Effect of Fire on Southern Mixed Prairie Grasses

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Highlight: *The long-term effect of fire was studied on the major grass species of west Texas when the winter-spring precipitation was 0 to 40% above normal. This and other studies indicate that sideoats grama and Texas wintergrass are harmed by fire. Buffalograss, blue grama, and sand dropseed were neither harmed nor benefited by fire. Vine-mesquite, Arizona cottontop, little bluestem, plains bristlegrass, and Texas cupgrass increased after burning for 1 or 2 years.*

Most data that we have on mixed prairie grasses following fire is either short-term or was taken following wildfires during drought years. We lack data on the long-term effects of fire during normal to wet years, when prescribed burning would be recommended. Moreover, for several species, we don't have any information as to how they respond to fire. This study was designed to collect data for several years on major grass species in west Texas, where prescribed burning might be recommended during years with normal to above normal winter and spring precipitation.

In the shortgrass prairie of Kansas, Launchbaugh (1964) found that the recovery time for a buffalograss (*Buchloe dactyloides*)-blue grama (*Bouteloua gracilis*) mixture, following a spring wildfire when the soil was extremely dry, took three growing seasons. The mixture recovered 36, 62, and 97% following the first, second, and third growing seasons respectively. Hopkins et al. (1948) and Dix (1960) reported similar results following spring burning in west-central Kansas and western North Dakota, respectively. Following another wildfire in New Mexico, Dwyer and Pieper (1967) found that production of blue grama was reduced 30% the first year. With above average precipitation the second year after burning, recovery was 97% of normal. Other studies on blue grama by Trlica and Schuster (1969) and on buffalograss by Heirman and Wright (1973) indicated that neither species was harmed by fire during years with average to above average precipitation.

Yield of sideoats grama (*Bouteloua curtipendula*) was reduced 51% by burning during a drought year, but only 12% during a wet year (Wink and Wright, 1973). Hopkins et al. (1948) found that a spring wildfire reduced the basal area of sideoats grama by 9 to 50%. In another study on bluestem ranges the basal cover of sideoats grama remained remarkably stable over a 10-year burning period (Anderson et al., 1970).

Little bluestem (*Schizachyrium scoparium*) decreased as much as 42%, if burned during dry years, and increased as much as 81%, if burned during wet years (Wink and Wright, 1973). Hopkins et al. (1948) found that little bluestem can decrease as much as 58% during dry years. Generally, however, it increases following prescribed burning (Aldous, 1934; Penfound and Kelting, 1950; Kucera and Ehrenreich, 1962; Anderson et al., 1970), unless it is burned too early or too late in the growing season or when soil moisture is low at the time of burning (McMurphy and Anderson, 1965; Owensby and Anderson, 1967; Box and White, 1969).

The long-term effect of fire on tobosa grass (*Hilaria mutica*) was reported by Wright (1972). During normal to wet years, tobosa produces two to three times more herbage after burning than the controls. By contrast, during dry years, it produces slightly less than the control. It is well adapted to fire and produces more than unburned tobosa for 3 to 4 years after a burn.

As long as moisture is adequate, vine-mesquite (*Panicum obtusum*) and meadow dropseed (*Sporobolus asper* var. *hookeri*) thrive after fire (Box et al., 1967; Wink and Wright, 1973). Tall grama (*Bouteloua pectinata*) also does well after burning during wet years, but declines as much as 60% during dry years (Wink and Wright, 1973). As indicated by changes in basal diameter, sand dropseed (*Sporobolus cryptandrus*) and red threeawn (*Aristida longiseta*) are generally harmed by fire (Trlica and Schuster, 1969). Dwyer and Pieper (1967) also found sand dropseed to be harmed by fire. Other species that they found to be harmed by fire included slimstem muhly (*Muhlenbergia filiculmis*), ring muhly (*M. torreyi*), wolftail (*Lycurus phleoides*), and galleta (*Hilaria jamesii*). However, this latter data is based on a wildfire during a year when precipitation was below average. Spring burns severely harm Texas wintergrass (Dahl and Goen, 1973), which is not surprising since it is a cool season perennial.

On the High Plains, tumble windmill grass (*Schedonnardus paniculatus*) was not harmed by fire (Trlica and Schuster, 1969). Arizona cottontop (*Digitaria californica*) was harmed by fire during dry years, but not during years when the fire was

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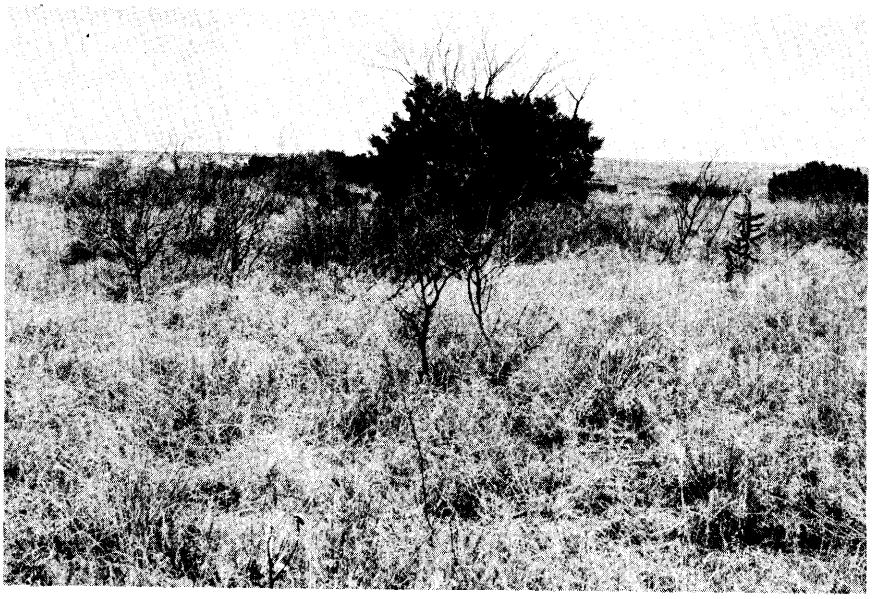

Fig. 1. *A variety of grass species existed in each study area. Only pure stands of grass species were sampled.*

followed by favorable moisture (Cable, 1967).

Methods

During years with average to above-average precipitation, yields of pure stands of the major grasses in west Texas were measured on burned and unburned paired plots for 2 to 4 years after a burn. Data were taken at various locations on the High and Rolling Plains of Texas, including Lubbock, Post, Guthrie, Colorado City, and Baird. Annual precipitation is 19 to 20 inches at all study sites except the one near Baird, which is 26 to 28 inches. Half of this precipitation falls during the winter-spring period. Elevation varies from 1,620 to 3,200 ft.

Plots were burned in late winter or early spring from March 15 to April 7, 1968, 1970, or 1972, when winter precipitation had been normal or above normal. Size of plots varied from 1 to 90 acres and were protected from grazing until the end of the study. A variety of grass species existed in each area with a few forbs which were considered insignificant on the sampling sites (Fig. 1).

Ten quadrats (2.4 ft^2) were clipped to sample current growth, and dead plant material (litter) on burned or unburned plots at each location. Vegetation at all sample locations was clipped in late July. Samples were oven dried and weighed.

Results and Discussion

During the years of the burns (1968, 1970, and 1972), winter-spring precipitation was 0 to 40% above normal on all sites. It was 40% above normal in 1968 and 1969, 5% above normal in 1970, 5 to 45% below normal in 1971, and normal in 1972 and 1973.

Buffalograss was burned at three locations in 1968 and at one location in 1972. The yields fluctuated somewhat from year to year, depending on precipitation, but they were similar on burned and unburned areas at all four locations. The data is summarized in Table 1.

Blue grama responded similarly to buffalograss (Table 1) for the one location at Lubbock in which it was studied. Data from both species is in direct contrast to that of Launchbaugh's (1964) and illustrates the difference in response of these species to a dry year vs a wet year. These species are not benefited by any kind of fire, nor are they harmed if burned following a winter-spring period with above-normal precipitation.

Sideoats grama (Table 1), the rhizomatous form (predominant form in west Texas), is always harmed by fire. During exceptionally wet years, it tolerates fire reasonably well (Wink and Wright, 1973), but it never benefits from fire. The data for this study were collected near Guthrie,

Table 1. Yields (lb/acre) of several grass species in west Texas on burned (burned in the spring of the first year listed) and unburned sites following fires when winter and spring precipitation was 0 to 40% above normal.

Species and year after burn	Burned		Unburned	
	Current growth	Litter	Current growth	Litter
Buffalograss				
1968	1686	–[3]	1494	728
1969	2063	306	1928	458
1970	1398	1572	1330	906
Blue grama				
1970	1680	–[3]	1429	2474
1971[1]	1369	699	1247	2584
1972	2142	1750	1754	1932
Sideoats				
1968	1854*	–[3]	2978	–[3]
1969	1841*	1052	3350	3271
1970	1120	2651	897	5571
1971[2]	748	1088	789	1933
Sand dropseed				
1968	2243	–[3]	2149	–[3]
1969	2543	2984	2557	4273
1970	2748	3020	2328	4128
Arizona cottontop				
1968	5152*	–[3]	2024	–[3]
1969	2649	2523	2694	4128
1970	456	4770	466	2326
Little bluestem				
1972	2518*	–[3]	1289	3560
1973	1240	1760	1216	2808

[1] Precipitation was 6% below normal.
[2] Precipitation was 45% below normal.
[3] Litter data was not taken.
[4] Different from the control (unburned) at the .05 level of significance.

Table 2. Yields (lb/acre) of vine-mesquite at two locations on burned and unburned sites following fires when winter and spring precipitation was 5 to 49% above normal.

Location and year after burn	Burned		Unburned	
	Current growth	Litter	Current growth	Litter
Colorado City				
1968	4272*	–[1]	708	–[1]
1969	659*	3936	78	3587
1970	790	3874	623	1638
Post				
1968	2527*	–[1]	1524	–[1]
1969	2742*	2385	1324	2794
1970	3368	4452	3496	5952

[1] Litter data was not taken.
*Different from the control (unburned) at the .05 level of significance.

Texas, and the first 2 years were relatively wet years with precipitation about 40% above normal. Even with good moisture, vegetative yields were reduced 40 to 45% for the first 2 years after burning. Thus, fire should not be recommended as a range improvement tool where the rhizomatous form of sideoats grama is a dominant species of the vegetation.

Sand dropseed showed no harmful effects from fire during a series of wet years. This is in contrast to data by Dwyer and Pieper (1967) and Trlica and Schuster (1969), who indicated that fire was harmful to sand dropseed. Since it is a bunchgrass, some harm might be expected if the plants are large. However, during this series of wet years at one location near Post, Texas, the small and medium-sized plants were not harmed by fire, nor were they benefited.

Arizona cottontop was studied at Colorado City, Texas, and observed at several other locations. In all cases it responded positively to fire for at least 1 year. On most sites we didn't know the species was so prevalent until the areas were burned. Seed production was very prolific on this species after being burned.

With average winter and spring precipitation in a 26- to 28-inch precipitation zone near Baird, Texas, little bluestem doubled in production the first year after burning and then reached equilibrium during the second growing season. Unless precipitation is below normal, little bluestem always seems to do well after a fire.

Vine-mesquite thrives after burning and produced more herbage than the controls for 2 years after a fire (Table 2). In addition, it produces many long stolens that spread and occupy new areas after a burn. It appears to be a true fire species, provided it is not subjected to heavy grazing immediately after burning.

Based on observations, plains bristlegrass (*Setaria leucopila*) and Texas cupgrass (*Eriochloa sericea*) do well after fire during wet years. Observations of the bunchgrass form of sideoats grama indicate that it also thrives after fire.

Conclusions and Management Implications

Winter-spring precipitation is the key to a successful prescribed burn. If precipitation is above normal, this and other studies indicate that sideoats grama and Texas wintergrass are the primary perennial grasses that will be harmed by fire in west Texas, and it will take at least 2 years for these species to fully recover. Buffalograss, blue grama, and sand dropseed are neither favored nor harmed by fire. Species that seem to thrive for one to three growing seasons after a fire include Arizona cottontop, little bluestem, vine-mesquite, tobosa, plains bristlegrass, and Texas cupgrass. Generally, these are the species that accumulate the most litter.

Except for tobosa grass, all of these species should be allowed adequate time for recovery before they are grazed. With normal to above normal precipitation, this means a 3- to 4-month rest period after burning. During drouth years the rest period will have to be longer, although we have never had to rest a pasture for longer than 7 months. Since tobosa grass is so coarse, it should be grazed within a few weeks after new growth begins on a burn. Otherwise, cattle will not eat it.

Burning should always be done on a manageable unit basis. If only a portion of a pasture is burned, animals will concentrate on the burn, no matter how long it has been rested. This is generally because burned plants are slightly more nutritious and there is no litter in the plants.

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