

# **Badlands National Park Dillon Prescribed Fire Monitoring Report**

*Prepared by Andy Thorstenson*

## **Introduction**

The Dillon prescribed fire is a 3132 acre unit comprised of both native and non-native mixed-grass prairie with isolated pockets of Cottonwood and willow drainages and areas of sparsely vegetated badlands. It is located on the northern edge of Badlands National Park and is bounded by the park loop road on the south and west, park boundary fenceline on the north, and the Quinn gravel road on the east. Ignition occurred during the operational periods of October 9 and 10 and November 21, 2002. On October 9, a blackline was established on the northern perimeter, on October 10, the blackline was extended along the east and a portion of the south perimeter. Ignition of the main portion of the unit began at 1105 on November 21 in the southeast corner of the burn unit, moved north and west, and ceased at approximately 1600.

Overhead personnel for the Dillon burn consisted of Burn Boss Dan Morford, Ignition Specialist Eric Allen and Jay Vogelsang as Ignition Specialist trainee, and Holding Specialist Steve Ipswitch. Holding forces consisting of ten Type 6 Engine, two ATVs, and one Type III water tender. Resources were drawn from the Black Hills Fire Use Module, the Northern Great Plains Fire Monitors, the National Park Service and the US Forest Service.

## **Objectives**

Primary resource objectives for the burn:

- Reduce total fuel loading 60 to 80% immediate post-burn
- Reduce cover of non-native grasses by 20 to 30%
- Increase relative cover of native grasses by 10 to 25%, 2 years post-burn

## **Summary of Events**

Prior to the day of the burn, the fire crew from Badlands National Park prepared for the burn with a mow line along the northern fenceline and southern portion to exclude a large area of non-native smooth brome. The mowline excluded Thistle Dam, a riparian feature on the east side of the unit.

Three long-term fire effects monitoring plots were installed at random within the burn unit prior to the burn. Biomass and soil moisture samples were collected near the monitoring plots. A briefing of all personnel occurred on site before each of the operational periods.

## **Weather Observations**

Weather observations were taken during all 3 days of ignition. During blackline, maximum temperature reached 78° with a minimum relative humidity of 20%. On November 21, Mike Carlbom began taking weather observations at 0730 with observations continuing until 1520. During the ignition period weather observations were amazingly consistent with temperatures ranging between 54° and 56° and relative humidity between 40% and 42%. Winds were also consistent during the burn period, coming from the north at 10-12 miles per hour, tapering off the 6-8 mph after 1400 and shifting slightly to the northwest. Observations for the November 21 burn period are summarized in Table 1.

**Table 1, Weather Conditions Observed on 11/21/02**

<b>Condition</b>	<b>Temperature</b>	<b>Relative Humidity</b>	<b>Winds</b>	<b>1-Hr Fuel Moisture</b>
<b>Prescription</b>	Not in Burn Plan	20-60%	2-10	5-11%
<b>Predicted</b>	Max 66° F	Min 28%	NW 8-13, variable after 3 p.m.	8%
<b>Observed</b>	Max 56° F	Min 40% Max 56%	North 10-12 Gusts to 15	9-10%

**Ignition Pattern**

Ignition of the blackline began on October 9 in the northeast corner and continued east to west along the north perimeter. On October 10, ignition began in the northeast corner and progressed south along the east boundary, then continued along the southern mowline. When the main portion of the unit was ignited on November 21, winds were predominantly from the north, so ignition began in the southeast corner and moved due north with 2 ignition teams. The larger team of 10 moved north along the east perimeter, Quinn Road, while a second team of 2 or 3 igniters moved northwest along Badlands Loop Road. An atv driptorch was utilized to ignite the area between these 2 ignition teams. The ignition team from the east edge reached the north fenceline then moved west to complete the perimeter ignition. Interior ignition continued with atv and hand ignition. 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. Fire behavior was not particularly active on any day of ignition. Wet fuel conditions slowed fire behavior during the 2 days of blackline operations. Cool temperatures, moderate relative humidity and low sun angle moderated fire activity when the main part of the unit burned. Closely spaced flanking ignition strips were used for much of the Dillon Unit. Fire behavior observations are summarized in Table 2.

**Table 2, Fire Behavior Observed on 11/21/02**

<b>Time</b>	<b>Fuel Model</b>	<b>Fire Type</b>	<b>Rate of Spread (ch/hr)</b>	<b>Flame Length</b>	<b>Flame Zone Depth</b>	<b>Comments</b>
1140	Agsm	Flank		12"	4-6"	
1150	Brin	Flank/back		6-12"	2-4"	
1233	Agsm	Head	15	12-18"		Plot AGSM 20
1233	Agsm	Flank	22.5		2'	Plot AGSM 20
1233	Agsm	Flank/head	10	18"	6-18"	Plot AGSM 20
1240	Agsm	Flank	6	8-12"	6-8"	
1330	Mix grass	Flank	2	6-8"	3"	Plot AGSM 19
1330	Mix grass	Flank/head		12-16"	1-2'	Plot AGSM 19
1330	Mix grass	Backing	1.5	6"	2-4"	Plot AGSM 19
1350	Mix grass	Backing	1.7	10-12"	4-6"	Plot AGSM 19

**Biomass and Soil Moisture Measurements**

Fuel loading samples were taken at the long term monitoring plots on the first day of blackline operations. Three samples from each plot were clipped to determine biomass or fuel loading by tons per acre. The sample fuel loading was on average 3.96 tons per acre and varied from 3.02 to 4.91 tons/acre in the Western wheatgrass prairie. Three soil moisture samples were taken within 5cm of the surface at random

throughout the burn unit on November 21. Samples were weighed and dried to obtain a mean soil moisture for the unit. The average soil moisture was 26.7% in the grassland with samples ranging from 18% to 33%.

**Smoke Monitoring**

Because of north winds holding resources along the southern perimeter of the burn unit were impacted by smoke. Fireline visibility ranged from a half mile to a mile with visibility as low as 100 meters. The National Weather Service predicted poor smoke dispersal for the day with mixing heights at 2000 feet above ground level. Once the fire backed away from the fireline, visibility increased dramatically and smoke impact along the fireline decreased. Smoke impacted the Badlands Loop Road significantly to the point where the road was closed to the public. Traffic control personnel were posted on the road at either end of the burn unit to provide for public safety on the roadway.

**Fire Monitoring**

Three long-term fire monitoring plots are located within the Dillon burn unit. All three plots are native mixed-grass prairie, dominated by western wheatgrass. The immediate postburn severity measurement showed that the vegetation had a value of “lightly burned”, while 62% of the substrate had a value of “lightly burned” and 38% had a value of “scorched”. This means that most all of the standing vegetation burned leaving approximately 2 inches of stubble. In the litter layer, less than 50% of the litter was consumed and the duff layer was largely unaffected. This limited severity was due to the low sun angle and relatively high (9%-10%) fine dead fuel moistures that accompany a late-season fire. These plots will be read 1, 2, 5, and 10 years after treatment of fire to determine vegetation changes.

**Conclusions**

The long-term health of ecosystems is the focus of the prescribed burning program here in the Northern Great Plains and at Badlands National Park, 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.

<b>Resource Objective</b>	<b>Monitoring Status</b>
Reduce total fuel loading 60 to 80% immediate post-burn	Based on ocular estimates fuel loading was reduced by 50-75%
Reduce Cover of non-native grasses by 20 to 30%, 2 year post-burn	Three native mixed-grass prairie plots will be read 1, 2, 5, and 10 years post burn to quantify these objectives
Increase relative cover of native grasses by 10 to 25%, 2 year post-burn.	Three native mixed-grass prairie plots will be read 1, 2, 5, and 10 years post burn to quantify these objectives

Attachment  
Fire Progression Map