



Grand Canyon



2011  
Fire Ecology  
Annual Report



## SUMMARY

The 2011 season brought many challenges that were met by the Grand Canyon National Park (GRCA) Fire Ecology Program. The season featured the monitoring of 55 Fire Monitoring Handbook (FMH) plots that were completed while crewmembers participated in a wide variety of opportunities supporting incidents nationally and locally. The continuation of the Rapid Assessment Protocol (RAP) pilot sampling resulted in 25 plot post-burn reads. To add to the season's accomplishments, 104 Composite Burn Index (CBI) plots were visited to assess burn severity within the 5 planned and unplanned fire incidents from 2010. New to the program this year was the incorporation of 21 Inventory & Monitoring (I&M) plot visits to further the expansion of GRCA's monitoring program data. Full staffing within the Fire Ecology Program for all of 2011 produced an efficient work environment and freed the Fire Ecologist to concentrate on analysis, outreach, and larger-scale tasks.

The program hit the ground running with the possibility of prescribed burns looming on both the South and North Rims. This created the need to complete both scheduled South Rim plot work and 11 FMH Year 10 reads before the start of the burns. These burns required Fire Effects Monitors (FEMOs) for both rims simultaneously, further extending the crew. As a result the staff was split into two crews for one payperiod with the aid of personnel from the Teton Interagency and Yellowstone National Park Fire Ecology programs to support the early season field work and monitoring demands.

After the initial rush the crew was able to settle into a more typical routine. For the second year a student position on the crew was filled through Grand Canyon's diversity program, this time from Northern Arizona University (NAU). Having two crewmembers hailing from NAU further strengthened the bond between the school and the GRCA Fire Ecology Program. With a full crew data

were gathered, entered, and checked for all of the 2011 season before the seasonal staff departed. This was done while incorporating an entirely new type of plot into our monitoring network, combining forces with the NPS Inventory & Monitoring program to expand our dataset in the mixed conifer forest type. To do so, a new set of protocols had to be learned, and how to add several of GRCA's existing protocols to I&M plots had to be decided. Additionally, the crew tested a new mobile device-based application throughout the season to be used for the digital collection of field data. A list was compiled of desired features not currently present in the software, and feedback was provided to developers about problems realized both within the software and integration with FFI.

Concurrent with the accomplishment of plot-related work, the program supported a busy fire season in the Southwest and crewmembers continued to expand both their skill sets plus their variety of contributions to fire operations. This balance would not have been possible without the experience of two returning crewmembers and the established permanent fire ecology staff. In some capacity, the crew partook in a total of 17 different incidents. These opportunities led to the completion of four taskbooks (FEMO, HECM, ICT5, GISS) to further increase the crew's ability to fulfill a diverse variety of roles within fire. Highlights of this experience included assignments as engine crewmember on the Wallow Fire, Helicopter Crewmember (HECM) on the Horseshoe 2 Fire, Geographic Information Systems Specialist (GISS) on the Area Command Team for the Las Conchas Fire, and Resource Advisor (READ) on the Deep Water Horizon Oil Spill response. The crew also continued its role as the primary FEMOs within Grand Canyon National Park and continued to provide support for the neighboring Kaibab National Forest on both prescribed and wildfire events, amounting to a total of 139 operational periods of local fire assistance.

The Ecologist expanded communication and outreach activities in 2011 by presenting four formal lectures, leading a field trip, working with NAU and Grand Canyon school groups, and presenting posters at the Grand Canyon Science Open House. In addition, the Ecologist continued to participate in the larger Southwest fire ecology community by serving on the program committee for the SW Fire Ecology Conference. The Ecologist also worked to expand the use and usability of the park's historic datasets during wildfire decision-making. New methods of utilizing the park's GIS and weather datasets were tested by the Ecologist and Fire GIS Specialist. Meanwhile, the Fire Ecology and Fuel Management Intern compiled past on-the-ground fire behavior, fuel moisture, and weather data into more usable formats. The second year of the internship program was a big success with the intern contributing to key data analysis, data management, planning, and operational tasks throughout the summer.

## STAFF ACCOMPLISHMENTS & AREAS OF FOCUS

**TABLE 1.** Fire Ecology Staff for 2011 calendar year.

Employee	Starting Date	Ending Date	# Pay Periods	Training	NWGG Task books
Windy Bunn, GS-11	1/01/11	12/31/11	26		
Li Brannfors, GS-7	1/01/11 5/09/11	2/27/11 12/31/11	21		FIRB-t
Jasper Peach, GS-6	4/08/11	11/17/11	16		ICT5 GISS FALB-t FIRB-t
Kate Milich, GS-5	4/25/11	11/17/11	15	S212 S290 B3 WFR	FEMO FFT1-t FALA-t
Alexander Spannuth, GS-5	5/09/11	10/06/11	11	B3 CPR/First Aid	HECM FFT1-t ABRO-t
Cynthia Worthington, GS-5	4/25/11	10/20/11	13	B3 CPR/First Aid	FEMO-t FALA-t
Katelynn Jenkins, GS-4 <sup>1</sup>	5/16/11	8/04/11	6	S130/190 S290 B3 CPR/First Aid	FEMO-t
Christina Anabel, GS-5 <sup>2</sup>	5/22/11 8/28/11	8/27/11 12/31/11	7 1.5	S290 S215 B3 WFDSS	FEMO ICT5-t FIRB-t

<sup>1</sup>Time for Katelynn Jenkins NOT funded out of hazard fuels base accounts due to funding provided by GRCA diversity student program

<sup>2</sup>Christina Anabel was the intern for this year and her time includes full summer payperiods and part-time project work during the fall semester. Christina's time was funded through the GRCA student diversity program and NOT from the fire effects base account.

**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	I&M Plots	Data Entry/Mgmt	FX Office	Monitoring (Rx or Wildfire)	Rx Fire Ops	Wildfire/ Incident Ops	Training Courses	Other
Li Brannfors, GS-7	12	1	4	4	5	38	3	4	1	1	27
Jasper Peach, GS-6	11	2	2	4	1	37	2	5	11	5	20
Kate Milich, GS-5	15	1	1	3	7	20	16	4	11	4	18
Alexander Spannuth, GS-5	19	1	3	5	7	18	22	1	14	1	9
Cynthia Worthington, GS-5	12	3	2	4	7	31	8	2	16	3	12
Katelynn Jenkins, GS-4	7	1	0	6	7	29	13	3	1	14	19

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

"Rx Fire Ops" includes time spent on non-fire fuels projects.

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

**TABLE 3. Base-hour Fire Effects Crew Focus Areas/Accomplishments in 2011.**

Focus Area	Percent Time	Accomplishments and Activities
<b>FMH Plots</b>	13%	<ul style="list-style-type: none"> <li>33 remeasurements, 6 pre-burn reads, 16 immediate post-burn reads</li> </ul>
<b>RAP Plots</b>	1%	<ul style="list-style-type: none"> <li>25 post-burn Year 2 reads across 3 Rx burn units</li> </ul>
<b>CBI Plots</b>	2%	<ul style="list-style-type: none"> <li>104 plots across 5 fires</li> </ul>
<b>I&amp;M Plots</b>	4%	<ul style="list-style-type: none"> <li>21 plot reads of fuel and tree data</li> </ul>
<b>Data Entry</b>	5%	<ul style="list-style-type: none"> <li>Entered all 2011 FMH &amp; RAP plot data by Oct 27</li> <li>Checked all 2011 FMH &amp; RAP plot data by Oct 27</li> </ul>
<b>Data Conversion &amp; Analysis</b>	1%	<ul style="list-style-type: none"> <li>Annual Report analysis on all major variables in program</li> <li>Additional analysis on newly installed RAP plots</li> </ul>
<b>General Office/ Supervision/ Admin</b>	30%	<ul style="list-style-type: none"> <li>Includes FMH, RAP, CBI, &amp; I&amp;M plot preparation and data filing/organization</li> </ul>
<b>Fire Monitoring (Rx or Wildfire)</b>	10%*	<ul style="list-style-type: none"> <li>Lead FEMO &amp; FEMO-trainees on 3 Rx fires at GRCA &amp; 2 Rx fires on Kaibab NF</li> <li>Lead FEMO &amp; FEMO-trainees on 4 wildfires at GRCA &amp; 1 wildfire on Kaibab NF</li> </ul>
<b>Fire Operations/ Assignments (Rx, Wildfire, Engine, Helitack, Non-fire Fuels Projects)</b>	12%*	<ul style="list-style-type: none"> <li>1 crewmember detailed for 2 weeks with Grand Canyon engine crew to Wallow Fire</li> <li>1 crewmember detailed for 2 weeks with Grand Canyon Helitack to Horseshoe 2 Fire</li> <li>Assistant went on 14 day GISS assignment with Area Command Team to Las Conchas Fire</li> <li>1 crewmember went on 21 day assignment to Deep Water Horizon Oil Spill recovery</li> <li>FIRB-t support by Lead and Assistant on multiple prescribed burns</li> <li>Cross-trained crewmembers with GRCA engines, mechanical fuel reduction projects, fuel sampling</li> </ul>
<b>Training</b>	3%	<ul style="list-style-type: none"> <li>All attended annual fire refresher</li> <li>1 seasonal completed S130/190</li> <li>1 seasonal completed S212</li> <li>2 seasonals completed S290</li> <li>3 seasonals completed B3 aviation safety</li> <li>3 seasonals completed First Aid+CPR</li> <li>1 seasonal completed Wilderness First Responder (WFR)</li> </ul>
<b>Travel Away from Duty Station</b>	—	<ul style="list-style-type: none"> <li>Total of ~3 months spent on South Rim or camped out on Walla Valley unit away from duty station</li> </ul>
<b>Other</b>	19%	<ul style="list-style-type: none"> <li>5% of crew time spent on PT</li> <li>7% of crew time spent on leave</li> </ul>

\*Approximately 1450 hours of overtime spent on fire activities, equaling 18% of total crew work time (base + OT), are not reflected.

**TABLE 4. Fire Ecologist Focus Areas/Accomplishments in 2011.**

Focus Area	Percent Time	Accomplishments and Activities
Planning	11%	<ul style="list-style-type: none"> <li>GRCA Fire IDT – reviewed 2 burn plans and 5 thinning plans, planning meetings and briefings for prescribed fires and wildfires</li> <li>Worked on compliance tasks (Section 7, wilderness MRA)</li> <li>Managed activities in NFPORS and participated in out-year planning</li> <li>Led collaborative planning with SCPN Inventory &amp; Monitoring group</li> <li>Reviewed GRCA Fire Management Plan</li> <li>Assisted with structure assessments for FLAG</li> </ul>
Presentations/ Education	6%	<ul style="list-style-type: none"> <li>Presented GCA Community Lectures in Prescott and Flagstaff</li> <li>Assisted Interpretation &amp; Environmental Education Division with fire wayside exhibits, field trips, and presentations to students</li> <li>Presented at GRCA Science Open House and Resource Update</li> <li>Assisted with NAU Communications class student video on fire</li> <li>Co-taught S244</li> </ul>
NPS Meetings/ Task Groups	9%	<ul style="list-style-type: none"> <li>CartoPAC working group and regional fire ecology meeting</li> <li>Fire and park staff meetings</li> <li>Fire, Compliance, &amp; Resource Management collaboration meetings</li> <li>Assisted with fuel portion of vegetation map database</li> <li>Burn severity planning for 2011 Southwest fires</li> </ul>
Interagency Work	9%	<ul style="list-style-type: none"> <li>Southwest Interagency Fuel Workshop steering committee</li> <li>Southwest AFE Conference program committee co-chair</li> <li>Forest Service: data compilation for 4FRI and Kaibab NF projects</li> <li>Reviewed draft MSO recovery plan</li> </ul>
Fire Assignments and Project Work	4%	<ul style="list-style-type: none"> <li>FEMO on 2 in-park wildfires and 1 in-park prescribed fire</li> <li>Assisted with chipping and pile burning on 2 thinning projects</li> </ul>
Research	4%	<ul style="list-style-type: none"> <li>Meetings and support for 2 M.S. student projects</li> <li>Meetings, data analysis, and proposals for internal research project</li> <li>Research permit reviews</li> <li>Provided data and proposal reviews for 5 other fire-related projects</li> </ul>
Data Collection	4%	<ul style="list-style-type: none"> <li>FMH and CBI plot data collection</li> <li>Field recon of prescribed fire and thinning units</li> </ul>
Data Entry & Management	4%	<ul style="list-style-type: none"> <li>Reviewed fire behavior and weather database compiled by intern</li> <li>Initiated data sharing with I&amp;M program, compiled field data for crew</li> <li>Identified and remedied FFI database errors</li> </ul>
Data Analysis	10%	<ul style="list-style-type: none"> <li>Analyzed FMH and RAP plot data, severity data, and past weather and fuel data for burn plans, wildfire planning, and annual report</li> </ul>
Supervision/ Admin	15%	<ul style="list-style-type: none"> <li>Supervised Lead Monitor</li> <li>Hired and supervised Fire Ecology &amp; Fuel Management intern</li> <li>Worked with Lead Monitor to hire seasonal crewmembers</li> <li>Managed fire monitoring activities budgets</li> <li>Travel, time, and purchasing</li> </ul>
Training & Conferences	10%	<ul style="list-style-type: none"> <li>SW Interagency Fuel Workshop, George Wright Society Conference</li> <li>Fire refresher, self-paced (Fire Family Plus, WIMS), webinars</li> <li>NPS required annual training</li> <li>PT (4%)</li> </ul>
Other	14%	<ul style="list-style-type: none"> <li>Travel between South and North Rims</li> <li>Paid leave and holidays</li> </ul>

## FIRE EFFECTS PLOT WORKLOAD

The 2011 season produced a moderate FMH plot load at Grand Canyon, with 16 immediate post-burn reads due to prescribed fire and wildfire activity. In addition 21 I&M plots were added to the program to increase plot representation in mixed conifer within the larger North Rim burn units.

**TABLE 5.** Fire Effects Plot Workload for 2011.

Rim	Monitoring Unit	Plot Type	Install/Pre-burn	Immed. Post-burn	Year 1	Year 2	Year 5	Year 10	Annual Total	Total Plots <sup>1</sup>
South	Ponderosa Pine <b>PIPO</b>	FMH	3	5	2	7	5		22	41
South	Pinyon-Juniper Woodland— <b>PIED</b> <sup>2</sup>	FMH							0	17
South	Buggeln	CBI			12				12	-
South	Hance/Watson 1	CBI			17				17	-
South	Picnic Rx	RAP <sup>3</sup>				10			10	10
South	Quarry Rx	RAP <sup>3</sup>				10			10	10
South	Moqui Rx	RAP <sup>3</sup>				5			5	5
North	Ponderosa Pine <b>PIPN</b>	FMH		11		1		11	23	30
North	Ponderosa Pine with White Fir Encroachment <b>PIAB</b>	FMH				7			7	27
North	Rocky Mountain Subalpine Conifer <b>PIEN</b>	FMH	3						3	17
North	Grassland Interior <b>GRIN</b>	FMH							0	10
North	Grassland Edge <b>GRED</b>	FMH							0	6
North	Saffron	CBI			61				61	-
North	Walla Valley	CBI			14				14	-
North	Walla Valley Rx	RAP <sup>3</sup>							0	6
North	Range Rx	RAP <sup>3</sup>							0	20
North	Thompson Rx	RAP <sup>3</sup>							0	20
North	Fawn Spring Rx	RAP <sup>3</sup>							0	20
North	Spring Canyon Rx	RAP <sup>3</sup>							0	20
North	Mixed Conifer	I&M <sup>4</sup>	21						21	21
<b>Total</b>			<b>27</b>	<b>16</b>	<b>106</b>	<b>40</b>	<b>5</b>	<b>11</b>	<b>205</b>	<b>280</b>

<sup>1</sup>Total Plots includes all permanent plots (FMH , RAP, or I&M) installed to date within a monitoring unit/type

<sup>2</sup>PIED monitoring type reads were discontinued in 2000

<sup>3</sup>Pilot sampling

<sup>4</sup>Fuel and tree data were collected to add to data collected by I&M crews

## **MONITORING OBJECTIVES & RESULTS**

### ***Fuel Loading & Tree Density***

Grand Canyon National Park's Fire Ecology Program has installed 148 permanent FMH-style plots to date and has burned 114 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 many of our major management objectives. The management objectives for each monitoring type were revised in 2010 to establish separate restoration and maintenance objectives. The following tables reflect this revision and, therefore, may differ from results reported in previous years. The PIEN and PIED monitoring types are no longer included in these tables because (1) these areas are thought to be within the natural fire regime and do not need restoration objectives and (2) maintenance objectives were not established because prescribed fires are not the management focus in these areas. Of the 9 restoration objectives listed in Table 6, we can say with statistical confidence we are achieving 5 of them after first entry fire and 3 of them after second entry fire.

Targeted mean fuel loading values were achieved during first entry fires in the PIPO and PIPN monitoring types. In the PIAB monitoring type, mean fuel loading fell within the targeted range, but the confidence limits extend above the targeted range (too much fuel remaining). After second entry fires, mean fuel loading values in all monitoring types were within the targeted range, but the confidence limits extend above the targeted range (too much fuel remaining) in the PIPO and PIAB monitoring types.

In the PIPO and PIPN monitoring types we cannot install the number of plots needed to overcome the variability in pole-sized tree density. In the PIPO monitoring type, mean pole-sized tree density was higher than the targeted value after first and second entry fire. In the PIPN monitoring type, mean pole-sized tree density fell within the targeted range after both first and second entry fire. However, the confidence limits extend above the targeted range (too many pole-sized trees) after the first entry fires and below the targeted range (too few pole-sized trees) after the second entry fires. The PIAB monitoring type has the minimum number of plots required to overcome variability in pole-sized tree density. After first entry fires in the PIAB type, mean pole-sized tree density was within the targeted range; however, the confidence limits extend above the targeted range (too many pole-sized trees). After second entry fires in the PIAB type, mean pole-sized tree density was well below the targeted range.

For large tree density, minimum plot numbers have been reached for all monitoring types except second entry fires for the PIAB monitoring type. Mean large tree density remained within the targeted range (and showed little change from pre-fire values) for first and second entry fires in the PIPO monitoring type. Mean large tree density decreased from pre-fire values in the PIPN monitoring type in both first and second entry fires, but mean values remained within the targeted range. Confidence limits extend below the targeted range (too few large trees) after the second entry fires in the PIPN monitoring type, but only a small number of plots have been read at this point. In the PIAB monitoring type, mean large tree density decreased from pre-fire values, but remained within target values after first entry fire. Only two plots have reached the year 5 measurement for second entry fires in the PIAB monitoring type, so values for this type are unreliable.

**Table 6.** Restoration Management Objectives and Monitoring Results for FMH plots in 2011. 1<sup>st</sup> entry and 2<sup>nd</sup> entry refer, respectively, to the first and second times an area has burned in any fire type (prescribed fire or wildfire).

Monitoring Unit	Restoration Management Objectives	Monitoring Results (n = # of plots)		Objectives Achieved?		Minimum Plot #s Achieved?
		1 <sup>st</sup> Entry	2 <sup>nd</sup> Entry	1 <sup>st</sup> Entry	2 <sup>nd</sup> Entry	
Ponderosa Pine (PIPO) South Rim	Reduce total fuel load to 0.2-9.3 tons/acre immediate post-burn	7.1 ± 0.8 tons/acre (-48%) (n=35)	7.9 ± 1.7 tons/acre (-48% due to fire 1 & 2) (-2% due to fire 2 only) (n=20)	YES	YES*	YES n=10
	Reduce poles (PIPO) with DBH of 1-6" to 16-81 trees/acre 2 years post-burn	85.1 ± 32.7 trees/acre (-27%) (n=35)	112.9 ± 44 trees/acre (-32% due to fire 1 & 2) (-5% due to fire 2 only) (n=19)	NO	NO	NO n=64
	Maintain overstory (PIPO) density with DBH≥16" of >14 trees/acre 5 years post-burn	19.7 ± 2.6 trees/acre (+0%) (n=32)	19.3 ± 3.8 trees/acre (+1% due to fire 1 & 2) (+3% due to fire 2 only) (n=17)	YES	YES	YES n=16
Ponderosa Pine (PIPN) North Rim	Reduce total fuel load to 0.2-15.7 tons/acre immediate post-burn	12.1 ± 1.6 tons/acre (-56%) (n=30)	10.3 ± 2.6 tons/acre (-60% due to fire 1 & 2) (-42% due to fire 2 only) (n=20)	YES	YES	YES n=10
	Reduce conifer poles with DBH of 1-6" to 16-81 trees/acre 2 years post-burn	70.5 ± 34.6 trees/acre (-60%) (n=29)	16.2 ± 10.2 trees/acre (-78% due to fire 1 & 2) (-44% due to fire 2 only) (n=10)	YES*	YES*	NO n=48
	Maintain overstory conifer density with DBH≥16" of >17 trees/acre 5 years post-burn	41.6 ± 4.4 trees/acre (-12%) (n=26)	38.4 ± 22.1 trees/acre (-25% due to fire 1 & 2) (-25% due to fire 2 only) (n=4)	YES	YES*	YES n=4
Ponderosa Pine w/ White Fir Encroachment (PIAB) North Rim	Reduce total fuel load to 1.7-19.0 tons/acre immediate post-burn	17.1 ± 3.4 tons/acre (-50%) (n=19)	17.6 ± 7.7 tons/acre (-59% due to fire 1 & 2) (-35% due to fire 2 only) (n=11)	YES*	YES*	YES n=6
	Reduce conifer poles with DBH of 1-6" to 16-100 trees/acre 2 years post-burn	86.6 ± 24.8 trees/acre (-65%) (n=20)	1.6 ± 1.5 trees/acre (-98% due to fire 1 & 2) (-63% due to fire 2 only) (n=10)	YES*	NO	YES n=10
	Maintain overstory conifer density with DBH≥16" of >20 trees/acre 5 years post-burn	26.3 ± 3.0 trees/acre (-26%) (n=14)	28.3 ± 0.0 trees/acre (+23% due to fire 1 & 2) (+9% due to fire 2 only) (n=2)	YES	YES	YES, 1 <sup>st</sup> entry NO, 2 <sup>nd</sup> entry n=7

**NOTE:** 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. Minimum plot calculations are based on pre-fire values; variable fire conditions increase the minimum number of recommend plots for post-fire analysis.

**YES\*** indicates that the mean value meets stated objectives but the confidence interval is outside the range of objective values.

Maintenance objectives were established in 2010 to help refine desired states for each monitoring type. On the South Rim, maintenance burning will likely continue in the form of prescribed fires, while on the North Rim, the expectation is that wildfires will be managed to achieve maintenance objectives. These objectives are for the general state of the landscape and will help define return intervals for prescribed fires on the South Rim and initiate planning for prescribed fires on the North Rim if wildfires are regularly suppressed. Measurement periods currently correspond to those for restoration targets but can be adjusted based on management need.

Maintenance burning in the PIPO type has resulted in achievement of both plot-based objectives. In the PIPN type, two plots have burned in third entry fire, but they both burned 2 years after the second entry fire. The small plot number and anomalous burn interval in the PIPN type make these results unreliable.

**Table 7.** Maintenance Management Objectives and Monitoring Results for FMH plots in 2011. 3<sup>rd</sup> entry refers to the third time an area has burned in any fire type (prescribed fire or wildfire).

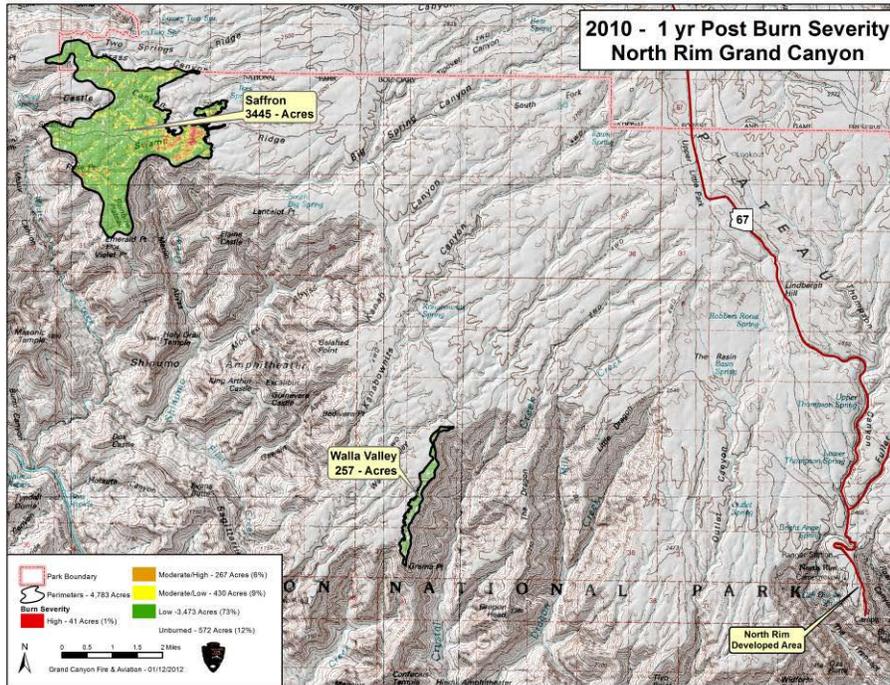
Monitoring Unit	Maintenance Management Objectives	Monitoring Results 3 <sup>rd</sup> Entry (n = # of plots)	Objectives Achieved?	Minimum Plot #s Achieved?
Ponderosa Pine (PIPO) South Rim	Maintain total fuel load of 0.2-9.3 tons/acre immediate post-burn	6.4 ± 1.9 tons/acre (-59% due to fire 1, 2, & 3) (-25% due to fire 3 only) (n=16)	YES	YES n=10
	Maintain tree (PIPO) density with DBH≥1" of 43-135 trees/acre 5 years post-burn	61.7 ± 13.9 trees/acre (-1.3% due to fire 1, 2, & 3) (+1.7% due to fire 3 only) (n=4)	YES	NO n=24
Ponderosa Pine (PIP) North Rim	Maintain total fuel load of 0.2-15.7 tons/acre immediate post-burn	5.3 ± 8.8 tons/acre (-53% due to fire 1, 2, & 3) (-18% due to fire 3 only) (n=2)	YES*	NO n=10
	Maintain conifer pole density with DBH of 1-6" of <81 trees/acre 2 years post-burn	16.2 ± 24.9 trees/acre (-81% due to fire 1, 2, & 3) (-25% due to fire 3 only) (n=2)	YES	NO n=48
Ponderosa Pine w/ White Fir Encroachment (PIAB) North Rim	Maintain total fuel load of 1.7-19.0 tons/acre	Not analyzed (n=0)	N/A	NO n=6
	Maintain conifer pole density with DBH of 1-6" of <100 trees/acre	Not analyzed (n=0)	N/A	NO n=10

**NOTE:** 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. Minimum plot calculations are based on pre-fire values; variable fire conditions increase the minimum number of recommend plots for post-fire analysis.

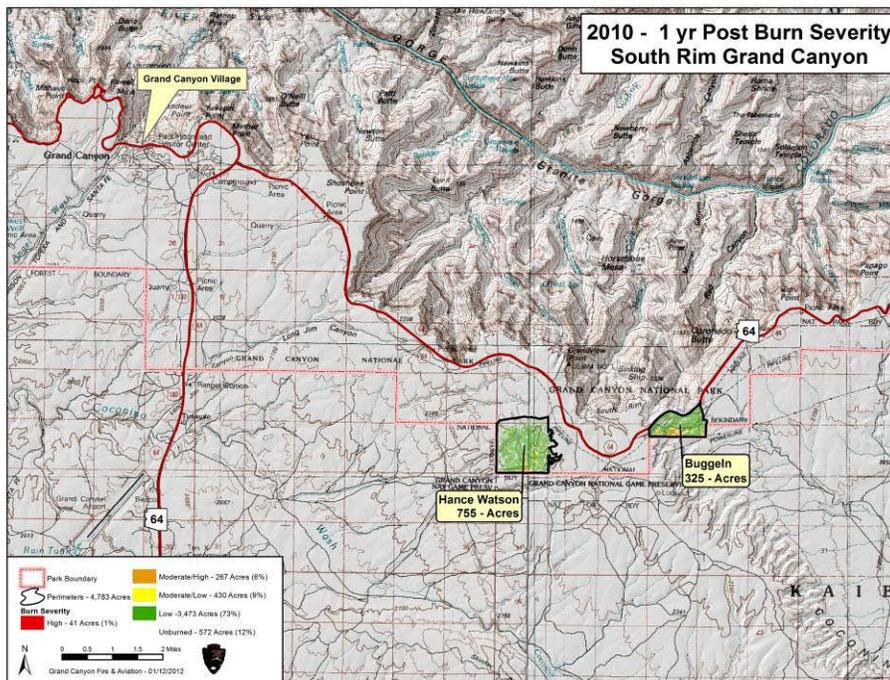
**YES\*** indicates that the mean value meets stated objectives but the confidence interval is outside the range of objective values.

## Burn Severity

As part of the Monitoring Trends in Burn Severity (MTBS) program, Composite Burn Index (CBI) burn severity assessments have been occurring annually at Grand Canyon since 2001. Between 2001 and 2011, 1,091 post-fire year 1 CBI-style plots have been measured in the park, providing Normalized Burn Ratio (NBR) satellite-correlated severity data on 46 fires over 105,000 total acres. This process is designed for field data and satellite imagery gathered one year following a fire; hence, 2011 work was performed on fires which burned in 2010. A total of 104 CBI plots were installed in 2011 across 4,783 acres in the Saffron Wildfire and the Buggeln, Hance, Watson, and Walla Valley Prescribed Fires.



**Figure 1.** Burn severity data collected one year post-fire on the North Rim.



**Figure 2.** Burn severity data collected one year post-fire on the South Rim

As part of the 2010 monitoring plan revision, landscape-scale severity objectives were established for the three monitoring types in which high severity fire was historically infrequent (PIPO, PIPN, and PIAB). In addition, severity objectives were established for mixed conifer forest in the 2009 Final Fire Management Plan EIS and 2009 Fire Management Plan Biological Assessment for the mixed conifer forest type (currently not an FMH monitoring type), and these objectives were included in the 2010 monitoring plan revision. The following table provides information on the extent of moderate-high and high severity fire in each monitoring type.

In all monitoring types, the percentage of moderate-high and high severity fire on the landscape falls within the objective ranges. Some patches of moderate-high and high severity fire exceed the objective size in all monitoring types.

**Table 8.** Management Objectives and Monitoring Results for fires from 2001-2010.

<b>Monitoring Unit</b>	<b>Management Objectives</b>	<b>Monitoring Results (all patches &gt;0.1 acres)</b>	<b>Objectives Achieved?</b>
<b>Ponderosa Pine (PIPO)</b> South Rim	Limit high severity fire to patches <5 acres across ≤5 % of monitoring type 10 year period fires from 2001 to 2010	<b>2%</b> moderate-high/high severity <b>11</b> patches >5 acres largest patch: <b>32</b> acres	<b>YES</b> - percent <b>NO</b> - size
<b>Ponderosa Pine (PIP)</b> North Rim	Limit high severity fire to patches <5 acres across ≤5 % of monitoring type 10 year period fires from 2001 to 2010	<b>3%</b> moderate-high/high severity <b>16</b> patches >5 acres largest patch: <b>52</b> acres	<b>YES</b> - percent <b>NO</b> - size
<b>Ponderosa Pine w/ White Fir Encroachment (PIAB)</b> North Rim	Limit high severity fire to patches <10 acres across ≤15 % of monitoring type 10 year period fires from 2001 to 2010	<b>12%</b> moderate-high/high severity <b>54</b> patches >10 acres largest patch: <b>288</b> acres	<b>YES</b> - percent <b>NO</b> - size
<b>Rocky Mountain Montane Conifer (Mixed Conifer)</b> North Rim	Limit high severity fire to ≤30 % of monitoring type fires from 2000 to Present	<b>18%</b> moderate-high/high severity	<b>YES</b>

## ADDITIONAL PROGRAM INFORMATION

**TABLE 9.** Additional Program Information for 2011.

<b>Program Category</b>	<b>Measurement</b>	<b>Park: Grand Canyon</b>
<b>Planning</b>	Does park have written Desired Future Conditions (DFCs)?	Yes
<b>Planning</b>	Date park-level monitoring plan completed (or revised)	2010
<b>Planning</b>	Total # project- or community-level monitoring plans	0
<b>Planning</b>	Assisted with how many Burned Area Emergency Rehabilitation (BAER) plans in 2011?	0
<b>Monitoring</b>	% 2011 data entered	100
<b>Monitoring</b>	% 2011 data quality checked	100
<b>Monitoring</b>	# prescribed fires monitored <sup>1</sup>	1
<b>Monitoring</b>	# non-fire fuels treatments monitored <sup>1</sup>	0
<b>Monitoring</b>	# wildfires monitored <sup>1</sup>	1
<b>Monitoring</b>	# BAER treatments monitored <sup>1</sup>	0
<b>Communication</b>	# project monitoring reports completed in 2011 <sup>2</sup>	1
<b>Communication</b>	# annual meeting(s) with park staff	3
<b>Communication</b>	# formal presentations of results	7
<b>Communication</b>	Do you use Minitab?	Yes
<b>Research</b>	Are research needs identified in Fire Management Plan (FMP) or monitoring plan?	Yes
<b>Research</b>	# proposals submitted in 2011	1
<b>Research</b>	# proposals funded in 2011	0
<b>Research</b>	# research projects supported in 2011 <sup>3</sup>	7
<b>Research</b>	Additional Comments	

<sup>1</sup>Number of fires/treatments completed in 2011 with fire/treatment effects monitoring conducted. Includes pre- and post-fire/treatment monitoring, but not on-site fire behavior monitoring. Does not include post-fire/treatment monitoring of fires/treatments that occurred prior to 2011.

<sup>2</sup>Project monitoring results included as part of this annual report. Existing GRCA protocol burn-day monitoring reports are not included in this number.

<sup>3</sup>Number of funded research projects supported including logistical info or support, staffing, data sharing, product reviews, etc.

## **FUTURE PROGRAM DIRECTION**

One of the top priorities for 2012 is to continue our collaboration with the I&M program by adding fire-related measurements to their existing plots and working with them to devise a data management protocol that will work for both groups. The active fire season for 2011 increased the FMH plot workload for 2012, but no more FMH installations are planned since the I&M plots will fill this need. The CBI plot workload will remain at typical levels but the continued struggle with multiple entry fire will persist into next season. Pilot data from the RAP plots will be analyzed to continue providing managers more incident-specific data. At present, 2012 work will be mostly on the North Rim (67%).

We would like to also continue to provide insight into the development of a mobile device-based application for FFI. Moving from paper datasheets to a mobile application has long been a goal of our program, and we hope to be heavily involved in the development of future products. The program will also continue our commitment to working with researchers to develop solid scientific datasets for management decision-making and with outreach staff to educate internal and external audiences about fire in GRCA and the NPS.



**Figure 3.** Fire Effects Crew plotshots.

## **CONTACTS**

Windy Bunn  
Fire Ecologist  
[windy\\_bunn@nps.gov](mailto:windy_bunn@nps.gov)  
928-638-7895

Li Brannfors  
Lead Fire Effects Monitor  
[li\\_brannfors@nps.gov](mailto:li_brannfors@nps.gov)  
928-638-7942

Jasper Peach  
Assistant Lead Monitor  
[jasper\\_peach@nps.gov](mailto:jasper_peach@nps.gov)  
928-638-7062