



SUMMARY

The 2009 season was productive and diversified for Grand Canyon National Park's (GRCA) Fire Ecology Program. In the process of making 48 Fire Monitoring Handbook (FMH) plot visits, all scheduled work was completed while allowing crewmembers wide-ranging training opportunities and contributing to the national fire management effort. Rapid Assessment Protocol (RAP) plots continued their expansion and contribution to the park's monitoring program, with installation of 25 more pilot plots and initial post-burn results from another 25. In addition, 13 Composite Burn Index (CBI) plots were installed within one fire at GRCA to allow assessment of burn severity, resulting in a grand total of 111 plot visits. Full staffing within the Fire Ecology Program for all of 2009 produced an efficient work environment and freed the Fire Ecologist to concentrate on analysis, outreach, and larger-scale tasks.

A returning crewmember from 2008 was selected for the vacant permanent Assistant Lead Monitor position, providing a virtually seamless transition of knowledge and leadership. Data analysis continued to increase with a full-time, dedicated Ecologist on staff for the entire year. In addition to analysis of standard monitoring objectives for the annual report, efforts were expanded to address data needs relating to Mexican Spotted Owl critical habitat, multiple entry prescribed fires, and higher elevation mixed-conifer prescribed fire objectives. Conversion of the GRCA database to FFI v1.03 occurred after the end of the field season, supplying the Ecologist with more robust tools for analysis and easing data entry for the crew.

The Ecologist continued work on revising the monitoring plan, increasing the fire management program's participation in research, and expanding communication and outreach. Key interdisciplinary meetings were held this year to update monitoring objectives and research needs for inclusion in the new Fire Management Plan (FMP). In addition, the Ecologist presented fire effects monitoring data at the Grand Canyon Field Institute's annual Guide Training School, at the 4th International Fire Ecology and Management Congress, and in a short article for the RX Effects newsletter. The new Assistant Lead spearheaded efforts to collaborate with the GRCA Environmental Education Branch and the Grand Canyon School to provide fire ecology educational opportunities for local students. This effort led to a successfully funded proposal through the Grand Canyon Small Grants Program for the Assistant to continue fire ecology education efforts in 2010.

Crewmembers, as usual, took part in a wide array of extracurricular activities. Two new crewmembers who previously had been red carded were able to provide basic fireline support immediately upon arrival, and subsequently concentrated on building more advanced qualifications. Cross-training Fire Effects crewmembers with all other field disciplines in our fire management program allowed the crew to provide myriad skills and increase overall staffing flexibility. In addition, Fire Effects crewmembers participated in cross-training activities with vegetation management crews focused on invasive plant control and sentry milk-vetch surveys. Personal interest by the crew greatly facilitated this multi-disciplinary learning. To spread the wealth of knowledge further, four other Grand Canyon fire personnel and two vegetation management personnel were cross-trained in fire effects plot protocols.

We continued our role of providing the primary fire behavior and weather monitoring support at Grand Canyon with every staff member from the Ecologist to new crewmembers assisting fire monitoring in-park or on the neighboring Kaibab National Forest on multiple occasions for either prescribed or resource benefit events. In-park, the crew gained experience during the Game Reserve and Aspen Fires with the Zion and Saguaro Modules. Additionally, the Assistant provided independent GIS support during the Aspen Fire on the North Rim. Out-of-park, one crewmember detailed with the Bandelier Wildland Fire Module in New Mexico for two weeks, and the Assistant served with the Grand Canyon Helitack crew in California for three weeks. Everyone served on several incidents as FIRB-trainee, ICT5, FFT1, FEMO, or simply another hand digging line.

Continuing the tradition of assisting other Fire Effects programs for a ninth consecutive year, one trip was made to help the Zion Fire Effects Crew accomplish plot work at Bryce Canyon National Park. We welcome these additional opportunities, as long as we continue to be able to accomplish all of our planned plot work at home.

Next season's FMH plot load looks to be an increase over 2009, based on more widespread prescribed burns on both rims. CBI plot workload will return to typical levels, with the added challenge of almost all plots falling in areas that were previously burned. Pilot data from the RAP plots will be analyzed, with the intent of refining our protocols and focusing our efforts for plot network expansion through that protocol to give managers more incident-specific data. Expanded use of the FFI database is planned as we hope to manage all FMH, CBI, and RAP data in FFI by the end of next year. At present, the 2010 workload will be mostly on the North Rim (69%).

STAFF ACCOMPLISHMENTS & AREAS OF FOCUS

TABLE 1. Fire Ecology Staff for 2009 calendar year.

Employee	Starting Date	Ending Date	# Pay Periods	Training	NWGG Task books
Windy Bunn, GS-9/11	1/01/09	12/31/09	26	M580 S260 S131 L180 B3	
Li Brannfors, GS-7	1/01/09 4/26/09 9/27/09	2/28/09 8/01/09 12/31/09	18.5	S490 (instructor)	ICT5 FFT1 FIRB-t
Jasper Peach, GS-6	3/13/09	11/21/09	18	S390 S133 S131 WFR	FFT1 HECM ICT5-t FALB-t GISS-t
Mary Jo Geldert, GS-5	5/06/09	10/24/09	12.5	S290 S271 S212 refresher S133 HTA	FEMO FALA HECM
Heidi Gillespie, GS-5	5/10/09	10/24/09	12	S290 S271 S212 refresher	FFT1 FEMO FALA HECM-t
Karen Koenig, GS-5	3/08/09 4/26/09	3/20/09 8/15/09	9	S390 S212 refresher S131 FVS	HECM-t FALA-t

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

Employee	FMH Plots	RAP Plots	CBI Plots	Data Entry / Mgmt	FX Office	Monitoring (Rx or Fire Use)	Rx Fire Ops	WFRB Ops	Suppression And Helibase Ops.	Training Courses	Other
Li Brannfors, GS-7	10	4	0	6	47	4	1	2	1	4	20
Jasper Peach, GS-6	9	2	0	6	38	4	1	10	10	9	12
Mary Jo Geldert, GS-5	16	5	0	12	24	17	1	1	9	6	10
Heidi Gillespie, GS-5	22	5	0	12	22	13	1	2	1	9	11
Karen Koenig, GS-5	25	1	0	0	22	12	0	0	2	14	24

"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 in 2009.

Focus Area	Percent Time	Accomplishments and Activities
FMH Plots	15%	32 remeasurements, 15 immediate post-burn reads, 1 install at GRCA - Assisted ~20 remeasurements at Bryce Canyon NP
RAP Plots	4%	25 RAP installs across 2 Rx burn units 25 RAP immediate post-burn reads across 3 Rx burn units
CBI Plots	0%	13 installs across 1 fire (by Ecologist & GIS Specialist)
Data Entry	7%	Completed all 2009 FMH & RAP plot data entry by Dec 4
Data Conversion & Analysis	1%	Annual Report analysis on all major variables in program
General Office/ Supervision/ Admin	32%	- Includes FMH, RAP, & CBI plot preparation and data filing/organization - Lead & Ecologist hired 2 new seasonal crewmembers - Lead supervised 1 permanent Assistant Lead & 3 seasonals 1 hr PT time/day for each crewmember - Paperwork!
Fire Monitoring (Rx or WFRB)	9%	- Lead FEMO & FEMO-trainees on 4 Rx fires at GRCA & 2 Rx on Kaibab NF - Lead FEMO & FEMO-trainees on 3 WFRB fires at GRCA
Fire Operations/ Assignments (Suppression, Rx, WFRB, or Helitack)	9%	1 crewmember detailed for 2 weeks with Bandelier Fire Use Module - Assistant went on 3 week HECM assignment to CA - Lead served as FIRB-t on Moqui Rx at GRCA - Lead served as ICT5-t, and Assistant and 1 crewmember as FFT1-t on Game Reserve Fire at GRCA - Initial attack support on multiple Type 5 fires at GRCA - GISS support by Lead and Assistant on multiple fires at GRCA - Sent 1 crewmember to 2-week Helicopter Training Academy at GRCA S Rim - Cross-trained crewmembers with GRCA engines, helitack, mechanical fuel reduction projects, fuel sampling - Provided IA coverage on N Rim while Engine 831 was out-of-park on assignments
Training	8%	- All attended annual fire refresher 1 seasonal attended S-131 at Prescott, AZ 3 seasonals attended S-212 refresher at GRCA 2 seasonals attended S-271 at Green Base, AZ & St George, UT 2 seasonals attended S-290 at Kanab, UT - Assistant Lead attended S-131, S-133, S-390, & WFR training - Lead helped teach S-490 at Albuquerque, NM 1 seasonal attended FVS training in Albuquerque, NM
Other	15%	- Set up DataRAM & EBAM for air quality monitoring on 4 Rx burns 8% of crew time spent on leave

TABLE 4. Fire Ecologist Focus Areas/Accomplishments in 2009.

Focus Area	Percent Time	Accomplishments and Activities
Planning	35%	• FMP Biological Assessment working group • Draft revision of Fire Monitoring Plan, to be completed in 2010 • FMP EIS response to comments and final revisions • STARFire workshop and follow-up • Fire ecology literature
Presentations	4%	• Presented GRCA fire effects data at the 4th International Fire Ecology and Management Congress • Co-authored two posters at Fire Ecology and Mgmt Congress • Prepared GRCA monitoring data article for RX Effects newsletter • Presented GRCA fire monitoring overview and data to the Grand Canyon Field Institute Guide Training School • Field trip for NAU Fire Monitoring and Modeling course
NPS Meetings/ Task Groups	4%	• GRCA Fire IDT – reviewed 3 project plans, planning meetings for wildfires • GRCA Climate Change Adaptation working group • Review teams for vegetation map, I & M network vegetation monitoring, park Foundation Statement • Fire staff meetings
Interagency Work	0%	• None
Fire Assignments	5%	• FEMO on 4 in-park RX fires and 1 in-park wildfire • FFT2 on 1 in-park wildfire
Research	3%	• Organized fire research needs workshop for park and network staff • Meetings and support for 2 M.S. student projects • Provided data and manuscript reviews for 4 additional projects
Data Collection	5%	• FMH, rapid assessment, and CBI plot data collection • Field recon of burn units
Data Entry & Management	2%	• Rapid assessment data entry and quality control • New fuel constants for FFI
Data Analysis	10%	• Summarized data for inclusion in new monitoring plan • Analyzed data for Biological Assessment • Summarized FMH and rapid assessment data for burn plans
Supervision/ Admin	7%	• Supervised Lead Monitor • Managed H14 budget • Travel, time, and purchasing
Training & Conferences	10%	• Fire training: M580, S260, S131, L180, B3, RT130, CPR/First Aid • Conferences: George Wright Society, Research on CO Plateau, Fire Ecology and Management Congress • On-line training: Wilderness Act, Minimum Requirements Decisions • NPS required training: IT Security, Privacy, Records • PT
Other	15%	• Fire education with Grand Canyon School and GRCA Environmental Education staff • Paid leave and holidays

FIRE EFFECTS PLOT WORKLOAD

The 2009 season produced a moderate FMH plot load at Grand Canyon, with a number of immediate post-burn reads due to expected prescribed and unplanned wildland fire activity. One new FMH plot was installed on the South Rim in a unit lacking plot representation. In order to supply managers and other stakeholders with more timely and targeted data from upcoming treatments, we installed 25 RAP plots between the South and North Rims. On the CBI front, 13 non-permanent severity plots were installed one year following the Walla Valley Fire from 2008.

TABLE 5. Fire Effects Plot Workload for 2009.

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	1	7		5	3		16	40
South	Pinyon-Juniper Woodland PIED¹	FMH							0	17
South	Picnic Rx	RAP*		10					10	-
South	Quarry Rx	RAP*		10					10	-
South	Moqui Rx	RAP*	5	5					10	-
North	Ponderosa Pine PIPN	FMH		1		8	6		15	30
North	Ponderosa Pine w/ White Fir Encroachment PIAB	FMH		7		7	2		16	27
North	Rocky Mountain Subalpine Conifer PIEN	FMH					1		1	17
North	Grassland Interior GRIN	FMH							0	10
North	Grassland Edge GRED	FMH							0	6
North	Walla Valley Fire	CBI	13						13	-
North	Thompson Rx	RAP*	20						20	-
Total			39	40	0	20	12	0	111	147

¹Total FMH Plots" includes all permanent FMH plots installed to date within a monitoring unit/type

¹PIED monitoring type reads were discontinued in 2000

*pilot sampling

MONITORING OBJECTIVES & RESULTS

FMH

Grand Canyon National Park's Fire Effects monitoring program has installed 147 permanent FMH-style plots to date and has burned 112 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 13 of them and the trend is so far very positive on another 2.

Table 6. Management Objectives and Monitoring Results for FMH plots in 2009.
Minimum plot numbers calculated on pre-fire data.

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	7.2 ± 0.8 tons/acre (-52.6%) (n=34)	YES	YES n=10
	Limit crown scorch on trees (PIPO) with DBH ≥16" to <30% immediate post-burn	16.6% ± 5.5 crown scorch (n=32)	YES	NO n=89
	Reduce poles (PIPO) with DBH of 1-6" to <200 trees/acre 2 years post-burn	86.2 ± 33.7 trees/acre (-26.0%) (n=34)	YES	NO n=64
	Achieve overstory (PIPO) density with DBH ≥16" of 19-25 trees/acre 5 years post-burn	21.8 ± 3.2 trees/acre (-0%) (n=24)	YES	YES n=16
Pinyon-Juniper Woodland (PIED) South Rim	Reduce total fuel load to <20 tons/acre immediate post-burn	11.9 ± 1.6 tons/acre (-31.6%) (n=13)	YES	YES n=3
	Limit overstory tree (all species) mortality to <20% 5 years post-burn	11.7% ± 6 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	12.1 ± 1.7 tons/acre (-62.2%) (n=29)	NO – Getting close, but second-entry treatment likely needed	YES n=10
	Limit crown scorch on trees (PIPO) with DBH ≥16" to <30% immediate post-burn	18.3% ± 7.1 crown scorch (n=29)	YES	NO n=108
	Reduce poles (PIPO) with DBH of 1-6" to <200 trees/acre 2 years post-burn	68.7 ± 34.6 trees/acre (-48.0%) (n=29)	YES	NO n=52
	Achieve overstory (PIPO) density with DBH ≥16" of 40-56 trees/acre 5 years post-burn	41.4 ± 4.4 trees/acre (-11.9%) (n=26)	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	17.1 ± 3.4 tons/acre (-53.2%) (n=19)	YES	YES n=6
	Limit crown scorch on trees (PIPO) with DBH ≥16" to <30% immediate post-burn	8.4% ± 4.1 crown scorch (n=19)	YES	NO n=113
	Reduce poles (ABCO) with DBH of 1-6" to <100 trees/acre 2 years post-burn	59.5 ± 22.3 trees/acre (-75.9%) (n=20)	YES	YES n=16
	Achieve overstory (PIPO) density with DBH ≥16" of 19-25 trees/acre 5 years post-burn	20.5 ± 3.1 trees/acre (-22.8%) (n=14)	YES	YES n=9
Rocky Mountain Subalpine Conifer (PIEN) North Rim	Reduce total fuel load immediate post-burn	31.9 ± 13.6 tons/acre (-60.5%) (n=4) NOTE: all plots burned in wildfire	YES - No quantitative goal has been established, but trend is of solid reduction	YES n=6 (12 plots installed with pre-burn data)

Assessment of objective success and fulfillment of minimum plot requirements are based on 80% confidence intervals, with R-value of 20 for overstory tree and fuel assessment and R-value of 25 for pole-sized tree assessment.

CBI

Composite Burn Index (CBI) burn severity assessments have been occurring annually at Grand Canyon since 2001. Between 2001 and 2009, 878 post-fire year 1 CBI-style plots have been installed in the park, providing Normalized Burn Ratio (NBR) satellite-correlated severity data on 36 fires over 91,000 total acres. This process is designed for field data and satellite imagery gathered one year following a fire; hence, 2009 work was performed on fires which burned in 2008. A total of 13 CBI plots were installed in 2009 in the 448 acre Walla Valley Fire.

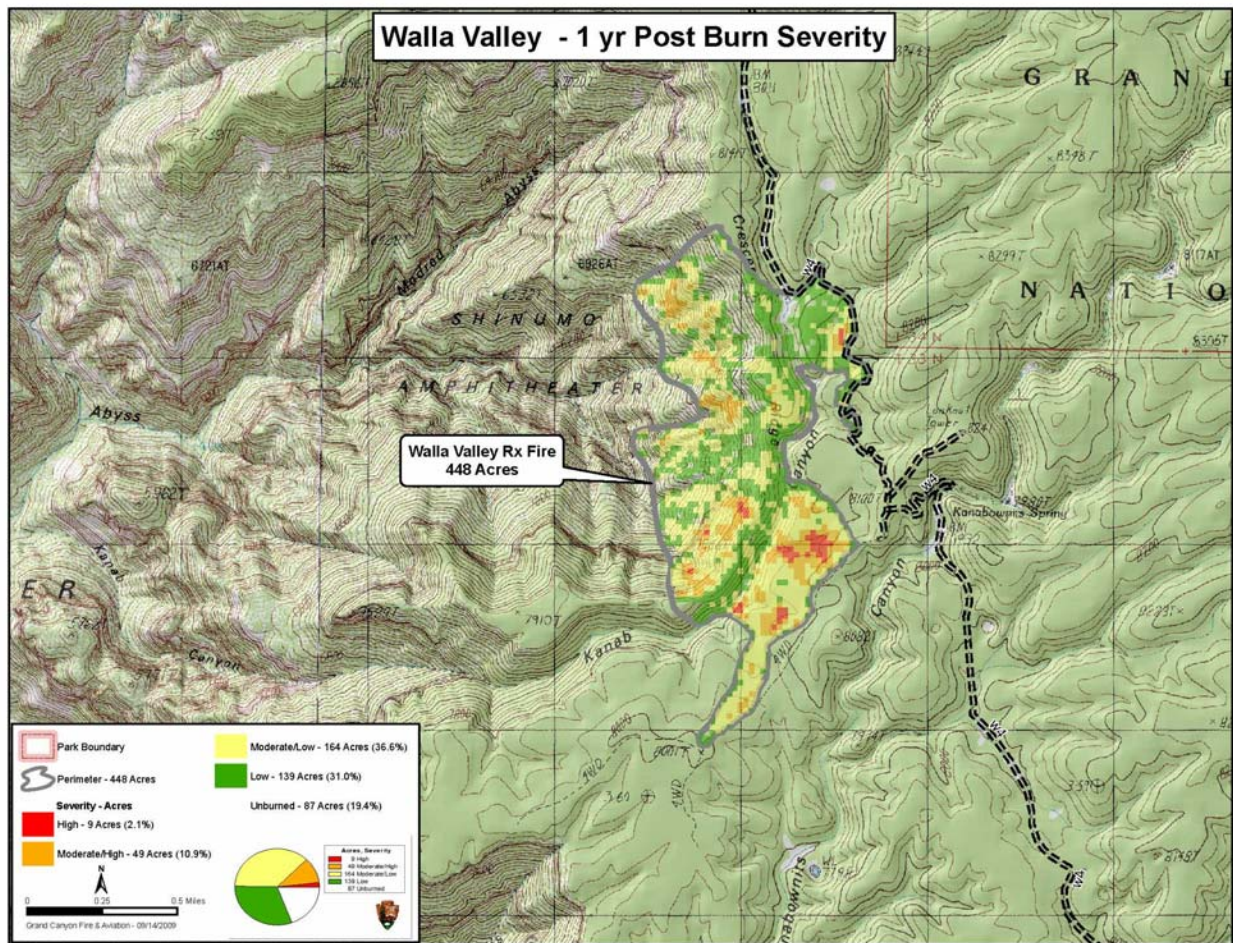


Figure 1. Walla Valley burn severity data collected one year post fire. Severity percentages are represented in the pie chart in the legend.

ADDITIONAL ANALYSIS

RAPID ASSESSMENT PLOTS ON THE NORTH RIM

The GRCA Fire Ecology Program began pilot sampling rapid assessment plots for project-level monitoring in the fall of 2008 and continued this effort in 2009. Project-level monitoring is designed to provide information on whether short-term management objectives have been met for a particular fire. With the 2009 Fire Management Plan, GRCA will begin implementing prescribed fire in the higher elevation mixed-conifer and spruce-fir vegetation types on the North Rim. High elevation forests occur in a relatively small area and are of high resource concern, so monitoring and evaluation through the adaptive management process is needed on a unit-by-unit basis. Since project-level monitoring will require a greater number of plots in each unit than landscape-level monitoring, pilot rapid assessment protocol (RAP) plots are being developed to accommodate this need. The following analysis compares RAP plots with FMH monitoring types familiar to GRCA fire management staff. Care must be taken in interpretation of these data as RAP plots are summarized over one burn unit while FMH plots are in multiple units across the landscape.

Range prescribed fire unit

The 2,316 acre Range prescribed fire unit is primarily mixed-conifer forest with higher average fuel loads and lower average tree densities than our current FMH PIAB (Table 6) monitoring type. White fir (*Abies concolor*), quaking aspen (*Populus tremuloides*), and ponderosa pine (*Pinus ponderosa*) are the dominant overstory species in the Range unit (Fig. 2). White fir, Douglas fir (*Pseudotsuga menziesii*), and subalpine fir (*Abies lasiocarpa*) are the dominant pole-sized tree species in the unit (Fig. 2). The tree composition in the Range unit differs significantly from the FMH PIAB monitoring type where white fir and ponderosa pine together make up 85% of both the overstory and pole-sized tree densities.

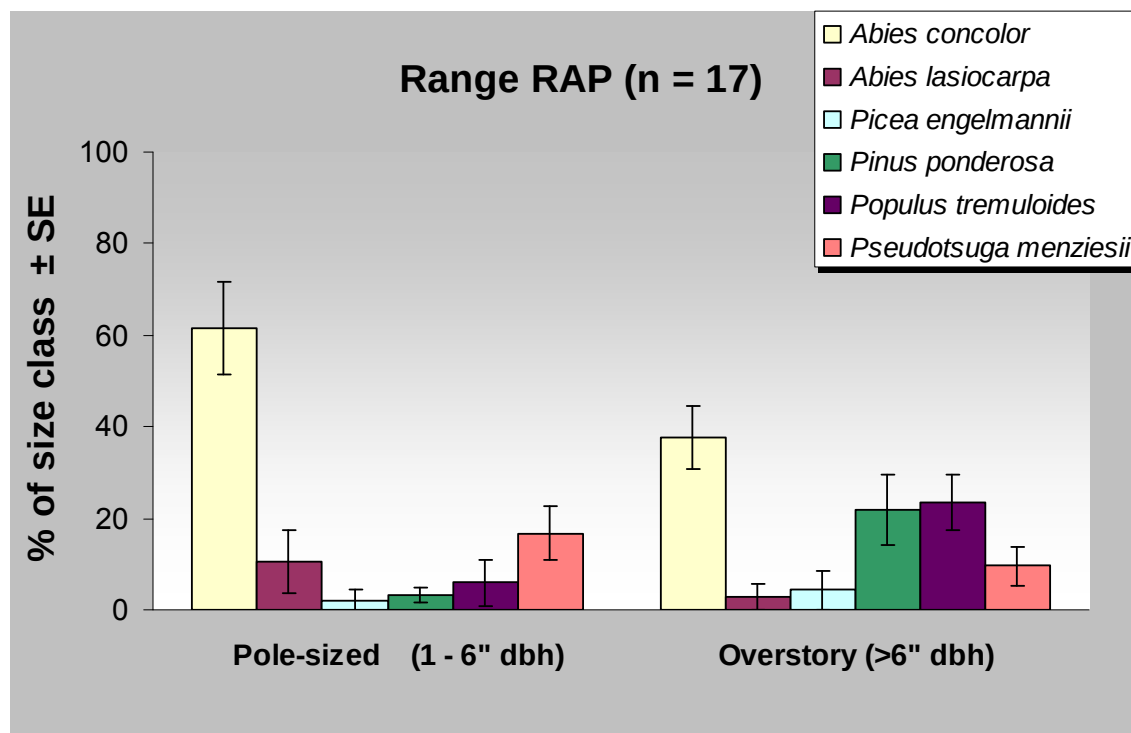


Figure 2. Pre-fire tree species composition of RAP plots in the Range unit.

Average pole-sized tree density is 37% lower in the Range RAP plots than in the FMH PIAB plots, but average overstory tree density is not significantly different between the plot types (Fig. 3). The pre-fire pole-sized tree density in individual Range RAP plots varies from 26 to 516 trees/acre, and pre-fire pole-sized tree density in individual FMH PIAB plots varies from 32 to 777 trees/acre (Table 7).

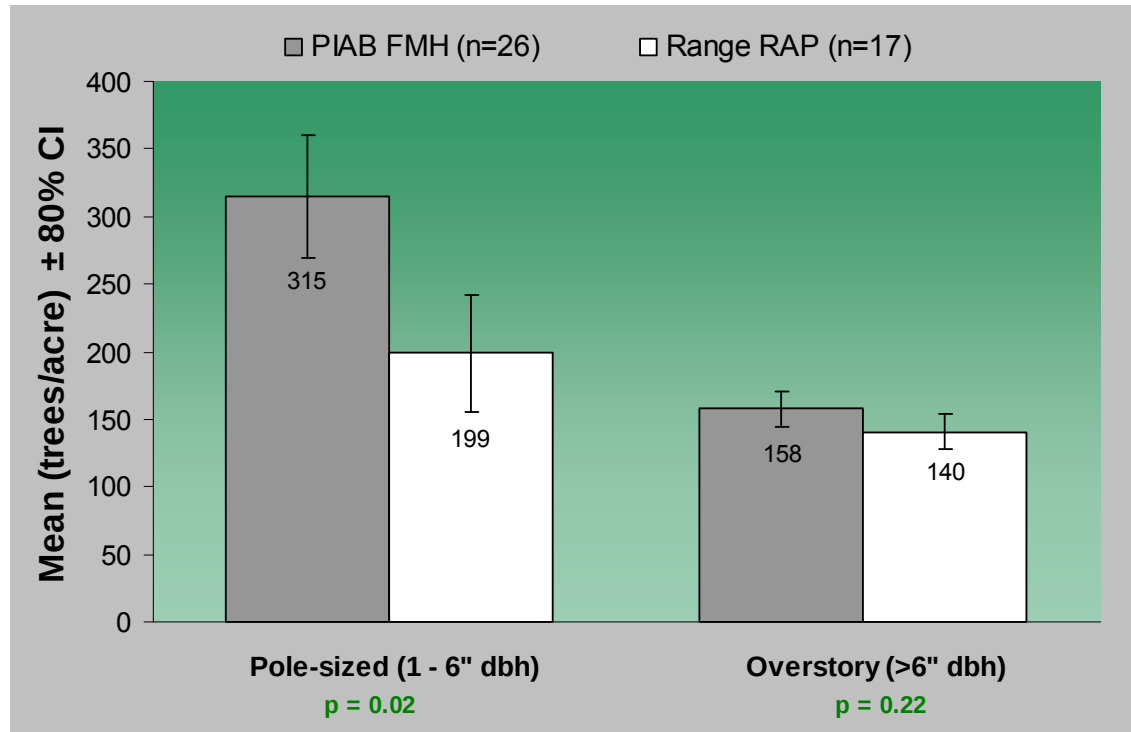


Figure 3. Pre-fire tree density differences between RAP plots in the Range unit and landscape-scale FMH PIAB plots.

Table 7. Pre-fire tree density and fuel loading for RAP plots in the Range unit and landscape-scale FMH PIAB plots.

	FMH PIAB pre-fire n = 26		Range RAP pre-fire n = 17	
	Mean $\pm$ 80% CI	Min – Max	Mean $\pm$ 80% CI	Min – Max
Pole-sized density (trees/acre)	314.5 $\pm$ 45.5	32.4 – 777.3	198.6 $\pm$ 43.0	25.8 – 515.5
Overstory density (trees/acre)	157.7 $\pm$ 12.8	64.8 – 247.0	140.5 $\pm$ 13.2	54.0 – 202.3
Total Loading (tons/acre)	38.4 $\pm$ 3.6	17.6 – 73.0	48.2 $\pm$ 7.1	18.2 – 85.1
1-, 10-, 100-hr TLFM (tons/acre)	4.1 $\pm$ 0.5	1.9 – 8.0	4.4 $\pm$ 1.0	0.3 – 11.7
1000-hr TLFM (tons/acre)	13.5 $\pm$ 2.7	0 – 43.8	19.9 $\pm$ 5.1	0 – 45.3
Litter + Duff (tons/acre)	20.7 $\pm$ 1.9	10.8 – 37.3	23.9 $\pm$ 3.1	11.3 – 42.1
Litter + Duff Depth (inches)	1.9 $\pm$ 0.2	1.1 – 3.4	2.1 $\pm$ 0.2	1.1 – 3.4

There is a trend toward higher total and 1000-hr TLFM average pre-fire fuel loading in the Range RAP plots than in the FMH PIAB plots, but the large variation in these fuel loading values make them statistically less significant (Fig. 4). The total pre-fire fuel load in individual Range RAP plots varies from 18 to 85 tons/acre, and total pre-fire fuel load in individual FMH PIAB plots varies from 18 to 73 tons/acre (Table 7).

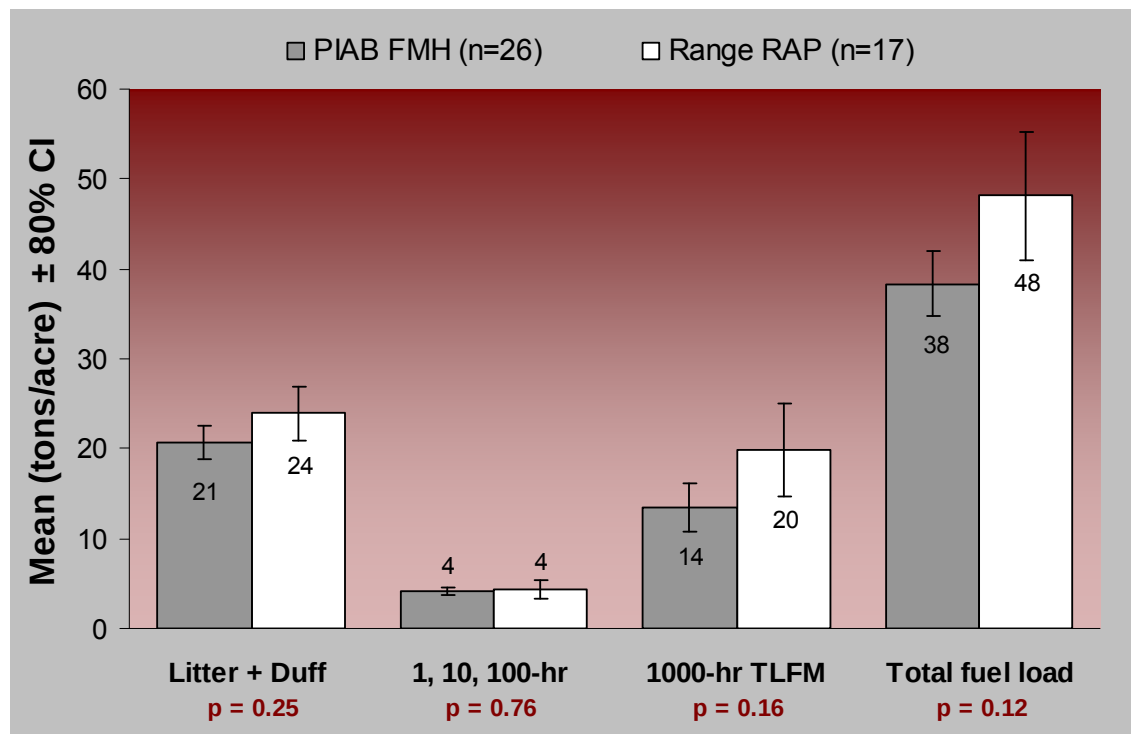


Figure 4. Pre-fire fuel loading differences between RAP plots in the Range unit and landscape-scale FMH PIAB plots.

Thompson-North Boundary prescribed fire unit

The Thompson-North Boundary prescribed fire is the only scheduled fire in the spruce-fir forests in the 10-year plan. The 2,007 acre Thompson-North Boundary prescribed fire unit has fuel loads and tree densities that are roughly equivalent to the current FMH PIEN (Table 6) monitoring type, although initial species composition differs between the plot types.

Engelmann spruce (*Picea engelmannii*) and quaking aspen are the dominant overstory species in the Thompson unit comprising an average of 73% of overstory density (Fig. 5). In the FMH PIEN plots, Engelmann spruce and quaking aspen together account for 54% of overstory density with white fir and subalpine fir contributing a combined 35% of overstory density. Engelmann spruce and subalpine fir are the dominant pole-sized conifer species in the Thompson unit comprising an average of 82% of pole-sized conifers (Fig. 5). In the FMH PIEN monitoring type, Engelmann spruce and subalpine fir contribute a combined 47% of pole-sized conifer density and white fir accounts for 43% of pole-sized conifers. Quaking aspen contributes substantially to pole-sized tree density in both the FMH PIEN plots and in the Thompson unit. However, no burn objectives target quaking aspen, so these trees were not measured in the Thompson unit.

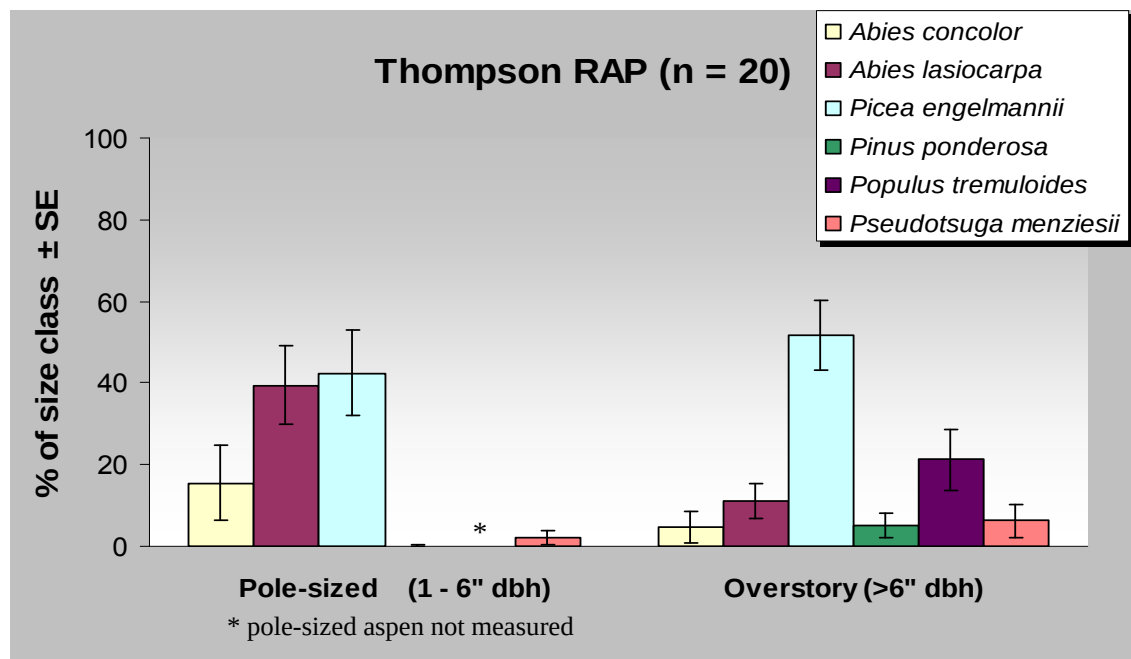


Figure 5. Pre-fire tree species composition of RAP plots in the Thompson unit.

Pole-sized conifer density varies widely in both the Thompson RAP plots and in the FMH PIEN plots masking any differences between the plot types (Fig. 6). Average overstory tree density is slightly lower in the Thompson RAP plots than in the FMH PIEN plots, but this difference is not statistically significant (Fig. 6). The pre-fire pole-sized conifer density in individual Thompson RAP plots varies from 13 to 838 trees/acre, and pre-fire pole-sized conifer density in individual FMH PIEN plots varies from 65 to 656 trees/acre (Table 8).

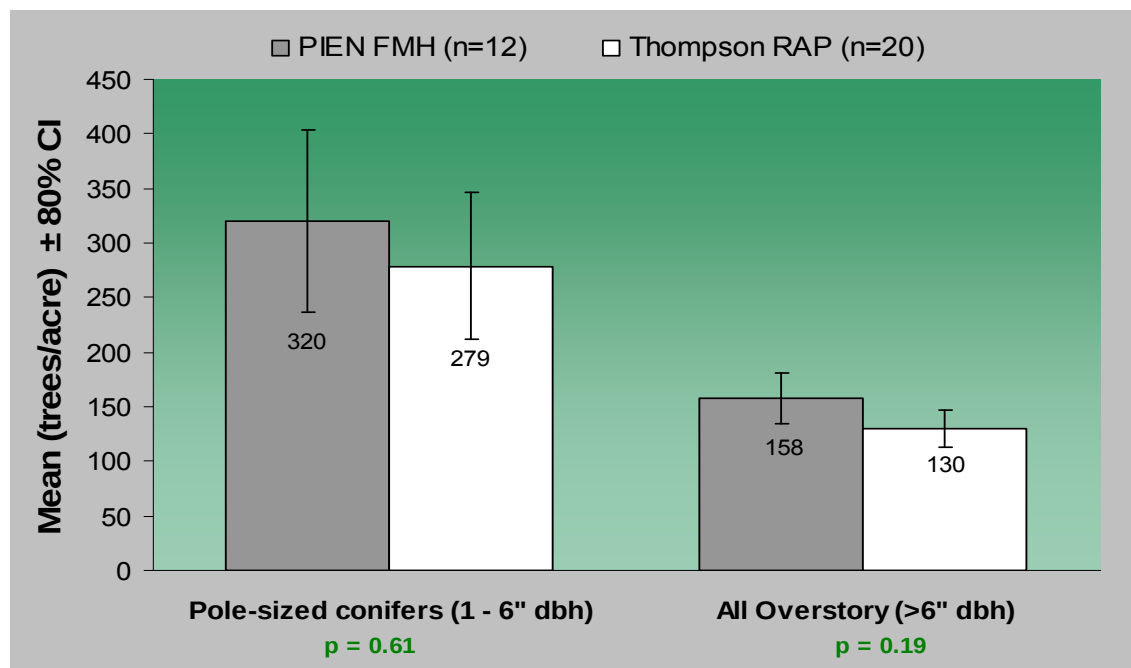


Figure 6. Pre-fire tree density differences between RAP plots in the Thompson unit and landscape-scale FMH PIEN plots.

Table 8. Pre-fire tree density and fuel loading for RAP plots in the Thompson unit and landscape-scale FMH PIEN plots.

	FMH PIEN pre-fire n = 12		Thompson RAP pre-fire n = 20	
	Mean $\pm$ 80% CI	Min – Max	Mean $\pm$ 80% CI	Min – Max
Pole-sized density (conifer trees/acre)	320.5 $\pm$ 83.5	64.8 – 655.9	279.0 $\pm$ 67.4	12.9 – 837.7
Overstory density (all trees/acre)	157.9 $\pm$ 22.7	76.9 – 279.4	129.5 $\pm$ 17.1	54.0 – 310.3
Total Loading (tons/acre)	66.2 $\pm$ 8.1	33.8 – 109.7	60.0 $\pm$ 7.2	9.2 – 94.6
1-, 10-, 100-hr TLFM (tons/acre)	6.2 $\pm$ 0.9	3.7 – 9.2	6.0 $\pm$ 1.1	0.7 – 18.4
1000-hr TLFM (tons/acre)	29.2 $\pm$ 5.3	3.1 – 48.8	32.2 $\pm$ 5.1	1.2 – 64.6
Litter + Duff (tons/acre)	30.9 $\pm$ 3.9	18.6 – 53.8	21.8 $\pm$ 2.9	5.8 – 35.7
Litter + Duff Depth (inches)	2.5 $\pm$ 0.3	1.6 – 4.0	1.8 $\pm$ 0.2	0.5 – 2.9

Litter + duff average pre-fire fuel loading is 29% lower in the Thompson RAP plots than in the FMH PIEN plots. All other fuel loading values are similar between the two plot types (Fig. 7). The total pre-fire fuel load in individual Thompson RAP plots varies from 9 to 95 tons/acre, and total pre-fire fuel load in individual FMH PIEN plots varies from 34 to 110 tons/acre (Table 8).

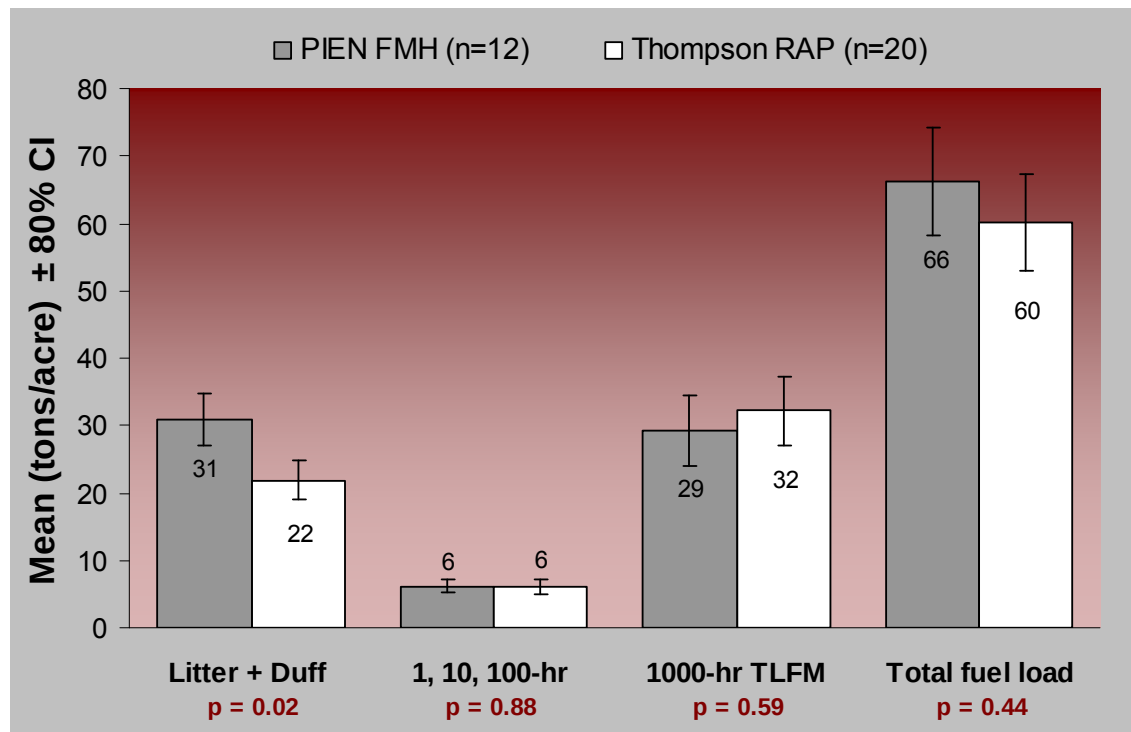


Figure 7. Pre-fire fuel loading differences between RAP plots in the Thompson unit and landscape-scale FMH PIEN plots.

ANNUAL REPORT SUPPLEMENT ADDITIONAL INFORMATION

Grand Canyon National Park uses FFI to maintain all FMH and Rapid Assessment plot data. CBI data are currently stored in MS Excel, but are scheduled for conversion to FFI.

In 2009, fire ecology staff had numerous meetings with fire staff, non-fire staff, and USFWS staff to discuss monitoring results. The meetings in which monitoring results were discussed fell into two categories: (1) landscape-scale and burn plan objective meetings and (2) meetings with the USFWS to discuss the Fire Management Plan Biological Assessment and Opinion. Two one-day meetings were held with fire staff to discuss programmatic monitoring results to date and revisions to landscape-scale monitoring objectives for the park Fire Monitoring Plan. Two additional meetings were held with fire staff to discuss FMH and rapid assessment monitoring data in relation to specific burn unit objectives. Approximately 8-10 meetings were held with park fire staff, non-fire staff, and USFWS this year regarding the 2009 Biological Assessment and Opinion. Fire monitoring data was a cornerstone of these meetings and was regularly discussed in relation to fire effects on Mexican Spotted Owl critical habitat. The 8-10 USFWS meetings are counted as only one annual meeting in the attached Annual Report Supplement. In addition to these meetings with park staff, the fire ecologist presented fire effects monitoring data at the Grand Canyon Field Institute's annual Guide Training School, at the 4th International Fire Ecology and Management Congress, and in a short article for the RX Effects newsletter.

At least 12 research projects were supported by fire ecology program staff (fire GIS specialist, fire ecologist, and fire effects crew) during 2009. Support activities for research projects included data contributions, input on research design and interpretation of results, proposal reviews, manuscript reviews, and logistical support.

Hats off to 2010!



Figure 8. Fire Effects Crew at play!

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