

National Park Service
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Natural Resource Stewardship and Science

PRESCRIBED FIRE MONITORING REPORT

Fort Scott National Historic Site
(IQCS fire number: 193889)

Natural Resource Data Series NPS/HTLN/NRDS—2011/190

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Burn Unit Summary

Pre-burn monitoring for the FOSC prairie was conducted by the HTLN Fire Effects crew. Monitoring sites were randomly assigned using GIS. Plot installation, photo point collection, and fuel load collection were completed on March 23rd. The remaining data collection was completed on March 24th. Fuel moisture and soil moisture measurements were taken pre-burn. Fire severity and spatial data collection was completed post-burn.

All three units A, B, and C were planned to be burned on March 24th. Deon Steinle, Fish and Wildlife Service, was the burn boss. The units were burned in the order C, B, A using a ring fire technique with adjustments as needed. The test fire for unit C was lit at 1630 hrs from the southeast corner. Unit B was lit from the Southern corner and C was ignited from the northwest corner. Burning was concluded at 1830 hours. An after action review was completed simultaneously with post-burn monitoring.

Burn Unit Measurements

Date: 3/24/11

Unit: A, B, C

Size: planned acres = 3.5, actual acres burned = 3.1.

Vegetation type: Tallgrass prairie (fuel model 3)

Personnel:

Burn Boss: Deon Steinle FWS

FEMO: Sherry Leis, Chris Kopek (trainee)

Team Lead: Dustin Jacob, Bill Peterson and Brittany Cole

Team Lead: Terry Heiser, Andrew Pierce, David Woolman

Staged engine: Dustin Jacob

Goals

Safely and efficiently reduce fuel loads with the use of fire while restoring and maintaining bottomland forest, upland forest, white oak savanna, and tallgrass prairie ecotone of eastern Kansas.

Resource objectives:

1. Burn units with a moderate to high intensity fire 85-95%.
2. Reduce 1-hour fuel loading 50-80%.
3. Reduce all woody plant species in units 40-70%

Prescribed fire objectives

1. Provide for public and firefighter safety.
2. Keep fire inside boundaries of the proposed prescribed fire units.

Table 1. Selected prescription elements. The full prescription can be found in the burn plan.

Variables	
Relative Humidity	25-60
Wind direction	N, S, or any easterly
Wind Speed (midflame)	1-10
Dead Fuel moisture (%) 1-hour	≥6
Rate of spread (ch/h)	286
Flame length, head fire (ft)	20
Fireline intensity (Btu/ft/s)	3892

Fuel Load

Unit C included substantial amounts of oak leaves from surrounding trees. Parts of unit B are heavily shaded and include cool season exotic species as well as elm leaves. Unit A also included a substantial proportion of cool season exotic grasses.

Table 2. Mean fuel load values by burn unit. Fuel load includes standing live, standing dead, as well as litter, and duff.

Site	N	Ton/acre	Stdev (ton/acre)
A	3	2.4	1.6
B	3	2.5	0.4
C	4	4.6	0.5
Park	3	3.1	1.2

Soil Moisture

Soils for this burn were at field capacity prior to the burn, a moist condition. Moisture in unit C was more variable likely because of the surrounding trees and thicker litter layer. Soil moisture can influence the moisture of the duff and litter layers contributing to fire intensity (Table 7) and reducing severity on the substrate (Table 8).

Table 3. Soil moisture. Volumetric soil moisture of 50% is considered a saturated condition, while 25% is the field capacity for plant available water and 10% indicates the permanent wilting point for plants.

Site	N	% volumetric moisture	Stdev
A	3	33.3	1.4
B	3	18.3	1.9
C	4	25.9	4.8
Park	3	25.8	6.8

Fuel Moisture

The prescription (Table 1) called for dead fuel moisture greater than 6%. The total fuel bed met the prescription criteria, but dead alone is unknown. Species of cool season grass were actively growing and added to the fuel moisture total. This level of fuel moisture along with low winds likely contributed to mild fire behavior (Table 7).

Table 4. Fuel moisture. Fuel moisture samples included both live and dead materials from the standing and litter portions of the fuel bed.

Site	N	% moisture	Stdev
A	3	12.1	1.2
B	3	24.7	6.8
C	4	14.5	2.3
Park	3	17.1	6.7

Weather Observations

Onsite weather during the burn fell within the prescribed ranges shown in Table 1.

Table 5. Weather observations. Relative humidity (RH).

03/24		Temperature				Wind		Fine dead fuel moisture	Prob. Of Ignition	Comments
Time	Location	Dry	Wet	Dew Point	RH	Speed	Direction	(Unshaded) %	%	
1700	East Parking lot	48	39	26	42	1	SE	9	30	SE aspect
1800	Unit A, south side	45	37	25	45	2	N/NE	9	30	NE aspect

Smoke Observations

Smoke did not inhibit activities on the fireline. Although the smoke column was low, it did not affect roads or residential areas because of good dispersal.

Table 6. Smoke observations.

Time	Location	Elevation of smoke column (ft)	Smoke column direction	Fireline visibility (ft)	Photo taken
1715	Unit C	40	W	clear	Yes
1735	Unit B	30	W	hazy	No
1800	Unit A, south side	60	W	moderate	No

Fire Behavior

Flame height was not recorded, however, because of the low wind speeds, flame length and flame height may have been similar on level terrain. Fire behavior observations indicated the fire was much less intense than prescribed. For example, rates of spread were slower and flame lengths were smaller than prescribed (Table 1).

Table 7. Fire behavior. Intensity was calculated using the formula $3(10FH)^2$. However, flame length (FL) was substituted for flame height (FH; flame height was not recorded). Rate of spread (ROS), Flame zone depth (FZD)

Time	Location (Unit)	Spread direction	ROS (Ch/hr)	FL	FZD	Fuel model	Intensity (Btu/ft/s)
1712	C	SE	4.5	4-8	3	3	128.8-515.3
1734	B	E	0.9.	1-2	2	3	8.1-32.2
1800	A	NE	4.5	3-5	2	3	72.5-201.3
1811	A	E	2.7	3-4	2	3	72.5-128.8

Fire Severity

Overall fire severity of the vegetation was moderate while the substrate was light. This means that in most samples only stubble < 2 in. remained of the vegetation, but some litter and duff remained on the soil surface. The soil and fuel moisture levels help to explain the less severe effects on the substrate.

Table 8. Fire severity values by site. N= number of samples. Samples were taken every meter along 10-m transects. Unit B included two transects because of the divided nature of the unit.

Site	N	Mean severity class Vegetation	Mean severity class Substrate
A	10	2.7	2.4
B	20	2.6	3.4
C	10	1.2	2.1
Park	3	1.8	2.8

Severity classes: 0 = NA, 1 = heavy, 2 = moderate, 3= light, 4 = scorched, 5 = unburned

Burn Extent

The burn units burned completely with only a few small spots remaining unburned (Figure 1). These spots were below the threshold size (0.4 ha) for spatial data collection.

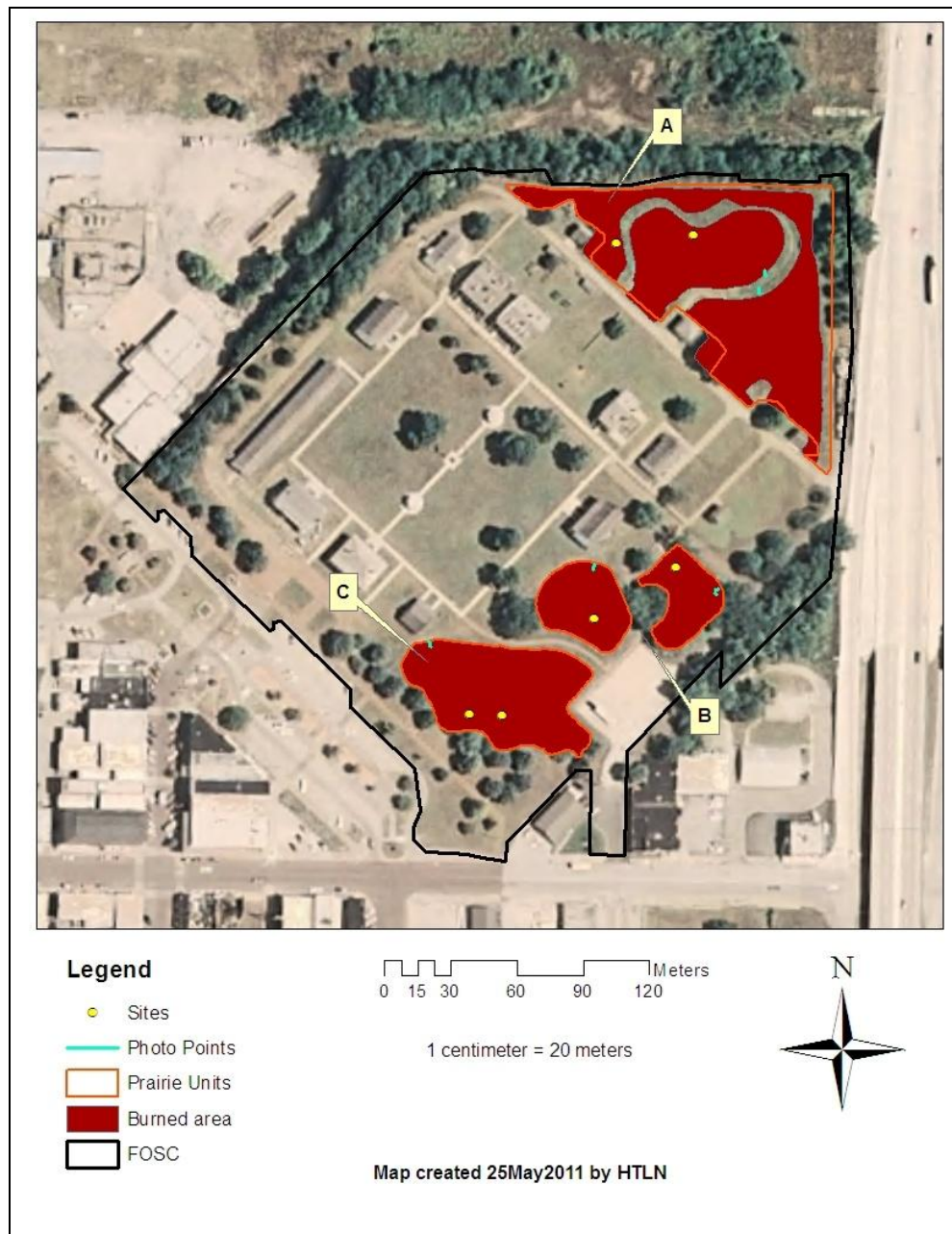


Figure 1. FOSC prairie units burned March 24, 2011. The boundaries of prairie units were collected by GPS prior to the burn as no spatial files were previously available.

Summary

FOSC plans to burn all the prairie units every three years. The 2011 burn was in keeping with that schedule. Additional monitoring was completed this year to support a developing vegetation management plan project which began this spring. Fire ecology monitoring methods were modified from the published protocol to accommodate the small size of the FOSC prairie units. The protocol can be found at:

http://science.nature.nps.gov/im/units/htln/library/Fire/FireEcol_2011_p.pdf. All spatial data will be included in a geodatabase.

The burn plan described specific objectives. The majority of these objectives were met with this fire. Photo points of the monitoring locations are included below for a visual contrast of pre- and post-burn at FOSC.

- Resource objective 1. Units were burned with a low to moderate intensity rather than the goal of moderate to high intensity.
- Resource objective 2. One-hour fuel loading reduction was achieved. Only 1 sample remained unburned (2.5% of the samples) and overall severity was light to moderate indicating that 50-90% of the fuel in sample was consumed.
- Resource objective 3. We are unable to address this objective.
- Prescribed fire objectives 1 and 2 were both achieved as the fire stayed inside the unit boundaries and safety was maintained.

Most criteria described in the prescription were met on burn day with the exception of fire behavior which was milder than prescribed. However, given the proximity to structures, the fire was more manageable than a more intense fire might have been. This burn is likely to stimulate native warm season grasses. Cool season grasses maybe neutrally or negatively affected because of the timing of the burn.

Appendix

Sample Site Photographs



Figure 2. Unit A east pre-burn



Figure 3. Unit A east post-burn. Daffodils remained unburned.



Figure 4. Unit B south pre-burn



Figure 5. Unit B south post-burn



Figure 6. Unit C pre-burn



Figure 7. Unit C post-burn



Figure 8. Unit C Kelley Collins looks on.



Figure 9. Unit B, the tree was surrounded by Japanese honeysuckle.



Figure 10. Daffodils in flames in unit A.