectives are less aggressive and we are right at the upper limit of our desired future condition. Error bars are a bit wider for the pre-burn prescribed values due to a smaller sample size.

These numbers reflect a great similarity in fuel reduction effectiveness between prescribed and fire use burns at Grand Canyon. Within each monitoring type, the differences in percent reduction are not statistically significant, owing more to variations in individual plots than treatment methods, in all likelihood.

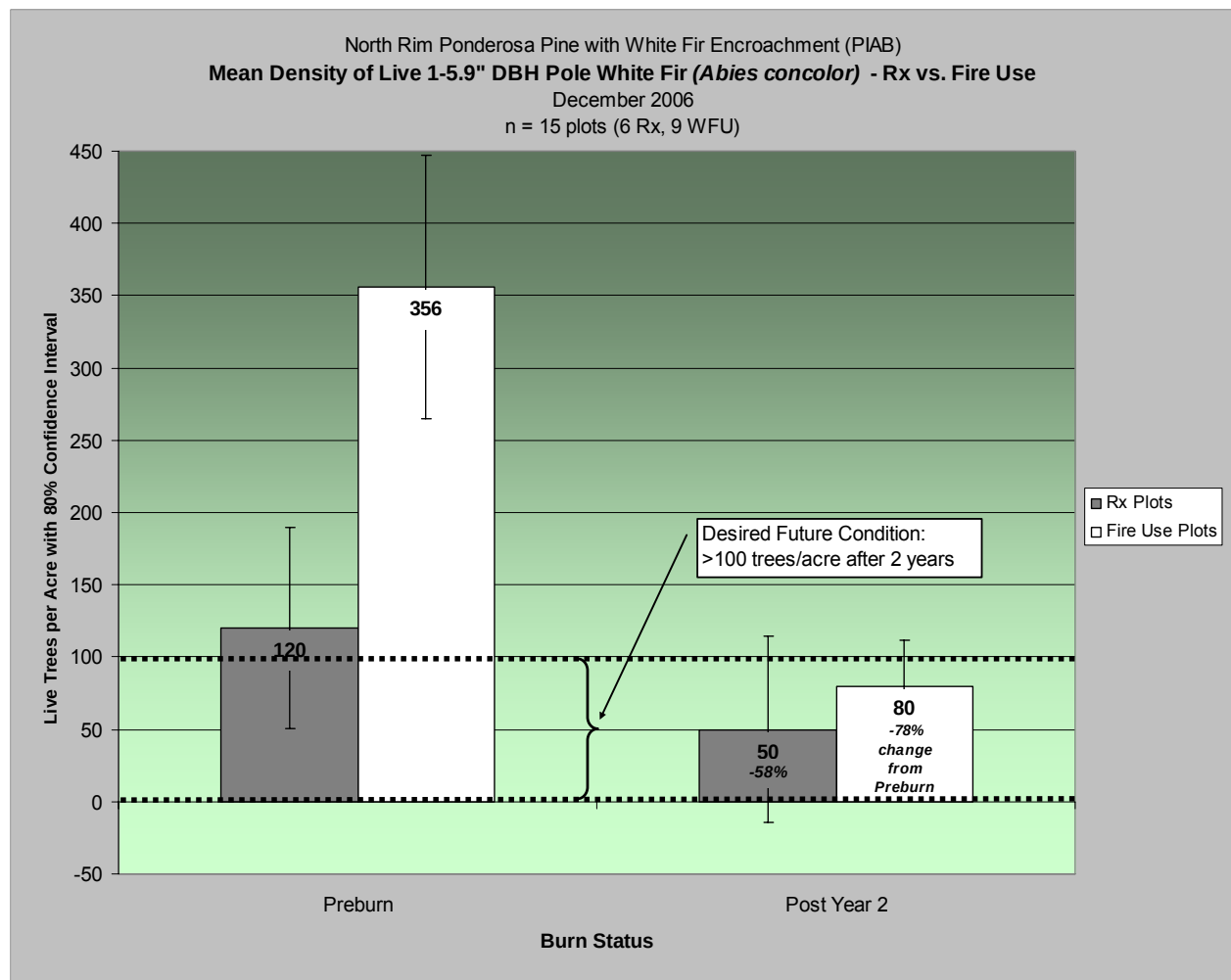


Pole Density

Pole densities are evaluated according to species at Grand Canyon. In pure ponderosa, our goal is to achieve ponderosa pole densities less than 200 trees/acre. A comparable selection of plots demonstrates pole reductions of 47% in fire use and 64% in prescribed fires; however, pre-burn conditions already were well within the desired future condition range. It would seem as though this objective should be refined by further research.



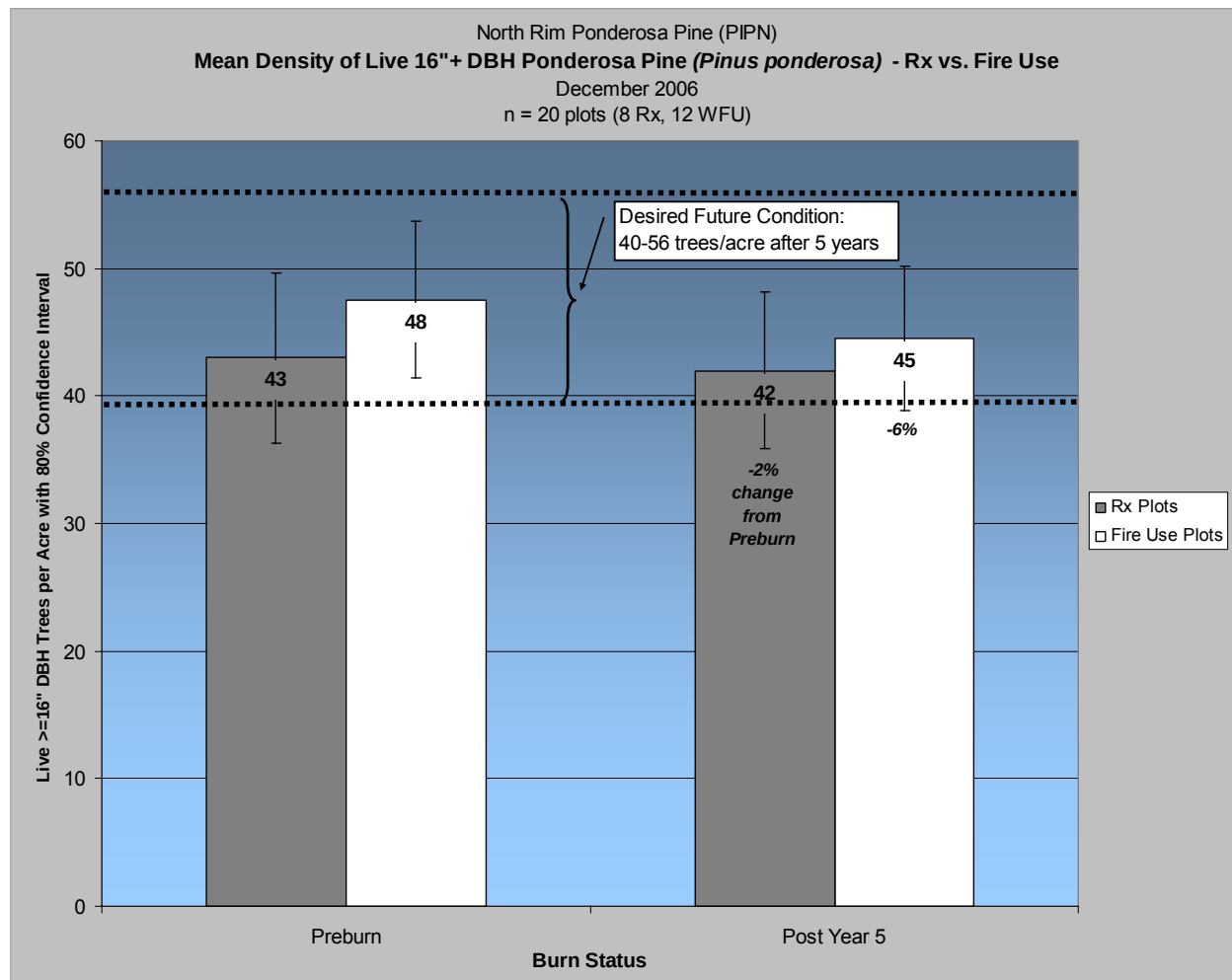
Percent reduction numbers are flip-flopped for ponderosa with white fir encroachment. In this denser monitoring type white fir is the species of concern, and fire use showed 78% reduction while prescribed burning only dropped pole numbers 58%. There is a glaring disparity between pre-burn densities in the two treatment types, with the nine plots burned in fire use demonstrating triple the amount of trees as the six burned in prescribed fires. Nonetheless, numbers two years post-burn show a drop in densities for both types of burns into the desired future condition of less than 100 trees/acre.



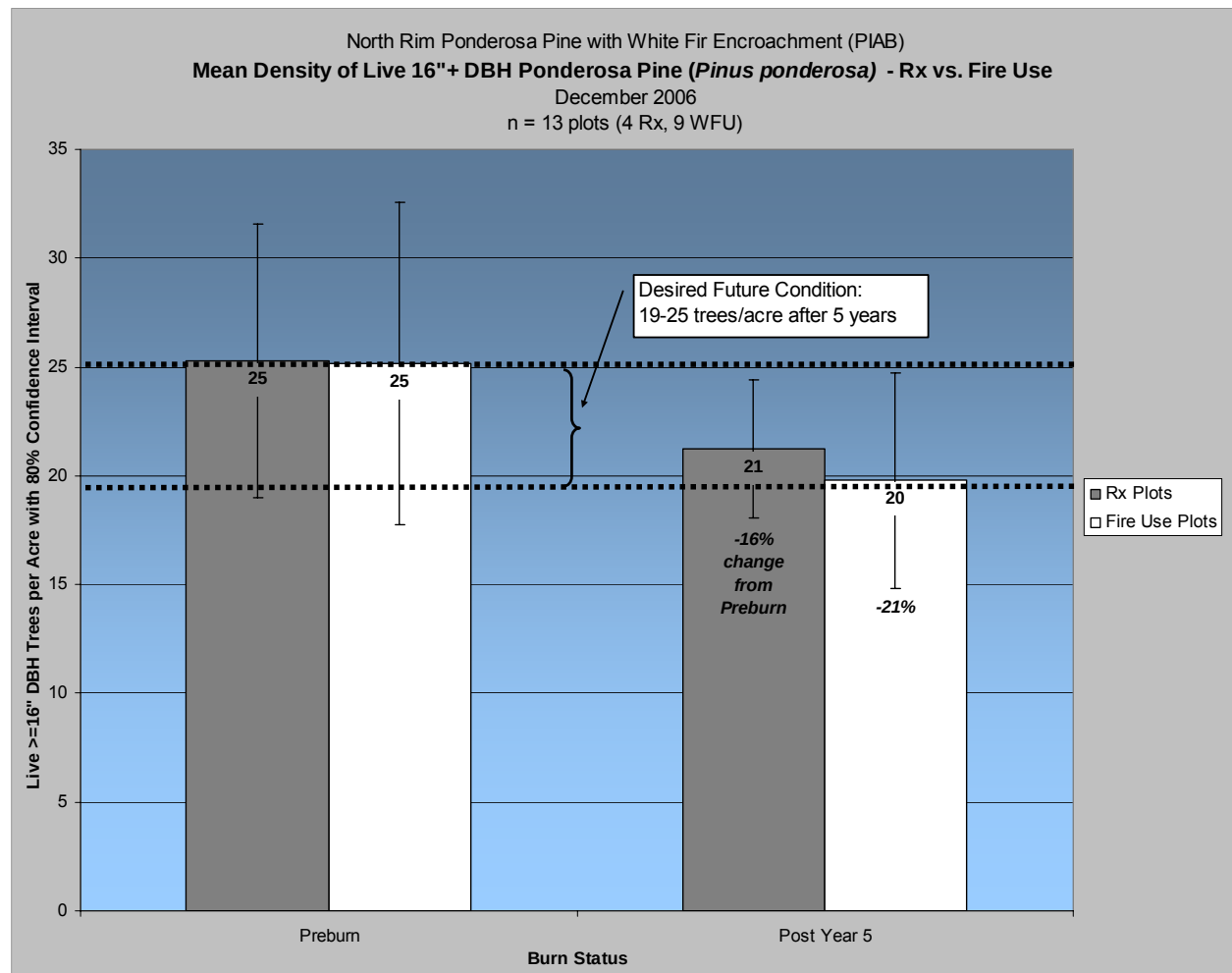
Just as with fuel loading, you'd have to say that prescribed and fire use treatments both seem to be doing the job for reducing poles. Minor variations aside, pole densities on average have dropped by at least half for all treatment types in both pure ponderosa and "mixed conifer" vegetation types.

Overstory Density

Keeping with the trend of comparing results in relation to our standard monitoring objectives, here we look at changes in overstory ponderosa pine with DBH ≥ 16 ". In pure ponderosa pine, we would like to achieve a desired future condition of 40-56 trees/acre in this size class, with the subsidiary goal of limiting mortality to 20%. It appears safe to say we have accomplished the dual objectives with both fire use and prescribed treatments. We were already within the desired range pre-burn, and kept mortality to less than six percent with both types of fire. The data set here is slightly smaller than for other analysis as we do not yet have five year post-burn data for five of the prescribed plots.



Once again, we have apparent success in ponderosa with white fir encroachment. The desired future condition of 19-25 trees/acre in ponderosa pine $\geq 16"$ DBH is half the density of the pure ponderosa monitoring type, owing in part to multiple overstory species competing for the same resources. Pre-burn we were at the upper end of the range and five years post-burn we are at the low end of the desired range. As might be expected, the percent mortality is higher in “mixed conifer” due to factors such as higher understory tree densities and the prevalence of ladder fuels. For fire use treatments, we have slightly exceeded the goal of limiting mortality to 20%, yet we are still within our density range of success for the objective. It appears as though these two objectives could be conflicting under some circumstances, and it begs the question as to which is paramount.

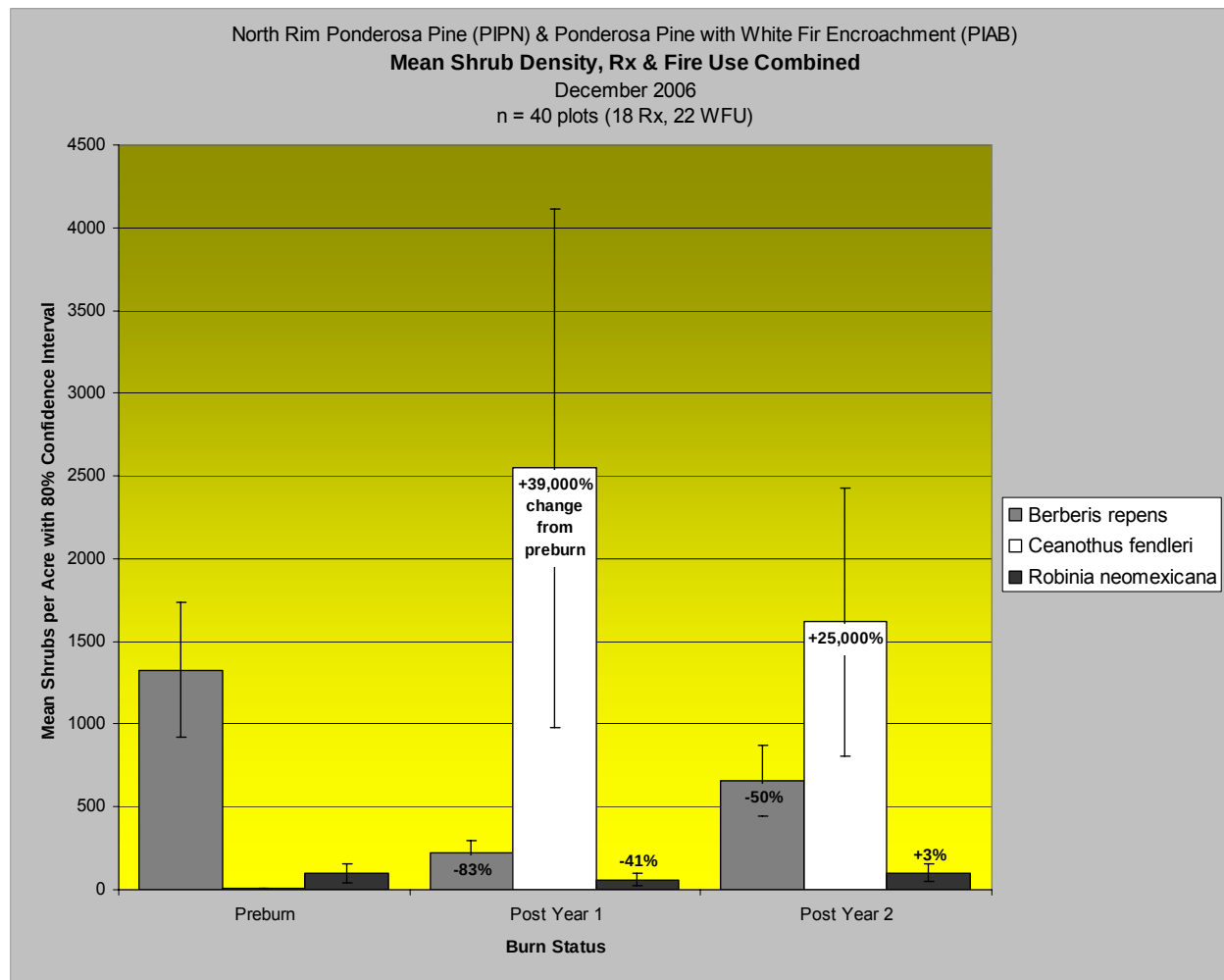


As with our previous two objectives, we again see positive results from both fire use and prescribed burns, with little noticeable difference between the types of treatment.

Taken as a whole, these data seem to demonstrate not only that first-entry prescribed fire and fire use are equally effective tools, but that they are being applied under consistent conditions at Grand Canyon. That there is no great disparity in results between treatment types strongly suggests that both prescribed burning and fire use continue to be employed as management strategies.

PREFERRED BROWSE SHRUB RESPONSE ON THE NORTH RIM

Grand Canyon's Wildlife Biologist recently expressed interest in the response of preferred browse shrub species to fire. While initially it seemed intriguing to break out results by treatment type and monitoring type as done for our main objectives, doing so yielded no significant differences. Therefore, we chose to present the results for the entire body of data on the North Rim in the pure ponderosa and ponderosa with white fir encroachment monitoring types. Although other shrub species are present, numbers were too insignificant to report. Creeping barberry (*Berberis* or *Mahonia repens*) was not identified as a preferred browse species, but it is one of the most common species encountered, so we included it for comparison.



In yet another example of the broken record banality seen throughout this report, “Fire is good.” Both *Ceanothus* and *Robinia* show net increases by two years post-burn, while *Berberis* is not yet recovered to pre-burn conditions. *Robinia* takes longer to respond while *Ceanothus* seems to peak one year post-burn. The exceptionally strong response from *Ceanothus* is noteworthy. For at least these species in question on the North Rim, fire treatments seem to have a positive effect on preferred browse shrubs.

Here's to happy trails in 2008

& remembering there's more to life than work



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