1982

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1982. *Transactions of the Nebraska Academy of Sciences,* X:5-6.

BIOLOGICAL AND MEDICAL SCIENCES

CHANGES IN MOISTURE CONTENT OF LITTLE BLUESTEM (*ANDROPOGON SCOPARIUS*) STANDING DEAD FOLLOWING RAINFALL

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The rate with which standing dead plant matter dries following precipitation was measured using clumps of little bluestem (*Andropogon scoparius*) collected during and after rainfall in March and April. The rate of drying averaged 3.6% to 7.1% moisture lost/hr immediately after precipitation. Air temperature averaged 7 C with 60% relative humidity, 35 km/hr wind speed, and 93% sunshine.

† † †

INTRODUCTION

Fires were a natural environmental factor in the development of the bluestem prairie of North America. They occurred throughout the year including summer months when the region receives most of its annual rainfall (Moore, 1972). Since green vegetation, at its peak during the summer, is unlikely to support a fire alone, the principal fuel for summer fires is standing dead and litter accumulated during previous growing seasons. Previous studies indicate that grasslands can support a fire when the moisture content of combined standing live and dead plant matter is as high as 38% (Bragg, 1978). The length of time that moisture from rainfall is retained by standing dead material is likely to influence the rate of spread of lightning-caused fires. Vogl (1974) suggested that, once ignited, a fire may persist despite rainfall. A rapid rate of drying, therefore, would allow a fire from a lightning strike to spread more rapidly than would a slower drying rate. This is an important consideration in the study of grassland fire ecology. Rapid drying of standing dead has been previously noted (Budowski, 1966; Vogl, 1969), but not quantified. This study, therefore, was initiated to provide preliminary, quantitative data on the rate of dry-down of grassland vegetation using one grass species evaluated at one time of the year.

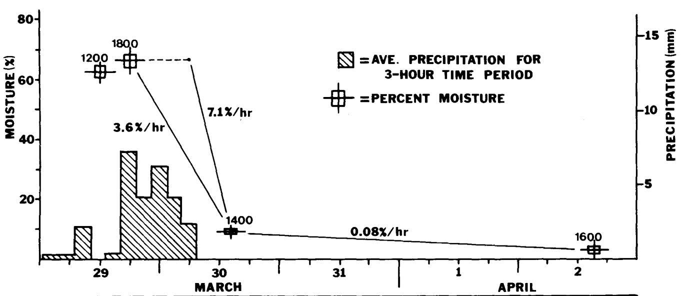
METHODS

The study was conducted at Allwine Prairie Preserve, a reestablished grassland research site in Douglas County, Nebraska. Standing dead plant matter from clumps of little bluestem (*Andropogon scoparius*) was clipped four times from 29 March-2 April 1976, both during and after an extended period of rainfall. Little bluestem was selected because (1) it was abundant; (2) grass clumps were likely to retain a maximum amount of moisture; thus, drying rates, expected to be rapid, would be conservative; (3) clumps facilitated collection of similar amounts of plant biomass of a single species; and (4) green plant matter was absent at the time of evaluation; the moisture content of green plant matter would have been difficult to distinguish from that absorbed by the dry plant matter. Climatological data (Anonymous, 1976) were obtained from the Omaha (North), Nebraska, National Weather Service Station located approximately 11 km east of the study site.

At each sampling date, 10 clumps of little bluestem, approximately 10 cm in diameter, were clipped 3 cm above the soil surface. An additional 10 clumps were obtained during each of the two collections made while it was raining. Clippings from each clump were placed immediately in individual plastic bags to prevent loss of water adhering to plant surfaces or evaporation of absorbed water. Ten clumps from each sampling date were subsequently weighed, oven-dried at 60 C for 24 hr, and reweighed to determine moisture content. Moisture of each sample was expressed as a percentage of dry-weight. The two additional collections of 10 clumps each were placed in a laboratory and allowed to air-dry for 6 hr. Temperature and relative humidity were recorded in the laboratory during the dry-down period. Moisture content was then measured using the same procedures given above.

RESULTS AND DISCUSSION

Moisture content of standing dead plant matter in the field declined from 66% during the period of maximum rainfall to 9% eight hours after cessation of rainfall; three days later, moisture averaged 3% (Fig. 1). The rate of drying during the first few hours after rainfall can be estimated by comparing plant moisture content during rainfall (1800 hr, 29 March) with that recorded shortly after rainfall ended (1400 hr, 30 March). Using this comparison, the rate of drying in the field during the first few hours is estimated to be 3.6% moisture lost/hr. Further, assuming that the plant moisture content at the time of cessation of precipitation (0600 hr, 30 March) was not less than that recorded during rainfall (1800 hr, 29 March), the maximum rate of drying is estimated to be 7.1%/hr. Subsequent drying rates were comparatively slow. Samples dried in the laboratory for 8 hr but under different conditions (22 C, no wind, and relative humidities of 22% and 41%), dried at rates of 6.6%/hr and 5.8%/hr.



AIR TEMP (C)	7	7	9	17
REL. HUMIDTY (%)	60	54	51	39
WIND (km/hr)	35	13	8	18
SUNSHINE (%)	93	90	100	95

FIGURE 1. Moisture content of standing dead plant matter and related precipitation and climatic conditions. Vertical lines of dice-grams connect maximum and minimum values; horizontal lines represent mean values and bars represent 95% confidence intervals, $\bar{x} \pm t_{0.05}$ SE. Values above dice-grams indicate time of measurement. Continuous lines are straight-line representations of the rate of drying.

The effect of humidity is shown by comparing laboratory results in which slightly higher dry-down rates (6.6%/hr) were obtained when relative humidity averaged 22% than with 41% relative humidity (5.8%/hr). Effects of air temperature and windspeed are likely to account for the higher maximum rates in the field than in the laboratory where variations in these conditions were negligible. In addition to climatic variations, differences noted may also be related to differences in plant species and to the stage of plant growth at the time of precipitation.

While limited in its scope, this study supports previously discussed observations that standing dead plant matter dries quickly and can burn within a short time after cessation of rainfall. The rate of drying may be even more rapid during the summer when temperature and windspeed are normally higher than during the spring.

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