



Tallgrass Prairie National Preserve 2015 Post-burn Summary

Natural Resource Data Series NPS/HTLN/NRDS—2016/1001



ON THE COVER

Photograph of bison in a recently burned grassland at the Tallgrass Prairie National Preserve, 2010.
Photograph courtesy of Sherry Leis, Heartland Inventory and Monitoring Network.

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Abstract

Two Section and East Traps were burned at Tallgrass Prairie National Preserve (TAPR) on April 14th and 15th, 2015. Fuel loads indicated plant communities in those units recovered from recent drought. The burn operation stayed within prescription and safety was maintained. The burn was patchy leaving much of East Traps unburned. In burned areas, fire severity was moderate to light. The patchy nature of the fire (extent and severity), contributed to reaching burn goals of increasing biological diversity by promoting varied plant structure to improve wildlife and nesting bird habitat. Additional goals of removing accumulated fuels were achieved primarily in Two Section.

Acknowledgments

We appreciate the assistance of Kristen Hase with spatial data collection and access to the preserve.

Introduction

Two Section and East Traps pastures were burned at Tallgrass Prairie National Preserve (TAPR) on April 14th and 15th, 2015 (Figure 1). These pastures were last burned one year earlier on April 15th. Primary objectives of prescribed burns at TAPR are to increase biological diversity, improve wildlife habitat, control undesirable vegetation, and manage fuel loads (Beacham 2011). A varied burn and grazing regime is implemented across the preserve to achieve these goals. Fire effects monitoring for the preserve aims to provide data to help managers evaluate the fire program in light of their goals.

Burn Unit Goals

Goals for prescribed burns at TAPR (Beacham 2011):

1. Increase biological diversity by promoting varied plant structure to improve wildlife habitat by implementing a varied fire and grazing regime.
2. Secondary objectives include controlling woody and undesirable vegetation, removing dead or old growth vegetation build-up, promoting re-growth of warm season grass species, and increasing native plant diversity.

The prescription developed for this burn includes a range of options including low, desired, and high (Table 1). Operationally, managers endeavor to maintain the burn within the desired intensity category of the prescription in order to achieve the goals of the burn. Managers recognize they have latitude within the whole range of the prescription to allow for variability of the weather, terrain, and fuels.

Table 1. Prescription elements based on the prescribed burn plan for Tallgrass Prairie National Preserve (Beacham 2011). ROS = (Rate of Spread).

Variables	Fire Intensity		
	Low	Desired	High
Relative Humidity (%)	60	30-45	25
Wind Direction	N/A	Directions that keep smoke off K-177, US-50 and out of Strong City.	N/A
Wind Speed (midflame)	5	7-10	15
1-hr fine dead fuel moisture (%)	12	8	6
Live Fuel Moisture (%)	75	60	30
Maximum Mixing Height (ft)		2,000 feet AGL	
Fuel Model (Number)			
	GR5 (105)	GR6 (106)	
Rate of Spread (ch/h)	370 ch/h	581 ch/h	
Headfire Flame Length (ft)	24 ft	33 ft	
Backfire Flame Length (ft)	3 ft	4 ft	
Backfire ROS (ch/h)	5 ch/hr	7 ch/hr	

Methods

The Heartland Network's fire ecology program has monitored TAPR 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, fuel load, fuel moisture (1-hr and 10-hr), soil moisture), fire behavior (manner and rate of spread (ROS), flame length, smoke observations, etc.), and fire effects (fire severity, percent of fuels consumed, changes in plant and animal community composition and structure, etc.). 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).

We have established virtual monitoring sites within each pasture burned in 2015 (East Traps n=3, Two Section n=5) to provide us with a more comprehensive understanding of fire effects. All monitoring site locations are shown in Figure 1.

Collection Dates

Fuel load sampling took place on October 1, 2014 for both pastures. Fire severity was documented at all sample sites post-burn, on April 20, 2015. Pre- and post-burn photos were taken in conjunction with fuel load and fire severity sampling.

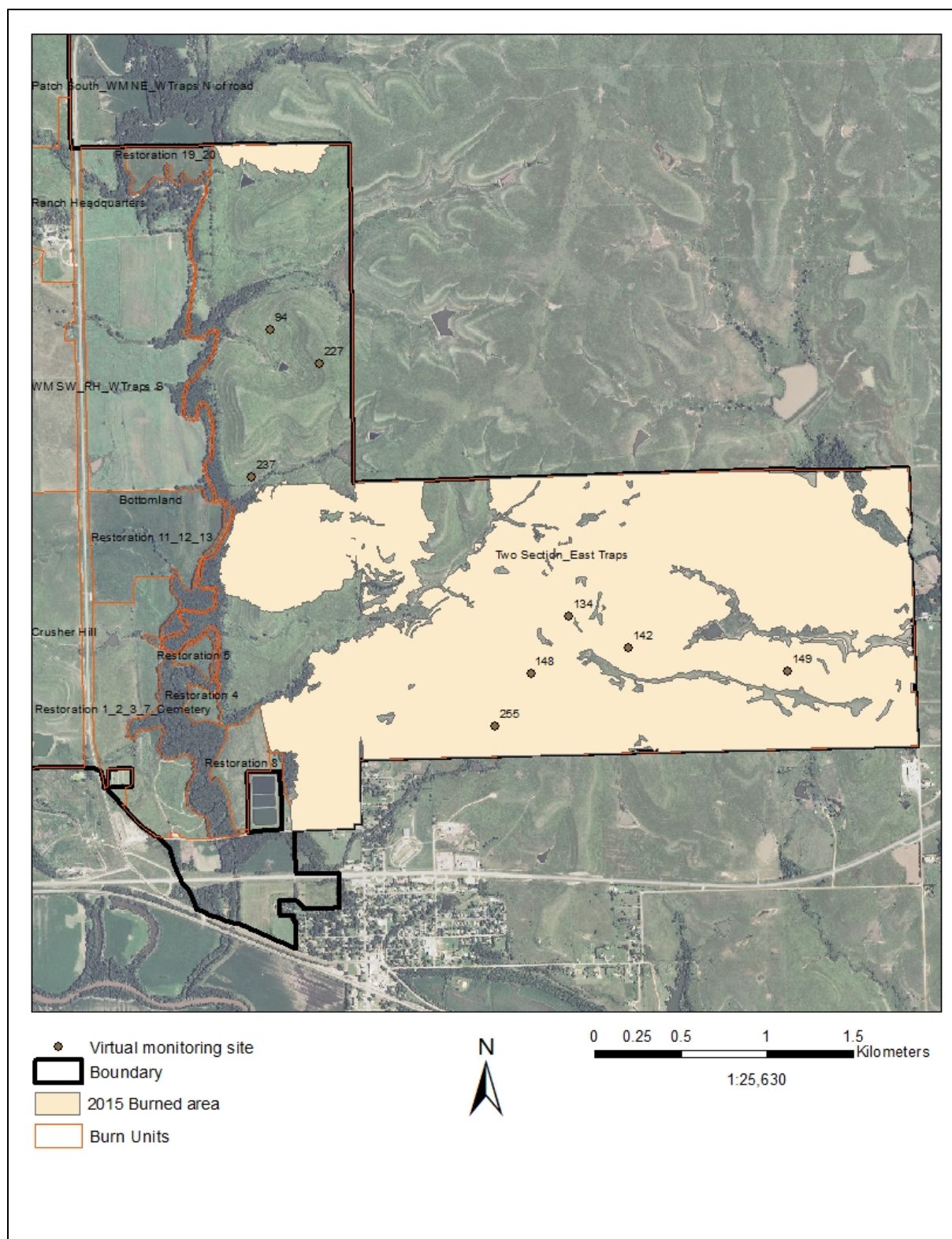


Figure 1. Map of burned areas from April 14th-15th, 2015 burns at Tallgrass Prairie National Preserve with monitoring site locations within East Traps and Two Section.

Fuel Load

We expected 10-20% loss of the fuel bed through decomposition over the winter months; however, the anticipated degradation is within the measurement error of most pastures at TAPR (personal communication C. Owensby 2010).

Fuel Moisture

10-hr fuel moisture values were collected from the Remote Automated Weather Station (RAWS) for burn date. One-hour fine dead fuel moisture was calculated using the RAWS data. Fuel moisture affects fire behavior and potentially fire severity. We were unable to physically collect fuel moisture in the Spring.

Weather

Weather data reported in Table 2 for the burn was collected from the RAWS.

Fire Severity and Fuel Reduction

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). Mean fire severity rankings for each site were used to infer fuel reduction. Proportions of categories for severity were assigned a fuel reduction percent and the sum for all the sites was converted to a percentage. Substrate fuels (litter, duff, soil surface) considered to be eliminated were in severity class 1, 2, and 50% of class 3; while vegetation fuels (standing plant matter) in severity class 1, 2, and 75% of class 3 were considered eliminated. The total for all sites was converted to a percentage for both substrate and vegetation to infer fuel reduction.

Geospatial Data

Spatial data for the fire was collected by Kristen Hase using a Garmin GPSmap 60Cx GPS unit. The data were incorporated into the HLTN fire geodatabase. All spatial work was processed with ESRI ArcGIS version 10.2 software. Percent burned area for the preserve as a whole used the acres within the official boundary of the preserve, planned burn areas, and burned area boundaries for calculation.

Results

Weather

Weather parameters for the spring burns were obtained from the local RAWS station for April 14-15 (Table 2) and fell within the prescription with the exception of wind gusts both days and relative humidity on the 15th. On the 14th, relative humidity was in the high range of the prescription and wind gusts were also in the high category or greater, although average windspeeds were primarily in the desired range. Relative humidity was high on the 15th putting it out of prescription. 1-hr fine dead fuel moistures were in the desired to high range on the 14th but in the low category on the 15th. Wind directions were sufficient both days to keep smoke off of highway 177 as desired.

Table 2. Weather observations collected from the Remote Automated Weather Station (RAWS) for April 14th and 15th, 2015 at Tallgrass Prairie National Preserve.

Time	Location	Temperature °F		Dew Point	RH (%)	Wind		% 10-hr fuel moisture	% Fire Dead fuel moisture
		Dry	Wet			Speed (mph)	Direction		Unshaded
April 14									
1000	RAWS (KTAL)	62	46	31	31	9 (17)	SW	8.6	7
1100		65	46	27	24	10 (20)	NNW	8.0	6
1200		67	48	30	25	11 (22)	N	7.6	6
1300		68	48	28	22	10 (20)	NNW	7.0	5
1400		67	47	28	23	11 (20)	NNW	6.9	5
1500		68	49	32	26	8 (18)	ESE	6.4	6
1600		69	50	34	27	7 (15)	WSW	6.2	7
1700		67	50	35	30	8 (14)	SSW	6.3	7
1800		66	48	32	28	8 (15)	SSE	6.2	9
April 15									
1000	RAWS (KTAL)	51	49	48	91	7 (11)	SE	16.4	14
1100		55	50	47	75	10 (15)	SSW	17.0	12
1200		57	51	48	71	7 (14)	SSW	14.1	10
1300		59	53	50	72	9 (16)	WSW	12.2	10
1400		61	56	52	73	8 (15)	WSW	11.5	10
1500		62	56	52	71	8 (14)	NNE	11.0	10
1600		62	56	53	72	10 (17)	WNW	11.5	11
1700		60	55	53	77	9 (17)	NE	11.5	12
1800		59	55	52	78	11 (19)	WSW	12.8	14

Fire Severity

We measured fire severity for both vegetation (standing) and substrate (litter, duff, and soil surface) fuels; severity was assessed using a five point class scale. Severity classes are as follows: 0 = NA, 1 = heavy, 2 = moderate, 3 = light, 4 = scorched, 5 = unburned. Mean fire severity for vegetation was 2.5 ± 0.28 (standard deviation) (moderate-light) and substrate was 3.5 ± 0.09 (light-scorched), indicating a light to moderate severity burn. In comparison to the 2014 burn, fire severity was similar for vegetation $2.4 (\pm 0.12)$ and slightly more severe for substrate $3.0 (\pm 0.14)$ in 2014. Moderate standing severity is defined by vegetation with unburned grass stubble less than 2 inches 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.

Fuel Load

At TAPR, fuels tend to increase with time since fire (Leis and Hinman 2015) however; grazing regime and annual precipitation play a significant role in determining aboveground biomass. Fuel load values collected for the 2015 burn were very similar to those collected in the same pastures in March of 2014 (Table 3).

Table 3. Fuel load collected on October 1, 2014 at the Tallgrass Prairie National Preserve.

Unit	Fuel Load (tons/acre) ($\pm$ standard deviation)
East Traps	2.1 (0.7)
Two Section	1.0 (0.2)
Park	1.6 (0.4)

Fuel Reduction

Since none of the three monitoring sites in East Traps burned, we calculated fuel reduction for each pasture separately (Table 4) from the unit as a whole. However, figure 4 shows that a small portion of East Traps did indeed burn. 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 measurements and should be only applied as estimates

Table 4. Fuel reduction values for April 14-15, 2015 burn at the Tallgrass Prairie National Preserve.

Unit	Vegetation Fuel Reduction (%)	Substrate Fuel Reduction (%)
East Traps	0.0	0.0
Two Section	85.5	24.4
Park	53.4	15.2

Burn Extent

Large portions of East Traps did not burn including all three monitoring sites within the pasture. (Figure 1). Although all five monitoring sites in Two Section did burn, the burn was decidedly patchier than in years prior (S. Leis, pers. obs.). 66.6% (1,376 acres) of the combined pastures burned.

Discussion

The April 2015 burns in Two Section and East Traps were patchy and incomplete. However, this mosaic of burned and unburned areas produces a varied plant structure which is beneficial to wildlife and meets one of the preserve's primary burn objectives. Cattle are also typically attracted to burned areas further increasing heterogeneity and biodiversity (Fuhlendorf et al. 2008). Prescribed fire objectives for public and staff safety were met for this burn and parameters stayed in prescription with the exception of wind gusts and low relative humidity on the second day of burning.

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Appendix A

Due to poor weather in October 2014, we were only able to take pre-burn photos at one monitoring site in Two Section (VF255).

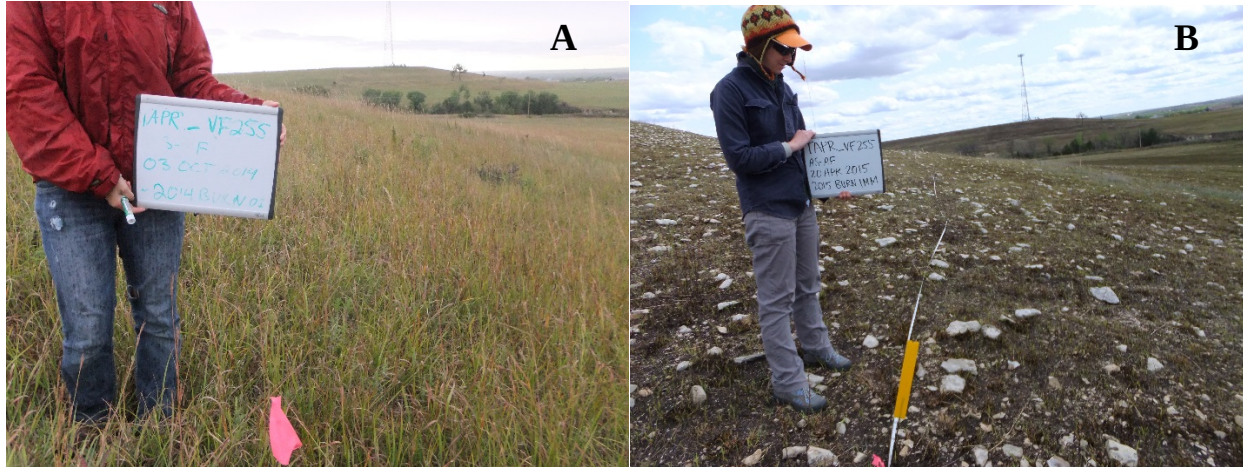


Figure A1. Monitoring sites VF255 pre-burn in October 2014 (A) and post-burn on 20 April 2015 (B) at Tallgrass Prairie National Preserve.



Figure A2. Monitoring sites VF142 (A) and VF149 (B) on 20 April 2015 at Tallgrass Prairie National Preserve.

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