Devils Tower National Monument
Graham Prescribed Fire Monitoring Report

Prepared by Cody Wienk

Introduction

The Graham burn unit is a 108-acre unit covered by ponderosa pine forest—both fuel models 2 and 9—with a few small pockets of mixed-grass meadow scattered throughout the unit. The unit is bounded by the visitor's center road on the west, north, and northeast sides and a mow line from the visitor's center south to the road. Ignition of the test burn occurred at 1000 on November 15th, 2001. Following a successful test burn, ignition of the rest of the unit continued from the northeast corner of the burn unit and ceased at approximately 1715.

Overhead personnel for the Graham burn consisted of Burn Boss Bill Gabbert with Dan Morford acting as Burn Boss Trainee, and ignition specialist Steve Ipswitch. Holding forces included one twenty-person hand crew, six Type 6 Engines, one ATV, and one Type III water tender. Additional resources included various personnel from the National Park Service, the US Forest Service, and local volunteer fire departments.

Objectives

Primary resource objectives for the burn:
- Limit overstory tree mortality to less than 30%, 2 years postburn
- Reduce dead and down fuels 30-50% immediate postburn
- 30-50% mortality in trees < 6" dbh
- Burn 80-100% of the burnable project area
- Decrease non-native herbaceous density and relative cover by at least 10%, 1 year postburn

Summary of Events

Prior to the day of the burn, the Black Hills Fire Use Module prepared for the burn by mowing a line along the southeast boundary and established progressive hose lays along this boundary. They also completed mechanical thinning of trees and downed fuel near park structures. Personnel from Badlands National Park mowed around the base of all utility poles located in the burn unit.

Two long-term fire effects monitoring plots were installed at various points within the burn unit prior to the burn. Fuel and soil moistures samples were collected within the monitoring plots the day before the burn.

A briefing was conducted for all personnel at 0800 on the morning of the burn. A National Weather Service spot forecast and on-site weather observations were obtained to assess compliance with prescription parameters. Prescription criteria were met and ignition commenced at 1000 and ceased at 1715. Post-burn evaluations on the fire effects monitoring plots are pending due to snow cover on the plots.

Weather Observations

Monitoring of weather conditions for the Graham Prescribed Fire began at 0800 and continued until 1700. Observations were taken every hour on the hour and broadcast over the radio on the command channel. On November 15th, 2001 the temperatures during ignition ranged from 47 to 65 degrees Fahrenheit. Winds were predominantly west and southwest during the burn period with a maximum wind speed of 8 mph at eye level. Observed and predicted weather conditions are summarized in Table 1.

Table 1, Weather Conditions Observed on 10/28/01

Condition	Temperature	Relative Humidity	Wind Speed (mph)	Wind Direction	1-Hr Fuel Moisture
Prescription	Not in Burn Plan	20-60%	2-10	N,NW,S,SW	5-11%
Predicted	Max 64° F	Min 22%	4-8 W becoming S 8 to 13	W becoming S	8-10%
Observed	Max 55° F	Min 29% Max 57%	0-6 Gusts to 8	W to SW	9-13%

Ignition Pattern

Ignition began at 1000 with a test in the northeast corner of the burn unit. The ignition team began lighting strips from the northeast corner along the north boundary working toward the west and south. At approximately 1100 part of the ignition team split off and began igniting north-south strips from the northeast corner to the visitor's center parking lot. By 1115, the portion of the team working along the north boundary (north team) reached drop point G. The north team continued to ignite 10 to 15 foot strips working toward the west and south while the other portion of the ignition team (east team) continued to work to the south and west. Shortly before 1200 the north team reached the fire effects monitoring plot #2 and by 1230 the east team had reached drop point B. The north team ignited the area around the historic cabin site at about 1400. Then by 1500 the east team had completed ignition between the utility line and the east boundary of the burn unit. Fire effects monitoring plot #9 was burned at approximately 1545. The remainder of the unit was ignited with several north-south strips from east to west with ignition ceasing at about 1715. (see attached fire progression map)

Fire Behavior Observations

Fire behavior observations were taken regularly during the day on different aspects and in different fuel types. Active fire behavior occurred as soon as ignition began and continued past sunset. Most of the unit burned as strip-headfire.

For backing fire, flame lengths ranged between 4 and 8 inches. Rates of spread for backing fire ranged from 0.4 to 0.7 chains per hour. Head fire rates of spread ranged from 0.8 to 17 chains per hour. Flame lengths for head fire ranged from 6 inches to 2 feet, with flame zone depths of up to 2 feet. Fire behavior observations are summarized in Table 2.

Table 2, Fire Behavior Observed on 11/15/01

Time	Fuel Model	Fire Type	Rate of Spread (ch/hr)	Flame Length	Flame Zone Depth	Comments
1011	PIPO 9	Backing fire	0.4	4 – 8 in.	1 – 3 in.	Test burn
1120	PIPO 9	Strip headfire	1.9	6 – 24 in.	3 – 24 in.	Plot 2
1130	PIPO 9	Strip headfire	6.0	8 – 14 in.	10 – 12 in.	50 m north of plot 2
1144	PIPO 9	Backing fire	0.7	4 – 6 in.	1 – 3 in.	Plot 2, Q 2
1225	PIPO 9	Strip headfire	0.8	6 – 8 in.	4 – 6 in.	Plot 2, P 1
1540	PIPO 2	Strip headfire	17.1	12 – 18 in.	12 – 14 in.	Plot 9
1550	PIPO 2	Backing fire	0.5	5 in.	2 in.	Plot 9, B 1
1550	PIPO 2	Backing fire	0.7	--	--	Plot 9
1600	PIPO 2	Strip headfire	5.9	8 – 10 in.	3 – 4 in.	Plot 9, 0 P

Biomass, Fuel and Soil Moisture Measurements

Biomass samples were not collected from this burn unit. Fuel and soil moisture samples were collected at both of the long-term monitoring plots on November 14, 2001. (see attached table and graph)

Smoke Monitoring

Smoke was not monitored on this burn.
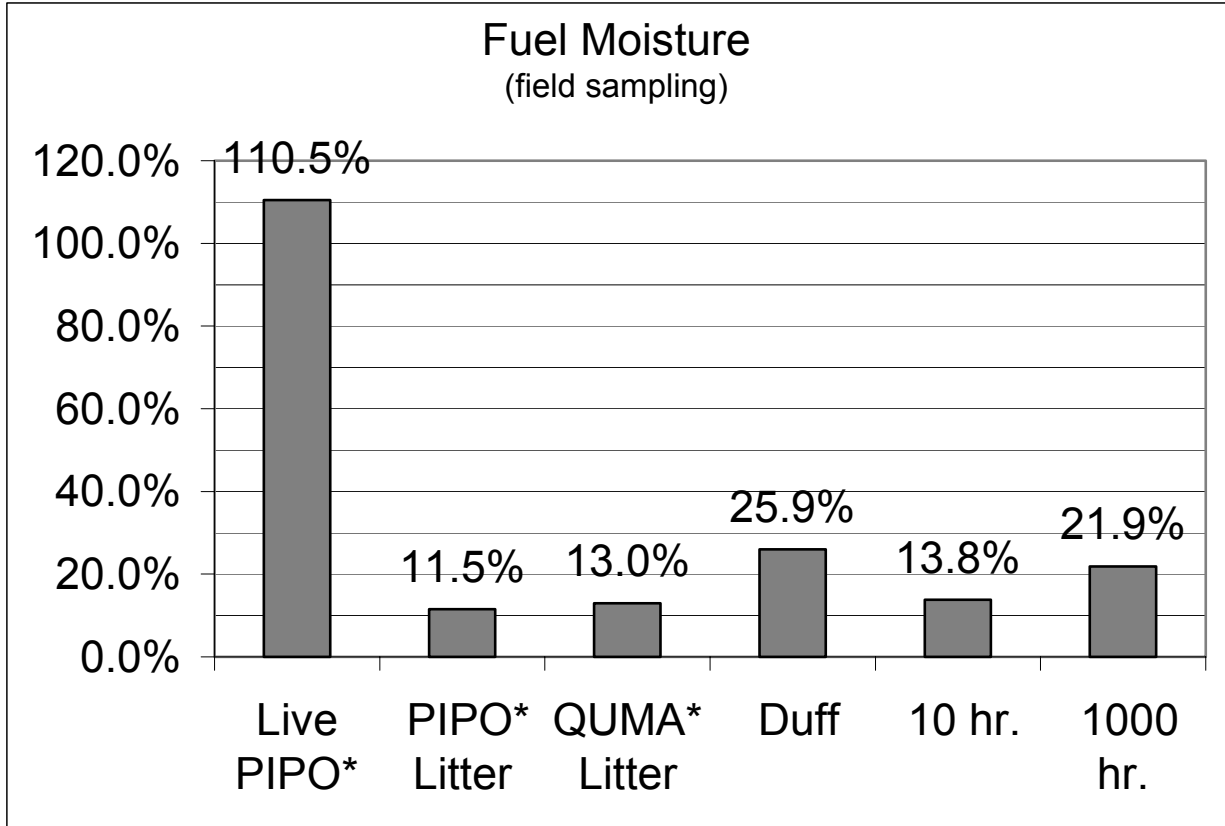
Fire Monitoring

Two long-term fire-monitoring plots are located within the Graham burn unit. One plot is located in ponderosa pine fuel model 2 and one plot is located in ponderosa pine fuel model 9. These plots will read approximately two weeks post-burn to determine burn severity of vegetation and substrate (litter and soil) if weather permits. They will be read 1, 2, 5, and 10 years after treatment of fire to determine the immediate, short, and long term ecological and vegetative effect fire had on this burn unit.

Conclusions

 The long-term health of ecosystems is the focus of the prescribed burning program in the Northern Great Plains and at Devils Tower National Monument, therefore certain criteria need to be assessed.
Some objectives are immediately measurable such as fuel loading reduction immediate post-burn. Other quantifiable specific objectives need to be viewed over the course of several years before results can be determined. With a long-term ecological monitoring program in place, a quantifiable assessment of prescribed fires specific objectives can be made.

Resource Objective	Monitoring Status
Limit overstory tree mortality to less than 30%, 2 years postburn	Based on initial ocular estimates overstory tree mortality was less than 30%
Reduce dead and down fuels 30-50% immediate postburn	Immediate post-burn measurements will be taken if weather permits
30-50% mortality in trees < 6" dbh	Two ponderosa pine plots will be read 1, 2, 5, and 10 years post burn to quantify these objectives
Burn 80-100% of the burnable project area	Based on ocular estimates at least 80% of the burnable project area burned
Decrease non-native herbaceous density and relative cover by at least 10%, 1 year postburn	Two ponderosa pine plots will be read 1, 2, 5, and 10 years post burn to quantify these objectives

Fuel Moisture
Graham Burn Unit
Devils Tower National Monument
November 14, 2001

Fuel Moisture
(field sampling)

	Live PIPO*	PIPO* Litter	QUMA* Litter	Duff	10 hr.	1000 hr.
Fuel Moisture	110.5%	11.5%	13.0%	25.9%	13.8%	21.9%

Weather Observations

Time:	1400
Dry Bulb:	63°
Wet Bulb:	47°
RH:	30%
Dew Point:	31°
Winds:	south at 0 - 2 mph
Cloud Cover:	50%
FDFM:	6 – 8%

10 hr fuel moisture sticks
14%

Soil Moisture

PIPO* Fuel Model 2: 20.1%
PIPO* Fuel Model 9: 12.7%

* PIPO – *Pinus ponderosa*, ponderosa pine; QUMA – *Quercus macrocarpa*, bur oak

Data collected by: Andy Thorstenson, Cody Wienk, Ann Hebig