



**National Park Service
Fire Ecology Annual Report
Calendar Year 2005**

Summary

Rocky Mountain National Park's fire effects crew kept busy during the 2005 field season with a number of varied tasks. In addition to typical fire effects plot work, the crew spent a substantial amount of time on compliance work associated with mechanical fuels treatments, including post-treatment surveys for exotic plant species. The following is a short review of the 2005 field season.

SUMMARY

Rocky Mountain National Park's fire effects crew kept busy during the 2005 field season with a number of varied tasks. In addition to typical fire effects plot work, the crew spent a substantial amount of time on compliance work associated with mechanical fuels treatments, prescribed fire, suppression, and search and rescue assignments. The following is a short review of the 2005 field season.

Plot work

ROMO	0 FMH Installs
	0 FMH Post-burn visits
	0 FMH YR01 visits
	5 FMH YR02 visits
	12 Rapid Assessment Installs

No prescribed burning occurred at Rocky Mountain National Park in 2005 and as a result, the crew did not conduct any immediate post-burn plot reads during the field season. Five year-2 plot reads were carried out in Front Range Ponderosa Pine and Ponderosa Savanna types following burning in 2003 (FPIPO1T09 #9, 25, 26, 27; FPIPS1T02 #14).

Twelve new Rapid Assessment plots were installed on Deer Mountain to monitor the effects of mechanical fuels treatments.

DINO 10 YR01 visits (5 experimental, 5 control)

In June the fire effects crew traveled to Dinosaur National Monument to resample monitoring plots following the 2004 Pearl Park prescribed burn. Data were collected following existing protocols developed by DINO resource management personnel. Five transects were located within the burn unit (experimental) and an additional 5 transects were located outside the unit (control). See Appendix A for an analysis of the data.

Post-treatment Invasives surveys

Aspen Glen/Fall River	5 acres
Deer Mountain	503 acres
Eagle Cliff	29 acres
Emerald Mountain	271 acres

The fire effects crew completed the first season of invasive plant surveys following pile burning on Eagle Cliff, the second season of surveys on Deer Mountain, Aspen Glen/Fall River, and the third year of surveys in the Emerald Mountain hazard fuels treatment area (ROMO). Over 800 acres were surveyed. Conservation measures included in 2002 WUI EA call for invasives monitoring annually for the first 3 years following treatment and then every other year for the next six years thereafter. All exotics encountered were identified, photographed, a GPS waypoint was recorded, and an estimate of patch size (if more than one individual) was recorded. This information is then passed on to the exotics crew lead for inclusion in the park exotics database.

Fuel moisture monitoring

The crew continued live fuel moisture monitoring on both sides of the park (ROMO). Species monitored throughout the fire season were ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and bitterbrush (*Purshia tridentata*). See graphs of seasonal trends in Appendix B.

In an effort to address past inconsistencies in 1000-hr fuel sampling, 1000-hr sampling “stations” were installed at several locations throughout the park in 2004. The stations consisted of three 6-8” diameter logs elevated off the ground. Material consisted of Douglas-fir and lodgepole logs salvaged from ongoing fuels treatment projects in the park. Sampling sites were located at: Beaver Meadows Visitor Center (7800’, next to RAWS weather station), Wild Basin Entrance Station (8300’), Willow Park (10,700’), Kawuneeche Visitor Center (8600’), and the Moraine Park 2F prescribed burn unit (8200’). Cookies were removed and processed every 2 weeks throughout much of the 2005 fire season.

Unfortunately due to the small number of samples at each site (n=3), data remained highly variable and of limited use. Mid-way through the season we began experimenting with an electronic pin-type moisture meter (Delmhorst J-2000 model with 18-ES external electrode). Although the external electrode takes a little TLC, we were very pleased with the results. A large number of samples of any size class can be read very quickly with immediate results.

Logs installed in 2004 were left in place and sampled using the moisture meter along with existing dead and down material in the vicinity of the sampling locations. Due to the speed with which sampling can be conducted, an additional sampling site at the Dunraven (North Fork) Trailhead (7900') at the request of the Fuels Specialist. We will continue to use the moisture meter as the primary means to sample 10-, 100-, and 1000-hr fuels.

Stream turbidity monitoring

Stream turbidity sampling continued in 4 tributaries of the Colorado River on the west side of the park (ROMO). The original intent of the monitoring was to gather baseline water quality data that could then be compared to measurements following prescribed fire. Data collected is passed on to Karl Cordova (Biologist) who maintains water quality records. Sampling protocols on file in the Fire Effects Office.

Fire dispatches

Fire effects crew members assisted with several suppression and prescribed fire assignments both in and out of park in 2005. Robin Keith (crewmember) went on a 14-day assignment as a Helicopter Crewmember with personnel from the Arapaho-Roosevelt National Forest. Wendy Middleton (crewmember) participated in several local initial attack assignments as well as the Bighorn Basin prescribed fire at Dinosaur National Monument in August. Nate Williamson (fire effects specialist) participated in three local initial attack assignments (1 in park, 2 on private lands).

Smoke monitoring

In an effort to monitor smoke output (and potential health impacts) from winter pile burning operations on Emerald Mountain, a DataRAM 2000 particulate monitor was placed on the roof of the Reusch Auditorium at the YMCA of the Rockies. Data were collected continuously from 2/28/2005 to 3/10/2005. The DataRAM was configured to monitor airborne particulate matter up to 2.5 micrometers in diameter (PM_{2.5}). PM_{2.5} are small enough to be inhaled deeply into the lungs and can result in adverse health effects, especially in children, the elderly, and those with respiratory or cardiovascular conditions.

PM_{2.5} concentrations (averaged over 24-hour periods) remained below levels deemed "unhealthy" according to EPA's National Ambient Air Quality Standards regardless of the number or size of piles burned in the park (see Appendix C for PM_{2.5} levels during pile burning operations). Additionally, PM_{2.5} levels during pileburning operations did not differ from ambient levels.

This summer, the DataRAM was placed on the roof of the Beaver Meadows Visitor's Center in preparation for the Moraine Park 2F prescribed burn. Previous particulate monitoring during prescribed fire operations had been conducted within the town of Estes Park, however the new location was chosen due to its proximity to occupied dwellings both in and adjacent to the park. Following cancellation of the burn the monitoring was stopped and the DataRAM removed. Although no burn data were collected, the new location worked out well and will likely be utilized again to monitor particulate output from future burns.

Table 1. Management Objectives and Monitoring Results 2005
(Please see Appendix A for an analysis of DINO's 2005 fire effects data)

Monitoring Unit	Management Objective	Monitoring Results (80% C.I.)	Objective Achieved?
Front Range Ponderosa Pine	40-80% total fuel reduction	38.9% reduction in total fuel load (n=5; 3 burns)	NO , but minimum sample size not achieved
	Limit overstory PIPO mortality to 5% within 5 years post-burn	28.6% reduction in overstory PIPO (n=1; 1 burn)	NO , but minimum sample size not achieved
	generate 5-35% mortality in pole-sized trees within 5 years post-burn	100% reduction in pole-sized trees (n=1; 1 burn)	NO , but minimum sample size not achieved
Ponderosa Savanna	40-80% total fuel reduction	28.2% reduction in total fuel load (n=5; 3 burns)	NO
	Limit overstory PIPO mortality to 5% within 5 years post-burn	5.9% reduction in overstory PIPO (n=4; 2 burns)	NO , but minimum sample size not achieved
	generate 5-30% mortality in pole-sized trees within 5 years post-burn	12.5% reduction in pole-sized trees (n=4; 2 burns)	NO , but minimum sample size not achieved
Lodgepole Forest Westside	40-80% total fuel reduction	54.1% reduction in total fuel load (n=4; 2 burns)	YES , but minimum sample size not achieved
	generate 10-45% mortality in overstory trees within 5 years post-burn	1% increase in overstory trees (n=3; 1 burns)	NO
Eastside Lodgepole Pine Manual Treatment	80-100% woody fuel reduction	24% reduction in woody fuel load (n=5; 1 treatment)	NO , but minimum sample size not achieved (<i>Note: when considering fuels > 1", fuels reduction is 69.2%</i>)
		24.1% reduction in overstory trees (n=5; 1 treatment)	N/A (<i>objectives not specifically tied to overstory density</i>)
		73.3% reduction in pole-sized trees (n=5; 1 treatment)	N/A (<i>objectives not specifically tied to pole-sized tree density</i>)
Lower Montane Mixed Conifer	40-80% total fuel reduction	53.0% reduction in total fuel load (n=2; 1 burn)	YES , but minimum sample size not achieved
	generate 10-25% mortality in overstory trees within 5 years post-burn	42.6% reduction in overstory trees (n=2; 1 burn)	NO , but minimum sample size not achieved
	generate 10-25% mortality in pole-sized trees within 5 years post-burn	30.3% reduction in pole-sized trees (n=2; 1 burn)	NO , but minimum sample size not achieved

Table 2. Fire Effects Plot Workload 2005

Park	Monitoring Unit	Type of Plot	Pre-treatment	Immediate Post	Post-treatment (1+ yrs)	Total Plots
Rocky Mountain	Front Range Ponderosa Pine	FMH Forest plot			4	15
	Ponderosa Savanna	FMH Forest plot			1	14
	Lodgepole Pine – West Slope	FMH Forest plot				14
	Eastside Lodgepole Pine – Manual Treatment	FMH Forest plot				6
		Photo point			73	73
	Big/Common Sagebrush	FMH Forest plot				8
	Lower Montane - Mixed Conifer	FMH Forest plot				13
		Photo point				3
	Grand Lake HFR	Rapid Assessment	12			8
	Deer Mtn HFR	Rapid Assessment				12
Florissant Fossil Beds	Ponderosa Pine	FMH Forest plot				2
	Ponderosa Savanna	FMH Forest plot				3
	Ponderosa Pine - Manual Treatment	FMH Forest plot				3
	Mixed Conifer - Manual Treatment	FMH Forest plot				4
	Mixed Conifer - Manual Treatment	Photo point				70
Great Sand Dunes	San Luis Valley - Rabbitbrush Prairie	FMH Forest plot				2
	San Luis Valley - Ponderosa Savanna	FMH Forest plot				6
	Pinyon Flats HFR	Photo point				7
Dinosaur*	Pearl Park Rx	Transect			10	10
Colorado						0
Black Canyon						0
Curecanti						0
Total			12	0	88	273

* Need to track down documentation of all existing transects (other than Pearl Park)

Table 3. Fire Ecology Staffing 2005

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Wendy Middleton	5/2/05	9/30/05	11	Refresher, S-212, S-290, Flora of Rocky Mountain National Park, CPR, Defensive Driving; FEMO taskbook initiated
Robin Keith	5/16/05	8/11/05	6.5	Refresher, Flora of Rocky Mountain National Park, Defensive Driving
Nathan Williamson	N/A	N/A	26	Refresher, S-390, FPA - Preparedness Module, A-110, B-3, S-271, FRCC Version 1.0, CPR, Defensive Driving; FEMO taskbook completed; IMR FMO conference, "Vital Signs" monitoring workshop, FEAT/Stats workshop

Table 4. Fire Ecologist Accomplishments/Focus Area

Category	Percent Time	Accomplishments/Focus Areas
Planning	20%	• San Luis Valley FMP/EA development • Biological Assessment for ROMO fuels management activities • Fuels planning (ROMO) • Vegetation map/Fuels crosswalks (GRSA, FLFO) • Fire danger risk assessments during fire season
Presentations	<5%	• Presented mechanical fuels treatment data/analysis at FEAT/stats workshop
NPS Meetings/ task groups	10%	• Internal scoping for Estes Valley Elk/Veg EIS planning process • Participated in Rocky Mountain Inventory and Monitoring Network “Vital Signs” monitoring meetings • IMRO Fire Management conference • FEAT/Stats workshop
Interagency work	<5%	• Trained vegetation/fuels mapping field crew (GRSA, BEOL)
Fire Assignments	<5%	FFT2 on 2 local fires (Initial Attack)
Data entry	10%	• Rapid Assessment plots • DINO fire effects transects
Data Conversion	5%	• FEAT
FMH Plot Work	10%	Includes fire effects work at DINO
WUI Plot Work	10%	Rapid Assessment plots
Data analysis	5%	• Rapid Assessment analysis • DINO fire effects analysis
Supervision/Admin	15%	• Supervised lead monitor, completed evaluations • Travel and time paperwork
Training	10%	• S-390 • FPA – Preparedness Module • S-271 • Supervisory Training
Miscellaneous	5%	• Search and Rescue, other duties “as assigned”

Publications

Booth, D.T., S.E. Cox, C. Fifield, M. Phillips and N. Williamson. 2005. Image analysis compared to other methods for measuring ground cover. *Arid Land Research and Management*. 19(2):91-100.

Innes, J.C., M.P. North and N. Williamson. submitted. Effect of silvicultural treatments and prescribed fire on woody debris and snag dynamics in a sierran old-growth mixed-conifer forest. *Canadian Journal of Forest Research*.

Table 5. Fire Effect Crew Accomplishments

Category	Percent Time	Notes
FMH plots	20	
WUI plots	20	
Other plot work	20	• Exotics surveys
Fire Assignments	10	• Helicopter crew member assignments • Local IA • Rx at DINO
Data entry	10	• FMH plot data • Exotics occurrence data
Training	10	• S-290 • Flora of Rocky Mountain National Park
Miscellaneous	10	• Search and Rescue, other duties “as assigned”

APPENDIX A.

Initial Results (Year 1) of the Pearl Park Prescribed Fire Project, Dinosaur National Monument

INTRODUCTION

In June of 2005 ROMO's fire effects monitoring crew resampled 10 fire effects monitoring transects associated with the Pearl Park prescribed burn unit. Pre-burn data was collected by DINO personnel in late June 2002. Five transects were located within the burn unit (experimental) and an additional 5 transects were located outside the unit (control).

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 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 (Table 1). Native perennial grasses increased 402% after burning. Needle-and-thread (*Stipa comata*) cover accounted for most of this increase, averaging 8.2% in the pre-burn data set and 38.5% after burning. Similarly, six-weeks fescue (*Vulpia octoflora*), a native annual grass which was not present in the pre-burn sampling, increased to almost 5% cover post-burn. Cheat grass (*Bromus tectorum*), the only exotic grass sampled, showed similar trends in both the treated and untreated plots. Prior to burning, cheat grass cover was 0.4% in the experimental plots and 0.9% in the controls. In the post-burn transect sampling, cover had increased to 10.5% within the burn unit and 15.6% outside the burn area.

Native forb cover increased dramatically 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), scarlet globemallow (*Sphaeralcea coccinea*; 0.1% pre-burn, 5.9% post-burn). Bare ground and litter cover decreased 22% and 87% respectively following burning.

Table 1. Average percent cover values for the Pearl Park burn unit pre-burn and one year following burning. Mean and standard deviation (in parentheses) are shown.

	Average Percent Cover						
	Native perennial grass	Native annual grass	Exotic grass	Native forb	Sagebrush	Bare Ground	Litter
Pearl Park Pre-burn	11.6	0	0.4	2.3	23.6	29.1	27.0
Pearl Park Yr-01	58.2 (11.0)	4.7 (0.9)	10.5 (9.5)	26.9 (6.4)	0	22.7 (3.3)	3.6 (3.3)
% Change	402%	-	2525%	1070%	-100%	-22%	-87%

Comparison of experimental plots (post-burn, year 1) vs. control

Native perennial grass cover was significantly higher in the burn unit than in the non-burned control (Table 2). Again, needle-and-thread cover accounted for most of this difference, averaging 5.4% in the control and 38.5% in the burn. Six-weeks fescue also showed significantly higher cover values inside the burn. Although cheat grass cover was lower in the burn unit, the difference was not significantly different than the unburned control.

Native forb cover was significantly higher in the burn unit than the control with blue tansy mustard, shy gilia, and scarlet globemallow explaining the majority of the difference.

Bare ground was approximately twice as high and litter values were roughly one third in the burned unit as compared to the control. Sagebrush was entirely absent in the burn unit. Exotic forb cover remained the same in both the burn and control (0.1% cover).

Table 2. Average percent cover values for the Pearl Park burn unit and unburned control. Mean and standard deviation (in parentheses) are shown.

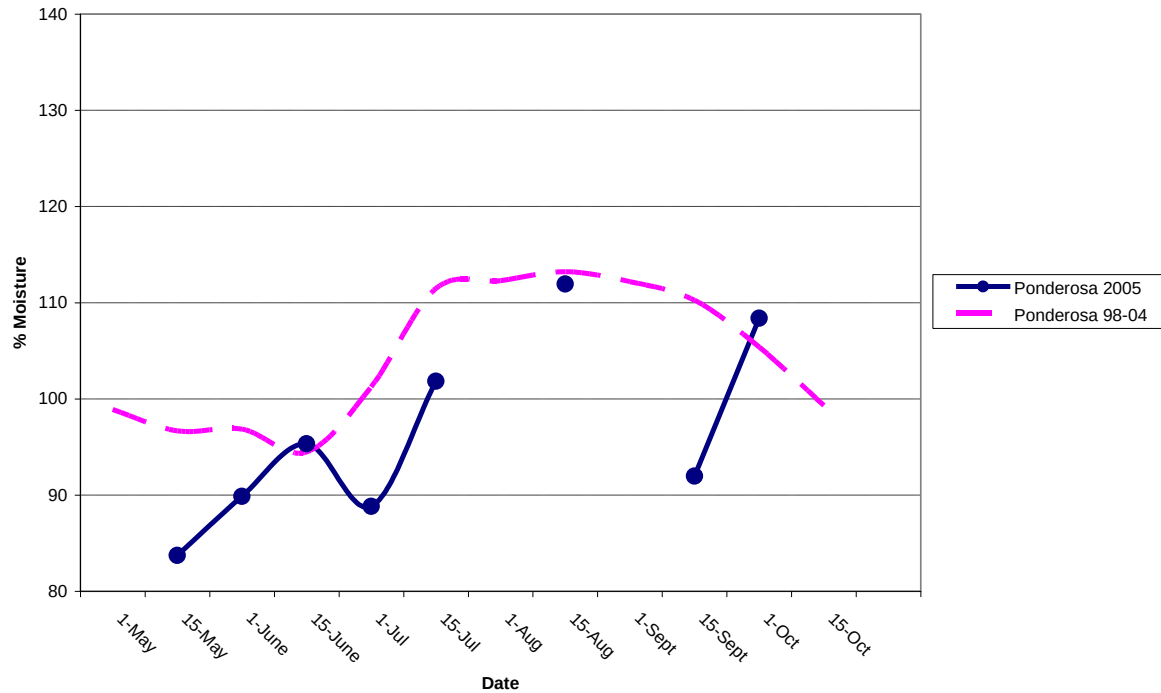
	Average Percent Cover						
	Native perennial grass	Native annual grass	Exotic grass	Native forb	Sagebrush	Bare Ground	Litter
Unburned Control	34.4 (9.7)	1.4 (1.3)	15.6 (7.1)	14.6 (2.9)	25.3	11.4 (5.9)	10.1 (1.5)
Pearl Park Yr-01	58.2 (11.0)	4.7 (0.9)	10.5 (9.5)	26.9 (6.4)	0	22.7 (3.3)	3.6 (3.3)

DISCUSSION

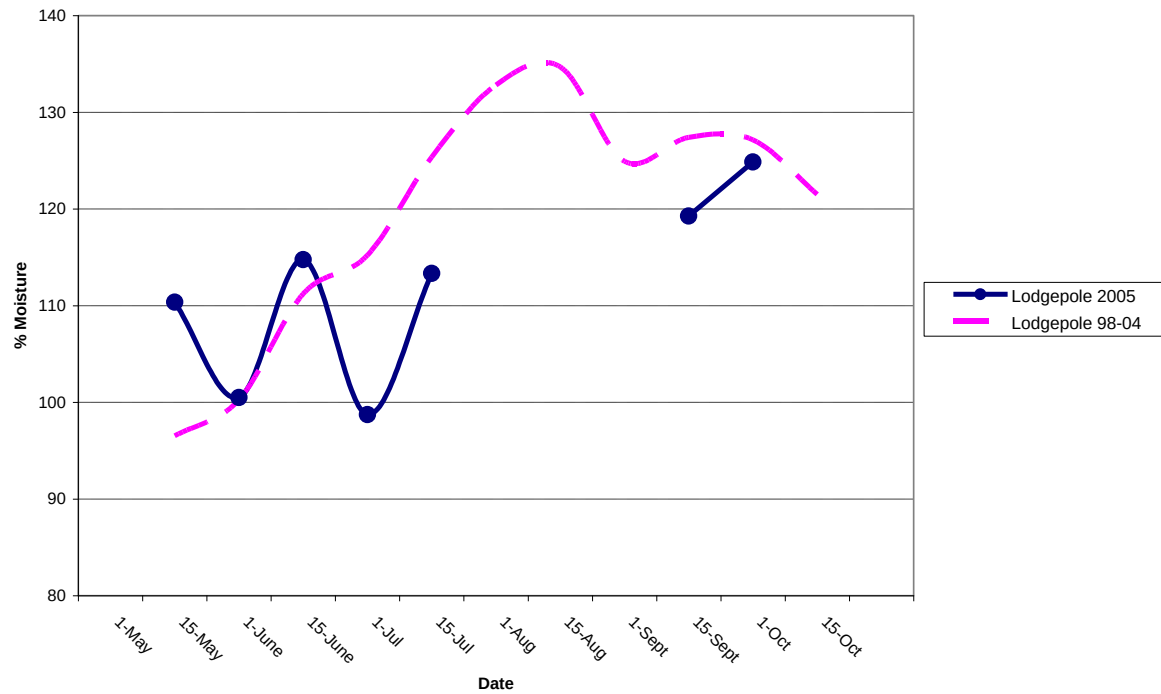
One year after burning the Pearl Park unit, it appears that both management objectives have been met: sagebrush cover has been reduced 100% (objective: 60-100% reduction) and native grass cover, both annual and perennial, has increased to 62.9% from a pre-burn level of 11.6% (objective: 30% cover within 2 years). Cheat grass cover has increased dramatically in both the experimental and control transects from the initial sampling in 2002 to the most recent sampling in 2005. Considering the increase across both burned and unburned areas, it does not appear that burning is a contributing factor in this increase. These plots will be monitored again in 2006 and periodically in the future. Future monitoring efforts should pay particular attention to cheat grass populations in these areas.

APPENDIX B.

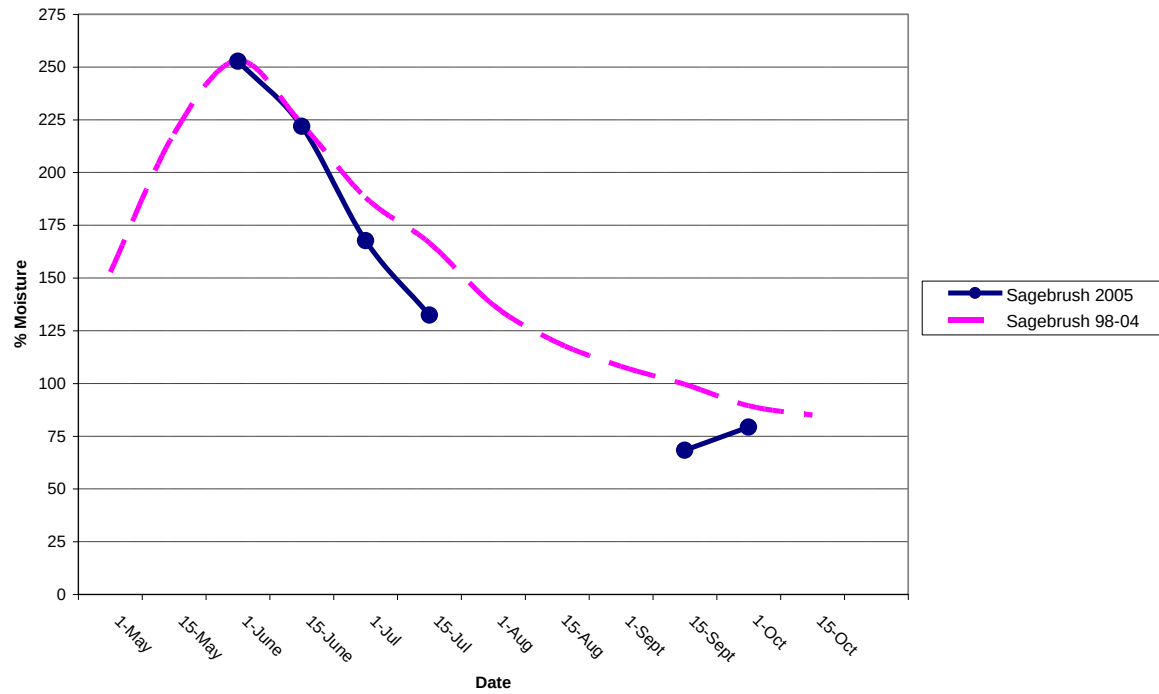
Live Fuel Moisture Trends - Ponderosa



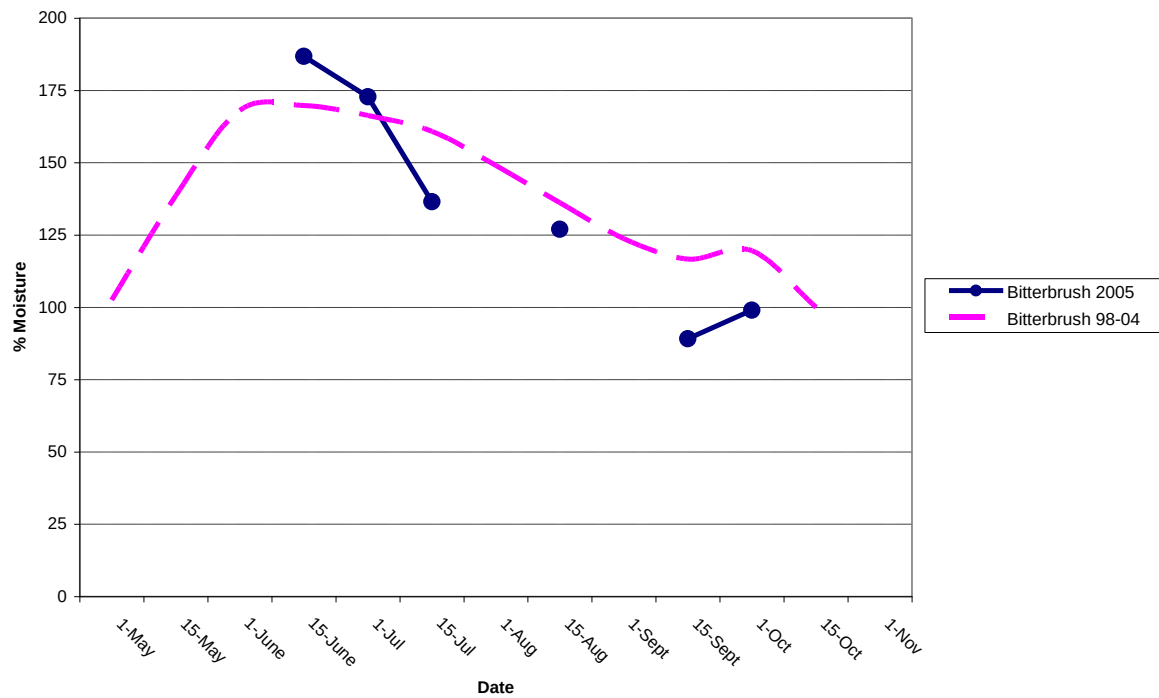
Live Fuel Moisture Trends - Lodgepole



Live Fuel Moisture Trends - Sagebrush

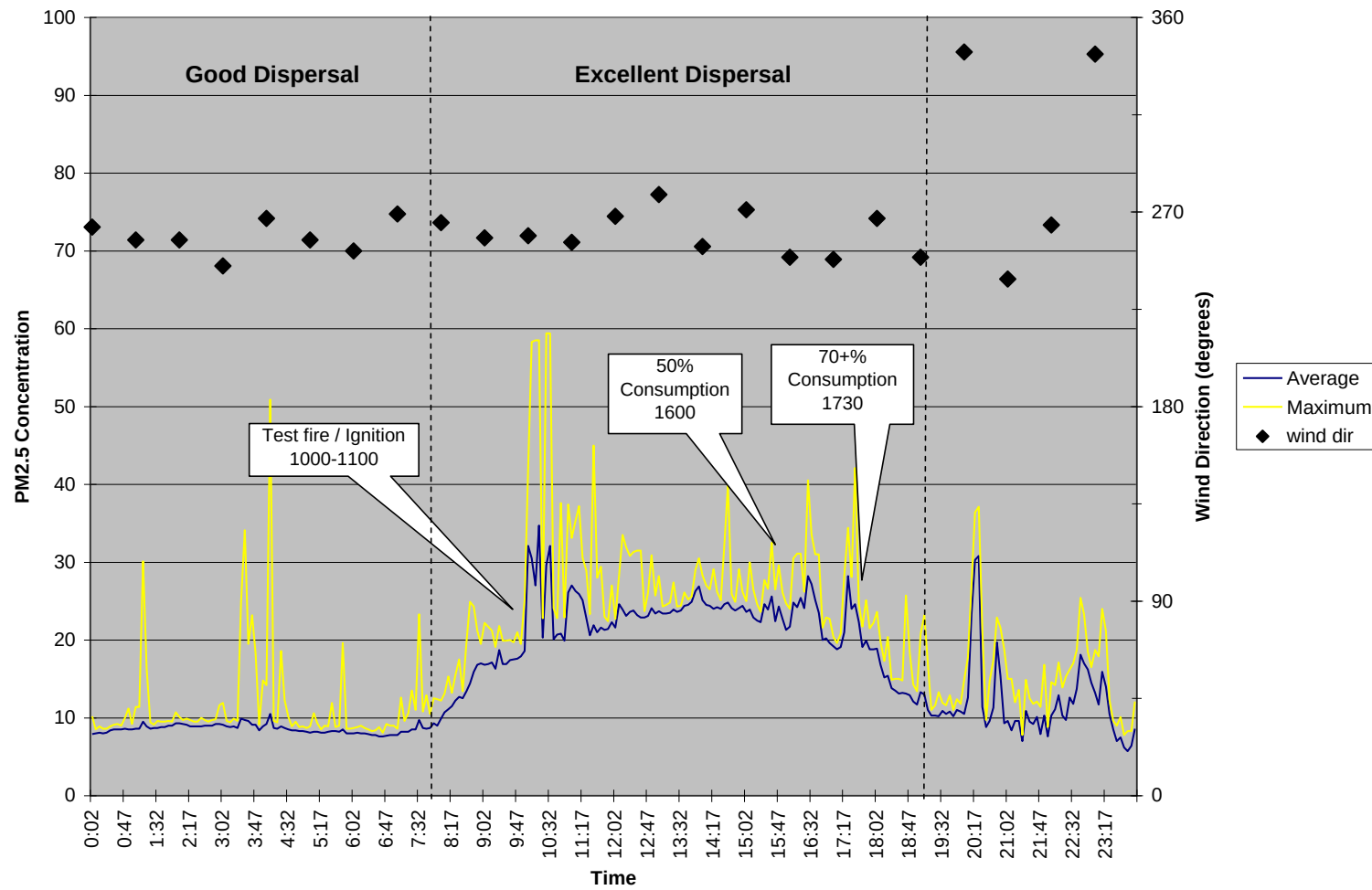


Live Fuel Moisture Trends - Bitterbrush

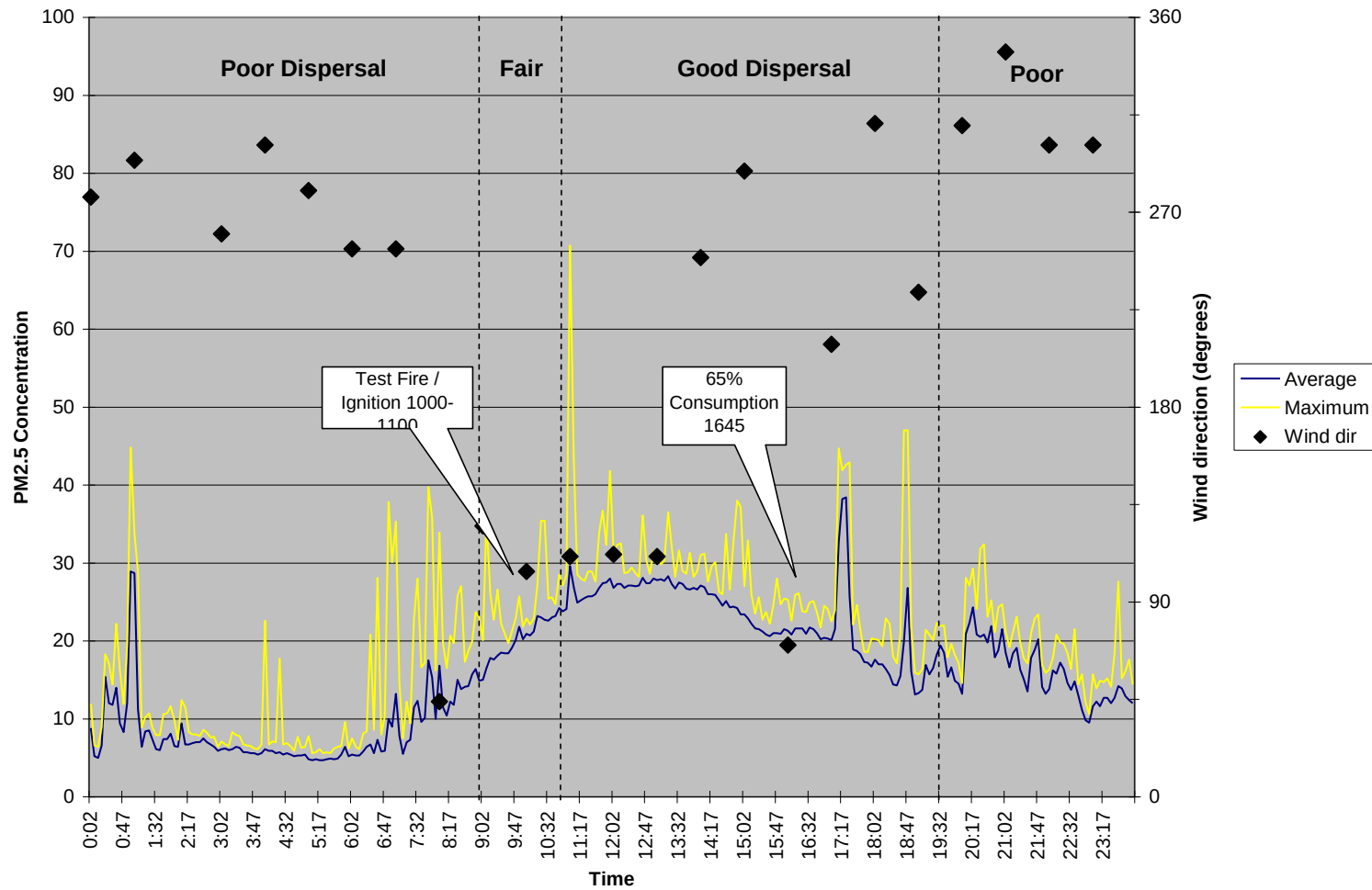


APPENDIX C.

Smoke (PM2.5) - Reusch Auditorium 3/2/05 1 Pile: 9750 cubic feet



Smoke (PM2.5) - Ruesch Auditorium 3/3/05
3 Piles: 9750 cubic feet/pile (29250 total)



Smoke (PM2.5) - Ruesch Auditorium 3/8/05
1 Pile: 33900 cubic feet

