



**National Park Service
Fire Ecology Annual Report
Calendar Year 2011**

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



Great Sand Dunes National Park and Preserve

A. Summary

The 2011 field season brought 2 new faces to the Rocky Mountain National Park (ROMO) - based fire effects monitoring crew. Matt Mueller (SHEN fire effects monitoring program alumnus) came on board as the crew lead in May and Kevin Osborne, a graduate student at Cal Poly was hired under the STEP program and started in June. Matt took advantage of the time prior to Kevin's start to catch up on the data entry backlog that has been hanging over the program for several seasons. Matt and Kevin racked up the miles traveling to Dinosaur National Monument (DINO), Mesa Verde National Park (MEVE), Black Canyon of the Gunnison National Park, (BLCA), Colorado National Monument (COLM), Curecanti National Recreation Area (CURE), Great Sand Dunes National Park and Preserve (GRSA), as well as conducting monitoring at their host park (ROMO).

Plot work

BLCA 6 Pre-burn plot installations
 8 Year 02 Post-burn plot visits

All plot visits at BLCA were conducted within the Green Grizzly prescribed burn unit. The post-burn plots were specifically designed to monitor changes in sage grouse habitat (line intercept transects). The pre-burn installations were standard FMH brush transects.

CURE 1 Pre-burn plot installation
 6 Photo-point installations

Monitoring efforts at CURE focused on collection of pre-treatment data and photos associated with the planned Soap Creek prescribed burn near the Ponderosa campground.

COLM 2 Post-burn plot visits

Post burn data were collected on 2 monitoring transects within the Red Canyon prescribed burn unit.

DINO 11 Year 07 plot visits
 8 Year 30 plot visits

The fire effects monitoring crew resampled monitoring plots associated with the Disappointment Draw, Thanksgiving Gorge, and Pearl Park prescribed burn units as well as the Headquarters housing area cheat grass project. All monitoring follows existing non-FMH protocols developed by DINO resource management personnel. Although all historical hardcopy plot data has been entered into Excel, additional editing is still required to allow conversion of this electronic data into a format suitable for FFI. See Appendix A for an analysis of the Pearl Park data.

GRSA 26 CBI plot visits (Year 01)

Twenty-six Composite Burn Index (CBI) plots were sampled within the 2010 Medano wildfire perimeter.

MEVE 4 Pre-burn plot installations

The fire effects monitoring crew made its first visit to Mesa Verde to collect pre-burn data in the Farview and Bobcat Canyon treatment units.

ROMO 4 Year 02 plot visits
 3 Year 05 plot visits
 1 Year 10 plot visits
 18 CBI plot visits (Year 01)

Year 02 plot visits were conducted in the Big/Common Sagebrush type (FARTR1D05) and the Front Range Ponderosa Pine type (FPIPO1T09). These plots were burned in the Estes Valley prescribed burn in the fall of 2009. Year 05 plot visits were conducted in 2 Front Range Ponderosa Pine plots and one Ponderosa Savanna (FPIPS1T02) plot. One Year 10 plot visit was conducted in the Front Range Ponderosa Pine type within the Moraine Park #2 prescribed burn. Eighteen CBI plots were sampled within the 2010 Cow Creek wildfire perimeter. See Table 3 for management objectives and monitoring results.

Table 1. Fire Effects Plot Workload (2011) 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	Transect	6		8	14	14
		Total	6	0	8	14	14

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			1	1
		Photo-point	6			6	6
		Total	7	0	0	7	7

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



Sunrise from the top of the Dugway, Dinosaur National Monument

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
Dinosaur	Bear Fire	Transect					6
	Bighorn Basin Rx	Transect					10
	Buster Flats	Transect					10
	Chew Basin	Transect					15
	Disappointment Draw	Transect			1	1	10
	Dry Woman	Transect					10
	East Cactus	Transect					10
	Green Mountain Slope	Transect					9
	HQ Housing Area	Modified Daubenmire			5	5	5
	Iron Mine Draw	Transect					5
	Iron Springs Bench	Transect					11
	Lower Disaster Falls	Transect					10
	Pearl Park Rx	Transect			10	10	10
	Peterson	Transect					6
	Pot Creek	Transect					10
	Ruple Ranch	Transect					8
	Slaugh Wall Rx	Transect					10
	Split Mountain	Age analysis					20
	Success	Transect					9
	Thanksgiving	Transect			8	8	8
	Triple C	Transect					9
	West Cactus I	Transect					10
	West Cactus II	Transect					10
	Zenobia Basin	Transect					8
		Total	0	0	24	24	229



Dinosaur National Monument

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	FMH Forest plot					3
Total			0	0	0	0	82

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	26	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	26	26	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
Total			4	0	0	4	4

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	18	18
	Front Range Ponderosa Pine	FMH Forest plot			3	3	19
	Ponderosa Savanna	FMH Forest plot			2	2	14
	Eastside Lodgepole Pine – Manual Treatment	FMH Forest plot					6
		Photo point					73
	Big/Common Sagebrush	FMH Forest plot			3	3	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	0	0	26	26	196

			Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Annual Total	Total Plots
		Total all Parks	25	0	86	111	628



Aspen regen, Cow Creek wildfire, Rocky Mountain National Park

Table 2. Fire Ecology Staffing 2011

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified	Training and Development
Matt Mueller (lead)	5/9/2011	9/29/2011	10.5	No	Refresher; Completed FFT1 taskbook; CPR
Kevin Osborne	6/6/2011	9/29/2011	8.5	No	Refresher; S-290 (online); opened FEMO taskbook; detail with Alpine IHC
Nate Williamson	1/3/2011	12/30/2011	26	Yes	Refresher; GSAN qualified; Agreements Technical Representative (ATR) refresher; CartoPac workshop; "Crucial Conversations"; WFDSS webinars; M-3; IMR-MWR Fire Ecology Workshop



Kevin with a pondo @ 9700', Cow Creek wildfire, Rocky Mountain National Park



Matt, Medano wildfire, Great Sand Dunes National Park and Preserve

Table 3. 2011 Management Objectives and Monitoring Results

Monitoring Unit	Management Objective	Monitoring Results ($\alpha = 80\%$)	Objective Achieved?	Year Last Analysis Completed
Pearl Park Rx (DINO)	60-100% reduction in sagebrush cover	100% reduction in sagebrush cover ($n=5$; 1 burn)	YES <i>see Appendix A for more detail</i>	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 <i>see Appendix A for more detail</i>	2011



Pearl Park control (unburned) transect #3: June 2011.



Pearl Park experimental (burned) transect #1: June 2011 (7 years post-burn).

Representative Conditions Within and Outside the Pearl Park Burn Unit, 7 Years Post-Burn

Monitoring Unit	Management Objective	Monitoring Results ($\alpha = 80\%$)	Objective Achieved?	Year Last Analysis Completed
Front Range Ponderosa Pine (ROMO)	40-80% total fuel reduction	32.4% reduction in total fuel load ($n=10$; 6 burns)	NO	2011
	Limit overstory PIPO mortality to 5% within 5 years post-burn	13.2% reduction in overstory PIPO ($n=4$; 2 burns)	NO , but mountain pine beetle mortality a factor	2011
	generate 5-35% mortality in pole-sized trees within 5 years post-burn	60.4% reduction in pole-sized trees ($n=4$; 2 burns)	NO , but mountain pine beetle mortality a factor	2011
Ponderosa Savanna (ROMO)	40-80% total fuel reduction	1.3% reduction in total fuel load ($n=10$; 4 burns)	NO (results not significant)	2011
	Limit overstory PIPO mortality to 5% within 5 years post-burn	0% reduction in overstory PIPO ($n=5$; 3 burns)	YES	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
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
	generate 10-45% mortality in overstory trees within 5 years post-burn	0.9% increase in overstory trees ($n=3$; 1 burn)	NO	2011
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>	2011
		33.6% reduction in overstory trees ($n=5$; 1 treatment)	N/A (objectives not specifically tied to overstory density)	2011
		70.2% reduction in pole-sized trees ($n=5$; 1 treatment)	N/A (objectives not specifically tied to pole-sized tree density)	2011
Lower Montane Mixed Conifer (ROMO)	40-80% total fuel reduction	50.1% reduction in total fuel load ($n=8$; 2 burns)	YES	2011
	generate 10-25% mortality in overstory trees within 5 years post-burn	39.2% reduction in overstory trees ($n=2$; 1 burn)	NO , but data only from two plots	2011
	generate 10-25% mortality in pole-sized trees within 5 years post-burn	28.1% reduction in pole-sized trees ($n=2$; 1 burn)	NO , but data only from two plots	2011

B. Fire ecologist accomplishments and areas of focus

Table 4. Fire Ecologist 2011 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	50%	- Continued development of EA, BA for ROMO FMP - Development of ROMO FMP - Section 7 consultation for ROMO FMP EA - Development of ROMO Fire/Fuels Treatment Monitoring Plan
Presentations	<5%	- NPS Fire management planning presentation at Front Range Fuels Treatment Roundtable Implementers meeting: Westminster, CO - Public meetings associated with release of FMP for public comment: Estes Park & Grand Lake
NPS Meetings/ task groups	<5%	- IMR RAWS Coordinator duties - IMR FMO Conference: Lakewood, CO - IMR-MWR Fire Ecology Workshop: Lakewood, CO - ROMO New Technology Committee member
Interagency work	5%	Assisted in data development/entry/analysis of interagency FPA data
Wildfire assignments	<5%	GSAN decision support assignments through Rocky Mountain Area Coordination Center
Prescribed fire projects	0%	
Non-fire fuels projects	0%	
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
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
Supervision/Admin	20%	- Hired, supervised, trained monitoring crew, completed evaluations - Developed work schedule, priorities - Travel and time paperwork
Training	5%	- M-3 Aviation Management for Supervisors - ATR (Agreements Technical Representative) Refresher - WFDSS webinars "Crucial Conversations" supervisory training
Travel out-of-park for plot or project work	0%	
Miscellaneous	5%	- DINO RAWS maintenance, first responder duties - GRSA RAWS maintenance, first responder duties - Acting FMO duties

C. Fire effects crew accomplishments and areas of focus

Table 5. Fire Effects Crew 2011 Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	20%	• ROMO, GRSA, MEVE, CURE, BLCA
WUI plots	<5%	
CBI plots	10%	• Cow Creek, Medano
Other plot work	20%	• DINO, COLM, BLCA fire effects plots (non-FMH)
Wildfire assignments	10%	• FFT1 trainee, FFT2 assignments
Prescribed fire projects	<5%	
Non-fire fuels projects	<5%	
Travel out-of-park for plot or project work	10%	
Data entry	25%	• Estimated amount of time spent entering data from paper to PC
Data analysis	<5%	
Supervision/Admin	<5%	• Payroll, travel authorization/voucher, etc.
Training	5%	• Refresher • CPR • S-290 • ROMO Backcountry Travel Training
Miscellaneous	<5%	• ROMO Junior Firefighter Program

D. Additional Program Information

Table 6. Planning - 2011

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 2011)	Assisted with how many BAER plans in 2011?
Rocky Mountain National Park	Yes (process based)	2012 (in prep)	0	0
Great Sand Dunes National Park and Preserve	No	2005	0	0
Florissant Fossil Beds National Monument	No	2002	0	0
Dinosaur National Monument	Yes	2005	0	0
Colorado National Monument	Yes	2005	0	0
Black Canyon of the Gunnison National Park	Yes	2006	0	0
Curecanti National Recreation Area	Yes	2006	0	0
Mesa Verde National Park	No	2010 (update of 2003 plan)	0	0

Table 7. Monitoring - 2011

Park	% 2011 Data Entered	% 2011 Data Quality Checked	# Prescribed Fires Monitored *	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored *	# BAER Treatments Monitored*
Rocky Mountain National Park	100%	100%	4	0	2	0
Great Sand Dunes National Park and Preserve	100%	100%	1	0	1	0
Florissant Fossil Beds National Monument	N/A	N/A	0	0	0	0
Dinosaur National Monument	100%	100%	4	2	0	0
Colorado National Monument	100%	100%	1	0	0	0
Black Canyon of the Gunnison National Park	100%	100%	1	0	0	0
Curecanti National Recreation Area	0%	N/A	1	1	0	0
Mesa Verde National Park	50%	100%	2	0	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 - 2011

Park	# of Project Monitoring Reports completed in 2011	# of Annual meeting(s) with Park staff	# of Formal presentations of results	Do you use Minitab?*
Rocky Mountain National Park	0	1	0	Yes
Great Sand Dunes National Park and Preserve	0	0	0	Yes
Florissant Fossil Beds National Monument	0	0	0	Yes
Dinosaur National Monument	1	0	0	Yes
Colorado National Monument	0	0	0	Yes
Black Canyon of the Gunnison National Park	0	0	0	Yes
Curecanti National Recreation Area	0	0	0	Yes
Mesa Verde National Park	0	0	0	Yes

* 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 - 2011

Park	Are research needs identified in FMP or Monitoring Plan? (yes or no)	# of Proposals Submitted in 2011	# of Proposals Funded in 2011	# of Research Projects Supported in 2011*	Additional Comments
Rocky Mountain National Park	Yes	1	4	4	
Great Sand Dunes National Park and Preserve	Yes	1	1	1	
Florissant Fossil Beds National Monument	Yes	0	0	0	
Dinosaur National Monument	No	0	0	0	
Colorado National Monument	No	0	0	0	
Black Canyon of the Gunnison National Park	Yes	0	0	0	
Curecanti National Recreation Area	Yes	0	0	0	
Mesa Verde National Park	Yes	0	0	0	

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

E. 2012 Direction

Direction for 2012 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 fire ecologist has been accepted to the February 2012 training session at the Prescribed Fire Training Center in Tallahassee, FL. The primary objectives of this training session are to gain additional experience prescribed fire planning and implementation and expand prescribed fire qualifications, particularly Firing Boss (FIRB). The fire ecologist has also been selected for a Long Term Analyst (LTAN) mentee position with the Rocky Mountain Area Type 2 Incident Management Team A. Both opportunities support the fire ecologist's goal of becoming fully qualified as an LTAN.

The fire effects monitoring field season will begin in May with monitoring visits currently scheduled for DINO, COLM, GRSA, MEVE, and ROMO.

Pearl Park Prescribed Fire Project: Pre-Burn – Year 7

Dinosaur National Monument

INTRODUCTION

The Pearl Park prescribed fire project was treated in 2004. The primary objectives of the burn were to reduce sagebrush cover and increase native grass cover. To investigate the effects of the prescribed fire treatment, 10 permanent vegetation monitoring transects were established in June of 2002 by DINO personnel: 5 transects were located within the burn unit (experimental) and an additional 5 transects were located outside the unit (control). ROMO's fire effects monitoring crew resampled the 10 monitoring transects at the following intervals: 1 year, 2 years, 4 years, and 7 years post-burn.

BURN OBJECTIVES

Specific objectives of the Pearl Park prescribed fire project are to:

1. Restore an area heavily impacted by sagebrush invasion to a grassland community by reducing sagebrush cover by 60 to 100%
2. Increase the canopy cover of native grass species to 30% within two years.

MONITORING METHODS

Transect data were collected following existing protocols developed by DINO Resource Management personnel. Protocols call for a set of five 100-meter transects to be established both within and outside of the burn unit. Each transect is 100 meters long and read at 1-m intervals. Two readings perpendicular to the transect are taken at each 1-meter interval through an optical device for a total of 200 sample points per transect and 1000 transect points per set of 5 transects.

The optical device consists of a 5X magnifier with a cross-hair and a mirror which reflects an image of the ground through the magnifier. The plant species or substrate intersected by the cross-hair in the reflected image is recorded. Multiple species may be recorded at each sample point; however substrate is only recorded in the absence of vegetation.

Where possible, data were analyzed using 2-sample t-tests with a significance level of 0.05 (raw pre-burn data not available at time of analysis, so no statistical inferences possible).

RESULTS

Comparison of experimental plots (pre-burn vs. post-burn)

Sagebrush (*Artemisia tridentata*) was completely eliminated from the study area following burning (see Table 1). Native grasses increased 442% one year after burning and remained 377% higher than pre-burn conditions 7 years after treatment (see Table 1, Figure 1). Needle-and-thread (*Hesperostipa comata*) cover accounted for most of this increase, averaging 8.2% cover in the pre-burn data set and 50.3% cover 7 years after burning. Cheat grass (*Bromus tectorum*), the only exotic grass sampled, showed similar trends in both the treated and untreated transects. Prior to burning, cheat grass cover was 0.4% in the experimental plots and 0.9% in the controls. One year following burning, cheat grass cover had increased to 10.5% within the burn unit and 15.6% outside the burn area (see Figure 2). Cheat grass cover increased through year 4 (30.7% cover within burn, 32.3% cover outside of burn) and showed a decrease in year 7 (21.4% cover within burn, 12.5% cover outside of burn). Cheat grass cover was higher in the unburned control transects in all years sampled with the exception of year 7.

Appendix A

Native forb cover increased dramatically one year following burning, showing an average increase of 1070%. Three forb species largely accounted for this difference: blue tansy mustard (*Descurainia pinnata*; 0% pre-burn cover, 7.8% post-burn), shy gilia (*Gilia inconspicua*; 0% pre-burn, 5.3% post-burn), and scarlet globemallow (*Sphaeralcea coccinea*; 0.1% pre-burn, 5.9% post-burn). By year 7 post-burn, native forb cover had decreased to 48% higher than pre-burn conditions. Bare ground cover decreased by 22% one year following burning and fell by 74% relative to pre-burn conditions 7 years after treatment. Litter was reduced by 87% one year after treatment and remains 50% lower relative to pre-burn conditions after 7 years.

Table 1. Average percent cover values for the Pearl Park burn unit pre-burn, 1, 2, 4, and 7 years following burning. Mean and standard deviation (in parentheses) are shown.

	Average Percent Cover					
	Native grass	Exotic grass	Native forb	Sagebrush	Bare Ground	Litter
Pearl Park Pre-burn	11.6	0.4	2.3	23.6	29.1	27.0
Year 1	62.9 (10.1)	10.5 (9.5)	26.9 (6.4)	0	22.7 (3.3)	3.6 (3.3)
Year 2	85.0 (11.6)	20.0 (14.4)	21.0 (9.0)	0	12.7 (4.3)	1.7 (2.1)
Year 4	43.0 (7.4)	30.7 (4.5)	4.7 (2.9)	0	8.3 (1.4)	20.9 (3.7)
Year 7	55.3 (12.2)	21.4 (8.8)	3.4 (1.2)	0	7.6 (2.5)	13.5 (2.7)

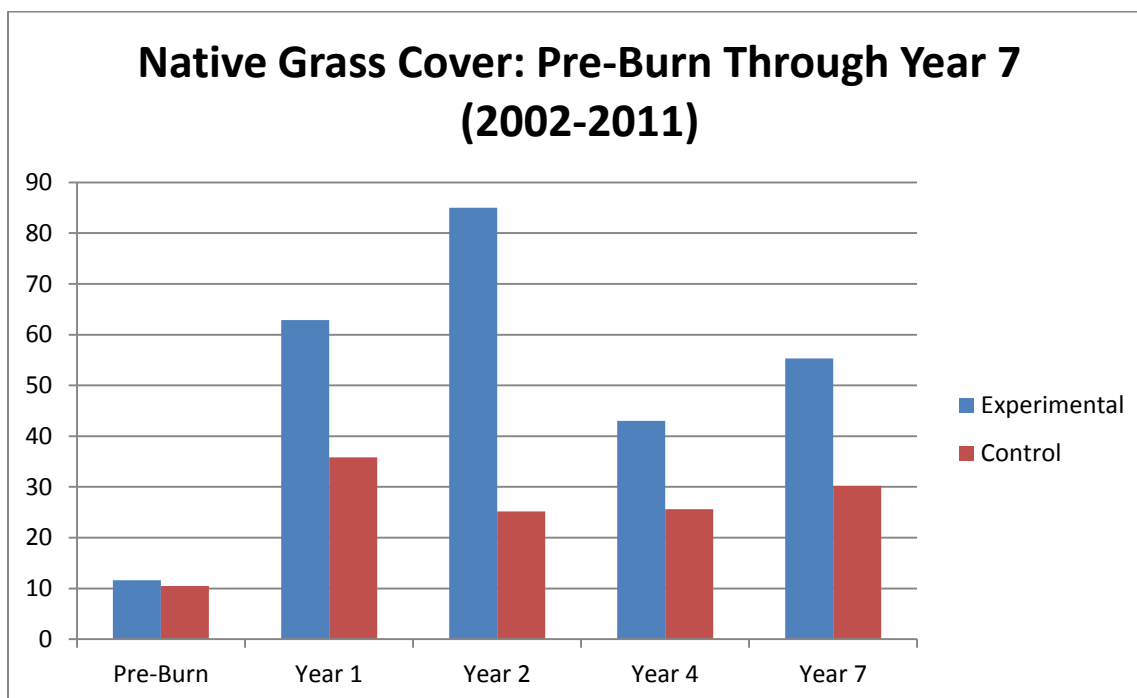


Figure 1. Native grass cover values for the Pearl Park burn unit pre-burn through year 7.

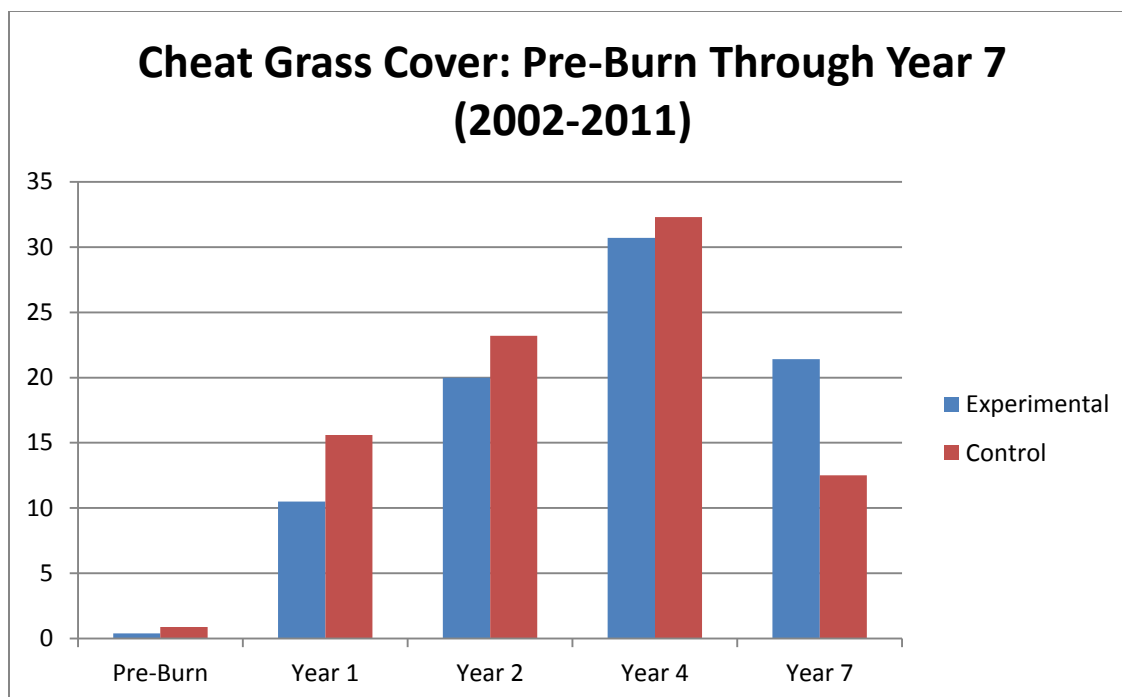


Figure 2. Cheat grass cover values for the Pearl Park burn unit pre-burn through year 7.

Comparison of experimental plots vs. unburned controls

Native grass cover was significantly higher in the burn unit than in the unburned controls for all post-burn visits (see Figure 1). Again, needle-and-thread cover accounted for most of this difference. Six-weeks fescue (*Vulpia octoflora*) also showed significantly higher cover values inside the burn (this species was absent pre-burn). Although cheat grass cover was lower in the burn unit in years 1, 2, and 4, the differences were not significantly different than the unburned controls. Cheat grass cover was significantly higher in the burn unit relative to the unburned controls 7 years after treatment (21.4% cover and 12.5% cover, respectively).

Native forb cover was significantly higher in the burn unit than the unburned controls one year after treatment with blue tansy mustard, shy gilia, and scarlet globemallow explaining the majority of the difference. Seven years following treatment, native forb cover is approaching pre-burn levels.

DISCUSSION

One year after burning the Pearl Park unit, it appears that both management objectives were met: sagebrush cover was reduced 100% (objective: 60-100% reduction) and native grass cover increased to 62.9% from a pre-burn level of 11.6% (objective: 30% cover of native grasses within 2 years following treatment). Figures 3 and 4 are representative of conditions within and adjacent to the Pearl Park burn unit 7 years after prescribed fire treatment.

Cheat grass cover increased dramatically in both the experimental and control transects from the initial sampling in 2002 (2002 was an exceptionally dry year and marked the fourth consecutive year of below average precipitation in the area – drought conditions likely explain the low pre-burn values for both exotic and native grass cover). Considering the increase in cheat grass cover across both burned and unburned areas, it does not appear that burning is necessarily a contributing factor in this increase. These plots will be monitored again in 2016

Appendix A

(Year 12 following treatment) and periodically in the future. Future monitoring efforts should pay particular attention to cheat grass populations in these areas.



Figure 3. Pearl Park control (unburned) transect #3: June 2011.



Figure 4. Pearl Park experimental (burned) transect #1: June 2011 (7 years post-burn).