

# **Knife River Indian Villages National Historic Site Big Hidatsa Prescribed Fire Monitoring Report**

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## Introduction

The Big Hidatsa prescribed fire is located within the boundaries of Knife River Indian Villages National Historic Site approximately 2 miles north of the Visitor center, east of Highway 57, and west of the Missouri River. Ignition of the 406 acre unit occurred on September 23<sup>rd</sup>, 1999.

Staff for the Little Missouri burn included Burn Boss Mike Beasley, Ignition Specialist Shaun Larson, and Ignition Specialist Trainee Guy Keene. Andy Thorstenson, Kevin Rehman, and Ed Waldron acted as Prescribed Fire Monitors. Fire Personnel in the ignition and holding assignments were from Theodore Roosevelt NP, Knife River NHS, Fort Union NHS, the US Fish and Wildlife Service, the Black Hills Fire Use Module, and the Northern Great Plains Fire Monitors.

Primary resource objectives for the burn were to:

- Reduce decadent thatch in prairie by at least 85% immediate postburn
- Reduce dead and down fuels in all size categories beneath the hardwood canopy 30-50%
- Decrease non-native herbaceous frequency and relative cover by at least 25% 1yr. post-burn
- Limit overstory tree mortality to less than 20% 2yr. postburn
- Cause mortality in seedling to pole-sized hardwoods encroaching in prairie

## Summary of Events

Knife River staff prepared for the burn by mowing a control line through areas of prairie. Archeological sites were mowed around to exclude fire from these areas. Paved, gravel, and dirt roads served as the other primary control lines. The burn unit was divided into three blocks roughly divided by vegetation class.

Burn overhead conducted a briefing for personnel 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. Ignition began at 10:00 and ceased at 16:45. Post-burn evaluations began the following day.

## Weather Observations

Monitoring of weather conditions for the Big Hidatsa Prescribed Fire began at 800 and continued every hour until fire activity diminished around 1650. On September 23<sup>rd</sup>, temperatures during ignition ranged from 48 to 73 degrees. Winds were consistently from the southeast throughout the burning period. Observed and predicted weather conditions are summarized in Table 1.

**Table 1                      Weather Conditions**

<b>Condition</b>	<b>Prescription</b>	<b>Predicted 23rd Sept</b>	<b>Observed 23rd Sept</b>
Temperature (F)	35-90	75 (max.)	48-73
Relative Humidity (%)	20-60	35 (min.)	93-40
Wind Speed (mph)	2-12	5-15	2-8 gusts of 12
Wind Direction	any	SE	SE
1-hr Fuel Moisture	4-11%	6%	6-8%

Ignition Pattern

Ignition occurred within three separate blocks within the Big Hidatsa burn unit (illustrated in Attachment 1). Initial ignition occurred within the Test Block at 1000. At 1025 ignition and holding teams were moved to Block A and ignition restarted at 1045. Lighting began in the Northwest corner and proceeded out along mow lines both to the east and to the south. A strip of Green Ash forest running parallel with the east border of Block A was excluded from the ignition pattern. Block A ignition was completed at 1245. The primary fire behavior in Block A was mainly wind-driven head with some flanking fire. At 1405 ignition of Block C (consisting mostly of Green ash forest) began and ceased at 1510. Ignition and holding crews were then taxied back to Block B. Ignition of Block B began at 1545 and ceased at 1650. The ignition of Block B consisted primarily of flanking/backing fires along the block boundaries with interior strip head fires. As requested by an adjacent landowner, a strip of brome and thatch were burned along the boundary fence line between the adjacent landowner and NPS at the end of the day.

Fire Behavior Observations

Fire behavior observations were taken throughout the day in all fuel types and on different aspects and slopes. The highest intensity burning occurred just after 1230 hrs. Flame lengths during this event averaged 6 feet with highest flame lengths near 8 feet. Rate of spread for a short duration reached 50 chains per hour or slightly more than a 1/2 mile per hour. In other fuel types, head fire showed less intensity with rates of spread of 20-40 chains per hour and lower flame lengths.

Fire behavior observations are summarized in Table 2.

Table 2

## Fire Behavior Observations

FIRE TYPE	FUEL TYPE	TIME	RATE OF SPREAD (CH/HR)	FLAME LENGTH	FLAME ZONE DEPTH	COMMENTS
Flanking	BRIN/POPR	11:48	2	1-2'	4-8''	
Flanking	POPR	12:45	50	2-3'	4'	
Backing (some flanking)	STCO	11:20	2	1-2'	6-12''	
Backing	STCO	11:35	3	1-2'	1'	
Backing (turned head)	BRIN	12:20	6.5	5-6'	6-8'	
Backing	BRIN	14:15	2	1'	4-6''	
Backing	FRPE/BRIN WOODS	14:25	na	6''	6''	
Flank/Head	BRIN	12:20	16	2-3'	3-4'	
Flank/Head	SHRUBS	14:30	na	4-6'	4-6'	
Head	STCO	11:15	12	1-2'	2-3'	
Head	STCO	12:30	35	4-6'	12-14'	
Head	STCO	12:35	24	4-6'	8-10'	
Head	POPR	12:45	46	6-7'	8-10'	
Head	FRPE/BRIN WOODS	14:20	na	4-6''	4''	Heavies (10's & 100's) weren't consumed
Head	BRIN	15:00	30	4'	10-15'	
Head	BRIN	16:00	40	3-4'	6-8'	

## \*\* Species codes

BRIN *Bromus inermis* Smooth Brome  
FRPE *Fraxinus pennsylvanica* Green ash  
POPR *Poa pratensis* Kentucky bluegrass  
STCO *Stipa comata* Needle-and-Thread  
SYOC *Symphoricarpos occidentalis* Western snowberry

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 of a known area were clipped to determine biomass or fuel loading at all plots. The sample fuel loading was 3.29 tons/acre and varied from 2.02-4.96 tons/ acre. The averages are found below in Table 3. Three soil moisture samples were taken within 5 cm of the surface and dried to obtain a mean soil moisture for the unit. The average soil moisture was 17.62%.

**Table 3 - Biomass**

<b>Monitoring Plot</b>	<b>Biomass Tons/Acre</b>	<b>Biomass avg Tons/Acre</b>
STCO1	2.02	
STCO2	2.38	3.29
STCO3	3.80	
STCO4	4.96	

Smoke Monitoring

Smoke impact to private residents north of the park was a primary concern on the Big Hidatsa Burn. Due to wind direction on September 23rd, smoke did not impact the visibility of Highway 57 west of the burn unit. Fireline visibility was fair to good in areas of low-lying heavy smoke. Personnel that encountered heavy smoke were few and were exposed only for brief intermittent periods.

Fire Effects Observation

Six long-term fire-monitoring plots are located within the Big Hidatsa unit. Four STCO (Needle-and-Thread) plots were burned during the ignition of Block A. These plots were read immediately postburn to determine burn severity and will be read 1, 2, 5, and 10 years after the fire to determine the vegetative effects of this prescribed burn.

Two long-term FRPE (Green Ash) plots were excluded from the ignition pattern due to concerns over local residents and long term smoke dispersal from 1,000 and 10,000 hour dead-and down fuels.

The Fire Monitoring Handbook has levels of fire severity that describe the intensity which material burned. Separate readings are taken for substrate (litter and soil) and vegetation to determine severity. The average severity for the six STCO plots indicated that the substrate was lightly burned and the vegetation was moderately burned, meaning foliage, twigs, and small stems were consumed in the fire. On the burn severity scale, Moderately burned vegetation corresponds with the objectives of reducing decadent thatch and 1 Hr. dead and down fuels 85% immediate post-burn.

Conclusions

The long-term health of the ecosystems is the focus of the prescribed burning program therefore many criteria need to be assessed. Some objectives are immediately measurable while others need to be viewed over the course of several years before results can be determined (See Table 4). With a long-term fire monitoring program in place, quantifiable assessment of prescribed fire goals can be made.

Table 4- Status of Resource Objectives

<b>Resource Objective</b>	<b>Status</b>
Reduce 1 Hr. dead and down fuels in prairie/old field by at least 85% immediate postburn	Biomass sample showed 83.3% reduction immediate postburn
Reduce dead and down (1,10,100-hr.) fuels under hardwood canopy 30-50% immediate postburn	The wooded area with plots within the burn unit did not burn.
Decrease non-native herbaceous frequency and relative cover by at least 25% 1 yr. postburn	4 fire effects plots will be read 1,2 and 5 years postburn to gauge this
Limit overstory tree mortality to less than 20% 2yr. postburn	The wooded area with plots within the burn unit did not burn.

Attachments

Attachment 1- Ignition Pattern for KNRI-Big Hidatsa RX for Sept 23<sup>rd</sup>,1999