

Wind Cave National Park
Highland Creek Prescribed Fire Monitoring Report
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Introduction

In its totality, the Highland Creek prescribed fire is a 1546 acre burn unit located within Wind Cave National Park. Composed of native and non-native mixed grass prairie (~70%) and ponderosa pine forest (~30%), the unit has been divided into two blocks, A & B. Block A (406 acres) burned on May 5th, 2002, and Block B (1141 acres) burned on October 19th, 2002. Each operational period has a separate report, this summary focuses on Block B.

Objectives

Primary resource objectives as stated in the burn plan:

- Reduce non-native cover by 50-90%; increase native perennial grass cover by 50-90%; increase native forb cover by at least 50% within 5 years post-burn.
- Achieve greater than 50% mortality in ponderosa pine regeneration (<2.5 cm DBH) within 2 years post-burn.
- Reduce dead and down (1, 10, and 100 hr.) fuels by 30-50% immediate post-burn.
- Reduce total biomass in prairie areas by greater than 60% immediate post-burn.
- Accomplish a “patchy” burn within drainages where hardwoods occur, to reduce the number of junipers and save some hardwoods.
- Reduce number of ponderosa pines up-slope from hardwood by 50%.

Summary of Events

Overhead personnel for the Highland Creek prescribed fire Block B consisted of:

- **Burn Boss**, Denny Ziemann
- **Deputy Burn Boss**, Bill Gabbert
- **Holding Boss**, Dan Morford
- **Ignition Specialist**, Shaun Larson
- **Lead Prescribed Fire Monitor**, Kevin Rehman

In preparation for the burn, Wind Cave staff, led by acting Engine Foreman, Sabrina Henry, established a 13,700 foot mow-line between drop point 4 (DP4) and drop point 8 (DP8) along segment C (see map1). In addition, Wind Cave staff posted “Drop Point” signs, established two porta-tanks at DP4 and Pumpkins at DP 6 & 7, improved mow-lines on the north and west portions of the perimeter, set up a portable repeater at DP2 at the lone pine pullout, and cached fuel and tools at various drop points.

Fire Monitors installed one forest plot and re-read two grass plots that were installed in the burn unit. Biomass, fuel and soil moistures were collected and calculated from the monitoring plots prior to the burn.

At 0800 on the 19th of October briefing commenced. A spot weather forecast was obtained from the National Weather Service in Rapid City. The spot weather forecast fell within the parameters

of the prescription and once resources were in place a test ignition began at 1000. The test burn was successful and ignition of the rest of the burn began at 1040 and ceased at 1900.

Ignition began at 1000 at DP1 (see map 1). From DP1 ignition team one headed east and south along segment A on NPS 5. Ignition team two headed south then east along segment B following the Highland Creek Trail and mowline. Meanwhile an interior ignition team followed the drainage that parallels NPS using a spot ignition technique. An ATV driptorch was attached to the interior ignition team but was responsible for interior ignition west of the drainage parallel with NPS 5.

Ignition teams secured the perimeter west of DP5 around 1730. Interior ignition occurred until 1900 when ignition ceased.

Fire Behavior Observations

Fire Behavior observations were taken in various areas of Block B in fuel models 1 and 9.

In fuel model 9, (ponderosa pine with needle-cast under-story) observed flame lengths for the head fire was 3 feet with rates of spread of 130 chains per hour. Note that one head fire observation was made. Monitoring of fire behavior proved difficult due to variable wind shifts and high intensity heat and consumption in the 100 and 1000 hour fuels. Based on ocular observations our one head fire observation is estimated to be conservative. Isolated torching occurred in pockets of ponderosa pine with some crown to crown torching.

In fuel model 1, (native and non-native mixed-grass prairie) observed flame lengths for backing and flanking fire ranged from 4 inches to 1.5 feet with rates of spread ranging between 0.75-10 chains per hour. Observed flame length for head fire was 6 inches to 3 feet. Observed rate of spread was 30 chains per hour. Once again, head fire observations in fuel model 1 are considered conservative. Variable winds made head fire observations difficult. Fire behavior observations are summarized in Table 1.

Table 1, Fire Behavior Observed on 10/19/02

Time	Fuel Model	Fire Type	Rate of Spread (ch/hr)	Flame Length	Flame Zone Depth	Comments
11:54	1	Backing	2.0 ch/hr	1-1.5'	6"-1''	West aspect
1220	1	Flanking	.75 ch/hr	6"-1'	8:-1'	
1300	1	Flanking/some head	10.0 ch/hr	4"-1.5'	4-6"	Plot: ansc104
1300	1	Backing	2 ch/hr	1'	2-6"	Plot: ansc104
1330	1	Backing	5.5 ch/hr	1'	6"	Became a head fire
1505	1	Backing/flanking	4 ch/hr	1-1.5'	1-1.5'	Shifting winds
1600	9	Head	130 ch/hr	3'	10'	Some torching/ gusts of wind pushed head fire through plot
1630	1	Backing	.75 ch/hr	1'	6"	agsm
1745	1	Head	30 ch/hr	6"-3'	1-2'	Plot: ansc 103

Weather Observations

On-site weather monitoring for the Highland Creek Prescribed Fire Block B, began at 0900. Weather observations prior to 0900 as well as the spot weather forecast were taken from the portable weather station located near the bison corrals. Observations were taken every half-hour and broadcast on the command radio frequency every hour, on the hour, (beginning at 0900) until ignition was completed at 1900.

The spot weather forecast predicted 20-foot winds from the west at 7-12 mph. Winds observed throughout the burn period were not forecasted in the spot weather forecast. Winds were variable, shifting and unpredictable in speed and direction. Throughout the day winds started from south and shifted to the north by the end of the operational period. During the burn period winds were observed from all directions, often times changing drastically by each half hour weather reading. Observed and predicted weather conditions are summarized in Table 2.

Table 2, Weather Conditions Observed on 10/19.02

Conditions	Prescriptions	October 19 Forecast	October 19 Observed
Max. Temperature (F)	90	63	65
Min. RH	20%	26	25
Wind Speed (mph)	2-10	7-12 mph	0-12 mph
Wind Direction	Any	West	All Directions

Fire Monitoring

Three long-term fire-monitoring plots are within Block B of the Highland Creek burn unit. Two long-term fire monitoring plots are fuel model 1, native and mixed grass prairie, predominantly little blue stem (*Andropogon scoparius*). The third long-term fire-monitoring plot is a fuel model 9, consisting of an over-story of Ponderosa Pine (*Pinus ponderosa*) with a grass under-story.

Biomass, Soil and Fuel Moisture Measurements

On October 7th, 2002, biomass, fuel and soil moistures were collected at the three plots within Block B. The biomass was clipped and oven-dried to determine fuel loading (tons per acre). Fuel and soil moisture samples were weighed and oven-dried. Grassland biomass average from 0.82 - 3.67 tons per acre and the average soil moisture was 22.6%

The forest plot pre-burn fuel loading was 16.8 tons per acre. Immediate post burn fuel loadings were at 4.4 tons per acre for 1's, 10's, and 100 hour fuels, litter and duff consumption. Fuel loading decreased by 74% in the forest plot. Fuel moistures are listed on table 3.

Table 3. Fuel Moisture Samples

Live Ponderosa Pine	98.15%
10 Hour fuels	11.32 %
100 Hour fuels	17.36 %
1000 Hour fuels	9.88 %
Litter	7.32 %
Duff	36.77 %

Conclusions

The long-term health of ecosystems is the focus of the prescribed burning program here in the Northern Great Plains and at Wind Cave National Park, therefore certain criteria need to be assessed. Some objectives are immediately measurable, 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.

Ocular estimates show most of the burn unit was lightly to moderately consumed. High mortality is expected in the seedling ponderosa pine (less the 2.5cm DBH). However, mortality in ponderosa pine overstory will probably not reach our objectives as stated in the burn plan. Monitoring of the forest plot over the next two to five years in this unit will give us an idea to the percentage of overstory mortality that did occur.

Reduce non-native cover by 50-90%; increase native perennial grass cover by 50-90%; increase native forb cover by at least 50% within 5 years post-burn.	Two native mixed-grass prairie plots will be read 1, 2,5, and 10 years post burn to quantify these objectives.
Achieve greater than 50% mortality in ponderosa pine regeneration (<2.5 cm DBH) within 2 years post-burn.	One ponderosa pine monitoring plot will be read 1, 2, and 5 years post burn to quantify these objectives.
Reduce dead and down (1, 10, and 100 hr.) fuels by 30-50% immediate post-burn.	Immediate post burn evaluations of our one forest plot show a 68.2% reduction in the one hour fuels and a 89.5% reduction in the 10 hour fuels.
Reduce total biomass in prairie areas by greater than 60% immediate post-burn.	Ocular estimates show a greater than 60% reduction of biomass in the prairie areas
Accomplish a “patchy” burn within drainages where hardwoods occur, to reduce the number of junipers and save some hardwoods.	This is not a quantifiable objective and will have to be determined after the first growing season based on ocular estimates.
Reduce number of ponderosa pines up-slope from hardwood by 50%.	One long term photo monitoring plot was established, but will not give a quantifiable record for this objective.