

Devils Tower National Monument Belle Fourche Prescribed Fire

May 7, 2013

Prepared by Dan Swanson

Burn Unit Summary

The Belle Fourche prescribed fire was completed May 7, 2013. This was the second prescribed fire entry into this unit in the past 15 years. The first prescribed fire in the unit was on April 29, 1998, and resulted in moderate to high Ponderosa pine overstory mortality in the south-central portion of the unit. Many of the snags created from the first prescribed fire have fallen to the ground which resulted in a high downed woody fuel loading. Reducing the heavy fuel loading in the unit was the primary objective for this prescribed fire. The 300 acre unit was located within open ponderosa pine communities with an understory consisting of mixed-grass prairie species. All interior and blacklining ignition operations were completed by 1830 on May 7. At 1342 on May 8, the prescribed fire was converted to wildfire as a 3-acre spotfire was unable to be contained southwest of the unit. The wildfire burned a total of 59 acres with only $\frac{3}{4}$ of an acre outside the park boundary.



A backing surface fire consuming woody fuels.

Objectives

- Achieve > 50% reduction in the 1 & 10 hr fuel loading.
- Achieve > 20% reduction in the 100 & 1000 hr fuel loading.
- Achieve > 20% decrease in non-native herbaceous cover two growing seasons after the burn.
- Burn > 70% of the project area to produce nutrient flush and to encourage the growth of native prairie grasses and forbs.
- Maintenance of ponderosa pine and mixed-grass prairie ecosystem with the use of fire.



Surface fire consuming standing and downed snags.

Personnel

Burn Boss: Al Stover, Kenn Perreault (trainee)

Task Force Division Lead #1: Lee Dueker

Task Force Division Lead #2: Eric Allen

Fire Monitor: Dan Swanson

Information Officer: Nancy Stimson

4 Type 6 Engines

2 firing teams of 4 personnel each

4 UTV's

Weather conditions

The National Weather Service in Rapid City predicted mostly sunny skies with a slight chance of showers and thunderstorms after 3:00 p.m. Southerly winds were forecasted in the morning becoming light and variable in the early afternoon and then turning easterly later in the day. The Spot forecast was very accurate for temperatures, relative humidity, and wind speed/direction.

Weather Observations May 7, 2013

Time	Temp.	RH	Wind Speed	Wind Direction	Comments
0950	63	38	2 G4	WSW	Test burn commenced at 1000
1100	68	32	3 G5	SW	
1200	71	25	3 G6	SE	
1300	71	25	2 G4	Var.	
1400	69	23	1 G3	ENE	Smoke column shading unit
1500	73	21	3 G5	E	Smoke column shading unit
1600	73	24	2 G4	ESE	Smoke column shading unit
1700	73	21	7 G10	ENE	Smoke column shading unit
1800	71	28	2 G4	ENE	Smoke column shading unit
1900	69	29	3 G5	NNE	

Wind speed in miles per hour, Temperature in degrees Fahrenheit

Fire Behavior

May 7

The test burn and fire ignition teams started from DP 9 due to the forecasted southerly winds. Prior to the test-burn at 0950, winds were upslope at 2 mph gusting to 4 mph from the west-southwest. The testburn was completed at 1000, and the winds were generally from the southwest or southeast for the next two hours. Backing and flanking rates of spread were observed between DP9 and DP10 from 1130 to 1220 of 0.5 to 1 ch/hr. Flame lengths were between 6 inches and 1 foot. By midafternoon backing flame lengths had increased to 1 - 2 feet west of DP4 with rates of spread still at 0.5 ch/hr. Isolated tree torching could be seen in some trees west of DP4. Both ignition teams generally used backing and flanking fire types as the burn unit was blacklined along the northern and western boundaries. Rates of spread in the timber were low with heavy fuels consuming well. Head fire activity was observed east of the administration building at 1720 with rates of spread of 20 ch/hr with flame lengths of 2 – 3 feet.

Fire Behavior Observations May 7, 2013

Time	Location	Fire Type	ROS	FL	Comments
1020	Near DP9	---	---	---	1000 hr fuels burning hot. Pole trees torching
1130	SE of DP9	B	½	6-9”	Surface fire carrying through needles
1145	B/W DP9 & DP10	B	1	6-24”	Surface fire carrying through grass
1220	E. side of tower – Tower tr.	F	½	6-12”	Surface fire carrying through needles
1550	W. of DP4 – Red Beds tr.	B	½	6-12”	Isolated tree torching
1720	E. of Admin.	H	20	2-3’	Surface fire carrying through grass
1740	E. of Admin.	B	1/2	6-24”	Surface fire carrying through grass

B=backing fire; F=flanking fire; H=head fire

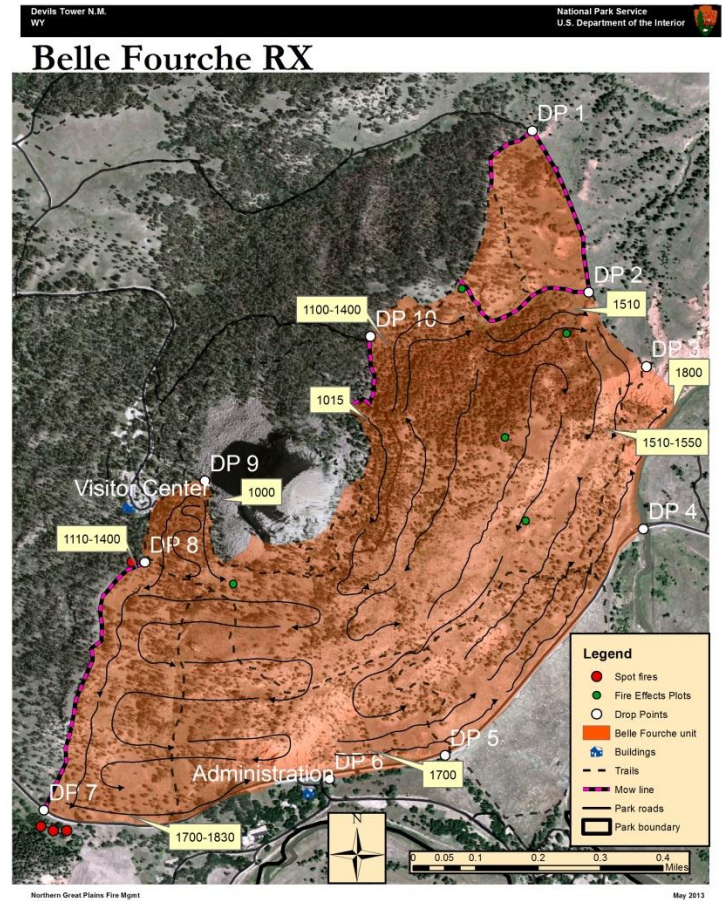
ROS = rate of spread measured in chains per hour (1 chain = 66 feet or ≈ 20 meters)

Fire Progression

May 7

With southerly winds forecasted for the morning, the test burn was initiated at DP 9 at 1000 on May 7. Winds were upslope from the west-southwest at 2-4 mph during the testburn. Shortly after the burn was determined a “go” at 1015, task force division team 2 blacklined the “finger” of the burn unit to the south of DP 9. Task force division team 1 positioned themselves about 0.10 miles south of DP 10 and an ignitor blacklined south towards DP9 and returned towards DP 10 adding depth to the perimeter. Another ignitor on ignition team 1 blacklined towards DP 10. At 1100 ignition team 1 reached DP 10. Once the area directly to the west, south, and east of the tower was secure, ignition team 2 blacklined towards DP 8. Task force division 2 reached DP 8 at 1110. A spotfire was detected and contained along the western boundary of the unit just west of DP 8 from 1300 to 1400. During this time period, ignition team 1 held up on ignition. Shortly after 1400, ignition team 1 left DP 10 and blacklined towards DP 2. At 1510 multiple ignitors from ignition team 1 strip head-fired the unit from DP 2 to DP 4. Ignition team 2 strip head-fired the western portion of the unit between DP 8 and DP 7, while ignition team 1 strip head-fired from DP 4 to meet up with ignition team 2. While ignition team 2 was at DP 7, a large ponderosa pine torched and sent embers across the perimeter to the southwest and started several small spot fires. Six to eight personnel quickly responded to the spot fires and put them out within 30 minutes. Following the strip head-firing of the interior of the unit, ignition team 1 brought fire east along the road from the administration building. They tied in with the Red Bed formation near DP3 at 1800. After the spot fires were secure near DP 7, ignition team 2 brought fire east along the road and tied in with ignition team 1’s black at the administration building at 1830.

Fire Progression Map



Belle Fourche Wildfire

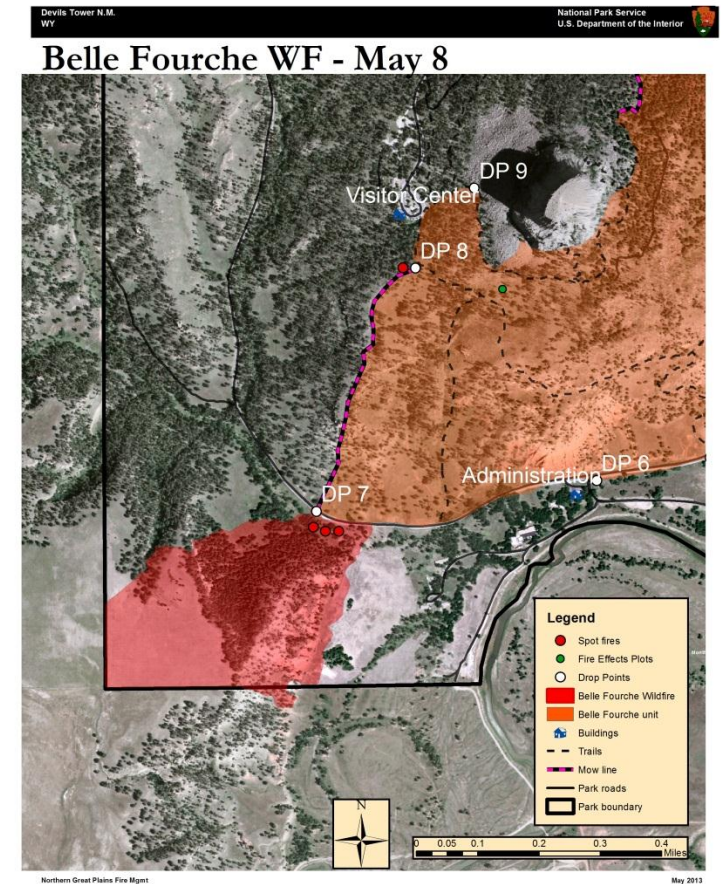
May 8

At 1250, a 3-acre spotfire was detected southwest of DP 7 in the same area that several spotfires were contained during the prescribed burn on May 7. The spotfire moved quickly uphill (southwest) in a ponderosa pine stand with grass and needlecast understory. Initially Koller and engine 628 worked the left flank and Engine 623 on the right flank. Dueker and Andreassen soon arrived and established line on the right flank. Nellen ordered a single engine air tanker (SEAT) to assist with control efforts. The wildfire continued moving uphill toward a cliff-band and Stover decided to convert it to a wildfire at 1342. Additional resources were ordered immediately, including six type 6 engines, one type 3 engine, one type 4 engine, and three 20-person crews. At 2004 a line was established around the wildfire, burn-out operations completed, and the wildfire 90% contained. Green-up had taken place in the prairie on the private property adjoining the southwest and southern park boundaries which aided the personnel in control efforts. No additional acres were burned from this point forward and the wildfire was contained at 1902 on May 9 at 58.8 acres.

Smoke Monitoring

May 7

The National Weather Service forecast predicted “fair” smoke dispersal during the morning increasing to excellent in the afternoon, with mixing heights between 1200 and 1800 feet above ground level (AGL) until noon then increasing to 10000 feet AGL in the afternoon. Winds were generally from the south and southeast in the late morning to early afternoon and the smoke column was pushed to the north-northwest. Smoke column heights were around 300 feet at 1120 rising to 700 feet AGL by 1230. Smoke column heights continued to increase in the afternoon with a peak height of 1200 feet AGL occurring at 1530. Late afternoon into evening the smoke column height decreased significantly. Smoke column heights were



800 feet at 1715 and 150 feet by 1900. Smoke column direction shifted from the northwest at 1715 to the southwest at 1900.

Fire Effects Monitoring

On May 8 post-burn data from four plots were collected in the unit. Analyses indicated that 1 and 10 hr fuel loading decreased by 69 and 70% respectively. 100 hr fuel loading was unchanged and 1000 hr fuels were reduced by 66%. Total fuel load was reduced by 61%.

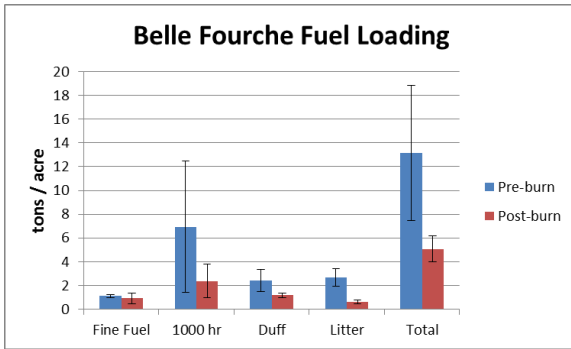


Figure 1 Changes in fuel loading in 4 monitoring plots at Devils Tower N.M. following the Belle Fourche prescribed fire. Values represent means \pm 1 standard error.

Severity measurements on these plots indicated the substrate burn severity was predominantly light indicating that the litter was partially to entirely consumed. Specific substrate burn severity classes were 69% light, 23% moderate, and 6% heavily. Vegetation severity was predominantly light indicating the foliage and smaller twigs were partially/completely consumed. Specific vegetation burn severity classes were 68% light, 27% moderate, and 6% heavily.

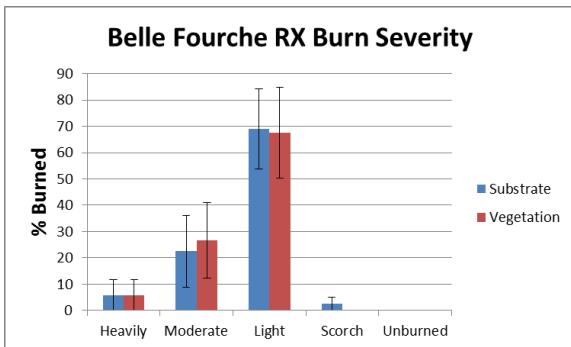


Figure 2 Burn severity classes from 4 monitoring plots at Devils Tower N.M. following the Belle Fourche prescribed fire. Values represent means \pm 1 standard error.

Conclusions

This unit was previously burned in the April 1998 prescribed fire and had heavy fuel loading in the south-central portion of the unit due to significant overstory ponderosa pine mortality. Many of these snags had accumulated on the ground and the reduction of this large diameter fuel loading was a primary objective of the burn. Fuel loading decreased by approximately 70% in the 1 and 10 hr fuel size class which exceeded the objective of a 50% decrease. Although the 100 hr fuels did not change following the burn, they comprised a very small amount of fuel loading at preburn levels. 1000 hr fuels comprised the largest woody fuel size class and decreased by 66% which far exceeded the objective of a 20% reduction. Secondary objectives were also met which included reduction of herbaceous thatch, nutrient recycling, and maintenance of native prairie ecosystems. Any wildfire that results from a prescribed burn is highly undesirable and rare (< 1% of all prescribed burns result in wildfires). However, the resource benefits of this particular wildfire that spread into the Southwest unit was beneficial for several reasons including that it was a low severity ground fire that consumed woody fuel biomass, and it recycled these nutrients back into the ecosystem which in turn will invigorate the native grasses and forbs in the understory.



Smoke column the evening following prescribed burn