



Homestead National Monument of America 2015 Prescribed Fire Monitoring Report

Natural Resource Data Series NPS/HTLN/NRDS—2016/1004



ON THE COVER

Prescribed fire at Homestead National Monument of America October 16, 2015. Photograph courtesy of Cody Wienk, NPS regional office, Omaha, NE.

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Acknowledgments

Thanks to Sarah Hinman for help with field work and to Homestead National Monument of America for support and access to the park.

List of Terms

<u>Term</u>	<u>Definition</u>
AGL	Above Ground Level
FL	Flame Length
FH	Flame Height
FZD	Flame Zone Depth
HTLN	Heartland Inventory and Monitoring Network
NPS	National Park Service
HOME	Homestead National Monument of America
ROS	Rate of Spread
RH	Relative humidity
StDev	Standard deviation

Burn Operations Summary

Units 3 and 4 at Homestead National Monument of America were burned on October 16, 2015. These units were last burned in 2011. The test fire was started at approximately 1110 on the south perimeter about mid-way between DP-A and DP-B (Figure 1). The ignitions group was split into two teams; one working west and one east from the test fire location. The coordinated ignitions completed the area south of the trail between DP-C and DP-G by 1200. The teams quickly transitioned to complete the remainder of the south sub-unit and were tied in at 1226 between DP-F and DP-G. After a short break to move equipment and personnel to the north sub-unit, ignition operations continued starting at DP-D and were finished by 1325 on the northeast perimeter.



Figure 1. Progression of ignitions during a prescribed fire at Homestead National Monument of America October 16, 2015.

Burn Unit Measurements

Date: October 16, 2015
Unit: 3, 4 (last burned in 2011)
Size: 27.3 acres attempted, acres burned (98.6%)
Vegetation: Restored tallgrass prairie (Fuel model: GR-6/8)
Personnel: Burn Boss: K. Perreault, E. Andreassen (trainee)
Ignition Specialist: M. Koller
Holding Specialist: B. Bundy
Fire Monitor: C. Wienk
Holding Resources: 2 Type-6 engines, 4 UTVs

Objectives The summary section will address how well the burn met prescribed fire objectives. Objectives are taken from the Incident Action Plan (Beacham 2015) as described in the prescribed fire plan (Beacham 2007).

Prescribed fire objectives:

1. Provide for the safety of park visitors and fire staff during operations.

Resource objectives:

1. Reduce shrub and small tree encroachment by 0-25%.
2. Stress cool season non-native grass species.
3. Reduce 1-hour grass litter by $\geq 70\%$ immediate post-burn.

The prescription developed for this burn includes a set of conditions derived to meet the objectives above.

Table 1. Selected prescribed fire prescription elements for fuel model 3 for Homestead National Monument of America. The full prescription can be found in the prescribed fire plan (Beacham 2007).

Variables	Preferred State
Relative Humidity	30-80 %
Wind direction	All winds except S to SW
Wind Speed (midflame)	1-8 mph
Dead Fuel moisture (%) 1-hour	≥ 7 %
Rate of spread (ch/h)	199
Flame length (ft)	16.7
Fireline intensity (Btu/ft/s)	2593

Methods

HTLN's Fire Ecology program has monitored HOME since 2009. This includes collecting a suite of data used to evaluate the effectiveness of fire on the landscape by way of documenting the fire environment (weather, fuels, topography), fire behavior (manner and rate of spread, flame length, etc.), and fire effects (percent of fuels consumed, changes in plant and animal community composition and structure, etc.). More specifically, data collected include fuel load, fuel moisture, soil moisture, burn day weather, fire behavior, smoke observations, and fire severity. Monitoring sites are randomly distributed in Unit 3 and sites are only sampled within the units that burn or are planned to be burned in a given year. Sampling methods for fire ecology monitoring are described in detail in the Fire Ecology Monitoring Protocol for the Heartland Inventory and Monitoring Network (Leis et al. 2011).

The monitoring sites sampled in 2015 were 07, 08, 09, 15, 16, and 17. Site 16 was part of the exclosure in Unit 3 and was not burned as part of the May fire. This was the first time fire ecology data was collected in these monitoring sites.

Collection Dates

Burn day monitoring took place on October 16, 2015. Fire severity, post-burn photo point monitoring, and GPS measurements of the burn perimeter took place on October 17, 2015.

Fuel Load

Grassland fuel load includes standing live, standing dead, as well as litter and duff. Fuel loads are assessed using a clipping technique. We were unable to assess fuel loads on the target burn units prior to the 2015 burn.

Fuel Moisture

1-hour fuel moisture was calculated on site using standard tables and onsite weather data. Fuel moisture, collected the day prior to the burn, affects fire behavior and potentially fire severity.

Weather

Weather and fire behavior were collected in the field by Fire Effects Monitor, Cody Wienk. Those data were used to calculate 1-hr fuel moisture and probability of ignition.

Fire Severity

Fire severity was measured for both vegetation and substrate using a categorical scale where 1 is severely burned and 5 is unburned (Leis et al. 2011).

Geospatial Data

The burn perimeter and unburned patches within the unit were mapped using a Trimble Nomad GPS unit, with a minimum mapping unit set to 0.5-acre for recording burned area. The spatial data were recorded and stored in a geodatabase.

Results

Weather Observations

Weather parameters (Table 2) collected onsite during burning fell within the preferred state of the prescription (Table 1). The sky was clear and sunny throughout the burn period.

Table 2. Weather observations collected at Homestead National Monument of America during the burn on October 16, 2015. Locations refer to points on progression map (Figure 1).

Time	Location	Temp (°F)				Wind		Fine dead fuel moisture unshaded (%)	Prob of ignition (%)
		Dry	Wet	Dew point	RH	Speed (mph)	Dir		
0845		38	36	33	83	Light	NNE	15	10
0945	Trailhead near HQ	46	40	32	59	1-2	N, variable	12	20
1100	South line near test fire	54	44	32	44	2-3	NW	8	40
1200	East line near VC	57	45	31	37	4-6	NE	7	40
1300	DP-D	60	47	33	36	1-3	NNW	7	50

Fire Behavior Observations

Fire behavior measurements are a key component to understanding fire effects (Table 3). During the burn, rates of spread were below prescribed (199 ch/h; Table 1) (Table 3). Flame lengths were also much less than prescribed. Fire intensity calculated from flame heights (Leis et al. 2011) was initially below prescription but then exceeded the prescribed level of 2593 BTU/ft/s.

Table 3. Fire behavior observed at Homestead National Monument of America during the burn on October 16, 2015. ROS (rate of spread), FL (flame length), FL (flame height), FZD (flame zone depth).

Time	Location	Fire type	ROS (Ch/hr)	FL (ft)	FH (ft)	FZD (ft)	Intensity (Btu/ft/s)
1110	Test fire	Backing	4-6	3-4	3	1-2	780.0
1119	Test fire	Head	N/A	10-12	6-7	NA	3661.7
1318	E	Head	20-30	6-8	6	5-6	3120.1



Figure 2. Fire behavior during a burn on October 16, 2015 at Homestead National Monument of America.

Smoke Observations

Smoke dispersal was good throughout the burn (Figure 3, Table 4). Winds remained out of the north, with some variability between northeast to northwest. The smoke column lifted 300-500 AGL before drifting to the south-southeast. Shortly after 1300 there was a brief shift in wind direction and speed while ignition crews were working on the north sub-unit. Wind speeds decreased and shifted to a westerly direction which pushed the column toward Highway 4. This only lasted a couple minutes and there were no significant impacts to visibility on the highway.



Figure 3. Smoke dispersal on October 16, 2015 at Homestead National Monument of America.

Table 4. Smoke observations collected during the prescribed fire at Homestead National Monument of America on October 16, 2015.

Time	Location	Elevation of smoke column (ft AGL)	Smoke column direction	Fireline visibility (ft)	Roadway visibility (ft)	Smoke column description
1130	Visitor Center	300-400	S-SE	≥100	N/A	
1200	Point F	300-400	S-SE	≥100	No issues	Smoke moving away from hwy.
1308	Point E	N/A	N/A	N/A	N/A	Brief push with west wind, minimal impact to the hwy.

Fire Severity

Fire severity and fire intensity are two parameters that contribute to plant mortality. It is often assumed that greater severity and intensity will lead to greater mortality of target species. Fire severity measures provide an indication of the result of the fire by assessing the remaining fuels, stratified by fuel layer (vegetation and substrate). Our assessment focused on herbaceous fuels (Table 4).

Fire severity classes used for monitoring were the following: 0 = NA, 1 = heavy, 2 = moderate, 3 = light, 4 = scorched, 5 = unburned. Fire severity in 2015 was moderate for standing fuels (park mean = 2.3 ± 0.2 stdev). Substrate fuels (i.e., litter, duff, and soil surface layers) mean fire severity was light (park mean = 2.9 ± 0.1 stdev). Moderate vegetation severity is defined by vegetation with unburned grass stubble less than 2 in. tall and plant bases burned to ground level and obscured in ash immediately after burning. Light substrate severity is defined as litter and duff that is only blackened to partially consumed.

Table 4. Post-burn fire severity values by site collected on at Homestead National Monument of America during the burn on 22 May 2015. Standard deviation in parenthesis.

Monitoring Site	Mean Severity Class	
	Vegetation (\pm StDev)	Substrate (\pm StDev)
01	2.1	2.9
03	2.3	3.0
VF14	2.5	2.8
VF19	2.1	2.7
Unit Mean (N=)	2.3 (0.2)	2.9 (0.1)

Severity classes: 1 = heavy, 2 = moderate, 3 = light, 4 = scorched, 5 = unburned

Fuel reduction

Vegetation (standing) fuels were reduced by about 92%. However, the prescribed fire objective of reducing grass litter $\geq 70\%$ was technically not met because substrate fuels (litter, duff, and soil surface) were only reduced by about 57%. However, this may be a semantic difference that will be addressed in a revision to the prescribed fire objectives (pending updating the plan in 2016). Fuel reduction elements have varied from burn to burn, but vegetation fuels have been reduced by $> 70\%$ each year (Table 5). Fuel reduction was inferred by calculating proportions of data in fire severity classes (see methods). The values for substrate and vegetation cannot be combined since the proportion of the fuel load contributed by both elements is unknown. The proportion of fuel reduction calculations are indirect analyses and should be only applied as estimates.

Table 5. Estimated fuel reduction from monitored burns at Homestead National Monument of America. Estimates should be used with caution.

Burn Year	Substrate (%)	Vegetation (%)
2010	37	83
2011	58	72
2014	55	99
2015	57	92

Burn Extent

The area of units 3 and 4 that were attempted burned completely with only an isolated location remaining unburned (Figure 4). 78.2% of the units burned, however, the burn lines were not mowed exactly with the boundaries of the burn units. Completeness calculated based on the mowed lines rather than burn unit boundaries was 98.6% (27.0 acres).

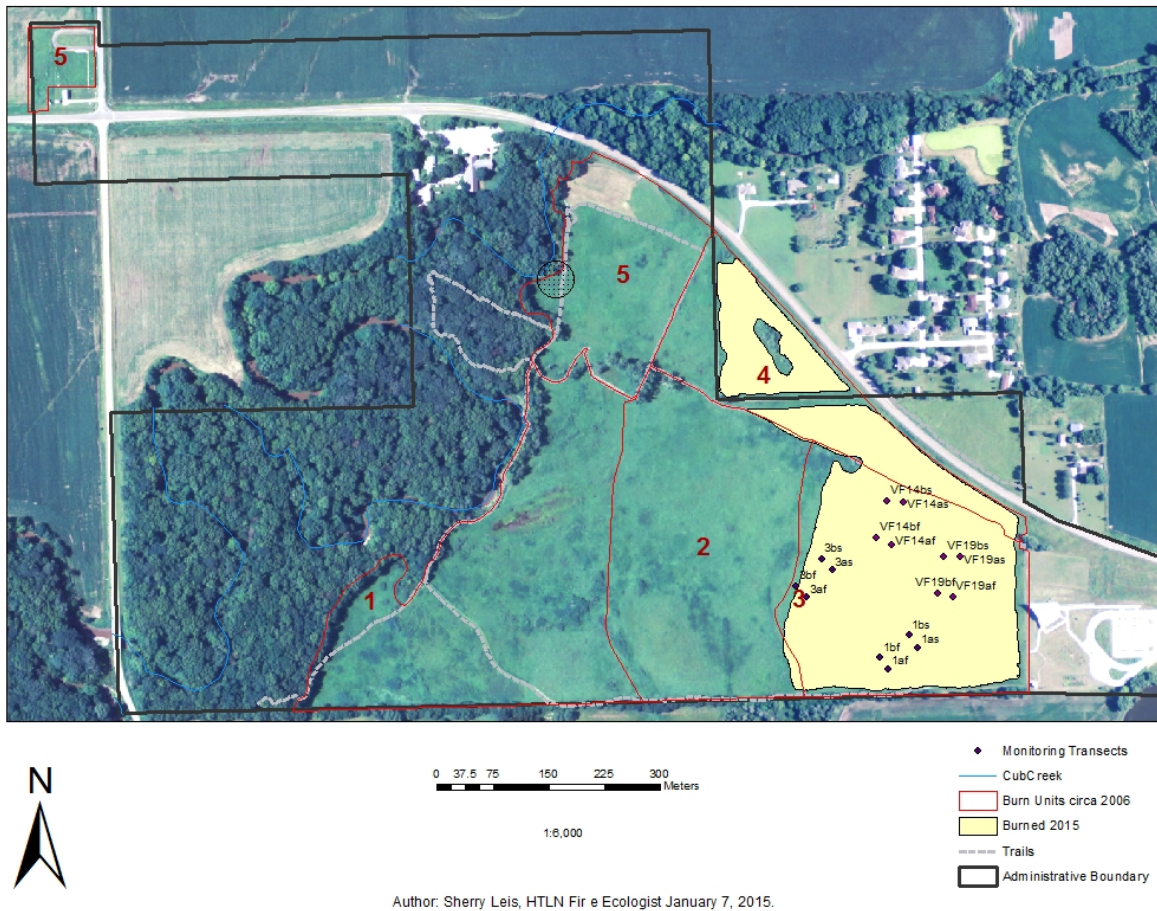


Figure 4. Extent of prescribed fire at Homestead National Monument of America October 16, 2016.

Summary

The prescribed fire at HOME October 16, 2015 met safety objectives including smoke dispersal for the public and firefighters. Weather parameters stayed in prescription during the burn. Fire behavior varied in terms of the prescription since intensity was greater than prescribed and flame lengths were shorter than prescribed. Fire severity was moderate for standing vegetation and light for surface fuels. Future reports may look at the relationship of prescribed fires with vegetation goals such as woody plant and invasive species control.

Literature Cited

- Beacham, S. 2007. Homestead National Monument of America prescribed fire plan. National Park Service.
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Appendix

Post-burn photographs were taken of each of the four monitoring sites. An image from one of the two transects in each site is provided for reference.



Figure A1. Post-burn photo of monitoring site 1 transect BS-BF at Homestead National Monument.



Figure A2. Post-burn photo of monitoring site 3 transect AS-AF at Homestead National Monument.



Figure A3. Post-burn photo of monitoring site VF14 transect AS-AF at Homestead National Monument.



Figure A4. Post-burn photo of monitoring site VF19 transect AS-AF at Homestead National Monument.

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