

Wind Cave National Park Rankin Ridge Tower Prescribed Fire Monitoring Report

*Prepared by Sabrina Henry
Wind Cave National Park*



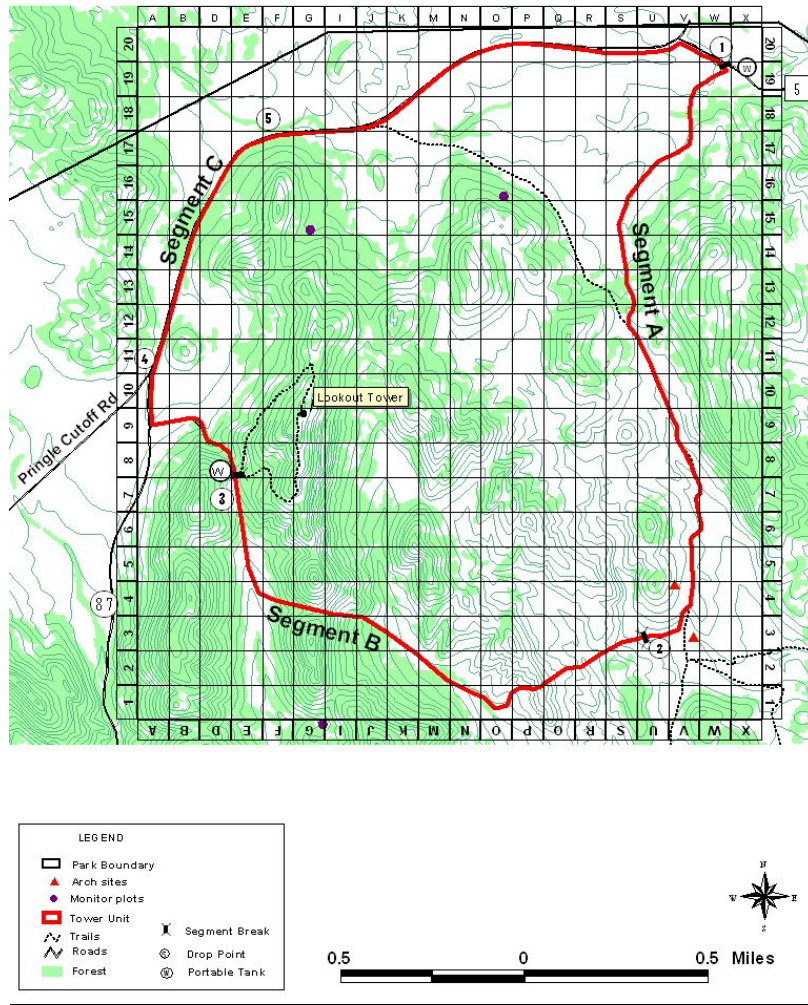
Introduction

The Tower Prescribed Fire encompasses 1231 acres and is the northernmost block of the Rankin Ridge prescribed fire unit. It is located in the northwest section of Wind Cave National Park along highway 87 and includes the Rankin Ridge Lookout Tower. This project is rated as a type 1 prescribed fire and consists of ponderosa pine forest and mixed-grass prairie. Ignition occurred on 3 days in the fall of 2005. Blackline ignition operations occurred on the east and south perimeters on September 15 and 21 and the broadcast burn was ignited in one operational period on October 25, 2005.

Vegetation Type: 60 % Native Mixed Grass Prairie, dominated by western wheatgrass
40 % Ponderosa Pine

Personnel: Burn Bosses: L. Dean Clark (IMR) and Dan Morford (WICA) trainee
Ignition Specialists: Mack McFarland (GRTE) and Eric Allen (WICA) trainee
Holding Specialist: Steven Ipswitch (WICA)
Fire Monitors: Katie Johnson (lead), Andy Thorstenson, Tyler Schmitt, and Sabrina Henry
Lookout/Human Repeater: Martha Jakobek (WICA)
Task Force Leader and Ignition (respectively):
Segment A: Rick Mossman (WICA), Sonya Feaster (WICA)
Segment B: Rick Mossman (WICA), Bob Kobza (WICA)
Segment C: Scott Beacham (MWR), Jim Dahlberg (WICA)
Plastic Sphere Dispenser Operator: Lance Spring (BHNF)
6 Type 6 Engines, 4 ATV's with water, 1 Water Tender, 1 Type 3 helicopter

Tower Project Map



Objectives

Objectives of the Tower RX are as follows:

Grasslands:

- Reduce grass thatch by a minimum of 25%.
- Increase native grasses to >75% of grass cover in areas of cool season grass and >95% of grass cover in areas of warm season grass

Forest:

- Achieve 20-40% mortality (within 2 yrs. post-burn), in ponderosa pine with >6" dbh.
- Achieve 40-60% mortality (within 2 yrs. post-burn), in pole size ponderosa pines (1-6" dbh).
- Achieve 70-90% mortality (within 2 yrs. post-burn) in ponderosa pine seedlings

Summary of Events

In preparation for the burn, the Wind Cave fire crew cleared dead and down fuel in timbered sections along the planned perimeter and mowed lines along the east and south perimeters. The mowed lines were then reinforced with a black line along Segment A and part of Segment B. The black line operations were conducted on September 15 and 21, 2005 with approximately 20 Wind Cave park personnel. On September 15, 1 ¼ mile of the east perimeter was black lined. On September 21, approximately ½ mile of black line was completed on the south east perimeter. Highway 87 served as the control perimeter along the west and north sides (Segment C) of the unit. Wind Cave staff also set up a 5400' hose lay along Segment B to reinforce the south control line that was not black lined. Portable tanks and pumps were established strategically around the perimeter of the burn unit, a contingency 5,000 gallon water tank was set up along highway 87 south of the unit, three helispots were established throughout the park for the helicopter, drop point signs were posted, and drip torch fuel mixed. A portable weather station was set up near the Rankin Ridge Fire Tower.

Northern Great Plains Fire Monitors installed 2 long-term fire effects monitoring plots to measure fuel load, tree density, and vegetation cover. Fuel and soil moistures were collected and calculated from the monitoring plots prior to the burn.

The Tower burn briefing was conducted at 0900 on October 25. After evaluating the spot forecast from the National Weather Service, the portable weather station observations and the on-site weather observations, it was determined that the weather was compliant with the burn prescription. Following a successful test burn, ignition of the burn unit commenced at 1045 and ceased at 1535 the same day.

Weather Observations

On-site weather monitoring for the Tower Prescribed Fire began at 0730. Weather observations prior to 0730 were taken from the portable weather station. Observations were taken and broadcast on the command radio frequency every hour, on the hour, beginning at 1000 until ignition was completed at 1535. On October 25, 2005 the temperatures during ignition ranged from 60 to 66 degrees Fahrenheit and relative humidity ranged from 21-30%.

The spot weather forecast predicted 20-foot winds to be west at 2 to 4 miles per hour becoming northeast in the afternoon. During briefing, weather observations taken by the fire monitors recorded variable winds well within the prescription parameters. Winds observed throughout the burn period were variable from the southwest to the northeast ranging from 1 to 5 miles per hour. Winds were predominately terrain driven. Observed weather conditions from the black line operations and broadcast burn are summarized in Table 1.

Weather Observations, Table 1.

Black Line Operations, September 15.

Time	Temperature		Dew Point	RH	Wind		Comments
	Dry	Wet			Speed	Direction	
0710	53	44	35	51	0-2	var	1 st observation for spot
0730	57	46	36	45	1+	var	2 nd observation for spot
0930	68	52	39	35	1+	E	
1000	69	52	38	33	0-3	NE	Winds coming around terrain
1100	72	53	38	29	1-5	Var SSW	Winds SSE-SSW down drainage but variable
1200	74	54	39	28	3-7, g-9	SSW	Down drainage
1300	72	52	35	26	5-8, g-12	SW	Strato-cumulus to NW
1400	71	51	33	25	6-10, g-16	SSW	Winds 10+ for 10 min, now calmer
1520	72	52	35	26	1-3, g-5	SW	40% cc, puffy q
1645	76	53.5	35	23	2-5	SW	10%

Black Line Operations, September 21.

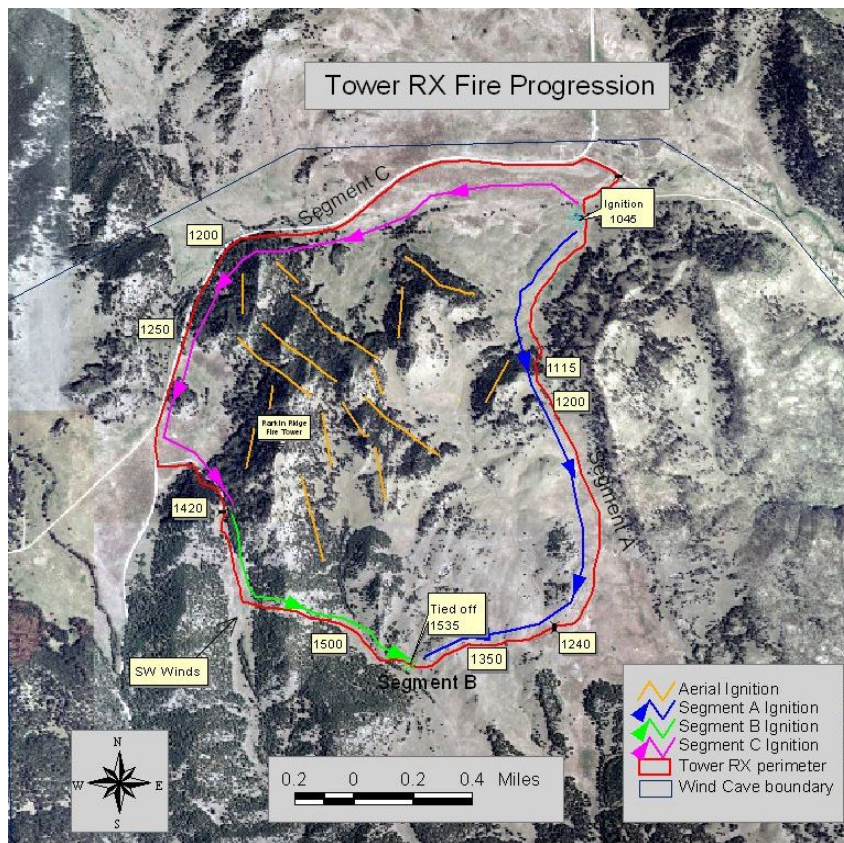
Time	Temperature		Dew Point	RH	Wind		Comments
	Dry	Wet			Speed	Direction	
0730	71	52	36	28	8-10, g-15		50% cumulus, 1 st observation for spot
0830	75	54	38	26	6-8, g-12	E	50% cumulus, 2 nd observation for spot
0920	72	50	29	20	0-4	NNE	40% cc
1000	78	54	34	20	1+	var	No breeze in canyon bottom, 5-8 on ridge top
1025	-	-	-	-	12-15, g-18	ENE, NE, NNE	5-10 min. of gusty winds, 12-15, g-18 on ridge top
1105	82	57	39	21			
1115	81	56	37	21	0-4	ESE	2 nd spin, 60% puffy q./stratus
1140	-	-	-	-	2-6	Var. upslope S	Clouds, thin cirrus
1205	82	56	36	19	12-15, g-18	Upslope S	Wind & terrain aligned at ridge, 6-8, g-12 in bottom
1240	84	58	40	21			Cirrus drainage
1325	85	59	41	22	7-10	S	
1430	80	55	35	20			

Broadcast Burn, October 25.

Time	Temperature		Dew Point	RH	Wind		Comments
	Dry	Wet			Speed	Direction	
0730	34	30	24	65	1-3	SW	clear
0930	51	41	30	44	0	-	clear
1000	59	46	34	38	0-2	E	clear
1100	63	47	31	30	3	SW	clear
1200	66	48	31	26	2-4	var./ N	
1300	66	49	34	30	2-5	SE	
1400	63	47	31	30	1-3	NE	
1500	64	45	23	21	1-5	Upslope SE	
1600	64	46	27	24	Light	SE	

A RAWS (Remote Access Weather Station) was set up near the Rankin Ridge Fire Tower

Fire Progression



Following a successful test burn, ignition on the Tower Prescribed burn began at 1045 at the northeastern corner along Segment A. Two ignition teams began lighting south along Segment A and east along Segment C with the Segment C team igniting ahead of the Segment A team to compensate for the westerly component in the south winds. At 1210, aerial ignition was

initiated on the northeastern slopes of the ridges east of the fire tower. Around 1320, helicopter began lighting west, north and east of fire tower. By 1420 Segment C ignition team tied in to the Segment C/B break. By 1240 the Segment A ignition team tied in to the Segment A/B break and continued along Segment B until 1350 when winds shifted to the south and the team held up. At 1330 Segment B ignition team ignited along the Rankin Ridge Tower road and burned out around the weather station at 1425. Aerial ignition ceased at approximately 1500. Very pistols were occasionally used to ignite the interior of the unit along Segment B. Segment B ignition team and Segment A team tied in with each other along Segment B completing perimeter ignition at 1535 hours.

Fire Behavior Observations

During the Tower burn, fire activity was monitored in different fuel and vegetation types, on all aspects, and on varying slopes. Fire intensity, rate of spread, and flame lengths were measured as the fire moved through the burn unit. Monitoring took place throughout the day in order to assess changes in fire behavior. The highest intensity behavior occurred between the hours of 1130 and 1430. After 1300 hours, much of the fire was shaded by the smoke column which limited fire behavior.

In Fuel Model 1 (both native and non-native mixed-grass prairie), observed flame lengths for backing and head fire ranged between 6 inches to 7 feet. Rates of spread for backing and head fire in Fuel Model 1 averaged 3 chains an hour with a maximum observed rate of 48 chains an hour.

In Fuel Model 2 (ponderosa pine), observed flame lengths for backing/flanking fire ranged from 4-18 inches with rates of spread at 0.5 to 3 chains per hour. Isolated torching of small ponderosa pine regeneration pockets occurred during the burn with some crown to crown spread.

Fire Behavior Observations, Table 2.

Fire Behavior in Segments A & C

Time	Location	Fire Type	ROS	FL	Fine Dead	Comments
1100	Test burn, northeast corner	b	1.3	8-12"	10%-s 8%-u	Continuous fuel, FM 1 little bluestem grass
1106	Test burn, dog town	h	0	0		<5% active perimeter
1125	little bluestem	h	48	4-7'		Uniform flame front fire whirls
1140	Meadow NE DP 1	b-h	2	6-10"	6%	Fire whirls
1230	Plot 2-9	All	Minimal	4"	9%	Minimal spread, fully shaded
1430	Tower slope	f	3	8-18"		Occasional torching in 5' tall pine regeneration
1515	"	b	0.5	4-8"		Picturesque backing fire
1525	"	b	0.5	4-8"		Flame impingement duration on seedling pipo 1:15 min

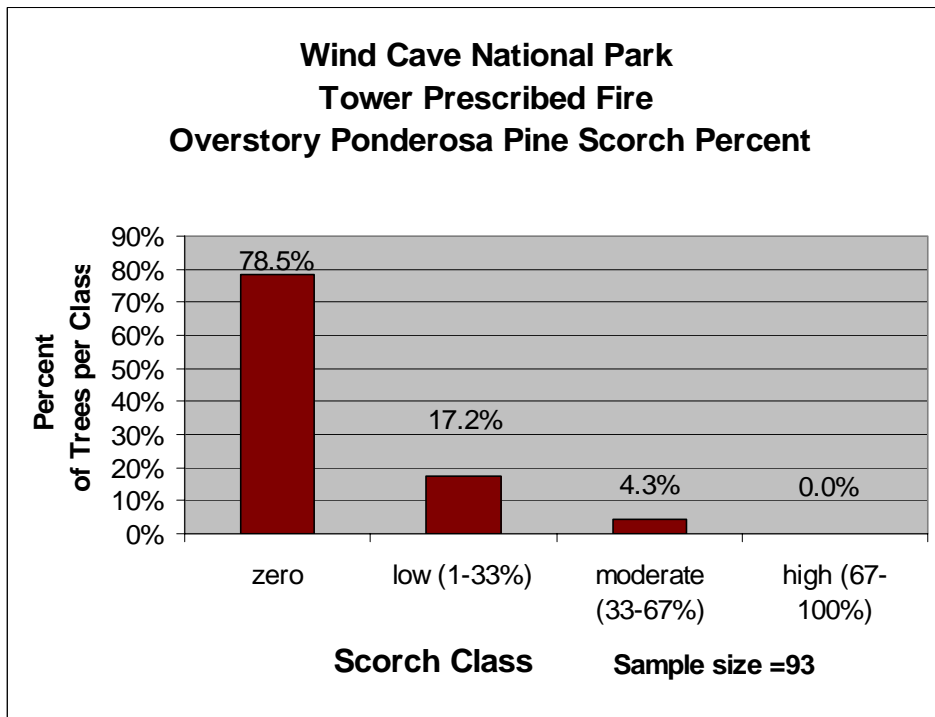
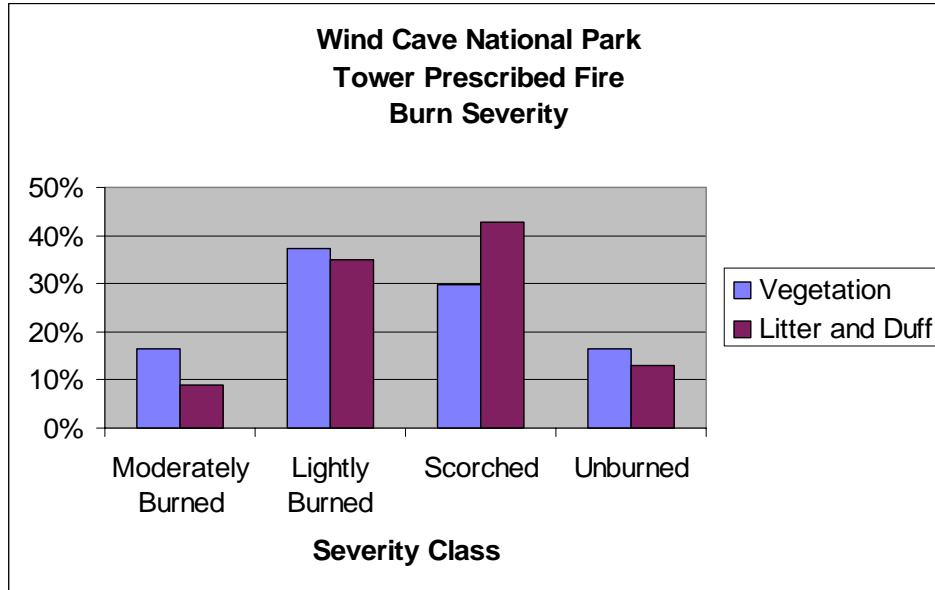
Fire Behavior in Segment A & B

Time	Location	Fire Type	ROS	FL	Fine Dead	Comments
1220	Segment A saddle	h/f	15	2-3'	6%	
1230	"	f	<1	6-24"	9%	Protected; needle cast; heavy duff accumulation
1240	"	h	6	6-24"		Patchy fuel; grazed; brja
1325	Midpoint S line (seg B)	b/f	3	2'		SE aspect
1428	"	b	3	2'		SW aspect
1430	"	h	20	3-5'		Smoke development over unit
1500	Segment B (K3)	b	1.5	10"	*5%-u 8%-s	Open pine woodland; *FD taken at SW corner of seg B.

ROS = rate of spread measured in chains per hour (1 chain = 66 feet or 20 meters); b = backing fire; f = flanking fire; h = head fire

Fuel Loading and Burn Severity

Plot	Transect	Pre-burn	Immediate post-burn	Change	Percent Change
pipo2-6	1	20.84	15.32	5.52	-26.5%
pipo2-6	2	17.71	15.15	2.56	-14.5%
pipo2-6	3	29.21	18.17	11.07	-37.9%
pipo2-6	4	24.35	15.06	9.29	-38.1%
Plot Total		23.03	15.93	7.11	-29.3%
pipo2-9	1	30.95	13.34	17.60	-56.9%
pipo2-9	2	43.90	11.81	32.08	-73.1%
pipo2-9	3	30.12	11.56	18.56	-61.6%
pipo2-9	4	40.33	22.13	18.20	-45.1%
Plot Total		36.33	14.71	21.61	-59.2%
Total		29.68 Tons/Acre	15.31 Tons/Acre	14.36 Tons/Acre	-48.4%



Fire Monitoring

There are two forest plots located within the Tower burn unit in Wind Cave National Park. Both plots are dominated by ponderosa pine and located on northern aspects. Post burn fuel load, burn severity of vegetation and substrate (litter and duff), and scorch percent were calculated. As observed in the immediate post-burn visit approximately 80% of the total area burned. Calculations show there was almost a 50% reduction in woody fuels as depicted in the above figure. In the two plots, post-burn severity assessments showed: 16% of the vegetation as

moderately burned, 37% as lightly burned, 30% as scorched and 16% as unburned. Substrate severity measurements showed: 9% as moderately burned, 35% as lightly burned, 43% as scorched and 13% as unburned. This translates that the burn severity may be low due to the fact both plots are located on north aspects. Higher severity was observed on east and south aspects following the fire though there are no plots in these locations to quantify severity. These plots will be read 1, 2, 5, and 10 years post-burn to document vegetation and fuel changes.

Smoke Monitoring

Due to predominantly southerly winds during the operational period, holding resources along the northern perimeter of the burn unit were occasionally impacted by smoke. Fireline visibility was good on the eastern and southern perimeters with fair/moderate visibility on the western/northern perimeter of Highway 87. Smoke did occasionally impact Highway 87 and a patrol ranger escorted traffic through the area. Throughout the day, the smoke column rose from 700 to 8000 feet above the fireline. Early in the day, transport winds carried the column to the east, but by about 1300 the smoke column was being pushed to the southwest. Toward the end of burn, the smoke column followed the topography to the east as it dissipated. The National Weather Service called for poor smoke dispersal until 1200 then fair with a mixing height of 2,200 feet above ground level. The winds were minimal throughout the entire burning period, which kept the smoke from dispersing and rising significantly. Overnight, a moderate amount of smoke settled into low lying areas to the east and south of the area.

Conclusions

The effects of the Tower prescribed fire on vegetation in Wind Cave National Park will be assessed in the coming years. Some objectives are immediately measurable while others need to be viewed over the course of the next two years before results can be determined. Fuel loading in 2 forest plots was reduced by 48%. Another burn plan objective was to achieve 20-40% mortality in >6" dbh ponderosa pines (within 2 years post burn). Following post-burn sampling, 78% of the ponderosa pines had zero scorch and only 21% had low to moderate scorch. This stress may not be significant enough to achieve mortality. Over time, vegetation monitoring will be conducted at the two FMH plots to determine whether the remaining project-specific objectives were achieved.

