

# **Badlands National Park West Sage Creek Prescribed Fire Monitoring Report**

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## **Introduction**

The West Sage Creek prescribed fire is a 3572 acre unit comprised of both native and non-native mixed grass prairie with isolated pockets of Green Ash woody draws and Cottowood/willow in the drainages. It is located on the western edge of Badlands National Park and lies within the Sage Creek Unit of the Badlands wilderness area. The boundary of the burn area consists of Park boundary on the west side, to the north is a mow line and large prairie dog town, and to the east is the South Fork of Sage Creek. Ignition occurred during the operational periods of October 16<sup>th</sup> and 28<sup>th</sup>. On October 16<sup>th</sup>, a blackline was established on the northern perimeter and a portion of the west perimeter. Following a successful test burn, ignition of the rest of the unit began at on October 28<sup>th</sup> in the southeast corner of the burn unit and ceased at 2000.

Overhead personnel for the West Sage Creek burn consisted of Burn Boss Bill Gabbert with Mike Carlbom acting as Burn Boss Trainee, and ignition specialists Eric Allen and Dan Morford, Holding forces included three twenty-person handcrews, four Type 6 Engine, four ATVs, and one Type III water tender. A helicopter was used for reconnaissance and logistical support. Additional resources included the Black Hills Fire Use Module, The Northern Great Plains Fire Effects Monitoring Team and various personnel from The National Park Service, The United States Forest Service, and State agencies.

## **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 year post-burn

## **Summary of Events**

Prior to the day of the burn, personnel from The Black Hills Fire Use Module and Badlands National Park prepared for the burn with a mow line along the southern and northern portion and established progressive hose lays along these boundaries

Four long-term fire effects monitoring plots were installed at various points within the burn unit prior to the burn. Biomass, fuel, and soil moistures were calculated within the monitoring plots.

A briefing was conducted for all personnel at 0700 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 2000. Post-burn evaluations on the fire effects monitoring plots began the following day.

## **Weather Observations**

Monitoring of weather conditions for the West Sage Creek Prescribed Fire began at 0700 to obtain a spot weather forecast from the National Weather Service. As of 0800, observations were taken every half hour until ignition was completed at 2000. Observations were broadcast on the hour over the command channel for all fire personnel. On October 28<sup>th</sup>, 2001 the temperatures during ignition ranged from 46 to 74 degrees Fahrenheit. Winds were predominantly North during the burn period with a maximum wind speed of 14 mph at eye level. Observed and predicted weather conditions are summarized in Table 1.

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

<b>Condition</b>	<b>Temperature</b>	<b>Relative Humidity</b>	<b>Wind Speed (mph)</b>	<b>Wind Direction</b>	<b>1-Hr Fuel Moisture</b>
<b>Prescription</b>	Not in Burn Plan	20-60%	2-10	N,NW,S,SW	5-11%
<b>Predicted</b>	Max 72 F	Min 17%	6-12 W becoming N 15 to 25	W becoming N	3%
<b>Observed</b>	Max 75 F	Min 19% Max 57%	6-10 Gusts to 14	NE to NW	3-12%

### **Ignition Pattern**

Ignition began at 1000. A test burn began in the southeast corner of the burn unit. Two ignition teams commenced lighting in opposite directions with Dan Morford's team heading west along the southern perimeter while Eric Allen's ignition team headed north along the eastern perimeter in the Sage Creek drainage. Allen's ignition crew reached drop point 3 at 1105, drop point 2 at 1145, drop point 1 at 1240, and tied in with the blackline in the northeast corner at 1605. Between 1605 and 1805 Allen's crew split into two crews with Todd Jensen in charge of the second crew. Allen's crew relocated to the northwest corner. Jensens crew started ignition from the northeast corner at 1805 lighting off the pre-existing blackline heading west. Jensen, Allen, and Morford's crew tied ignition together at Drop point B at 2000 (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. A large part of the unit burned as a flanking fire that originated on the east perimeter and continued flanking toward the west throughout the day and into the night.

For backing fire, flame lengths ranged between 8 inches and two feet in fuel model 1 (both native and non-native mixed-grass prairie). Rates of spread for backing fire ranged from 2 to 4 chains per hour. Flanking fire spread from 1 to 6 chains per hour and produced flame lengths from 1 to 4 feet. Head fire rates of spread ranged from 48 to 240 chains per hour in fuel model one. Flame lengths for head fire ranged from 3 to 8 feet, with flame zone depths of up to 30 feet. Fire behavior observations are summarized in Table 2.

**Table 2, Fire Behavior Observed on 10/28/01**

<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>
1030	1	Backing	2 chains/hour	18" – 24"	1'	Snowberry shrub interspersed with grass
1030	1	Backing	2 chains/hour	12" – 18"	6" – 8"	Western Wheat Grass
1130	1	Backing	3 chains/hour	3" – 12"	4" – 6"	Sparse fuels of Western Wheat Grass and Side Oats Grama
1420	1	Backing	2.5 chains/hour	8" – 18"	6" – 8"	Western Wheat Grass/Side Oats Grama
1430	1	Backing	4 chains/hour	16" – 24"	1'	Western Wheat Grass
1130	1	Flanking	2 chains/hour	12" – 18"	4" – 12"	Sparse fuels of Western Wheat Grass and Side Oats Grama
1135	1	Backing/flanking	3 chains/hour	18" – 36"	12" – 18"	Green Needle Grass
1220	1	Flanking/head	6+ chains/hour	4'	1' – 5'	Western Wheat Grass
1700	1	Flanking	3 chains/hour	3'	3'-6'	3 miles of flanking fire
1800	1	Backing/Flanking	1.25 chains/hour	12" – 24"	1'	Western Wheat Grass
1335	1	Head	48 chains/hour	3' – 4'	3'	Western Wheat Grass in Non-Preheated fuels
1345	1	Head	240 chains/hour	6' – 7'	+20'	Western Wheat Grass in Preheated fuels
1346	1	Head	60 chains/hour	2' – 4'	4' – 5'	Western Wheat Grass/Side Oats Grama in Sparse Fuels
1435	1	Head	90 chains/hour	4'	10' – 15'	Western Wheat Grass/Side Oats Grama (14 MPH Winds)
1130	1	Head	> 60 chains/hour	8' – 18'	+30'	Full consumption of Silver Sage and rapid consumption of heavies in Green Ash/Cottonwood Draws

**Biomass and Soil Moisture Measurements**

Fuel loading and soil moisture samples were taken at the long term monitoring plots on the day before the burn. Three samples from each plot were clipped to determine biomass or fuel loading by tons per acre. The sample fuel loading was on average 2.62 tons per acre and varied from 1.55 to 3.48 tons/acre in the prairie. Three soil moisture samples were taken within 5cm of the surface at each of the four plots. Samples were weighed and dried to obtain a mean soil moisture for the unit. The average soil moisture was 18.44% in the prairie and 22.7% in the brush.

**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 200 meters. The National Weather Service predicted good smoke dispersal for the day with mixing heights at 3000 feet above ground level. Once the fire backed away from the fireline, visibility increased dramatically and smoke impact along the fireline decreased.

### **Fire Monitoring**

Four long-term fire-monitoring plots are located within the West Sage Creek burn unit. Two plots are native mixed-grass prairie, two are native shrub plots. These plots were read immediately post-burn to determine burn severity of vegetation and substrate (litter and soil) and 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 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 more the 60%
Reduce Cover of non-native grasses by 20 to 30%, 2 year post-burn	Two native mixed-grass prairie plots and two shrub 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.	Two native mixed-grass prairie plots and two shrub plots will be read 1, 2, 5, and 10 years post burn to quantify these objectives