

THE EFFECT OF PRESCRIBED BURNING AT DIFFERENT FUEL  
MOISTURE LEVELS ON VEGETATION AND SOILS OF GRASSLANDS  
IN WIND CAVE NATIONAL PARK

F. Robert Gartner  
South Dakota State University

Objectives

One of the major grassland communities in Wind Cave National Park is the little bluestem - big bluestem - sideoats grama (Schizachyrium scoparium-Andropogon gerardi-Bouteloua curtipendula) Community. The effects of fire on the components of this plant community were deemed important because: 1) this warm season community occupies a significant portion of the grasslands of the Park; 2) the community occurs on soils that are usually shallow, rocky, and weakly developed and are, therefore, highly susceptible to erosion if the plant cover is reduced by fire; and 3) previous pilot studies have indicated a wide variation in response to fire by the major components of this community, possibly due to variations in fuel and soil moisture at the time of ignition.

While the general nature of the relationship between the moisture content of fuel at the time of burning and vegetation response is known, the relationship has not been evaluated in a quantitative manner. Quantitative evaluation is desirable in order to use prescribed fire in the total Park Management Plan, and to write meaningful burning prescriptions.

The objectives of this study are to determine the effects of different levels of fuel and surface soil moisture at the time of ignition of prescribed fires on vegetation composition, yields, and on post-burn soil moisture, soil temperatures, and soil chemistry of the grasslands of Wind Cave National Park.

Procedures

The study was designed to include burning at three fuel moisture levels, together with an unburned control, with four replications of each treatment. At some locations in the Park, the warm season plant community previously described is dominated by a nearly pure stand of little bluestem. In other locations, that species may be considered a co-dominant with big bluestem and sideoats grama. Therefore, the treatments described above were randomly assigned to a relatively homogeneous set of plots located in each of those two variations of the plant community.

Initially, different fuel moisture levels were to be obtained by adding water at different rates or at different intervals before ignition. However, naturally occurring fuel moisture differences on different dates permitted ignition of "dry", "medium", and "wet" treatments between May 26 and June 2, 1978.

Before ignition, the following information was collected: basal area and length of previous year's flower culms of little bluestem, dead and green fuel loads, fuel and surface soil moisture, and soil samples for chemical analyses. Permanent photo points were located and initial photos taken. During the burns, measures of wind speed and direction, air temperature, relative humidity, maximum fire temperatures, and flame heights were recorded. Photographs and measurements of plant length and soil moisture were taken periodically throughout the summer of 1978. Clipping to estimate 1978 plant yields was completed in mid-August. The number and length of flowering culms of little bluestem were recorded at the time of clipping.

### Results

Burning conditions for the "dry", "medium", and "wet" treatments are summarized in Table 1. Analyses of vegetation and soil response have not been completed. Initial indications are that the vegetation and soil differences due to burning conditions are negligible. The lack of vegetation and soil response may have been due to the range in burning conditions being too narrow. Adequate precipitation following treatment may also have reduced the vegetation differences between treatments by allowing fire damaged vegetation to recover and "catch up" with the undamaged vegetation. Complete data analysis will be necessary before any definite conclusions can be drawn.

### Acknowledgment

The support of Wind Cave National Park personnel in conducting the burning necessary for this research is greatly appreciated.

Table 1. Burning conditions for three different fuel moisture levels on two sites in Wind Cave National Park.

Treatment	Date	* Site 1		* Site 2		Air Temperature (°F)	Relative Humidity (%)	Wind Speed (mph)
		Mulch Moisture (%)	Soil Moisture 0-1cm (%)	Mulch Moisture (%)	Soil Moisture 0-1cm (%)			
Dry	5/26/78	30.2	33.2	32.0	34.4	70	37	8
Medium	6/1/78	37.6	41.5	47.5	34.3	51	61	7
Wet	6/2/78	45.6	46.5	40.1	44.3	55	50	7

\* Site 1 = Little bluestem site.

Site 2 = Mixed warm season site.