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Some Effects of the 1946–48 Drought on Ranges in Southwest Texas

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SERIOUS changes in range condition are apparent after three years of drought in southwestern Texas. Stocking records and range survey data from ranches cooperating in soil conservation districts provide an exceptional record during this critical period on privately operated ranges.

Effects of drought upon ranges and systems of management in various parts of the country have been popular topics with range specialists and ranchers for many years. Notable writings on the subject are those by Jardine and Forsling (*7*) on the drought of 1917–18 on the Jornada range in New Mexico, Lister and Schumacher (*8*) and Nelson (*9*) on semi-desert ranges of Arizona, Craddock and Forsling (*5*) on sheep range in Idaho, Sarvis (*10*) on that of the northern Great Plains, Savage (*11*) on the Southern Great Plains, and Albertson and Weaver (*1*, *2*, *3*) on the drought of 1933–36 in the midgrass and mixedgrass prairies.

The account here is based on information obtained incidentally to assisting ranch operators within a radius of approximately 50 miles of San Angelo, Texas, in developing and applying conservation plans in cooperation with the North Concho River, the Eldorado Divide, and the Concho Soil Conservation Districts. This information includes detailed stocking records by pastures from 1945 through 1948, range surveys at the time of developing the plans, recurring utilization checks and revisions of survey data, and some clipping of grass plots in permanent exclosures.

The area is in the southern portion of the Mixed Prairie, where the major climax dominants are sideoats grama (*Bouteloua curtipendula*), curlymesquite (*Hilaria belangeri*), buffalograss (*Buchloe dactyloides*), and hairy grama (*Bouteloua hirsuta*). A number of other midgrasses and short grasses were present in the climax. With widespread abuse of ranges, a number of shrubs of desert affinities have invaded or increased to produce a disclimax savannah on most of the area. The most important of these is mesquite (*Prosopis juliflora*).

The Drought of 1946–48

During the three years 1946–48 the area around San Angelo experienced the most severe drought in its 44 years of rainfall records. Compared to an average annual precipitation of 21.59 inches, the totals for these years, at San Angelo, were 7.13, 11.50, and 13.86 inches, respectively (Fig. 1). Similar conditions prevailed over a large area in southwest Texas, from Abilene and Coleman west and southwest into Mexico and New Mexico.

By the summer of 1946 ranchmen were complaining of the drought and re-

ductions in herds were general in the face of diminishing feed supplies. A year later the drought was compared with that of 1917–18, which oldtimers described as the worst on record. Although neither ranges, stock, nor stockmen were suffering the distress remembered from the earlier drought, a comparison of rainfall records showed the current moisture deficit more severe. Better livestock prices, better ranching practices, and better care of the range doubtless eased the effects of the drought.

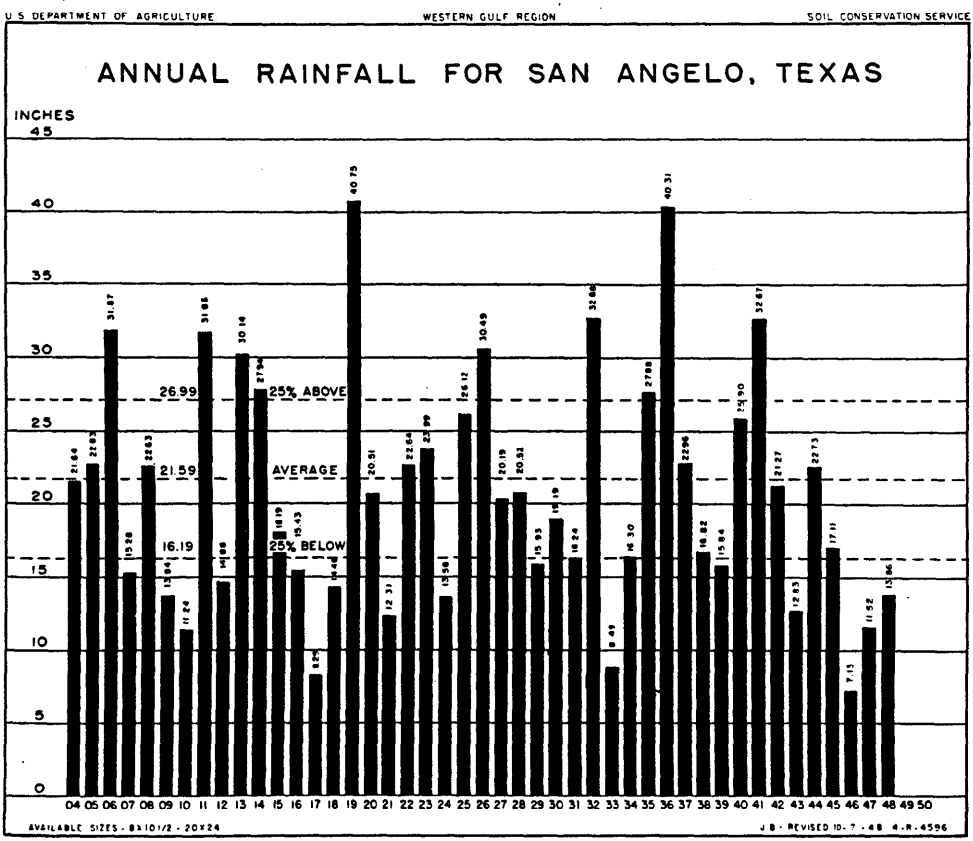

FIG. 1. Annual rainfall at San Angelo, Texas

TABLE 1

Stocking rates during growing season

In animal-units per section year-long

	ACTUAL	PROPER
1945	50	36
1946	34	26
1947	35	24
1948*	32	20

* To October 1.

The fall of 1918 brought relief from that drought at the end of the second year of less than 50 per cent normal rainfall, but in 1948 extreme conditions continued practically unabated. Obviously, normal livestock operations cannot be continued during such a period. Detailed records from some twenty ranches reveal trends in livestock numbers and range conditions during this period.

STOCKING RATES AND USE OF RANGE

Livestock reductions in response to the drought are indicated in Table 1, which

shows actual and "proper" rates for the growing season each year on the cooperating ranches. Further heavy liquidations of herds took place in the spring of 1948, but records on a limited number of ranches up to October 1 did not indicate any further change in grazing pressure on the range.

Actual month-by-month use-records on specific pastures did not bear out the impression of repeated heavy reductions in livestock as the drought progressed. The records indicated that the major reduction was made during 1946.

Whatever may have happened to the total livestock inventory, the disposition of the stock on the range since 1946 was maintained at a fairly constant stocking rate on pastures from which records were available. On many ranches in this area, field crops normally contribute a considerable proportion of the forage supply. With their failure, stock had to be kept on the native range. Much supplemental feed was also purchased and fed on the pastures. Thus grazing pressure on the average was not actually reduced in keeping with reductions in total livestock numbers.

Even with reduced stock, more severe use of the range resulted during the drought years 1946 to 1948 than in 1945. Table 2 shows the degree to which ranges examined were grazed at the end of the growing season each year, in percentages of the total acreage in each class. "Heavy" use is considered to be temporarily damaging, and "severe" use permanently damaging to the productivity of the range. "Light" and "moderate" use are not damaging and in normal years result in range improvement.

Effect on Range Conditions

The effect of this continued heavy and severe use of the grass is apparent in changes in range condition. During 1948 a total of 18,673 acres of range which had been surveyed before the drought was reexamined and reclassified as to condition.

The following changes in range condition were noted:

3,553 acres, or 20 percent, improved one condition class

8,577 acres, or 45 percent, declined one condition class

6,540 acres, or 35 percent, remained in the same condition class

As range conditions are classified in these soil conservation districts, a change of one condition class means, roughly, a change of 25 percent for the better or worse in the kinds of plants occupying a range site. It does not refer to whether or not the grass is "short", or to the amount of growth in a season. Range condition is based on the stand of desirable plants present in comparison to the best combination possible on each site. It therefore reflects the relative capacity of the range to produce forage with whatever moisture is available (*6*).

TABLE 2

Degrees of use of range

Percent of total acreage in each class

	LIGHT	MODERATE	HEAVY	SEVERE
1945	16	52	28	4
1946	1	15	34	50
1947	4	28	43	25
1948*	16	32	36	16

* To October 1. At least half of the acreage in each class on this date can be expected to be used enough to place it in the next higher degree of use by the end of the season.

The scale used to classify ranges is as follows:

Excellent—75 to 100 percent desirable plants

Good—50 to 75 percent desirable plants

Fair—25 to 50 percent desirable plants

Poor—Less than 25 percent desirable plants

TABLE 3

Range conditions

Percent of total acreage in each class

	TOTAL ACRES SURVEYED	EXCELLENT	GOOD	FAIR	POOR
1945 and 1946	32,343	T	40	35	25
1947	17,931	0	19	45	36
1948	32,250	T	15	56	29

loss will be felt even after normal moisture is restored, because it reflects a change in kinds of plants present to produce feed when conditions are favorable. These losses were suffered on ranches actively applying, to varying degrees, a planned conservation program.

Another indication of the trend is shown in Table 3, which summarizes the

TABLE 4

Use of selected pastures during the drought

In animal units per section year-long

	1945			1946			1947			1948
	Sum.	Wint.	Year	Sum.	Wint.	Year	Sum.	Wint.	Year	Sum.
Pasture A										
Proper			38							17[b]
Adjusted[a]	32	25		21	12		15	20		13
Actual	31	39	37	17	1	10	17	22	18	18[c]
Degree of use	Mod.	Mod.		Mod.	Mod.		Hvy.	Hvy.		Mod.[e]
Pasture B										
Proper			25							20[b]
Adjusted[a]	23	18		15	8		11	14		15
Actual	19	17	53	24	17	21	25	20	23	18[c]
Degree of use	Lgt.	Lgt.		Mod.	Hvy.		Hvy.	Hvy.		Hvy.[e]
Pasture C										
Proper			25							21[b]
Adjusted[a]	21	17		14	8		10	13		16
Actual	52	37	53	31	14	27	3	39	25	15[d]
Degree of use	Sev.	Sev.		Mod.	Hvy.		Lgt.	Sev.		Mod.[d]
Pasture D										
Proper			32							13[b]
Adjusted[a]	27	21		18	10		13	17		10
Actual	61[c]	37[c]	40[c]	33	20	27	55	15	35	0
Degree of use	Lgt.[c]	Mod.[c]		Lgt.	Mod.		Sev.	Sev.		None
Pasture E										
Proper			40						23[b]	
Adjusted[a]	29	27		22	12		9	12		11
Actual	73	46	60	10	69	40	57	20	40	0
Degree of use	Hvy.	Sev.		Hvy.	Sev.		Sev.	Sev.		None

[a] Proper rate adjusted by percentage of normal rainfall during the preceding 12 months at beginning of the season.

[b] Based on resurvey.

[c] For 4 months to August 1.

[d] For 5 months to September 1.

[e] Use probably not as great as indicated by stocking records since this pasture contains no permanent water and gates were left open to adjoining pasture.

The foregoing figures, then, indicate a net loss of 25 percent in productivity on 25 percent of the range examined. This condition of all the range surveyed each year since 1945. These figures include both those pastures classified by site and condi-

tion in planning, and those reclassified in subsequent examinations.

Some Case Histories

As indicated before, the heavy and severe use of the grass, and the downward trend in range condition during drought years, took place in the face of reductions in livestock on ranches. Specific pasture records illustrate this more graphically than averages and summaries. Data on the use and condition of these pastures are presented in Tables 4 and 5. For comparison, all stocking records are expressed in animal units per section; unless otherwise stated, this is on a yearlong basis.

TABLE 5

Range conditions before and after drought

In percent of acreage in each class

	RANGE CONDITION			CHANGES IN CONDITION			PROPER STOCKING RATE
	Good	Fair	Poor	Gain	None	Loss	
	%	%	%	%	%	%	
Pasture A, 878 acres							
1945	64	36					38 AU/S
1948	10	70	20		10	90	17
Pasture B, 1350 acres							
1945	35	65					27 AU/S
1946	58	42					
1948	25	67	6	1	80	19	20
Pasture C, 596 acres							
1945	31	58	11				27 AU/S
1948	2	87	11		71	29	21
Pasture D, 510 acres							
1945	70	30					32 AU/S
1948			100			100	13
Pasture E, 127 acres plus 63 acres field							
1945	100						40 AU/S
1947		40	60			100	23

Pasture A. Pasture A consists of 878 acres, of which 42 percent is valley or deep upland site, 29 percent normal upland, and 29 percent thin upland or hill site. Over 10 years this pasture had been stocked lightly and it made material improvement. In 1944—about an average growing year—it was stocked at 38 animal units per section. A detailed survey before spring growth started in 1945 indicated light to moderate use, while a classification of range condition showed 64 percent in good and 36 percent in fair. On this basis the rate of 38 animal units per section was accepted as "proper" for this pasture, which was then used as a base for other surveys. This evaluation was confirmed in 1945, when the pasture was stocked at 37 animal units per section, and utilization surveys again indicated light to moderate use, although rainfall was slightly below normal that year.

Then came the drought. Use of the pasture was drastically curtailed when the grasses failed to make normal growth. Stocking in 1946 amounted to 10 animal units per section, and in 1947 to 18 animal units per section, approximately one-third and one-half, respectively, of the accepted "proper" rate. A re-examination in August, 1948, revealed 90 per cent of

the acreage had lost one condition class despite the light stocking.

Annual weeds or bare ground replaced much of the excellent turf of sodgrasses and sideoats grama (Fig. 2). The condition in August, 1948, was classified as 10 percent of the acreage good, 70 percent fair, and 20 percent poor.

amounted to 18 animal units per section. In response to this light use in a year of nearly normal growing conditions, the deeper soil areas improved in composition until 58 percent of the pasture was considered in good condition (Fig. 3) and 42 percent in fair at the beginning of the growing season in 1946. Bitterweed ac-

FIG. 2. A dense cover of sod grasses and sideoats grama in Pasture A in 1946 deteriorated to a sparse stand of grasses and annual weeds by the summer of 1948. The plants by the spade are sideoats grama.

Pasture B. Another pasture on the same ranch was making rapid improvement when the drought started, and was also stocked at less than the "proper" rate during the drought. This pasture of 1350 acres was 65 percent in fair condition and 35 percent in good condition when the ranch was surveyed in 1945. By comparison to Pasture A, the proper rate of stocking on Pasture B was set at 27 animal units per section. Total use during 1945

tinea (*Actinea odorata*), which was prominent on the valley sites in 1945, was reduced to a minor element. Somewhat heavier stocking, but still well below the "proper" figure, was practiced in 1946 and 1947, the rate figuring 21 and 23 animal units per section, respectively. Nevertheless, all the gain made in 1945 was lost. Bitterweed along with other annuals reappeared in the spring of 1948 following the reduction in the stand of grass. The

condition of the pasture was classified in August 1948 as 25 percent good, 69 percent fair, and 6 percent poor (Fig. 4).

Pasture C. Pasture C illustrates a range that had been heavily used and, like Pasture B, was in fair condition at the beginning of the drought. The rate of stocking was reduced during the first drought

mal units per section in 1945 to 27 in 1946 and 25 in 1947, with two months of deferment and light stocking during the rest of the summer of 1947. The resurvey in 1948 showed 2 percent in good condition, 87 percent in fair, and 11 percent poor.

Pasture D. Pasture D was in the same condition at the beginning of the drought

FIG. 3. This good cover of buffalograss and curlymesquite in Pasture B was an improvement of one condition class due to light stocking in 1945, a year of normal growing conditions.

year to the recommended "proper" rate based on the 1945 survey. As a result of this use, 70 percent of the acreage held its own in condition and 30 percent declined one condition class. This pasture of 596 acres consisted of 90 percent deep upland site and 10 percent ordinary upland. The survey in 1945 showed 31 percent in good condition, 58 percent fair, and 11 percent poor, with the proper rate of stocking indicated as 25 animal units per section. Actual stocking was reduced from 53 ani-

as Pasture A, about 70 percent good and 30 percent fair. It was stocked at about the "proper" rate during the first year of drought, but was excessively used during the summer of 1947. Most of the desirable grasses were eliminated and the entire pasture was classified in poor condition in August, 1948. This pasture consists of 510 acres, 70 percent deep upland and 30 percent thin upland. The proper rate of stocking indicated by the 1945 survey was 32 animal units per section. Actual stock-

ing in 1946 amounted to 27 animal units per section and in 1947 averaged 35 animal units per section. However, stocking from April to October 1947 amounted to 55 animal units per section, and for a period of three months the pasture carried a load of 95 animal units per section. The present cover includes only scattered remnants of curlymesquite and buffalograss in a desert-like expanse of bare ground, annual broomweed (*Gutierrezia*), caltrop (*Kallstroemia*), and pricklypear (*Opuntia*) with an overstory of mesquite.

FIG. 4. By the summer of 1948 the cover in the same area shown in Figure 3 had declined again to one dominated by annual weeds.

Pasture E. Pasture E is a small farm pasture of 127 acres used in connection with 63 acres of cropland. The native pasture is 60 percent deep upland and 40 per cent ordinary upland. Surveys in 1942 and again in 1945 classified the entire area in good condition. Different parts of the pasture were contour ridged and furrowed in 1937 as a part of the original soil conservation demonstration project of the U. S. Department of Agriculture at San Angelo. Evaluation studies of the effect of these mechanical treatments were carried out on this pasture during the period 1938 to 1940. The average of the ground cover on three plots in the contour furrowed area at the beginning and end of these studies was as follows:

	1938		1940	
	Cover	Composition	Cover	Composition
	%	%	%	%
Buffalograss	17.5	85	33.5	88
Threeawn	2.7	13	3.6	9
Tobosa	0.45	2	1.11	3
Total	20.65	100	38.21	100

It is difficult to evaluate the stocking rate on a combination of native pasture and field grazing such as this, but based on the survey of the pasture in 1945 and the expected production of the field in small grain for grazing, the "proper" rate of stocking for the combined acreage was figured at 40 animal units per section. Actual stocking in 1945 was 60 animal units per section, and in 1946 and 1947 was the recommended "proper" rate of 40 animal units per section. The field contributed little feed during the two drought years and the degree of use of the native grass in all three years was severe. A re-examination of the pasture in the fall of 1947 showed that the deep uplands, or 60 per cent of the acreage, had deteriorated to poor condition and the upland, or 40 per cent, had declined to fair. The pasture was not used during 1948 because it produced no feed. The cover consisted of scattered remnants of the sod grasses, dominated by a dense stand of filaree (*Erodium texanum*) and annual broomweed (Fig. 5).

FIG. 5. Chart quadrat records from this area in Pasture E show the cover in 1938 and 1940 to be 85 percent to 88 percent buffalograss. In the spring of 1948, only a few remnants of grasses remained, with Texas filaree the predominant plant.

The foregoing five case histories may be recapitulated as follows:

Pasture A—Proper rate of stocking before the drought, followed by one-third to one-half "proper" rate during the drought, reduced good condition to fair.

Pasture B—Light stocking before the drought improved fair condition to good; three-fourths "proper" rate during the drought reduced good condition to fair.

Pasture C—Heavy stocking before the drought and "proper" rate during the drought reduced good condition to fair and left most of fair condition in fair.

Pasture D—A moderate rate of stock-

TABLE 6

Composition of Protected Area

	1946	1947	1948	1949
Sideoats grama	15	7	5	3
Texas wintergrass	22	15	29	17
Other decreasers	3	7	6	2
Buffalograss and curly-mesquite	57	65	52	32
Invaders (mainly annuals)	3	6	8	46
Total coverage	60	50	50	50

already in fair condition with a predominance of the short sodgrasses were more likely to remain in the same condition class with moderate or light grazing, than those in good condition. Even under the lightest intensities of use, most of the midgrasses of higher moisture requirement succumbed and dense stands of grass characteristic of good condition ranges were thinned by death of individual plants of

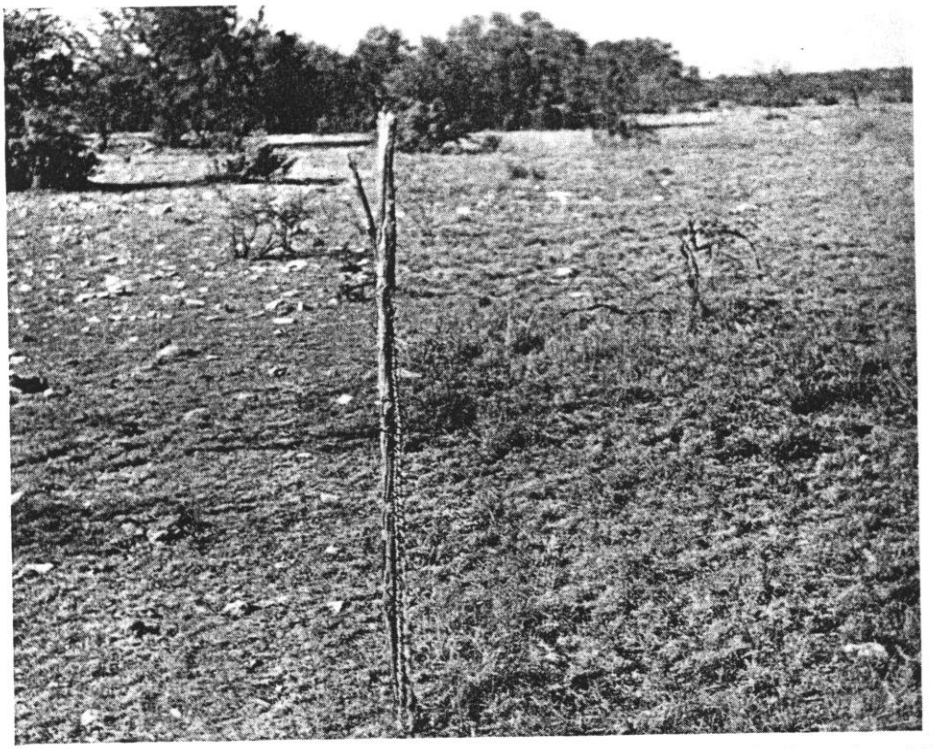

FIG. 6. A fence-line contrast between an exclosure (right) and a pasture in the spring of 1948 shows that the decline in range condition was not due entirely to the drought.

ing before the drought followed by one year of excessive stocking during the drought reduced both good and fair conditions to poor.

Pasture E—Heavy stocking before the drought and "proper" numbers during the drought reduced good condition to poor.

These examples show that even the most conservatively used pastures lost in range condition during the drought. Those all species. Those on which rate of stocking exceeded the recommended "proper" rate at any time during critical drought years were almost completely reduced to poor condition, regardless of their pre-drought condition.

EFFECT ON UNGRAZED GRASS STANDS

It is difficult to distinguish between the effects of drought and the effects of graz-

ing. Exclosures, or areas from which livestock are permanently excluded, help to evaluate the separate effects of these two factors.

Several such exclosures on cooperating ranches near San Angelo indicate the effect of the drought, apart from grazing, on the range. Data from one such exclosure on the Foster Rust ranch south of Van Court in the Concho Soil Conservation District, are typical of the trends observed.

This area is on a deep upland site which was fenced out of a pasture in 1938. At that time it was covered with the poisonous bitterweed actinea. Five years later it was covered with a good turf of buffalograss and curlymesquite, with a scattering of sideoats grama, Texas wintergrass (*Stipa leucotricha*), and other grasses.

Detailed records were made of the composition and density of the grass cover at the beginning of the growing season (about April 1) each year, beginning in 1946. These figures are shown in Table 6.

These observations show that there was a definite thinning of the stand during the first year of the drought, but little change since. There was a shift from the taller grasses of high moisture requirement to the shorter sodgrasses, but no serious invasion of undesirable plants (Fig. 6), although ample moisture in the spring of 1949 allowed annuals to occupy space left by the thinning of the perennial grass stand. This is not considered serious as the stand of perennials is well distributed over the ground and should promptly suppress the annuals after this first flush growth. No large bare areas developed in this pro-

FIG. 7. Although somewhat thinned by the drought, the turf of curlymesquite in the exclosure still had the ground well covered in the spring of 1948.

tected area where the litter covered the soil and maintained a uniform though thinner stand of grasses. (Fig. 7 and 8). These trends are illustrated in Figure 9. General observations on a total of about 100 acres of exclosures including the three major grassland sites of the area that have been protected from grazing eight to ten years show similar results. Only on extremely shallow soils underlain by continuous rock was there noticeable change in composition, although density was reduced in some places.

Clippings of similar plots were made at approximately the same dates each year in the protected area just described on the Rust ranch. The total pounds of forage per acre in April and September are shown in Table 7. The April yields are illustrated by the bar graph in Figure 9.

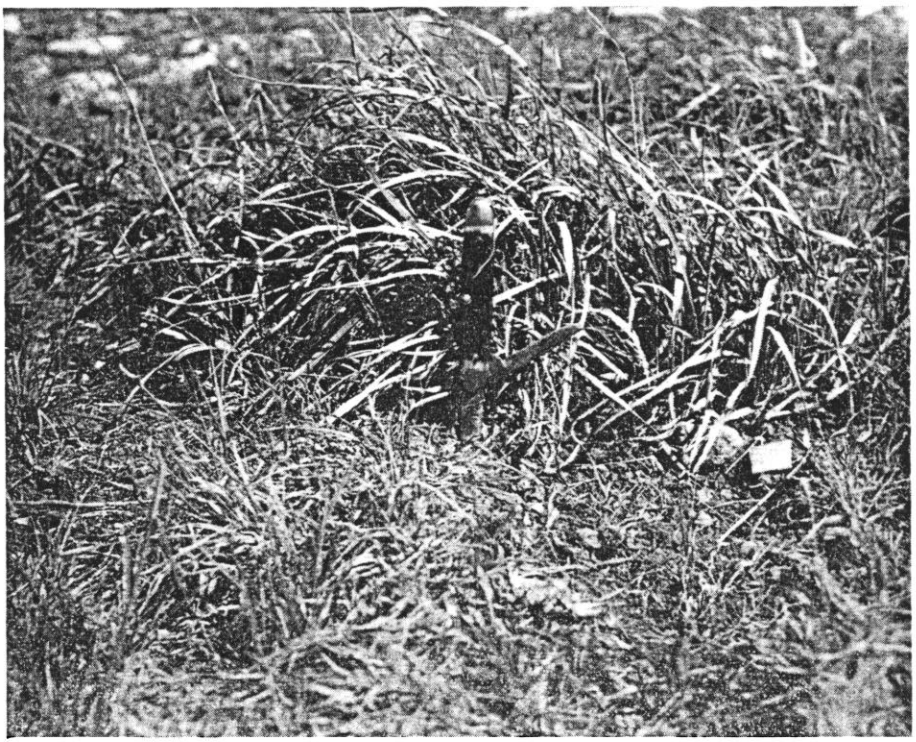

FIG. 8. Before any spring rains had fallen in 1948, sideoats grama in the exclosure had sufficient vigor to make early spring growth.

EFFECT ON GROWTH

While the drought ordinarily caused no serious change in the stand of grass where the grasses were not injured by grazing, it did reduce the amount of growth made each year as the drought progressed.

Similar trends were found on other protected areas, whether they represented good or poor combinations of plants.

Even where there was no change in the stand of grasses, the amounts of growth produced toward the latter part of the drought were not more than one-fifth to one-half the yield of the same grasses three years earlier.

This explains why even light stocking failed to avoid injury to ranges during 1946, 1947, and 1948. Even where livestock numbers were cut in half, the per-

centage of topgrowth consumed may have been twice or three times that removed during times of normal production. Such complete usage of the forage crop damages and eventually kills the grass plants.

But we have seen that such a course cannot be followed without devastating results during a period such as 1946–48. Undoubtedly, the same was true in 1917–18, and probably also in 1933–34.

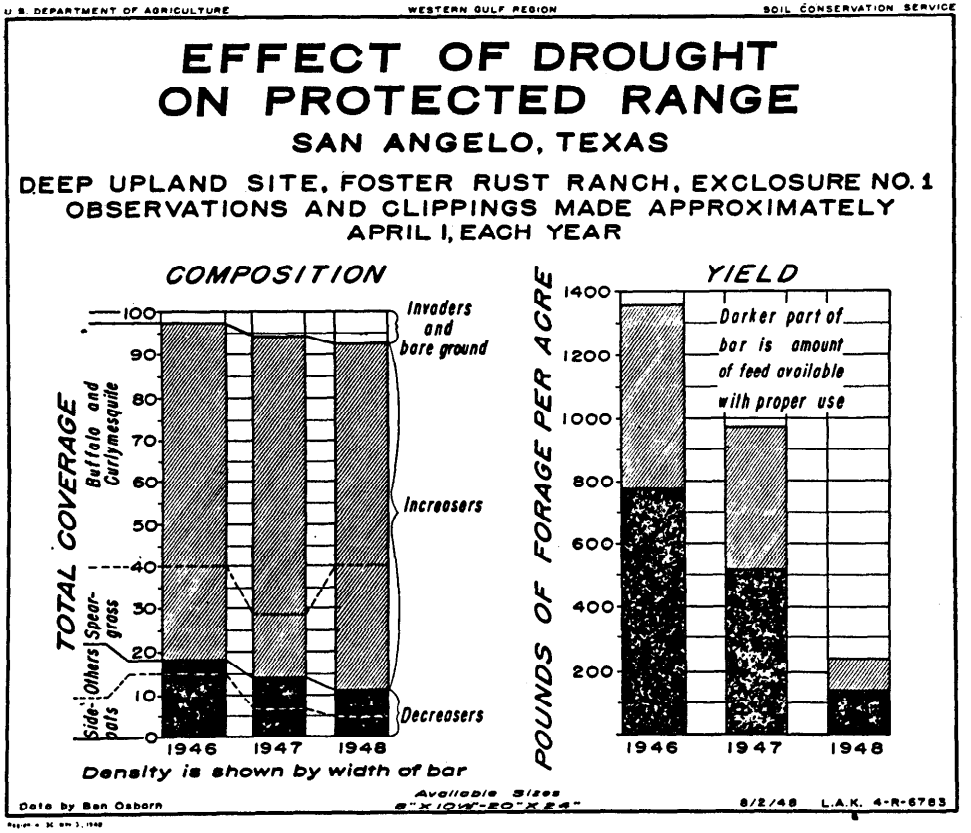

FIG. 9. Composition and yield of forage in an exclosure protected from grazing

MANAGEMENT TO MEET DROUGHT

Conservative range management is predicated upon a safe or "proper" stocking rate which, if followed, is expected to average out to the advantage of the range. It is anticipated that the injury done by overuse in a low rainfall year will be overcome by the extra growth made by the range in the better years to follow. This has proved to be sound if a safe stocking rate is found and reasonable flexibility in the herds is provided to meet seasonal variations in forage supplies.

TABLE 7

Forage Yields of Protected Area

Pounds per acre, dry weight

	APRIL		SEPTEMBER	
	Total weight	Available feed	Total weight	Available feed
1946	1,361	767	1,701*	953*
1947	980	529	871	479
1948	245	135	598	329

* October.

From the evidence at hand it appears that any grazing would have been damag-

ing during these three years. Even in exclosures, there was loss of grass plants, and only the mulch on the ground kept the soil covered and protected the thinning grass stands.

If decline in range condition cannot be avoided during drought, the objective must be to preserve a basic stand of desirable grasses to make possible rapid restoration after the drought is over.

Several systems have been suggested to meet variations due to droughts. Best known in the Southwest, perhaps, is the recommendation that ranges be stocked at 25 percent below the average grazing capacity (*4*). It is pointed out that this rate of stocking insures adequate forage in a majority of years. Various adaptations of the percentage level have been suggested for different localities. Jardine (*7*) recommended stocking during severe droughts as follows: Year before drought 100 percent, first year of drought 85 percent, second year 60 percent, third and subsequent years 50 percent.

From the information just reviewed, however, it is evident that these systems would not have been safe in the San Angelo territory in the three drought years. Good range management requires more than providing adequate forage for stock; with modern transportation and marketing, occasional range feed deficits can be met by moving stock or by supplemental feeds. Conservative management must protect the productive capacity of the range, and to do this it is necessary to avoid lasting injury to perennial grass stands.

In the recent experience in soil conservation districts, a flexible system of stocking based on the moisture already received and with constant watch to avoid over-use is suggested. Essentials of this system are:

1. Regard the so-called proper rate as a base rate to be followed as a guide so long as rainfall does not vary from the normal more than 20 percent or 25 percent. When there is greater variation, adjust the base rate up or down by the same percentage.

2. Use the total rainfall for a period including the *past two* growing seasons as a basis for evaluating growing conditions at any time. This will reflect not only the volume of growth resulting from conditions during the current season, but also the composition, density, and vigor of the stand surviving the previous season, on which the current season's growth is produced. For example, Nelson (*9*) found that density of black grama was influenced primarily by the previous summer's rainfall, while height growth on existing stands was controlled by the current season's moisture.

This system also will base stocking on the moisture already actually received, and the forage crop actually produced, rather than the average expected.

The San Angelo area has two growing seasons each year, in spring and fall, with partial summer dormancy between. Therefore a 12-month period is a satisfactory base for calculating percentage of normal rainfall. Where this is not true, an average of the past two years should be used.

How this would have applied to the sample pastures previously described is shown in Table 4 as the "adjusted" stocking rate. It will be noted that the actual stocking of Pasture A followed this value closely season by season. While the range condition declined from good to fair on most of the pasture, the composition and soil conditions were still favorable for a rapid recovery. Examination of the pasture after a late summer rain in 1948 and again early in the spring of 1949 showed desirable perennial grass plants well spaced for a rapid recovery.

3. Do not exceed "moderate" use of the forage on the ground, regardless of the

stocking rate. Recognize that a certain amount of forage and litter must be left to preserve the grass and protect the soil.

If livestock numbers are adjusted seasonally to the rainfall already received, and with constant attention to the degree of use of the grass, forage consumption and production should stay in balance.

If the base rate is in turn modified with changes in composition, and if it is kept in adjustment with variations in rainfall, safe stocking rate should result.

Summary

1. During 1946–48 the area around San Angelo, Texas, experienced the most severe drought in 44 years of weather records.

2. Actual stocking rates of pastures were reduced materially in 1946 but have remained relatively constant since, and are still above "proper" rates.

3. Despite reduced livestock numbers, the degree of use of the grass has been heavy to severe on most of the range since 1946.

4. Range conditions have declined seriously despite efforts at conservation.

5. Detailed histories of stocking and changes in range condition from 1945 to 1948 are presented for five pastures.

6. Composition of perennial grass stands in ungrazed exclosures has not materially changed during the drought, but annuals have invaded the thinned stands with the first season of adequate moisture.

7. Forage production in 1948, however, was only one-fifth to one-half as much as on comparable areas in 1945 in ungrazed exclosures.

8. Evidence reviewed indicates that ranges in fair condition can recover rapidly with favorable growing conditions, and good management, but those in poor condition will improve very slowly without artificial conservation treatments and seeding.

9. A criterion for adjusting stocking rates in proportion to the rainfall already received is suggested.

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