Fall and Winter Burning of South Texas Brush Ranges[1]

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Highlight

Plots with no pretreatment and pretreated by shredding, chopping, scalping, root plowing, and root plowing and raking were subjected to a fall fire, a winter fire, and a fall fire with a winter reburn the following year. All burning treatments reduced brush cover when compared to the unburned control. Burns on pretreated areas were more effective in reducing brush than were fires in vegetation with no pretreatment. Two burns were more effective in reducing brush than was a single fire. Standing crops of herbage on all burned plots were greater than on the control. Fall burned plots had the largest amounts of grass; winter burned areas contained the most forbs.

Control of woody plants is a major problem associated with the management of Texas rangelands. In spite of active brush control practices throughout the state, the extent and density of woody weeds has increased to over 88 million acres (Smith and Rechenthin, 1964). In the South Texas area alone, over 9,600,000 acres were treated to reduce brush density in the decade prior to 1958 (Carter, 1968). Most of these same ranges were treated again in the last 10 years, or need some control of brush at the present time.

Regardless of the method used to control the brush, new woody plants become established soon after the original ones have been destroyed. In most cases, the botanical composition of the brush complex may be altered, but regrowth is so rapid that most ranges need retreatment in 5 to 15 years after the original control program. Control of brush reinvasion following original treatment should be considered a maintenance item in the budget of most Texas ranchers.

An effective and inexpensive method of brush control is needed. Periodic mowing and fertilization of ranges may retard brush encroachment (Powell and Box, 1967), but may be expensive or impractical in some areas.

The cessation of grass fires has been suggested as a major cause of brush increase in South Texas (Allred and Mitchell, 1955; Lehmann, 1965). Conclusions reached by these authors were based primarily on historical reports. All the early writings suggest a positive relationship between the decrease of fires and the increase of brush.

Results from a planned burn by Box, Powell and Drawe (1967) show that fire will decrease brush density and cover without seriously harming grass production. This paper examines the effectiveness of single fires in fall and winter and two fires in consecutive years as tools for maintaining brush free ranges following mechanical control.

The study was conducted on the Rob and Bessie Welder Wildlife Refuge, San Patricio County, Texas. The refuge is located near the southern end of the Texas Gulf Prairies and Marshes described by Thomas (1962) and represents a transitional area between the Gulf Prairies and the South Texas Plains. The soil type on the study area is Victoria clay, and vegetation is a typical chaparral-bristlegrass community (Box and Chamrad, 1966). The study area normally receives about 30 inches of precipitation annually. Temperatures are relatively warm throughout the year, and plant production generally follows rainfall curves.

Methods and Materials

During the summer of 1963, two replications of six mechanical brush control treatments were established in randomized blocks on chaparral communities. Two 20 acre replications of each of the following treatments were used: 1) control with no brush treatment, 2) shredding with a rotary mower, 3) roller chopping, 4) scalping with a K-G blade, 5) root plowing, and 6) root plowing and raking.

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In September, 1965 strips 150 × 220 yds were burned on each 20 acre plot. In December, 1966 additional 75 × 220 yd strips were burned on each plot and half the strip burned in 1965 was reburned. The result was three 75 × 150 yd strips on each plot, one fall burned, one winter burned, and one burned two years in succession.

Vegetation was sampled on each strip the summer before the winter burn, August 1966, and again in August 1967. Data were analyzed as a splitplot, randomized block design. Canopy cover of brush species on each strip was sampled using 15 line intercepts, each 100 ft long. Weight of herbage was estimated on 40 plots, each 2.4 ft², on each strip.

Results

All plots pretreated in 1963 by mechanical brush control practices burned uniformly. Although there was considerable regrowth of brush species present, grass and other herbaceous material grew in sufficient densities under the brush plants to allow the fire to carry through the brush mottes and under the individual brush plants. Canopy cover was reduced sufficiently to make almost all forage available to livestock. Areas that had not been pretreated by mechanical brush control burned unevenly and resulted in a patchy appearance. Grassy areas between brush clumps burned clean, but insufficient fuel was present within the large brush mottes to allow the fire to burn through them.

Reduction in Brush Canopy

Brush canopy in the summer of 1967 was significantly lower on all burned areas compared to the unburned control (Fig. 1). Burning reduced brush canopy cover an average of 24% on areas that had not been pretreated by mechanical control. There was no statistical difference at the .05 level between the percent reduction following fall, winter, or two successive fires in the area without pretreatment. The uneven pattern of burning was not improved by successive burns. The large mottes probably could withstand repeated fires due to the lack of fuel to carry a fire through them.

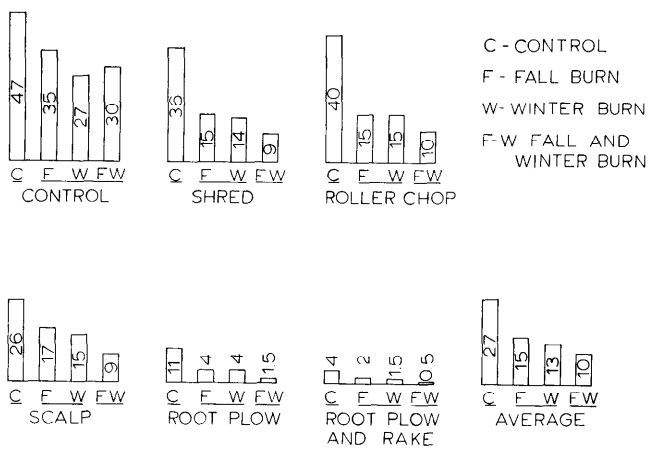

FIG. 1. Canopy cover (%) on pretreated areas of the Welder Wildlife Refuge following prescribed burning treatments. Treatments connected by a solid line are not significantly different from each other at the 0.05 level.

Table 1. Reduction (%) in canopy cover of all brush plants on burned areas of the Welder Wildlife Refuge (measured August 1967).

Pretreatment	Percent reduction		
	Fall	Winter	Fall-Winter
Control (no burn)	33	43	35
Shredded	59	61	75
Chopped	62	62	73
Scalped	36	41	66
Root plowed	70	64	85
Root plowed and raked	44	71	87

Reduction in brush canopy was significantly greater on all pretreated plots than on the untreated control plots. The fall burn reduced brush canopy an average of 55% on all pretreated plots; the winter burn resulted in a 57% reduction; and burning in two successive years gave 71% less brush canopy. With the exception of the root plowed and raked plot, where insufficient fuel resulted in a poor fall burn, there was no difference between the percent reduction following fall and winter burning. Two successive burns resulted in a further significant loss of brush canopy in all instances.

Although there was no statistical difference in the amount of brush canopy cover on fall and winter burned plots in the summer of 1967, the fall fire appeared to damage the brush plants more severely than the winter fire. The fall burned plot was sampled after a full year of regrowth. Box et al.

Table 2. Composition (%) of brush species on burned areas of the Welder Wildlife Refuge.

Species	Control	Time of burn		
		Fall	Winter	Fall & Winter
Acacia farnesiana	10.0	19.9	16.5	21.3
A. rigidula	9.0	7.9	13.3	12.6
A. tortuosa	T	1.2	0.8	7.8
Berberis trifoliolata	4.1	2.8	1.6	2.2
Celtis spinosa	5.0	8.1	4.3	5.4
Condalia obovata	2.0	3.1	1.3	1.8
C. obtusifolia	2.5	2.9	6.7	3.0
Diospyros texana	1.0	2.3	T	0.9
Lycium berlandieri	1.0	T	T	T
Opuntia leptocaulis	4.7	4.8	1.3	0.9
O. lindheimeri	8.4	5.9	5.1	6.5
Prosopis glandulosa	43.2	31.9	33.9	28.5
P. reptans var. *cinerascens*	4.6	1.3	7.0	3.7
Zanthoxylum fagara	3.8	4.7	7.6	3.5

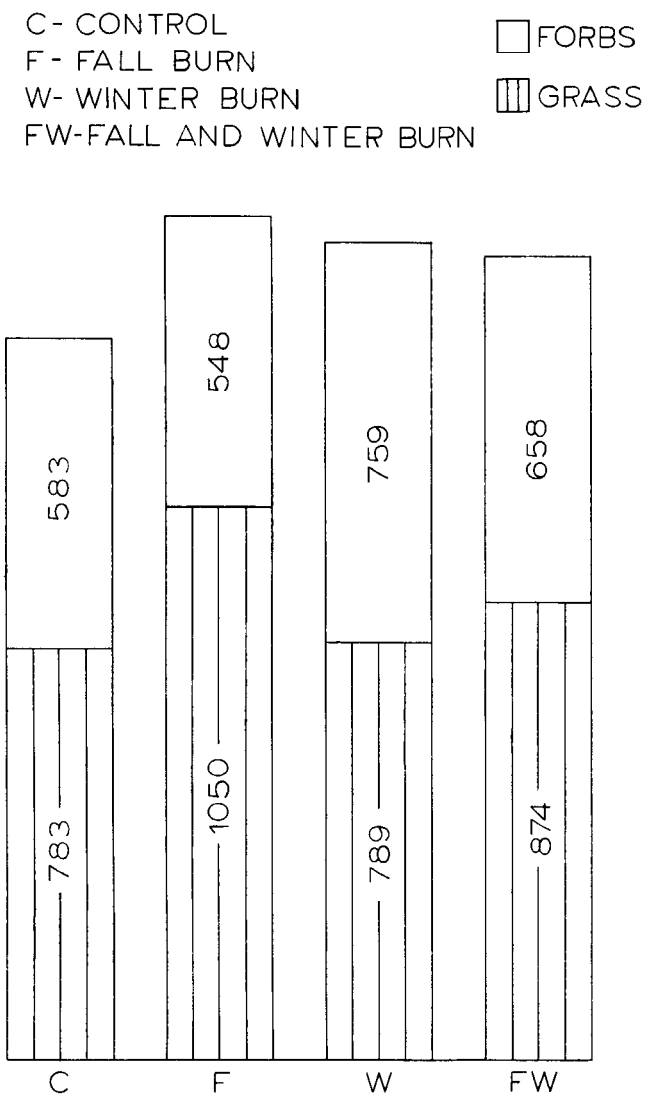

FIG. 2. Standing crop of herbage (lb) on untreated areas of the Welder Wildlife Refuge.

(1967) reported average canopy reduction of 56 to 78% on the fall burned plots the first growing season following the fire.

The least amount of canopy reduction occurred in areas that had been scalped as a pretreatment brush control measure where the brush plants were large. The greatest reduction was in areas that had been root plowed or root plowed and raked. Here brush plants grew singly and were completely surrounded by fuel.

The percent composition of brush canopy cover was altered by the burning treatments (Table 2). Huisache (*Acacia farnesiana* (L) Willd.), blackbrush acacia (*A. rigidula* Benth.), twisted acacia (*Acacia totuosa* (L) Willd.), and lote bush (*Condalia obtusifolia* Hook.) all increased in relative abundance. Agarito (*Berberis trifoliolata* Moric.), lycium (*Lycium berlandieri* Dunal.), tasajillo (*Opuntia leptocaulis* DC.), mesquite (*Prosopis glandulosa* Torr.), and creeping mesquite (*P. reptans* Benth. var *cinerascens* (Gray) Burkart) all declined in relative abundance. Percent kill was not determined for each species. Box et al. (1967) and White (1969) reported varying mortality of brush depending upon conditions at the time of the fire and stage of growth of the plants.

Response of Herbaceous Vegetation

More total herbage was produced on all burned areas than on the unburned control (Fig. 2). The fall burned area produced significantly (.05 level) more grass than any other treatment. The winter burned area had significantly (.05 level) more forbs than any other treatment. The fall and winter burned areas produced more total herbage, and more in both the grass and forb categories, than the control. They produced about the same amount of total herbage as those burned in fall or winter only, but they had less grass and more forbs than plots burned fall only and less forbs and more grass than plots burned winter only. Yield of individual species on the treated areas is included in Table 3. These findings are similar to those of Grelan and Epps (1967) who reported increased production in Louisiana following fire.

In general, plants that increased following burning were those normally considered "disturbance" species. For instance, filly panic (*Panicum filipes* Scribn.) and plains bristlegrass (*Setaria leucopila* (Scribn. and Merr.) K. Schum.), produced more on all burned plots than on the control. Several other grasses were more abundant on fall burned areas than on the control plots or strips that had been burned in the winter. However, statistically significant differences could not be shown between individual species response to the burning treatment.

Conclusions and Recommendations

Both fall and winter burning will effectively reduce brush canopy and frequency in South Texas chaparral communities. Fall burning appears to be slightly more effective in reducing brush cover than winter fires.

Fall burning tends to reduce forb production the following year and increase the amount of grass produced (Box et al., 1967). Winter burning has an opposite effect—forbs are increased and grasses remain unchanged in production. Burning for two successive years, once in the fall and once in the winter, gives a balance between grass and forbs similar to the unburned control, but total production is higher.

Fires are not particularly effective in reducing brush in South Texas unless some form of pretreatment is practiced. Where fire is used without

Table 3. Herbage production (lb/acre) by species, on burned plots on the Welder Wildlife Refuge.

Species	Control	Time of burn: Fall	Winter	Fall & Winter
Grasses				
Andropogon saccharoides	126	119	39	44
Aristida roemeriana	48	79	29	48
Buchloe dactyloides	355	330	315	401
Chloris verticillata	20	8	20	8
Hilaria belangeri	T	24	7	17
Panicum filipes	43	90	60	85
P. obtusum	20	51	49	57
Paspalum pubiflorum	57	12	28	33
Schedonnardus paniculatus	4	11	2	T
Setaria geniculata	13	42	12	3
S. leucopila	12	110	85	82
Sporobolus asper	36	87	33	42
S. pyramidatus	6	5	11	T
Stipa leucotricha	77	28	56	24
Tridens albescens	31	47	39	18
T. congestus	22	5	2	9
Others (4 of less than 1 lb/acre each)	3	2	2	3
Total grasses	873	1050	789	874
Forbs				
Ambrosia psilostachya	72	94	117	70
Cienfuegosia sulphurea	4	1	7	3
Commelina erecta	24	13	15	14
Croton monanthogynus	40	28	42	44
Desmanthus virgatus	30	20	20	31
Lythrum californicum	2	1	3	6
Malvastrum aurantiacum	3	10	3	2
Phyla incisa	8	26	10	27
Portulaca pilosa	8	3	12	9
Ratibida columnaris	2	3	8	3
Ruellia sp.	110	95	86	116
Solanum eleagnifolium	23	26	40	59
Verbesina microptera	30	41	66	64
Xanthocephalum texanum	219	185	322	203
Others (11 of less than 1 lb/acre each)	7	2	8	7
Total forbs	583	548	759	658
Total herbage	1456	1598	1548	1532

pretreatment, the result is an uneven and patchy burn with the large mottes left intact. Repeated burnings could conceivably reduce the size of the mottes by gradually eroding them around the edges, but it is not likely that chaparral areas would burn that often.

Therefore some sort of pretreatment is desirable. It appears that any type of mechanical control that will crush or knock down the larger brush and dense mottes will enhance the effects of fire. Best results can probably be obtained by waiting sufficiently long following pretreatment for the crushed woody fuel to dry and a crop of herbaceous material to mature among the debris.

No detrimental effects on herbaceous vegetation have been observed following a fire. In fact, grass production may be increased (White, 1969). Therefore, we recommend careful use of fire as a management tool in South Texas chaparral.

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