



**National Park Service
Fire Ecology Annual Report
Calendar Year 2014**

**Colorado Front Range &
Northwest Colorado
Park Clusters**



Tonahutu wildfire, Rocky Mountain National Park, August 14, 2014

A. Summary

Both Chris Kopek (Fire Effects Monitor crew lead) and Andy Forget (Fire Effects Monitor) returned in 2014 for a second season on the Rocky Mountain National Park (ROMO) based Fire Effects Monitoring crew. Chris and Andy conducted monitoring activities at Dinosaur National Monument (DINO), Mesa Verde National Park (MEVE), Colorado National Monument (COLM), Florissant Fossil Beds National Monument (FLFO), and host park ROMO. Additional duties included wildland fire response both in and out of park and search and rescue efforts at ROMO.

Chris and Andy traveled to Crater Lake National Park (CRLA) on a 2-week assignment as members of the ROMO Wildland Fire Module on the Founder's Day incident. They both also completed a 2-week detail with the Alpine Interagency Hotshot Crew, working 6 on incidents in 4 states. Chris continued progress on his Firefighter Type 1 (FFT1)/Incident Commander Type 5 (ICT5) taskbook throughout the season. Andy was able to complete his Fire Effects Monitor (FEMO) taskbook and is now fully qualified. Nate Williamson continued working as a Long-Term Fire Analyst (LTAN) mentee on Rocky Mountain Area IMT2 Team A during the 2014 fire season (1 out of area assignment), provided fire behavior analysis on his home unit, resumed his commitment to the Wildland Fire Management Research, Development & Application (WFM RDA) Fire Behavior Specialist call-when-needed list, and participated in local initial attack as ICT5, FFT1, and FFT2.

COLM 2 Year 04 plot visits

Post burn data were collected on 2 monitoring transects within the Red Canyon prescribed burn unit (burned in 2010).

Plot work

DINO 4 Year 01 plot visits
 10 Year 07 plot visits
 14 Year 12 plot visits

The fire effects monitoring crew resampled monitoring plots associated with the 2013 Wild-Hacking wildfire. Initial monitoring was conducted by the Black Hills Wildland Fire Module. Year 07 plot visits were conducted in the Slaugh Wall prescribed burn (prescribed fire conducted in 2007). Year 12 plot visits were conducted in the Disappointment Draw prescribed burn (burned in 2002) and the Bear wildfire which also burned in 2002. All monitoring conducted at DINO follows existing non-FMH protocols developed by DINO resource management personnel.

FLFO 4 Pre-Burn plot installations

Four Rapid Assessment plots were installed and sampled at FLFO in anticipation of prescribed burns along the northern boundary of the park (East Florissant project) in the fall of 2014. These units were not burned in the fall but are planned to be burned in 2015.

MEVE 2 Pre-Burn plot installations
 10 Pre-Burn photo-points
 1 Post-Burn plot visit
 3 Year 03 plot visits

Pre-treatment sampling at MEVE was included 2 additional plots in the Upper Navajo treatment unit (7 plots total) and the installation of 10 photo-points in the Goodman treatment unit. One post-burn sampling visit was conducted in the Bobcat Canyon ponderosa pine restoration project (see Appendix A). The fire effects monitoring crew conducted 3 Year 03 plot visits in the Farview prescribed burn unit (Year 02 visits missed due to demands of wildfire response during 2013 fire season; see Appendix B).

ROMO 5 Pre-Burn plot visits
 8 Year 05 plot visits
 6 Year 10 plot visits

Five Pre-burn plot visits were sampled in previously installed monitoring plots within the Front Range Ponderosa Pine (FPIPO1T09) monitoring type. The previous visits of these plots had “expired” (> 2 years since data last collected) and were revisited in anticipation of future planned

broadcast burning. Eight Year 05 plot visits were conducted in Big/Common Sagebrush (FARTR1D05), Ponderosa Savanna (FPIPS1T02), and Front Range Ponderosa (FPIPO1T09) monitoring types following the 2009 prescribed burn in Upper Beaver Meadows. Year 10 plot visits were conducted in the Front Range Ponderosa Pine and Eastside Lodgepole Pine – Manual Treatment (FPICE1T08) monitoring types. See Table 3 for management objectives and monitoring results.

Due to the demands of wildfire response, scheduled plotwork at BLCA and CURE did not occur.

Table 1. Fire Effects Plot Workload (2014) and Total Plots Installed

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Black Canyon of the Gunnison	Green Grizzly	Line Intercept Transect					14
		Total	0	0	0	0	14

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Colorado	Liberty Cap	Point Intercept Transect					7
	Monument Mesa	Point Intercept Transect					2
	Red Canyon	Point Intercept Transect			2	2	4
	Ute Mesa	Point Intercept Transect					15
		Total	0	0	2	2	28

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Curecanti	Soap Creek	FMH Forest plot					1
		Photo-point					6
		Total	0	0	0	0	7

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Dinosaur	Bear Fire	Point Intercept Transect			4	4	6
	Bighorn Basin Rx	Point Intercept Transect					10
	Buster Flats	Point Intercept Transect					10
	Chew Basin	Point Intercept Transect					15
	Disappointment Draw	Point Intercept Transect			10	10	10
	Dry Woman	Point Intercept Transect					10
	East Cactus	Point Intercept Transect					10
	Green Mountain Slope	Point Intercept Transect					9
	HQ Housing Area	Modified Daubenmire					5
	Iron Mine Draw	Point Intercept Transect					5
	Iron Springs Bench	Point Intercept Transect					11
	Lower Disaster Falls	Point Intercept Transect					10
	Pearl Park Rx	Point Intercept Transect					10
	Peterson	Point Intercept Transect					6
	Pot Creek	Point Intercept Transect					10
	Ruple Ranch	Point Intercept Transect					8
	Slaugh Wall Rx	Point Intercept Transect			10	10	10
	Split Mountain	Age analysis					20
	Success	Point Intercept Transect					9
	Thanksgiving	Point Intercept Transect					8
	Triple C	Point Intercept Transect					9
	West Cactus I	Point Intercept Transect					10

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Dinosaur (cont.)	West Cactus II	Point Intercept Transect					10
	Wild-Hacking	Point Intercept Transect			4	4	4
	Zenobia Basin	Point Intercept Transect					8
Total			0	0	28	28	233

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Florissant Fossil Beds	Mixed Conifer - Manual Treatment	FMH Forest plot					4
	Mixed Conifer - Manual Treatment	Photo point					70
	Ponderosa Pine	FMH Forest plot					2
	Ponderosa Pine - Manual Treatment	FMH Forest plot					3
	Ponderosa Savanna	Rapid Assessment	4			4	4
		FMH Forest plot					3
		Total	4	0	0	4	86

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Great Sand Dunes	Medano WF	CBI					26
	Pinyon Flats HFR	Photo point					7
	San Luis Valley Ponderosa Savanna	FMH Forest plot					6
	San Luis Valley Rabbitbrush Prairie	FMH Brush Plot					19
	San Luis Valley Rabbitbrush Prairie	FMH Forest plot					2
Total			0	0	0	0	60

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Mesa Verde	Farview	FMH Brush plot			3	3	3
	Bobcat Canyon	FMH Forest plot		1		1	1
	Goodman	Photo point	10			10	10
	Upper Navajo	FMH Brush plot	2			2	7
		Total	12	1	3	16	21

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Rocky Mountain	Cow Creek WF	CBI					18
	Front Range Ponderosa Pine	FMH Forest plot	4		2	6	19
	Ponderosa Savanna	FMH Forest plot			1	1	14
	Eastside Lodgepole Pine – Manual Treatment	FMH Forest plot			5	5	6
		Photo point					73
	Big/Common Sagebrush	FMH Forest plot	1		6	7	8
	Lower Montane Mixed Conifer	FMH Forest plot					21
		Photo point					3
	Grand Lake HFR	Rapid Assessment					8
	Lodgepole Pine – West Slope	FMH Forest plot					14
	Deer Mtn HFR	Rapid Assessment					12
		Total	5	0	14	19	196

			Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
		Total all Parks	21	1	47	69	645

Table 2. Fire Ecology Staffing 2014

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified	Training and Development
Chris Kopek (lead)	5/5/2014	10/31/2014	13* (2 pay periods funded through project work with fuels module)	Yes	S-271; First Aid/CPR; S-211 Refresher; S-212 Refresher; READ (online); B-3 (Aviation Safety); Defensive Driving; Bloodborne Pathogens; HAZWOPER; <i>OTJ Training:</i> Monitoring techniques, Fuel Moisture Sampling; Data Management; Fire Assignments as FEMO and FFT1/ICT5 trainee.
Andy Forget	5/5/2014	10/31/2014	13* (2 pay periods funded through project work with fuels module)	Yes	First Aid/CPR; S-211 Refresher; S-212 Refresher; READ (online); B-3 (Aviation Safety); Defensive Driving; Bloodborne Pathogens; HAZWOPER; <i>OTJ Training:</i> Monitoring techniques, Fuel Moisture Sampling; Data Management; Fire Assignments as FEMO trainee (taskbook completed).
Nate Williamson	1/1/2014	12/31/2014	26	Yes	S-590; S-260; Operational Leadership; First Aid/CPR; Defensive Driving;; Bloodborne Pathogens; Fire Assignments as FFT1, ICT5, FARS, GSAN, and LTAN mentee.

Table 3. 2014 Management Objectives and Monitoring Results

Monitoring Unit	Management Objective	Monitoring Results ($\alpha = 80\%$)	Objective Achieved?	Year Last Analysis Completed (Data Range)
Pearl Park Rx (DINO)	60-100% reduction in sagebrush cover	100% reduction in sagebrush cover ($n=5$; 1 burn)	YES	2011 (2003-2011)
	Increase cover of native grasses to 30% within 2 years post-burn	85% cover of native grasses 2 years post-burn ($n=5$; 1 burn)	YES	2011 (2003-2011)
Dry Woman PNF (DINO)	no specific objectives stated		General analysis completed	2013 (1984-2013)
Bighorn Basin Rx (DINO)	Improve winter habitat for bighorn sheep Restoration to pre-settlement grassland vegetation		Specific objectives not addressed by monitoring efforts	2013 (2004-2012)



Andy, Spruce incident (ROMO), July 1, 2014

Monitoring Unit	Management Objective	Monitoring Results ($\alpha = 80\%$)	Objective Achieved?	Year Last Analysis Completed (Data Range)
Front Range Ponderosa Pine (ROMO)	40-80% total fuel reduction	32.5% reduction in total fuel load ($n=9$; 5 burns)	NO <i>Note: when considering woody fuels only, fuels reduction is 31.9%</i>	2014 (1999-2014)
	Limit overstory PIPO mortality to 5% within 5 years post-burn	27.6% reduction in overstory PIPO ($n=10$; 6 burns)	NO , but mountain pine beetle mortality a factor	2014 (1999-2014)
	generate 5-35% mortality in pole-sized trees within 5 years post-burn	49.8% reduction in pole-sized trees ($n=10$; 6 burns)	NO , but mountain pine beetle mortality a factor	2014 (1999-2014)
Ponderosa Savanna (ROMO)	40-80% total fuel reduction	1.3% reduction in total fuel load ($n=10$; 4 burns)	NO (results not significant)	2011 (1998-2011)
	Limit overstory PIPO mortality to 5% within 5 years post-burn	0% reduction in overstory PIPO ($n=5$; 3 burns)	YES	2011 (1998-2011)
	generate 5-30% mortality in pole-sized trees within 5 years post-burn	30.0% reduction in pole-sized trees ($n=5$; 3 burns)	YES	2011 (1998-2011)
Lodgepole Forest Westside (ROMO)	40-80% total fuel reduction	62.1% reduction in total fuel load ($n=4$; 2 burns)	YES (results not significant)	2011 (1998-2003)
	generate 10-45% mortality in overstory trees within 5 years post-burn	0.9% increase in overstory trees ($n=3$; 1 burn)	NO	2011 (1998-2003)
Eastside Lodgepole Pine Manual Treatment (ROMO)	80-100% woody fuel reduction	12.7% reduction in woody fuel load ($n=5$; 1 treatment)	NO (results not significant) <i>Note: when considering woody fuels > 1", fuels reduction is 63.8%</i>	2012 (2001-2012)
		33.6% reduction in overstory trees ($n=5$; 1 treatment)	N/A (objectives not specifically tied to overstory density)	2012 (2001-2012)
		70.2% reduction in pole-sized trees ($n=5$; 1 treatment)	N/A (objectives not specifically tied to pole-sized tree density)	2012 (2001-2012)
Lower Montane Mixed Conifer (ROMO)	40-80% total fuel reduction	50.5% reduction in total fuel load ($n=8$; 2 burns)	YES	2012 (1998-2012)
	generate 10-25% mortality in overstory trees within 5 years post-burn	61.9% reduction in overstory trees ($n=7$; 2 burns)	NO , but mountain pine beetle mortality a factor	2012 (1998-2012)
	generate 10-25% mortality in pole-sized trees within 5 years post-burn	48.2% reduction in pole-sized trees ($n=7$; 2 burns)	NO , but mountain pine beetle mortality a factor	2012 (1998-2012)

B. Fire ecologist accomplishments and areas of focus

Table 4. Fire Ecologist 2014 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	20%	- Participated in rewrite of East Florissant Prescribed Burn Plan - Coordinated with regional Ecologist on status BAER Plan progress (Big Meadows, Fern Lake, Woodland Heights) - Produced bi-weekly Fire Danger Assessment documents throughout the fire season - Developed draft proposal for a quantitative approach to determining fire danger outside the summer fire season - Development of ROMO Fire/Fuels Treatment Monitoring Plan
Presentations	5%	- Various presentations to ROMO Fire Staff (e.g. Weather Observations, Fire Danger Rating, etc.) - Fire Ecology/Forest Health: ROMO Interpretive staff - Fire Ecology: Estes Park High School
NPS Meetings/ task groups	5%	- IMR RAWS Coordinator duties - NPS Fire Weather Program Committee - IDT member for ROMO Exotic Plant Management EA planning process - Consulted with ROMO and CSU staff on vegetation monitoring - ROMO New Technology Committee member - Conducted WFDSS intro/refresher workshop for ROMO fire staff
Interagency work	5%	- Represented NPS as member of Rocky Mountain Area Fire Danger Rating Sub-committee - Assisted in data development/entry/analysis of interagency FPA data - Helped instruct WFDSS workshop for R2 USFS staff
Wildfire assignments	20%	- LTAN mentee on RM IMT2A (1 out of area assignment) - Worked remotely as a Fire Behavior Specialist for area wildfires at request of RMACC - Local Initial Attack as ICT5, FFT1, and FFT2 - Continued commitment to the WFM RDA Fire Behavior Specialist call-when-needed list
Prescribed fire projects	<5%	Participated in winter pile burning operations
Non-fire fuels projects	<5%	
Research	5%	- Collaborated with Colorado State University researchers with several proposals for ROMO and GRSA projects - ATR (Agreements Technical Representative) for several projects at ROMO and GRSA - Assisted CSU undergraduate student with Honors thesis project (subalpine fires in the Rocky Mountains)
Data collection	<5%	Monitors completed bulk of data collection
Data entry	<5%	Monitors completed bulk of data entry
Data analysis	10%	- Completed annual report, continuing analyses of previous season's data - Developed joint annual report for FLFO with NPS Inventory & Monitoring Program (in review)
Supervision/Admin	15%	Hired, supervised, trained monitoring crew, completed evaluations

		• Developed work schedule, priorities • Travel and time paperwork
Training	10%	• S-590 (Advanced Fire Behavior Interpretation; Tucson, AZ) • S-260 (Interagency Incident Business Management: Estes Park, CO) • Operational Leadership (Estes Park, CO) • ROMO Fire Training Days (pumps, engine operations, hoselays, etc.) • Introductory AFS training (Estes Park, CO) • ATR (Agreements Technical Representative) refresher • Annual refresher and Work Capacity Test (Estes Park, CO)
Travel out-of-park for plot or project work	0%	
Miscellaneous	5%	• GRSA RAWS maintenance, first responder duties • Plans Section Chief on ROMO Type 3 All Hazard Team •



Nate, Deception Complex (Willamette National Forest), August 24, 2014

C. Fire effects crew accomplishments and areas of focus

Table 5. Fire Effects Crew 2014 Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	20%	• ROMO, MEVE
WUI plots	<5%	• ROMO
CBI plots	0%	
Other plot work	20%	• DINO, COLM, FLFO fire effects plots (non-FMH)
Wildfire assignments	20%	• FFT1 trainee, ICT5 trainee, FEMO trainee, FFT2 assignments
Prescribed fire projects	<5%	
Non-fire fuels projects	<5%	• Wild Basin rare plant surveys
Travel out-of-park for plot or project work	5%	• DINO, MEVE, COLM, FLFO
Data entry	15%	• Estimated amount of time spent entering data from paper to PC
Data analysis	<5%	
Supervision/Admin	<5%	• Payroll, travel authorizations/vouchers, etc.
Training	15%	• S-271 (Helicopter Crewmember) • First Aid, CPR • B-3 • S-211, S-212 refreshers • ROMO Backcountry Travel Training
Miscellaneous	5%	• ROMO Search & Rescue



Chris (ROMO plotwork), August 2014

D. Additional Program Information

Table 6. Planning - 2014

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 2014)	Assisted with how many BAER plans in 2014?
Black Canyon of the Gunnison National Park	Yes	2006	0	0
Colorado National Monument	Yes	2005	0	0
Curecanti National Recreation Area	Yes	2006	0	0
Dinosaur National Monument	Yes	2005	0	0
Florissant Fossil Beds National Monument	No	2002	0	0
Great Sand Dunes National Park and Preserve	No	2005	0	0
Mesa Verde National Park	No	2010 (update of 2003 plan)	0	0
Rocky Mountain National Park	Yes (process based)	2014 (in prep)	0	3

Table 7. Monitoring - 2014

Park	% 2014 Data Entered	% 2014 Data Quality Checked	# Prescribed Fires Monitored *	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored *	# BAER Treatments Monitored*
Black Canyon of the Gunnison National Park	N/A	N/A	0	0	0	0
Colorado National Monument	100	100	1	0	0	0
Curecanti National Recreation Area	N/A	N/A	0	0	0	0
Dinosaur National Monument	100%	100%	2	0	2	0
Florissant Fossil Beds National Monument	100	100	1	0	0	0
Great Sand Dunes National Park and Preserve	N/A	N/A	0	0	0	0
Mesa Verde National Park	100	100	2	2	0	0
Rocky Mountain National Park	80%	80%	4	1	0	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 - 2014

Park	# of Project Monitoring Reports completed in 2014	# of Annual meeting(s) with Park staff	# of Formal presentations of results	Do you use Minitab?*
Black Canyon of the Gunnison National Park	0	0	0	Yes
Colorado National Monument	0	0	0	
Curecanti National Recreation Area	0	0	0	
Dinosaur National Monument	0	0	0	
Florissant Fossil Beds National Monument	0	0	0	
Great Sand Dunes National Park and Preserve	0	0	0	
Mesa Verde National Park	2	0	0	
Rocky Mountain National Park	0	1	0	

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

Additional project monitoring reports are currently in preparation and will be completed throughout the winter and spring.

Table 9. Research - 2014

Park	Are research needs identified in FMP or Monitoring Plan? (yes or no)	# of Proposals Submitted in 2014	# of Proposals Funded in 2014	# of Research Projects Supported in 2014*	Additional Comments
Black Canyon of the Gunnison National Park	Yes	0	0	0	
Colorado National Monument	No	0	0	0	
Curecanti National Recreation Area	Yes	0	0	0	
Dinosaur National Monument	No	0	0	0	
Florissant Fossil Beds National Monument	Yes	0	0	0	
Great Sand Dunes National Park and Preserve	Yes	0	1	1	
Mesa Verde National Park	Yes	0	0	0	
Rocky Mountain National Park	Yes	0	2	2	

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

E. 2015 Direction

Direction for 2015 will include continued analysis of data and presentations/discussion with fire and resource management staff regarding the implications of those analyses. As time allows, the fire ecologist will seek out opportunities to share/present data to a variety of audiences (e.g. park staff, school groups, scientific community, etc.). The ROMO-based Fire Ecology program purchased a Panasonic Toughbook this winter with the intention of moving to data entry in the field. This is anticipated to add time in the field, however it is hoped that it will result in greater overall efficiency by eliminating the data entry step in the office.

The fire ecologist will continue to pursue opportunities to complete Firing Boss (FIRB) qualification through prescribed fire and wildfire assignments. This will allow the pursuit of a longer term goal of becoming a fully qualified Long-Term Fire Analyst (LTAN). Additionally, the fire ecologist will pursue opportunities to work towards Resource Unit Leader (RESL) in wildland fire as well as Planning Section Chief (PSC) on the ROMO All Hazards Type 3 Incident Management Team.

Pending approval to hire seasonal fire effects monitoring staff, the fire effects monitoring field season will begin in May with monitoring visits currently scheduled for BLCA, CURE, DINO, FLFO, GRSA, MEVE, and ROMO.



Founder's Day incident (CRLA), September 8, 2014

Initial Results of the Bobcat Canyon Ponderosa Pine Restoration Project Mesa Verde National Park

PROJECT DESCRIPTION

Bobcat Canyon is located south and east of the main Wetherill Mesa Developed Area within Mesa Verde National Park. This narrow canyon is home to one of the largest populations of ponderosa pine (*Pinus ponderosa*) remaining in the park. Most of these trees are mature individuals with little pine reproduction evident. The objective of this project is to stimulate natural regeneration of ponderosa pine by creating a seed bed underneath the trees using prescribed fire. Approximately 10 acres of prescribed burning is proposed through multiple treatment entries.

Pre-burn preparation work to minimize fire damage to the estimated 75 mature pines within the treatment unit consisted of the removal of live and dead brush for a distance of 15-25 feet from around tree boles. Cut debris was lopped and scattered outside the clearing radius. Accumulated needle cast layers were also raked to a distance of 5 feet away from tree boles to limit excessive cambial heating and root damage. The prescribed burn was conducted on April 8, 2014. A total of 11 acres were burned and it is estimated that 70-80% of the burn unit was affected by fire (see Figure 1).

MONITORING METHODS

Monitoring protocols were derived from the National Park Service Fire Monitoring Handbook (NPS 2003). In July 2011, one standard 20 x 50 m forest monitoring plot (Bobcat #1) was installed on the east side of the canyon. This plot was sampled in 2011 prior to treatment and again in 2014 following treatment.

Due to the small sampling size (1 plot), no statistical analyses were performed.

RESULTS

Dead and Downed Fuel Loading

Results indicate modest increases in the smaller size classes of fuels (1-, 10-, and 100-hr fuels; Table 1, Figure 1). However, large diameter fuels (1000-hr) were reduced by 71%. Litter and duff fuel loading were reduced by 95% and 82% respectively. Total fuel loading (all size classes, litter, and duff) was reduced by 78% (see Table 1; Figures 2, 3).



Figure 1. Bobcat Canyon prescribed burn, April 8, 2014 (Keith Krause photo).

Table 1. Bobcat Canyon surface fuel loading pre- and post treatment.

	Pre-treatment	Post-treatment	
Fuel Type	Loading (tons/acre)	Loading (tons/acre)	Percent change
1-hr	0.09	0.12	33.3%
10-hr	1.01	1.33	31.7%
100-hr	1.97	2.32	17.8%
1000-hr	5.83	1.67	-71.4%
Litter	15.40	0.71	-95.4%
Duff	18.44	3.37	-81.7%
TOTAL	42.74	9.52	-77.7%
	Pre-treatment	Post-treatment	
Fuel Type	Depth (inches)	Depth (inches)	Percent change
Litter	3.10	0.10	-96.8%
Duff	1.80	0.30	-83.3%
TOTAL	4.9	0.4	-91.8%

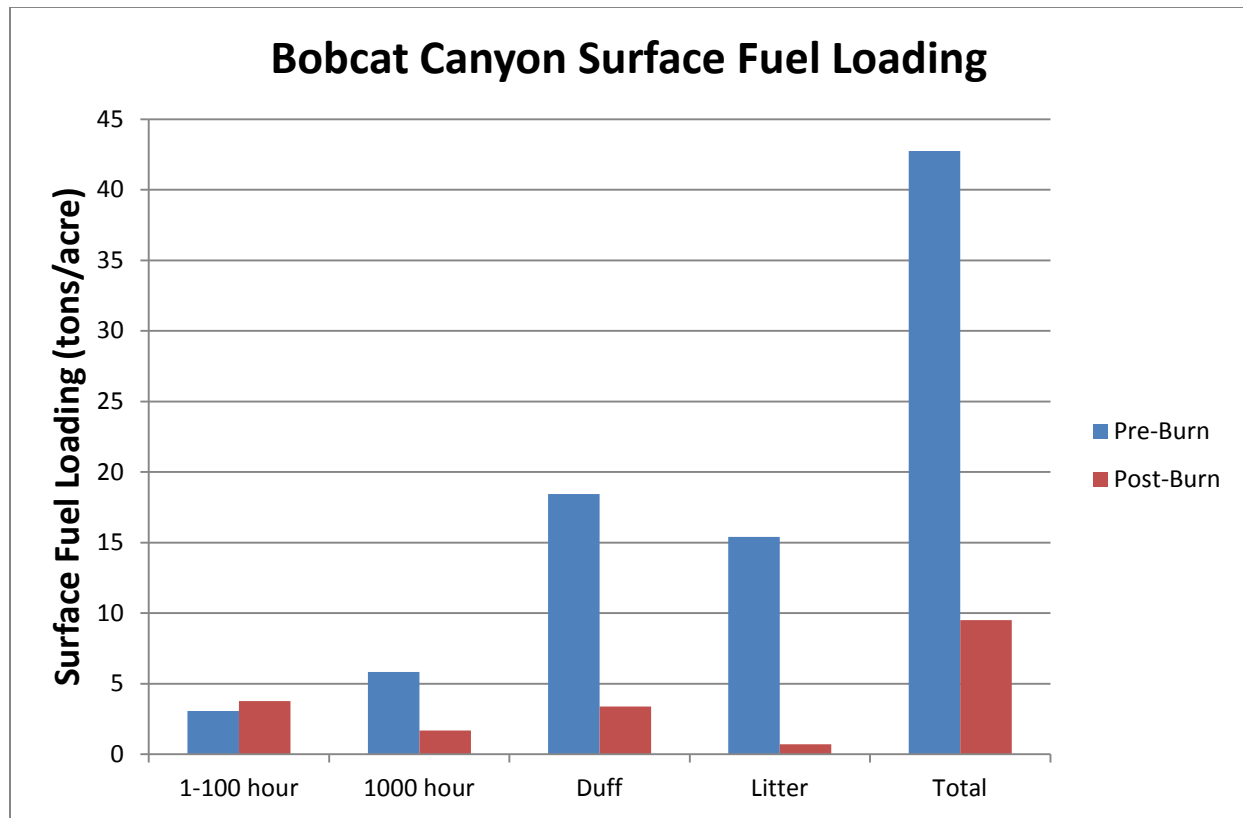


Figure 2. Bobcat Canyon surface fuel loading pre- and post-treatment.



Figure 3. Surface fuel consumption, Bobcat Canyon prescribed burn, April 8, 2014 (Keith Krause photo).

Appendix A

STAND STRUCTURE AND COMPOSITION

Stand structure and composition data were collected prior to treatment and 2 months following treatment. Initial results indicate an overall reduction of 55% for live mature trees (≥ 6 -inch diameter at breast height; see Figure 4). All living mature ponderosa pine were retained following treatment (4.1 trees/acre before and after treatment). Mature pinyon pine (*Pinus edulis*) was reduced 56.2% (64.8 trees/acre pre-treatment, 28.3 trees/acre post-treatment) and mature Utah juniper (*Juniperus osteosperma*) was reduced 66.6% (12.1 trees/acre pre-treatment, 4.1 trees/acre post-treatment).

Prior to treatment, pole-sized trees (≥ 1 -inch < 6 -inch diameter) averaged 259.0 stems/acre consisting of 75% Gambel oak (*Quercus gambelii*) and 25% pinyon pine. No live poles remained following treatment (100% reduction). The only species represented in the seedling size category (< 1 -inch diameter) both prior to and following treatment was Gambel oak. Seedling density was reduced 32.3% from a pre-treatment density of 2509.1 stems/acre to a post-treatment density of 1699.7 stems/acre.

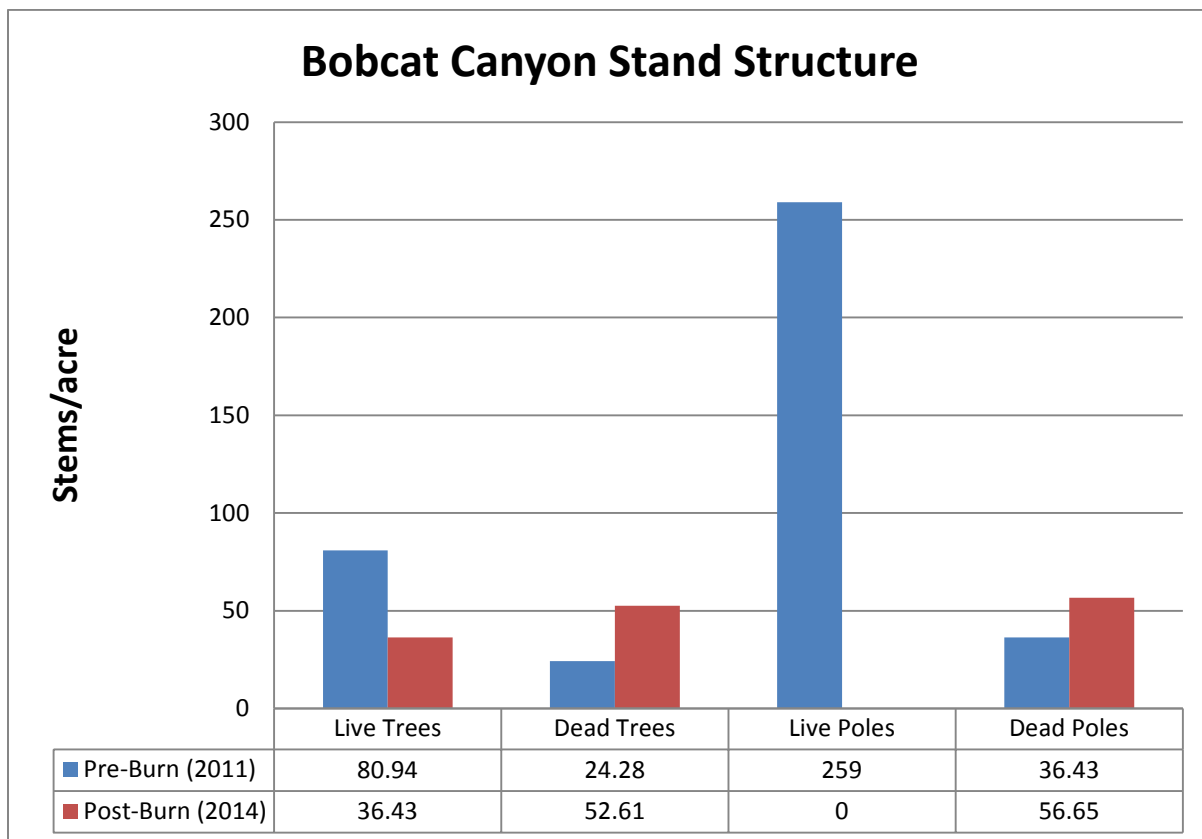


Figure 4. Bobcat Canyon stand structure pre- and post-treatment.

UNDERSTORY VEGETATION

No exotic species were encountered prior to or following treatment. The only graminoid encountered, muttongrass (*Poa fendleriana*), was the most common understory species comprising 18.1% cover pre-treatment and 12.1% cover post-treatment (reduction of 33.3%;

Figure 5). Forbs were a minor component of the understory prior to treatment (1.8% total cover) and consisted of fewflower pea (*Lathyrus pauciflorus*) and an unknown penstemon (1.2% and 0.6% cover respectively). No forbs were encountered in the post-treatment plot visit. Subshrub cover remained unchanged following treatment (4.2% cover) and consisted of white sage (*Artemisia ludoviciana*), Oregon grape (*Mahonia repens*), and black sage (*Artemisia nova*). Shrub cover was reduced 38.4% following treatment (7.8% cover pre-treatment, 4.8% cover post-treatment). Shrub species encountered both before and following treatment consisted of serviceberry (*Amelanchier utahensis*), sumac (*Rhus trilobata*), and mountain lover (*Paxistima myrsinites*).

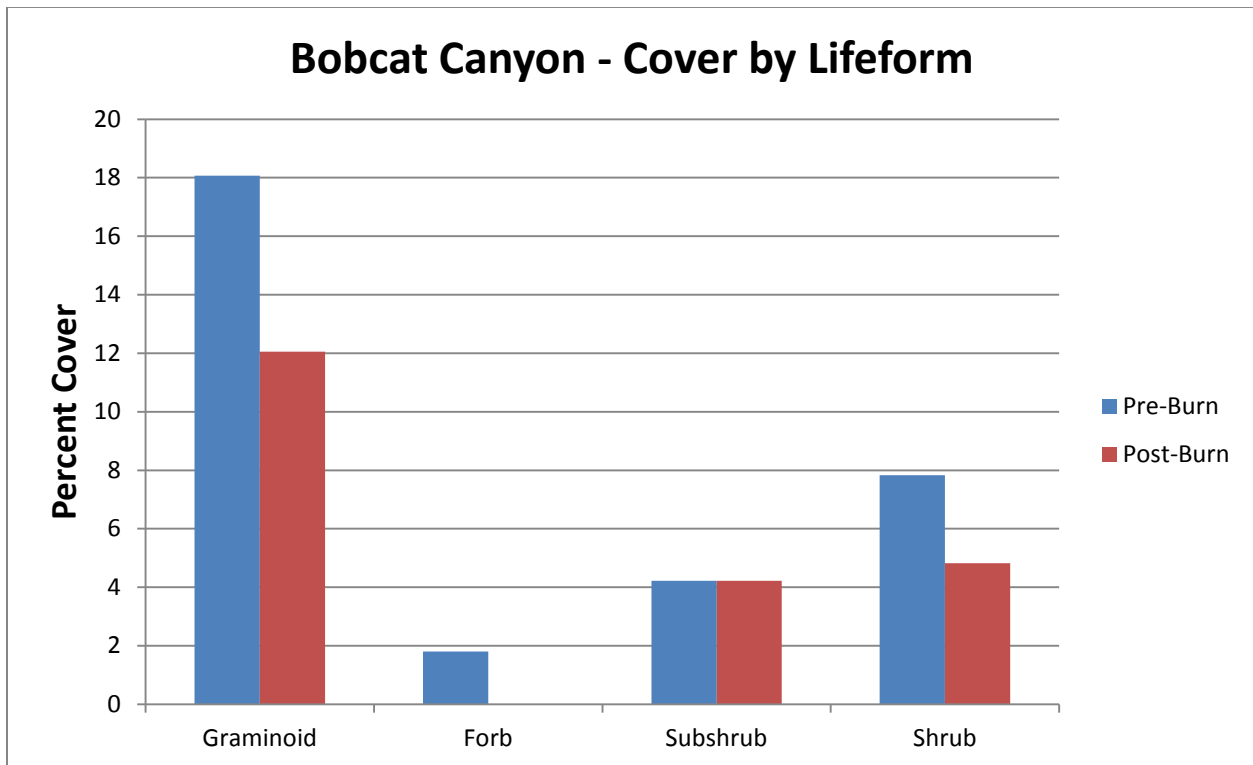


Figure 5. Bobcat Canyon understory composition pre- and post-treatment

DISCUSSION

The modest increases in the smaller sized fuels (1-hr, 10-hr, and 100-hr classes) would be expected given the levels of activity that occurred during treatment operations. Smaller branches are likely to break off as trees are felled and bucked and the material scattered onsite. Post-thinning prescribed fire resulted in a 71.4% reduction in large diameter fuels (1000-hr), 95.4% reduction in litter, and 81.7% reduction in duff. Overall fuels reduction (78% reduction) should moderate both the intensity and severity of future wildfires in Bobcat Canyon. The reductions in mature trees and pole-sized trees (55% and 100% respectively) should reduce competition for resources and consequently improve vigor among the remaining trees.

Appendix A

However, it is important to keep in mind that these data are from one plot only and may not adequately represent the entire treatment unit.

CONCLUSION

Although this analysis is based on a limited data set (1 plot), initial results indicate that the Bobcat Canyon Ponderosa Pine Restoration Project at Mesa Verde is having the intended effect of reducing surface fuels while maintaining existing mature ponderosa pine (see Figure 6). Figures 7 and 8 are taken from the same location prior to the prescribed burn and again 2 months after the burn. Although no new ponderosa pine seedlings were encountered during the post-treatment visit, the substantial reductions in litter and duff loading and depth have created conditions more conducive to ponderosa pine seedling establishment than existed prior to treatment. Data collection and analysis will continue in future years to document recovery and long-term change in Bobcat Canyon.



Figure 6. Bole char on ponderosa pine, Bobcat Canyon prescribed burn, April 8, 2014 (Keith Krause photo).



Figure 6. Bobcat Canyon (pre-burn): July 7, 2011.



Figure 7. Bobcat Canyon (post-burn): June 19, 2014.



Figure 8. Overview of Bobcat Canyon prescribed burn, June 19, 2014.

Appendix A

REFERENCES

NPS. 2003. Fire Monitoring Handbook. Fire Mangement Program Center, National Interagency Fire Center, Boise, ID.

Farview Prescribed Fire Project: Pre-Burn – Year 3 Mesa Verde National Park

PROJECT DESCRIPTION

The Farview prescribed fire project is located in the north central portion of Mesa Verde National Park and surrounds the Farview Developed Area. The project consists of 7 individual treatment units totaling approximately 62 acres. The project area is bounded by the Wetherill Mesa Road to the north, the Farview Lagoon Rd #0705 to the east, an east-west section line from this road to the Main Park Entrance Road, then north along a section line to the Wetherill Mesa Road.

Vegetation within the treatment areas is predominantly mountain shrub consisting of Gambel oak (*Quercus gambellii*), serviceberry (*Amelanchier utahensis*) with lesser amounts of chokecherry (*Prunus virginiana*) and cliff fendlerbush (*Fendlera rupicola*). Very scattered pinon (*Pinus edulis*) and juniper (*Juniperus osteosperma*) trees are also present within several units. On the more southerly exposures, perennial grasses and scattered shrubs including rabbitbrush (*Ericameria nauseosa*) and big sagebrush (*Artemisia tridentata*) fill in the pockets between individual or small clumps of oak and serviceberry.

MONITORING METHODS

Monitoring protocols were derived from the National Park Service Fire Monitoring Handbook (NPS 2003). In July 2011, three standard 30-meter brush monitoring plots were installed in the treatment unit. These plots were sampled in 2011 prior to treatment, in 2012 following treatment, and again in 2014. Data were analyzed with single factor Analyses of Variance with a confidence level of 80%.

RESULTS

Dead and Downed Fuel Loading

Dead and downed woody fuels consisted primarily of 1- and 10-hour fuels. Fuels in the 100-hour size class were only encountered along one transect during a 2014 visit. No 1000-hour fuels were encountered. Results indicate downed woody fuel loading increased significantly following treatment (see Figure 1). Average duff and litter loading were not significantly different between sampling events. Differences in total fuel loading were highly variable and not significant, however average values after 3 years were higher than pre-treatment values.

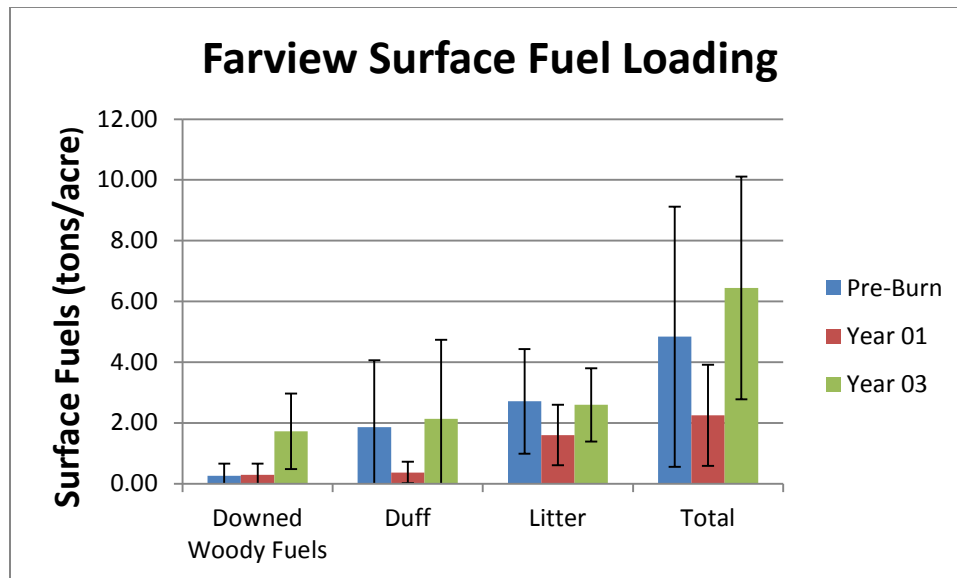


Figure 1. Farview surface fuel loading pre- and post-treatment. Values represent means $\pm$ standard deviation.

VEGETATIVE COVER

Vegetative cover was highly variable from plot to plot and between plot visits. Average pre-treatment vegetative cover was 116%; 95.3% average cover the summer following treatment, and 122.3% in 2014. Differences in total vegetative cover were not found to be significant. Among the various lifeforms sampled, only subshrub cover was found to be significantly different between visits (see Figure 2). The most common subshrub species encountered was ballhead sandwort (*Arenaria congesta*) which comprised 38% average cover pre-treatment, 14% average cover in 2012, and 39% average cover in 2014). Black sagebrush (*Artemisia nova*) was the next most common subshrub species encountered and comprised an average cover of 12% across all sampling dates. Broom snakeweed (*Gutierrezia sarothrae*) was the only subshrub species eliminated from the sampled transects following treatments (11% average cover pre-treatment, 0% cover following treatment).

The most common graminoid species encountered was muttongrass (*Poa fendleriana*) comprising average cover of 43% pre-treatment, 60% average cover in 2012, and 36% average cover in 2014. The most common forb encountered during sampling was fleabane (*Erigeron flagellaris*) which comprised 4% average cover pre-treatment, 8% average cover in 2012, and 16% cover in 2014. The only non-native species encountered was smooth brome (*Bromus inermis*) which was found along one transect in 2012 (0.67% average cover). Smooth brome was not encountered along any transects in 2014. The most common shrub species encountered was snowberry (*Symphiocarpus oreophilis*) which was reduced from 52% average cover pre-treatment to 31% average cover in 2012, and recovering to 53% average cover in 2014.

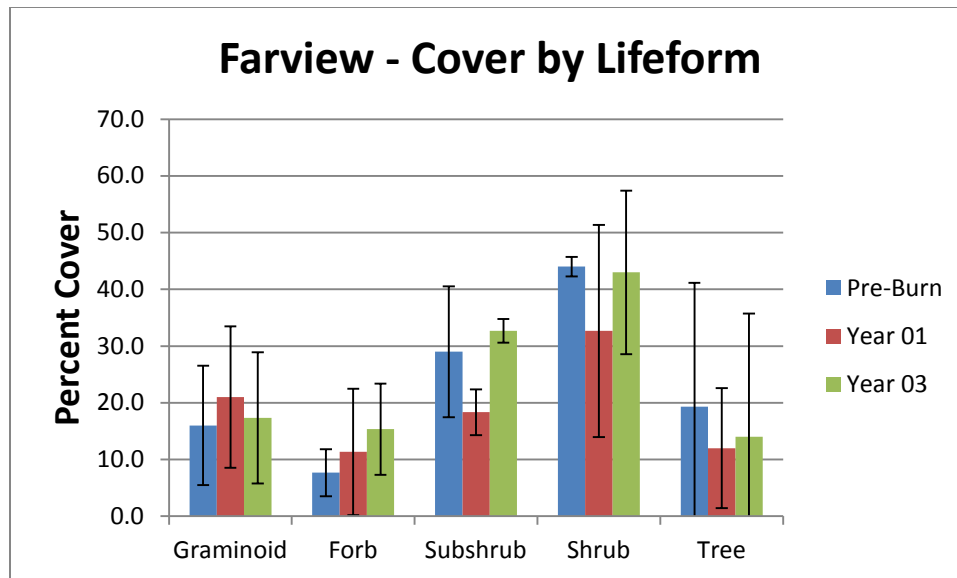


Figure 2. Farview Cover by lifeform loading pre- and post-treatment. Values represent means $\pm$ standard deviation.

In terms of density, live subshrub density increased significantly by 2014 (see Figure 3). Black sagebrush increased from an average pre-treatment density of 3304.9 stems/acre to 4451.6 stems/acre in 2014. Rabbitbrush, which was not present prior to treatment, had a density of 1821.1 stems/acre in 2014. Live shrub density also increased significantly from an average pre-treatment density of 8903.1 stems/acre, to an average of 72,371.3 stems/acre in 2014. The most common shrub species were snowberry (5867.9 average stems/acre pre-treatment, 36,489.2 average stems/acre in 2014) and serviceberry (2225.8 average stems/acre pre-treatment, 33,521.5 average stems/acre in 2014). Differences in density of dead subshrubs, dead shrubs, live trees, and dead trees were not significant between plot visits.

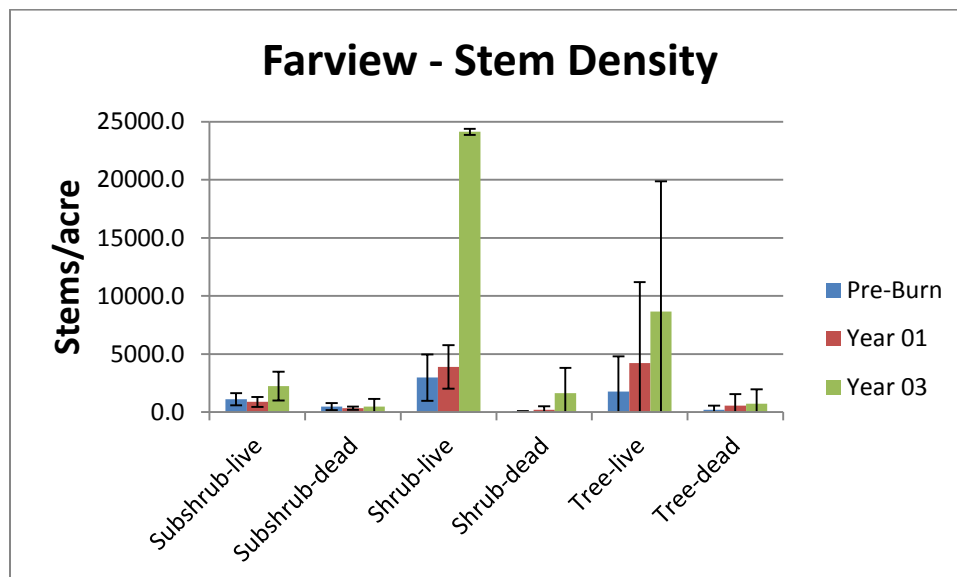


Figure 3. Farview stem density pre- and post-treatment. Values represent means $\pm$ standard deviation.

Appendix B

DISCUSSION AND CONCLUSION

Increases in woody fuel loading in year 3 are likely due to standing material that was killed in the prescribed fire treatment eventually falling to the surface. The dramatic increase in density of snowberry and serviceberry is not surprising, given that both species have the ability to resprout from their rootcrowns following topkill by fire. The high variability in many of the data collected is likely due in part to the low number of transects sampled (3). Hopefully as treatments continue, additional monitoring plots will be installed. The existing transects will continue to be monitored in the future to document long-term change.

NPS. 2003. Fire Monitoring Handbook. Fire Mangement Program Center, National Interagency Fire Center, Boise, ID.