



Rocky Mountain National Park Fire Ecology Annual Report Calendar Year 2007

SUMMARY

The Rocky Mountain fire effects crew started the 2007 season with a trip to Colorado National Monument to establish monitoring plots in the Ute Mesa prescribed burn unit. In June the crew traveled to Dinosaur National Monument to re-read plots in the Bighorn Basin burn, collect pre-burn data for the SlauchWall burn, and collect age structure data in the Split Mountain area. The remainder of the summer was spent at Rocky establishing FMH plots, revisiting photo-points, monitoring live and dead fuel moistures, and participating in fire assignments.

2007 saw the return of prescribed fire to Rocky Mountain National Park after a 4 year absence. The 200 acre Horseshoe prescribed fire, conducted in October, was the largest prescribed fire in the history of the park. Initial analysis (using FFI) indicates total surface fuel reduction of 41% across all plots in the Horseshoe burn (objective: 40-80% reduction).

Plot work

ROMO	16 FMH Pre-Burn Installs
	7 FMH Post-burn visits
	0 FMH YR01 visits
	0 FMH YR02 visits
	5 FMH YR05 visits

Seven new plots were installed and 2 previously installed plots were re-read in the Lower Montane Mixed Conifer type (FPICM1T08 #27 – 35); six plots were installed (or previously installed plots were revisited) in the Front Range Ponderosa Pine type (FPIPO1T09 #7, 28, 30, 31, 32, 33); one plot was revisited in the Ponderosa Savanna type (FPIPS1T02 #3). These plots were established within the Horseshoe Park and North Lateral Moraine prescribed burn units. Post-burn plot visits were conducted following the Horseshoe Park prescribed burn. Year 5 visits were conducted on Emerald Mountain in the Eastside Lodgepole Pine Manual Treatment type (FPICE1T08 #1 – 5). Photo-points on Emerald Mountain were also relocated and photographed.

COLM 15 Pre-Burn Installs

In May the fire effects crew traveled to Colorado National Monument to install monitoring plots within the proposed Ute Mesa prescribed burn unit. Transect data were collected using a modified version of the protocols developed and in use at DINO. See Appendix A for an initial analysis of the data.

DINO 10 Pre-Burn visits (5 experimental, 5 control) 10 YR02 visits (5 experimental, 5 control)

In June the fire effects crew traveled to Dinosaur National Monument to resample monitoring plots associated with the 2005 Bighorn Basin prescribed burn and the 2007 Slaughter Wall burn. Data were collected following existing protocols developed by DINO resource management personnel. The crew also installed and sampled 20 age structure analysis plots in the Split Mountain area.

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 C.

Sampling of 10-, 100-, and 1000-hour fuel moistures continued using the Delmhorst electronic moisture meter over the course of the 2007 field season. Dead and down fuels were sampled approximately every 2 weeks at the following locations: Wild Basin Entrance Station (8300'), Willow Park (10,700'), Kawuneeche Visitor Center (8600'), and the Moraine Park 2F prescribed burn unit (8200').

Smoke monitoring

In an effort to monitor smoke output (and potential health impacts) from the Horseshoe prescribed burn, a DataRAM 2000 particulate monitor was placed at the Fall River Hydroelectric Plant (along Fall River due south of the Fall River Visitor Center). Data was collected continuously from approximately 09:00 on 10/3/2007 (test fire occurred at 11:05 on 10/3) to 13:45 on 10/15/2007 (see Appendix B for results).

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 2006. Dorothy Wallace-Senft (crewmember) participated in a local search and rescue as a helicopter crewmember (HECM) as well as a 14-day suppression assignment in

Idaho as a firefighter (FFT2). Nate Williamson (fire ecologist) participated in local initial attack, a 16-day suppression assignment in Montana as a squadboss (FFT1) trainee, and as a lead fire effects monitor (FEMO) on the Horseshoe prescribed burn at ROMO.



1. Burnout, Rombo Mountain Fire, Montana



2. Group torching, Horseshoe prescribed burn, ROMO

Table 1. Management Objectives and Monitoring Results 2007

Monitoring Unit	Management Objective	Monitoring Results (80% C.I.)	Objective Achieved?
Front Range Ponderosa Pine	40-80% total fuel reduction	53.3% reduction in total fuel load (n=6; 4 burns)	YES
	Limit overstory PIPO mortality to 5% within 5 years post-burn	28.6% reduction in overstory PIPO (n=1; 1 burn)	NO , but data from only one plot
	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 data from only one plot
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
	generate 5-30% mortality in pole-sized trees within 5 years post-burn	12.5% reduction in pole-sized trees (n=4; 2 burns)	YES
Lodgepole Forest Westside	40-80% total fuel reduction	54.1% reduction in total fuel load (n=4; 2 burns)	YES
	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 (Note: when considering fuels > 1", fuels reduction is 69.2%)
		24.1% reduction in overstory trees (n=5; 1 treatment)	N/A (objectives not specifically tied to overstory density)
		73.3% reduction in pole-sized trees (n=5; 1 treatment)	N/A (objectives not specifically tied to pole-sized tree density)
Lower Montane Mixed Conifer	40-80% total fuel reduction	53.4% reduction in total fuel load (n=9; 2 burns)	YES
	generate 10-25% mortality in overstory trees within 5 years post-burn	42.6% reduction in overstory trees (n=2; 1 burn)	NO , but data from only two plots
	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 data from only two plots

Table 2. Fire Effects Plot Workload 2007

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	6	1		19
	Ponderosa Savanna	FMH Forest plot	1			14
	Lodgepole Pine – West Slope	FMH Forest plot				14
	Eastside Lodgepole Pine – Manual Treatment	FMH Forest plot			5	6
		Photo point			73	73
	Big/Common Sagebrush	FMH Forest plot				8
	Lower Montane - Mixed Conifer	FMH Forest plot	9	6		21
		Photo point				3
	Grand Lake HFR	Rapid Assessment				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*	Split Mountain	Age analysis	20			20
	Bighorn Basin Rx	Transect			10	10
	Pearl Park Rx	Transect				10
	Slaugh Wall Rx	Transect	10			10
Colorado	Liberty Cap Rx	Transect				7
	Ute Mesa Rx	Transect	15			15
Black Canyon						0
Curecanti						0

* Need add other existing plots at DINO thanks to Jenny Byington's detective work.

Table 3. Fire Ecology Staffing 2007

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Myron Boles	4/30/07	7/26/07	6.5	Refresher, Backcountry Training, CPR/First Aid
Dorothy Wallace-Senft	4/30/07	9/27/07	11	Refresher, Backcountry Training, CPR/First Aid; HECM trainee assignment
Nathan Williamson	N/A	N/A	27	Refresher, S-491 instructor (2x), S-490, NEPA/§106 Training, CPR/First Aid; FFT1 trainee assignment

Table 4. Fire Ecologist Accomplishments/Focus Area

Category	Percent Time	Accomplishments/Focus Areas
Planning	20%	• FMP development (ROMO) • Fuels planning (ROMO, GRSA) • Fire danger risk assessments during fire season
Presentations	<5%	• Presented subalpine fire ecology lecture to residents of Allenspark, CO
Meetings/ task groups	15%	• Front Range Fuels Treatment Partnership - Roundtable meetings - Core Team meetings - Steering Committee meetings • Climate Change Workshop • Backcountry training development • Glen Haven CWPP development • Allenspark CWPP development • Mountain Pine Beetle symposia • Colorado Bark Beetle Collaborative
Fire Assignments	5%	• FFT1 trainee assignment • FEMO on in-park Rx assignments • FFT2 on in-park suppression assignments
Data entry	5%	• FMH plots • DINO fire effects transects • COLM
Data Conversion	5%	• FEAT • FFI
FMH Plot Work	5%	Includes fire effects work at DINO, COLM
Data analysis	5%	• Horseshoe Rx post-burn • Horseshoe Rx particulate concentration • DINO fire effects analysis
Supervision/Admin	20%	• Supervised fire effects crew, completed evaluations • Travel and time paperwork
Training	10%	• S-490 Advanced Fire Behavior Calculations • NEPA/ §106 Workshop • FOR 437 LANDFIRE: Concepts, DATA, & Methods • FEMA IS-700, 800 • Supervisory Training
Miscellaneous	5%	• Search and Rescue, other duties “as assigned”

Table 5. Fire Effect Crew Accomplishments

Category	Percent Time	Notes
FMH plots	30	
Other plot work	25	• Photo points • DINO/COLM plot work
Fire Assignments	10	• Suppression assignment with Northern CO type 2 crew • Local IA
Data entry	15	• FMH plot data • DINO/COLM plot data
Training	10	• Backcountry Training • GPS usage • CPR/First Aid
Miscellaneous	10	• Search and Rescue, other duties “as assigned”

APPENDIX A.

Initial Results (Pre-burn Monitoring) of the Ute Mesa Prescribed Fire Project, Colorado National Monument

INTRODUCTION

In May of 2007 ROMO's fire effects monitoring crew established and sampled 15 fire effects monitoring transects within the Ute Mesa prescribed burn unit. Five transects were established in each of 3 burn blocks (Ute Mesa #1-3). No control transects were established outside the unit due to the fact that the unit comprised all available sagebrush habitat in the area.

MONITORING METHODS

Transect data were collected following a modified version of protocols developed by DINO Resource Management personnel. As in the Liberty Cap unit, 50-meter sampling transects were used rather than the 100-meter transects called for in the DINO protocols. Two readings were taken at 1-m intervals along the transect for a total of 100 sample points per transect. At each sample point, the plant species or substrate intercepted was recorded. Multiple species may be recorded at each sample point; however substrate was only recorded in the absence of vegetation.

The field crew specifically noted the prevalence of cheat grass (*Bromus tectorum*), throughout the burn unit. Discontinuous patches were present in all burn blocks, often under the shade of pinyon or juniper. Other exotic species observed were purple mustard (*Chorispora tenella*) and picture vine (*Tribulus terrestris*).

RESULTS

Sagebrush (*Artemisia tridentata*) was the most prevalent species encountered with an average of 5.5% total cover across all transects (Table 1). Native forbs and grasses accounted for just over 6% cover combined. Cheat grass was found on 7 of the 15 transects and accounted for the highest percent cover of any single species in the unit, averaging 3.4% cover. Litter and dead wood together accounted for 28.8% cover across all transects (litter: 24.0%; wood: 4.8%). Bare ground and rock accounted for 25.3% cover (bare ground: 19.6%; rock: 5.7%). Please see Table 2 for a list of species encountered.

Table 1. Average percent cover values for the Ute Mesa burn unit.

Average Percent Cover							
Native perennial grass	Native annual grass	Cheat grass	Native forb	Sagebrush	Biological soil crust	Bare ground	Litter
1.5	0.3	3.4	4.3	5.5	15.2	19.6	24.0

Table 2. Species encountered in Ute Mesa burn unit.

Grasses	Synonym	Common name
<i>Bromus tectorum</i>		cheat grass
<i>Carex</i> sp.		sedge
<i>Elymus elymoides</i>		squirreltail
<i>Koeleria macrantha</i>		Junegrass
<i>Leymus salinus</i>	<i>Elymus salinus</i>	Saline wildrye
<i>Hesperostipa comata</i>	<i>Stipa comata</i>	needle and thread
<i>Poa fendleriana</i>		
<i>Poa secunda</i>		unknown bluegrass
<i>Vulpia octoflora</i>	<i>Festuca octoflora</i>	sixweeks fescue
Forbs		
<i>Gilia inconspicua</i>		shy gilia
<i>Penstemon cyanocaulis</i>		bluestem beardtongue
<i>Cryptantha flavoculata</i>		roughseed cryptantha
<i>Cryptantha gracilis</i>		narrowstem cryptantha
<i>Lappula occidentalis</i>	<i>Lappula redowskii</i>	flatspine stickseed
<i>Draba cuneifolia</i>		wedgeleaf draba
<i>Ephedra viridis</i>		mormon tea
<i>Lepidium montanum</i>		mountain pepperweed
<i>Packera multilobata</i>	<i>Senecio multilobata</i>	lobeleaf groundsel
<i>Descurainia pinnata</i>		western tansymustard
<i>Plantago patagonica</i>		woolly plantain
Shrubs		
<i>Artemisia tridentata</i>	<i>Seriphidium tridentatum</i>	big sagebrush
<i>Ericameria nauseosa</i>	<i>Chrysothamnus nauseosus</i>	rubber rabbitbrush
<i>Cercocarpus montanus</i>		mountain mahogany
<i>Fraxinus anomala</i>		singleleaf ash
<i>Opuntia polyacantha</i> var. <i>erinacea</i>	<i>Opuntia erinacea</i>	grizzlybear pricklypear
Trees		
<i>Juniperus osteosperma</i>	<i>Sabina osteosperma</i>	Utah juniper
<i>Pinus edulis</i>		twoneedle pinyon

APPENDIX B.

2007 Horseshoe Prescribed Fire – PM_{2.5} Monitoring

The Horseshoe prescribed burn was an approximately 200 acre burn conducted in several subunits during the first 2 weeks of October 2007. The burn area is located in Rocky Mountain National Park, west of the Fall River entrance in Horseshoe Valley, south of Fall River and north of Deer Ridge Junction. Ignition occurred by hand on 10/3, 10/4, 10/5, and 10/11. Project goals were to:

- Provide for public and personnel safety
- Reduce hazardous fuel accumulations
- Protect values at risk by reducing the potential for high intensity wildland fire, providing for increased protection for the resources and infrastructure of Rocky Mountain National Park and its neighbors

In an effort to monitor smoke output (and potential health impacts) from the Horseshoe prescribed burn, a DataRAM 2000 particulate monitor was placed on the roof of the Fall River Hydroplant (adjacent to Fall River at the west end of Fish Hatchery Road). This location is approximately 0.5 miles due east of the burn. Data was collected continuously from approximately 09:00 on 10/3/2007 (test fire occurred at 11:05 on 10/3) to 13:45 on 10/15/2007. It should be noted that the DataRAM is an optical “real-time” particulate sampler and is not an Environmental Protection Agency (EPA) approved device for determining airborne particulate concentrations. Particulate data generated from DataRAMs can overestimate actual particulate concentrations by 20 – 90% (Trent et al. 2000). For these reasons, this data is not intended to ascertain whether ambient air-quality standards were met or exceeded (Pat McGraw, Air Pollution Control Division, personal communication). The best use for these instruments is to determine whether the local particulate concentrations are relatively high or low and whether concentrations are going up or down.

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 (see Table 1 for PM_{2.5} levels and corresponding health advisory categories and visibility values).

In September 2006, the EPA lowered the National Ambient Air Quality Standard for PM_{2.5} from 65 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) to 35 $\mu\text{g}/\text{m}^3$ averaged over a 24-hour period. Corresponding Air Quality Index (AQI) values are currently under revision to reflect the lower threshold. Until the revised AQI values are released, the old values are still being used (Table 1). The 24-hour threshold was exceeded on 6 of the 13 days monitored (Table 2). The first day the 35 $\mu\text{g}/\text{m}^3$ threshold was exceeded was on 10/3, the initial day of ignition operations. On 10/5 PM_{2.5} concentrations reached unhealthy levels between 00:02 – 00:27 and 18:32 – 23:57, otherwise levels were primarily below 15 $\mu\text{g}/\text{m}^3$ (Good). On 10/6 PM_{2.5} levels were considered unhealthy between 00:02 – 01:37, for the remainder of the day levels remained well below 15 $\mu\text{g}/\text{m}^3$. PM_{2.5} levels rose to unhealthy levels for approximately a half an hour in the morning of 10/11 (03:57 – 04:27) and again in the evening (19:07 – 22:07). On 10/12 unhealthy levels of PM_{2.5} were recorded for approximately 7 hours in the morning (02:42 – 09:52). Similarly, unhealthy levels of PM_{2.5} were recorded on the morning of 10/13 for 6 hours in the morning (03:42 – 09:42).

Winds associated with unhealthy PM_{2.5} levels varied, however were primarily out of the west. As might be expected, unhealthy PM_{2.5} levels were rarely associated with an east wind. Daytime PM_{2.5} levels generally remained low, however as was anticipated, nighttime down drainage airflow resulted in periods of very high PM_{2.5} levels within the Fall River corridor east of the Park.

Table 1. PM_{2.5} health advisory levels and corresponding visibility values.

Air Quality Index Categories with Corresponding Visibility Values and PM _{2.5} levels			
Adjective Rating	Air Quality Index Values	Visibility (miles)	PM _{2.5} (24-hr average)
Good	0 - 50	10+	0 - 15.4
Moderate	51 - 100	6 - 9	15.5 - 40.4
Unhealthy for Sensitive Groups	101 - 150	3 - 5	40.5 - 65.4
Unhealthy	151 - 200	1.5 - 2.5	65.5 - 150.4
Very Unhealthy	201 - 300	0.9 - 1.4	150.5 - 250.4
Hazardous	301 - 500	0.8 or less	over 250.5

Table 2. 24-hour average PM_{2.5} concentrations for Horseshoe prescribed fire.

Date	24-hour concentration	Exceeded EPA limit?
10/3/2007	38.0	Exceeded
10/4/2007	29.0	No
10/5/2007	115.0	Exceeded
10/6/2007	69.4	Exceeded
10/7/2007	8.7	No
10/8/2007	15.7	No
10/9/2007	23.3	No
10/10/2007	20.1	No
10/11/2007	66.6	Exceeded
10/12/2007	114.0	Exceeded
10/13/2007	38.6	Exceeded
10/14/2007	3.2	No
10/15/2007	1.0	No

Particulate (PM_{2.5}) - Fall River Hydro Plant 10/3/2007 - 10/15/2007

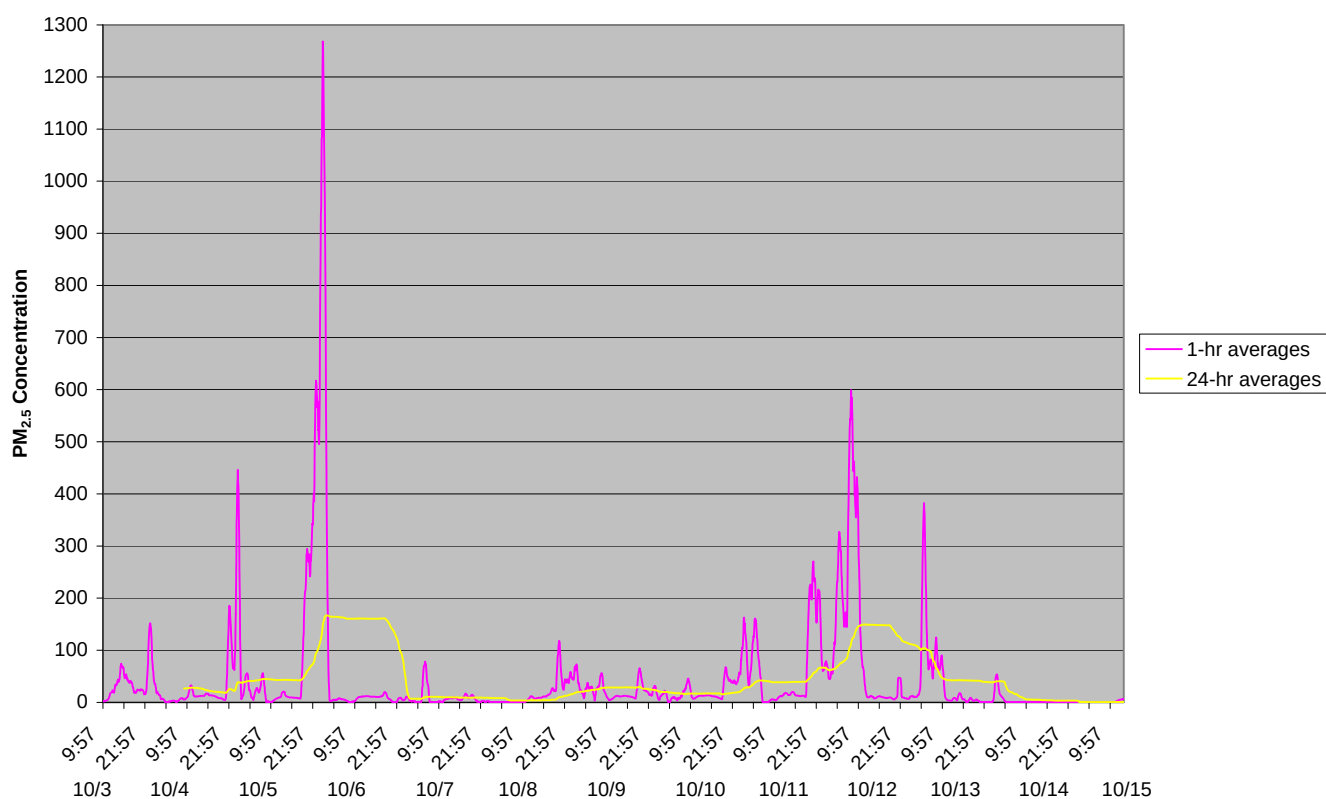


Figure 1. Particulate concentrations 10/3/2007 – 10/15/2007



10/3/2007 13:22, Many Parks Curve



10/3/2007 14:49 Fall River Visitor Center



10/4/2007 11:03 Horseshoe Park (Hwy 34)



10/4/2007 13:43 Many Parks Curve



10/5/2007 06:55 Horseshoe Park (Hwy 34)



10/5/2007 13:52 adjacent to unit D23



10/11/2007 15:44 adjacent to unit D53



10/12/2007 06:57 Horseshoe Park (Hwy 34)

Contacts/References

McGraw, Pat. Colorado Department of Public Health and Environment, Air Pollution Control Division: 303-692-3235

Sievers, Greg. Town of Estes Park Facilities Manager: 970-577-3586.

Trent, Andy, Mary Ann Davies, Rich Fisher, Harold W. Thistle, and Ronald Babbitt. 2000. Evaluation of Optical Instruments for Real-Time Continuous Monitoring of Smoke Particulates. Report #0025 2860. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Development Center. 38 p.

Western Regional Climate Center. RAWS USA Climate Archive. <<http://www.wrcc.dri.edu/wraws/>>.

Additional photographs are located in the following location:

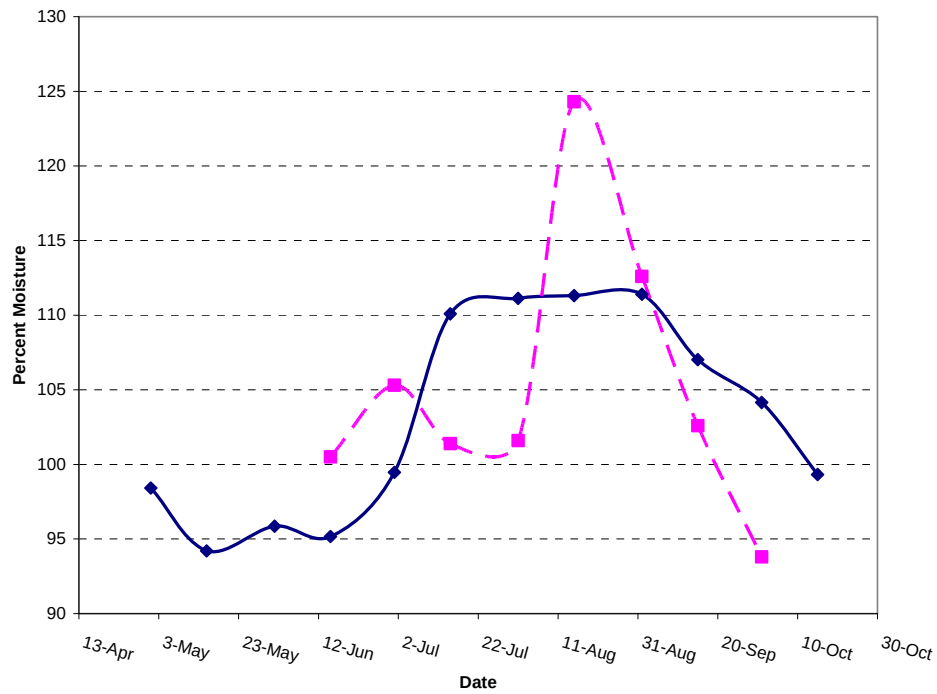
O:\resmgmt\Fire Management\Fuels Projects\FMU's\Fall River FMU\Horseshoe RX\photos

Data used are available in the following location:

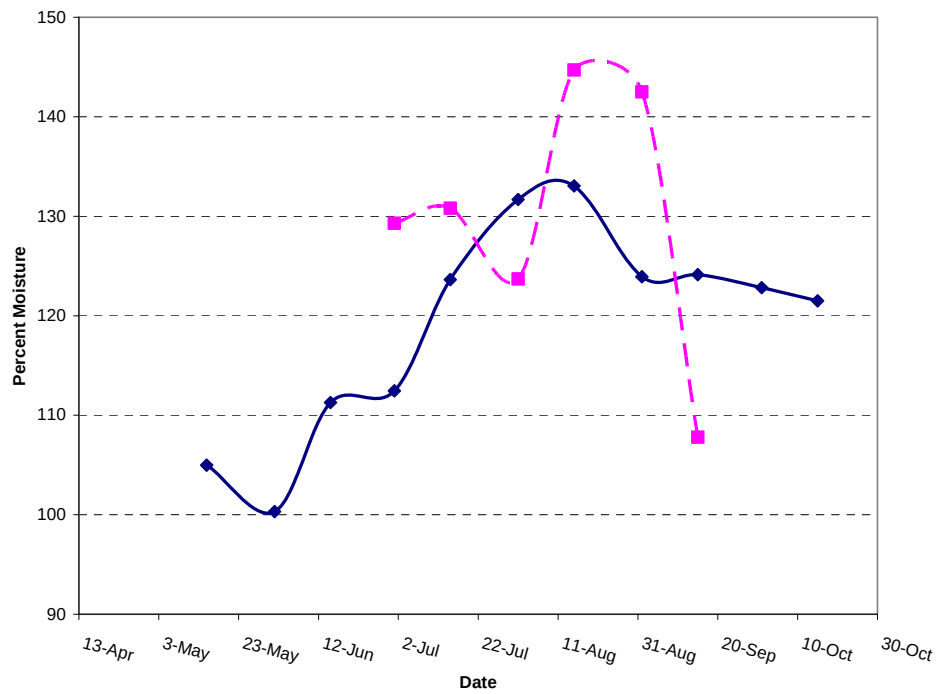
O:\resmgmt\Fire Management\Fuels Projects\FMU's\Fall River FMU\Horseshoe RX\Smoke

APPENDIX C.

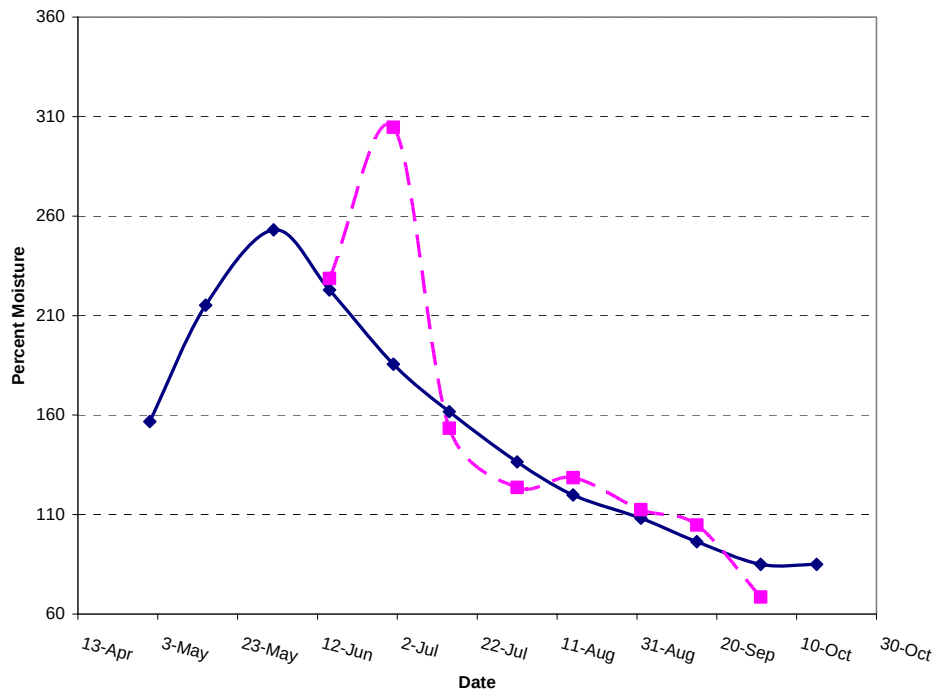
Live Fuel Moisture Trends - Ponderosa



Live Fuel Moisture Trends - Lodgepole



Live Fuel Moisture Trends - Sagebrush



Live Fule Moisture Trends - Bitterbrush

