

Agate Fossil Beds National Monument Carnegie Prescribed Fire Report

Prepared by Valena Hofman

Burn Unit Summary

The 2009 Carnegie prescribed fire is a 500-acre unit primarily consisting of mixed native grass prairie with a small amount of riparian wetlands along the Niobrara River. The unit is bounded by mowed line along the east and south fence lines and by a two-track along the west line. The north line was established along the Niobrara River. During the burn some modifications to the unit were made,

excluding the northeast portion of the unit and excluding an area near the Hoffman house. The Carnegie unit was burned in two operational periods, May 28th and 29th, with blacklining the east line the first day and burning the unit on the second day. Three monitoring plots were within the burned unit and received some degree of fire.



Blacklining operations along east line with NPS and Harrison VFD personnel.

Objectives

- Provide for public and firefighter safety during operations.
- Keep fire within the burn unit boundaries.
- Reduce burnable fuel load.

Personnel

Burn Boss: Eric Allen, Jason Devcich (trainee)

Firing Boss: Kenn Perreault

Holding Specialist (DIVS): Alan Stover

(STEN): Andy Thorstenson

Fire Monitors: Valena Hofman (trainee)

Ignition Resources: 1 Squad

Holding Resources: 6 Type 6 engines, 2 ATVs, 1UTV, 1 Water tender, Harrison VFD & 1 Squad

Weather conditions

For May 28th, the National Weather Service in Cheyenne, WY predicted warm temperatures (80° F), mostly sunny skies becoming partially cloudy with chance of showers and isolated thunderstorms in the afternoon. Winds were to be light and upslope 5-9mph, with good smoke dispersal. Minimum relative humidity (RH) was predicted to be 24%. The following day's prediction for May 29th, was similar with increasing clouds and chance of precipitation; a forecasted high of 85°F, min RH of 21%, light westerly winds changing to northwest 10-12mph with gusts to 18mph in the afternoon, and chance of showers and thunderstorms. While the spot forecasts for the two days were generally accurate, the timing of precipitation, thunderstorms and wind shifts differed. Weather was collected every half hour during the first day due to low fuel moistures and RHs and on the hour during the second day of operations; information was broadcasted to all burn personnel.

On the 28th hours the max temp reached the predicted 81°F while the min RH was 28%, 4% higher than predicted, at 1600. The forecasted scattered rain and virga occurred at 1400 hours, but then cleared until 1500 hours when clouds and winds increased, with gusts reaching 19mph (exceeding Rx prescription).

During the 29th the max temp reached 86°F, barely warmer than predicted at 1500 and min RH was 28%, 7% above predicted, coinciding with the end of the burn at 1600 hours. The spot forecast had called for changing winds in the afternoon and rain/storms by 1400 hours; actual winds were from the southwest (versus predicted west) and were gusting to 15mph by 1200 hours and increased to gusts of 17mph shifting north & north-northwest by 1300 hours. The building storm over the unit around 1415 hours along with the earlier visual observation and wind influences occurred close to prediction.

Table 1-A contains weather observations for May 28th, while Table 1-B has May 29th observations.

Table 1-A. May 28th Weather Observations

| Date | Time | Temp. | RH | Wind Speed | Wind Direction | Comments |
|---------|------|-------|----|------------|----------------|---|
| 5/28/09 | 1000 | 74 | 46 | 4-6 | WSW | Altocumulus clouds to west |
| 5/28/09 | 1100 | 77 | 43 | 6-9 | WNW | T-storm building to SW; winds slope influenced |
| 5/28/09 | 1200 | 80 | 32 | 6-9 (14) | N | Altocumulus; T-storm dispersing to SW |
| 5/28/09 | 1230 | 80 | 30 | 6-9 (11) | NNE | Altocumulus |
| 5/28/09 | 1300 | 80 | 30 | 6-9 (15) | N | Altocumulus |
| 5/28/09 | 1330 | 81 | 28 | 4-6 | N | Building T-storm to S |
| 5/28/09 | 1400 | 77 | 33 | 5-9 | N | Virga, scattered rain; 100% shaded; building clouds to SW |
| 5/28/09 | 1430 | 80 | 32 | Light | NW | Building clouds to SW; rain to S |
| 5/28/09 | 1500 | 76 | 35 | 11-15 (17) | W | Winds increased during Wx reading |
| 5/28/09 | 1530 | - | - | 15-17 (19) | WSW | Strong gusty winds |
| 5/28/09 | 1600 | 73 | 39 | 14-16 | SW | Strong winds |
| 5/28/09 | 1630 | 78 | 31 | 7-9 (12) | SSW | |
| 5/28/09 | 1715 | 78 | 37 | 11 (13) | W | |
| 5/28/09 | 1800 | 74 | 34 | 6 (10) | SW | |

Table 1-B. May 29th Weather Observations

| Date | Time | Temp. | RH | Wind Speed | Wind Direction | Comments |
|---------|------|-------|----|------------|----------------|--|
| 5/29/09 | 0930 | 71 | 51 | 5-8 (10) | W | |
| 5/29/09 | 1000 | 74 | 43 | 7-10 (13) | W | Jet contrails disappearing. |
| 5/29/09 | 1100 | 79 | 35 | 5-8 (10) | SW | Jet contrails lingering. Cumulus to West at 1040 hrs |
| 5/29/09 | 1200 | 85 | 33 | 8-11 (15) | SW | Building cumulus to W & NW |
| 5/29/09 | 1300 | 79 | 29 | 8-12 (17) | N | 1255 hrs - NW winds |
| 5/29/09 | 1415 | 84 | 33 | 5-8 (15) | NNW | Building cumulus nearby; thunder; 1430 hrs – brief NE 6mph winds |
| 5/29/09 | 1500 | 86 | 32 | 5-8 (12) | NNW | Building cumulus present overhead |
| 5/29/09 | 1600 | 85 | 28 | 4-6 (9) | N | Cumulus present; end of burn |
| 5/29/09 | 1700 | 83 | 29 | 8 (10) | NNW | |

Wind speed in miles per hour, Temperature in degrees Fahrenheit

Fire Behavior

The Carnegie unit had one primary fuel type, mixed grass prairie, and contains moderate topography. Primary fire carrier was thatch, senesced needle-and-thread grass (*Hesperostipa comata* [HECO]), and yucca plants (*Yucca glauca* [YUGL]), with a strong component of green fuel. In areas of the unit sedges (*Carex* sp. [CAREX]) were present and provided additional fuel. Most vegetation was in green-up stage, with some early season forbs in flower.

Fire behavior was predominantly driven by topography and available fuels with winds and aspect as secondary influences. Head fires consumed the majority dead and most green vegetation, while backing and flanking fires consumed most dead and up to

half of the green vegetation. Fire behavior was also influenced by interior ignition from drip torches (on foot and ATVs) and flares.

On both days, fire behavior was most active on slopes with yucca and dense grass, with creeping and dying fire behavior in areas with scarce carrying fuels along lower, flatter elevations and some hillsides. Near the Hoffman house, fire behavior consisted of a slow head fire with partial consumption of fuels producing large a volume of smoke. Fire observations for both days are summarized in Table 2.



Head fire through plot GFV 4



Ignitions during second day of burn.

Table 2. Fire Behavior Observations

| Date | Time | Location | Fire Type | ROS | FL | Comments |
|---------|------|----------------------------|-----------|----------|---------|---|
| 5/28/09 | 1050 | Map pt. E | B | <1 c/h | 4'' | CAREX partial carrier. Green & brown veg burning but fire self-extinguished. YUGL burning. |
| 5/28/09 | 1125 | ½ miles south of Map pt. E | F | 7 c/h | 12-24'' | Black-lining operations. Fire on a slope; suppressed and extinguished at this point. |
| 5/28/09 | 1330 | Map pt. F/E | H | 12 c/h | 36-72'' | Black-lining operations. Fire in black-line pulling together. |
| 5/29/09 | 1018 | South line | F | 3 c/h | 4-6'' | Green vegetation, up slope. YUGLs with 8' flames. |
| 5/29/09 | 1115 | East line by knob | B | 1.5 c/h | 4-8'' | Live and dead HECO. Sunny, sheltered from winds. Most fuels consumed. |
| 5/29/09 | 1330 | GFV 4 | H | 16 c/h | 36-60'' | Primarily HECO with some YUGL. |
| 5/29/09 | 1330 | GFV 4 | F | 6 c/h | 6-12'' | Primarily HECO with some YUGL. |
| 5/29/09 | 1350 | Near GFV 3 | B | 1.25 c/h | 4-8'' | HECO and <i>Salsola</i> sp.; Primarily flanking & head fire through scattered vegetation with 50% burned. |
| 5/29/09 | 1350 | GFV 3 | F | 2.5 c/h | 12-24'' | |
| 5/29/09 | 1400 | GFV 3 | H | 7 c/h | 12-36'' | Moderately dense HECO with a dead>live ratio. Backing fire consuming decently. |
| 5/29/09 | 1513 | South of Map pt. AA | B | 1.5 c/h | 6-12'' | Good fuels; fire side sloping. Backing fire consuming decently. |
| 5/29/09 | 1525 | South of Map pt. AA | F | 2 c/h | 12-36'' | |

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)
 FL = flame length

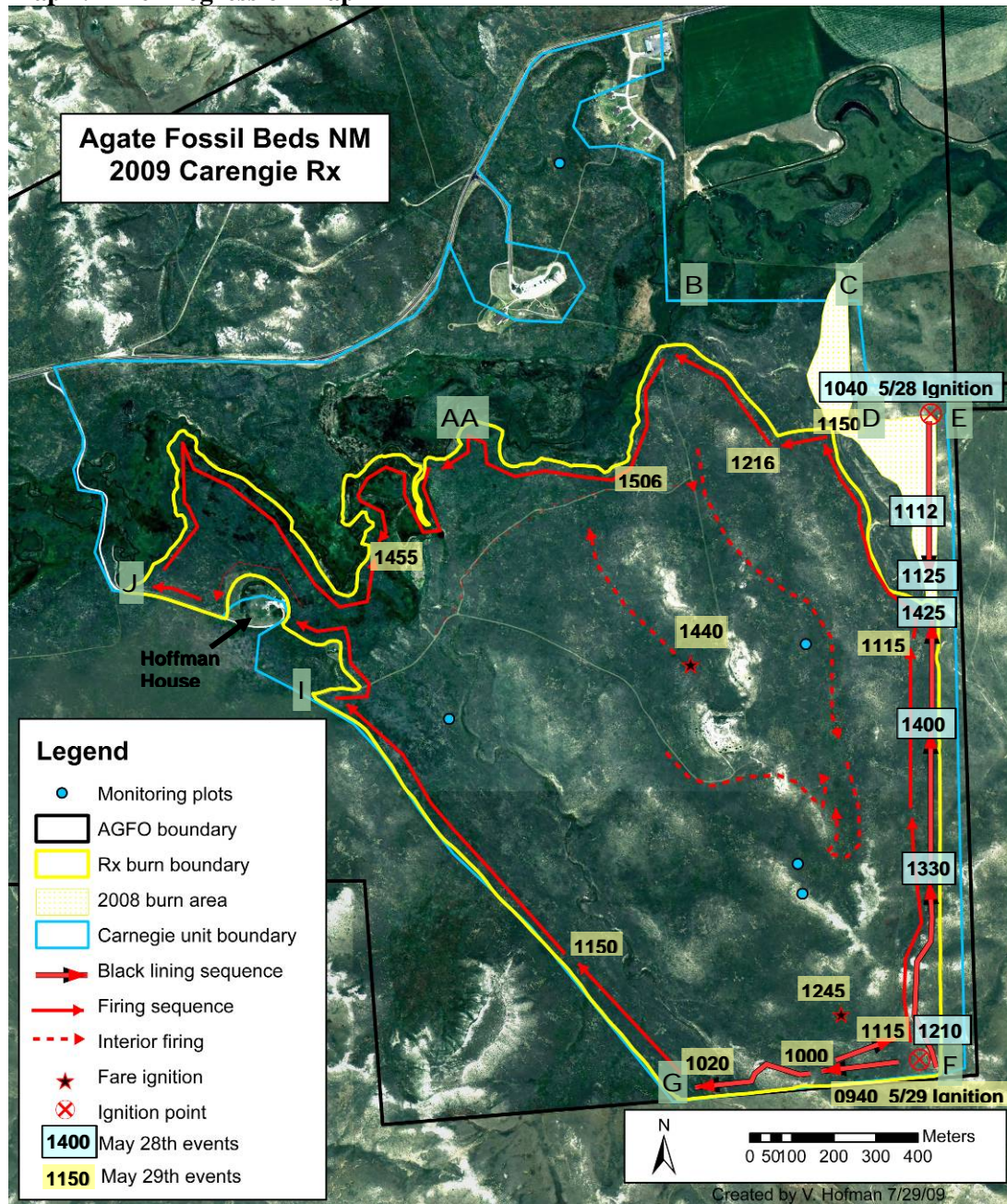
Smoke Monitoring

Smoke dispersal was forecasted to be good-excellent during day one and poor the following night, then poor becoming good midday on the 29th. Minimal smoke observations were made over the two days as smoke was generally spread out both over time and spatially due to firing sequence.

On May 28th predominantly north winds moved the patchy smoke south during the day while blacklining. At 1218 hours smoke from the blacklining fire was wind driven, reaching a height of only 20 feet above ground level (agl). Approximately two hours later at 1410, smoke was still blown toward the south but was reaching 100' agl. This occurred near the end of the days burning operations.

On the 29th westerly winds sent smoke toward the east, with some column formation occurring. At 1130 smoke was reaching heights of 200' agl but 15 minutes later, under 100% cloud cover, the smoke laid over and was under 100' agl. Firing operations in the northwestern portion of the unit near the Hoffman house, in riparian vegetation, produced the most impressive smoke of the burn, creating a thick yellow-brown plume rising between 200-500' agl).

Map 1. Fire Progression Map



Fire Progression

Burning the unit occurred over two days; May 28th operations focused on enhancing the east line with blackline and burning the entire unit on May 29th.

On May 28th, blacklining ignitions and holding began at point “E”; with one team lighting south approximately one chain’s width between the fence mow line and a secondary mow line. Several engines were

holding on the east side of the fence while ATVs and personnel were holding on the west side of firing. Ignitions were halted at 1125 in a draw due to increased fire behavior and wind direction. Firing operations reset to map point “F” and resumed heading north. Blacklining was completed at 1425 at the draw. Resources were then moved back to point “F” with

plans to blackline the south line but fire operations halted due to high winds.

Burn procedures on May 29th began a point “F” at 0940. Firing was executed with two ignition teams lighting in opposite directions along the lines. The west line ignition team began blacklining along the south line. Blacklining and securing the corner at map point “F” was completed by 1115 hours. The other team moved northward along the east line, lighting off of the previous’ days blackline. Modifications were made along the east perimeter during firing due to decreased fuels in the 2008 burn area; ignitions were held along a draw and a paved path. The two teams met along the Niobrara River, securing the fire perimeter at 1455 hours.

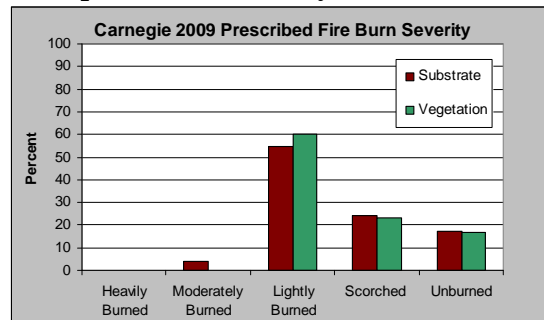
Fire Effects Monitoring

Three monitoring plots were sampled within the boundaries of the Carnegie prescribed fire for fuel load and post burn severity. Fuel loading was collected prior the burn with the biomass ranging 1.31 – 4.78 tons/ acres with a mean of 3.07 tons/ acre.

The post burn severity measurements were collected the afternoon following burn completion (Graph 1). Overall the burn severity was light or less with over 50% of the standing vegetation and the substrate (litter, duff, and woody fuels) considered “lightly burned”. Only substrate was considered to be “moderately burned” at <5% of the sample. Results indicated that 15% of the vegetation and substrate was “unburned” supporting the visual estimation of 80% burn coverage.

Due to low-to-moderate fire behavior, the interior of the unit was ignited with strip fire and flares. Flares were fired into the southern portion of the unit at 1245 and proved ineffective due to a wind shift, while flares at 1440 in the center of the unit carried. Strip firing via foot and ATV was most effective, primarily lighting along draws and slope bases (see dashed lines on map). One trainee fire effects monitor was within the unit during the burn and observed two monitoring plots; plot GFV 4 burned at 1330 and GFV 3 at 1350, both with head and flanking strip fires. The third monitoring plot, closest to the Hoffman House, was not observed but did burn from perimeter ignitions.

Graph 1. Burn Severity



Conclusions

Goals achieved through the Carnegie Prescribed Fire included maintaining firefighter and public safety; successful completion burn within unit boundary, and reduced fuel load, with specific fuel and vegetation response to be assessed over the coming years.

The National Park Service appreciates the opportunity to develop interagency cooperation with the Harrison Volunteer Fire Department. Their participation led to a successful project.