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South Dakota Cattle Feeders Field Day Proceedings  
and Research Reports, 1977

Animal Science Reports

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1977

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### Recommended Citation

Lewis, J. K.; Waller, S. S.; Lacey, J. R.; and Gibbens, R., "Effect of Range Condition on Steer Gains" (1977). *South Dakota Cattle Feeders Field Day Proceedings and Research Reports, 1977*. Paper 5.  
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A.S. Series 77-14

Effect of Range Condition on Steer Gains

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Introduction

Range is a vast resource that makes up about 43% of the world's land surface, about 50% of the adjacent United States and slightly over 51% of South Dakota. This land is generally unsuited for cultivation due to low precipitation, shallow soils, poor drainage or temperature restrictions but is well adapted to grazing.

Livestock and livestock products contribute 73% of South Dakota's total farm income, approximately \$1.5 billion. During 1975, 37% of all cattle, 45% of cows and heifers that calved, 69% of all sheep and lambs and 42% of all calves born in South Dakota occurred on its range. Highly productive, well-managed range can allow the beef producer to carry his cattle to a heavier weight prior to entering a feedlot and thus shorten time on feed. Furthermore, slaughter cattle can be produced on range. In 1974, about 35% of the slaughter cattle were grass fed.

As our range is reduced due to encroachment of residential and industrial development and as eastern grazing land is converted to grain production in response to increased human population, there is an increased burden on range for livestock production. This can only be accomplished through more efficient use of the remaining range which requires careful, knowledgeable management. This current study was initiated to provide information on the effect of the range condition of summer range on livestock production.

History

A summer intensity of grazing study was begun at the Cottonwood Range and Livestock Experiment Station in 1942. The station is located approximately 75 miles east of Rapid City, South Dakota. Summer grazing pastures were lands transferred from the Land Utilization Project administered by the Soil Conservation Service to the South Dakota Agricultural Experiment Station in 1939. These lands were rested from grazing until fences were built and the experiment begun in 1942. When the experiment began, the pastures had not completely recovered from the drought of the 1930's and were rated in mid-good range condition. Under continued heavy grazing, western wheatgrass (Agropyron smithii) decreased and the shortgrasses (buffalograss, Buchloe dactyloides, and blue grama, Bouteloua gracilis) increased. Under the light grazing regime, western wheatgrass increased and the shortgrasses decreased in relative amount. Under moderate grazing the percentages remained about the same. By the late 1950's the heavily grazed pastures appeared to have stabilized in low fair range condition, the moderately grazed pastures in high fair to low good and the lightly grazed pastures in high good to low excellent range condition.

In this study as in all intensity of grazing studies that have been conducted for several years, the effects of both low range condition and high degree of utilization were being studied at the same time. No experimental studies were found which compared the productivity of pastures in different range condition classes under proper grazing use. Consequently, in 1970, this experiment was revised to compare forage and livestock production from pastures in different range condition classes when managed for optimum livestock production while maintaining the existing range condition classes.

#### Soils and Weather

Range sites are predominantly clayey in texture. The dominant soil of the uplands is Kyle silty clay.

Precipitation by months and by season for the period 1970 through August, 1977, was documented (table 1). Annual precipitation equaled or exceeded the mean in all but 2 of the 7 years and vegetation-year precipitation (September to August) exceeded the mean in 4 of the 8 years, averaging 16.20 inches or 5% above average. Cool season precipitation exceeded the mean in 6 of 8 years, averaging 10.80 inches or 19% above average. March, April and May precipitation exceeded the mean in 6 of the 8 years, averaging 6.80 inches or 25% above average. In contrast summers (June through August) were drier than the mean in 6 of the 8 years, averaging 5.34 inches or 16% below average.

The precipitation during September and October of the year preceding the growing season was above the mean in 4 of the 8 years and 3 of the 4 was followed by an average or wetter than average spring, thus providing very favorable conditions for growth and development of Japanese brome (Bromus japonicus). The sequence of years with wetter than average cool season precipitation favored the increase of cool season western wheatgrass producing a strong upward trend in range condition. Relatively heavy stands of Japanese brome in 1974 caused the cattle to avoid large areas of ordinary uplands and to concentrate on drainageways, ridges and areas with less annual brome. Following the dry fall of 1974 and dry early spring of 1975, Japanese brome did not germinate in large amounts. Consequently, western wheatgrass began to increase rapidly in the low range condition pastures.

#### Procedure

The Cottonwood Research Station maintains six experimental summer pastures in three different range condition classes, high, medium and low (figure 1). Each range condition is represented by two pastures (replications). Pastures 1 and 4 are maintained in fair range condition (72 and 80 acres, respectively), pastures 2 and 5 are in good condition (141 and 133 acres, respectively) and pastures 3 and 6 are in low excellent range condition (183 acres each).

From 1971 to 1975, steer calves were purchased after weaning in the fall and grazed on deferred winter range in excellent condition, supplemented with soybean meal or with various nonprotein nitrogen supplements. Steers used during the summers of 1976 and 1977 were obtained in the spring. Pastures were grazed from early or mid-May through October for full use in 1971 and 1972.

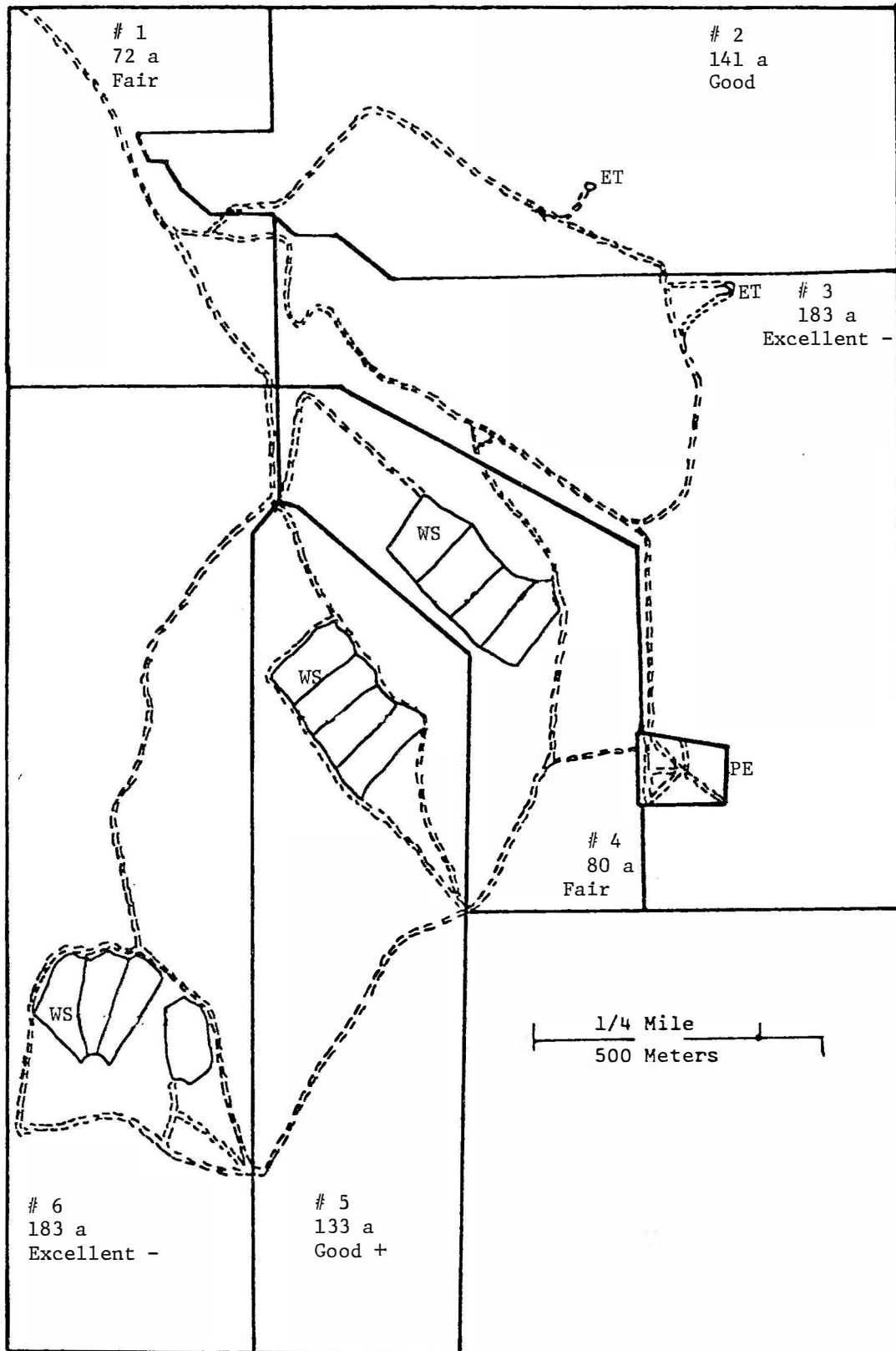


Fig. 1. Map of the summer grazing pastures showing pasture number, acres, range condition, location of permanent enclosure (PE), evapotranspiration plots (ET), experimental watersheds (WS) and trails. Cottonwood Research Station, 1976.

Table 1. Monthly and Seasonal Precipitation at the Headquarters, 1970-77,  
in Relation to the Mean, 1910-74, Cottonwood

Month	1970	1971	1972	1973	1974	1975	1976	1977
January	0.48	0.73	0.12	0.30	0.20	1.29	0.32	0.29
February	0.38	0.80	0.37	0.10	0.16	0.34	0.33	0.19
March	0.74	0.55	0.38	3.38	0.53	1.75	0.30	3.47
April	3.66	4.00	0.69	1.73	3.17	2.16	2.47	1.60
May	1.06	4.46	5.34	3.41	2.24	1.02	1.90	4.36
June	1.09	1.78	2.06	1.25	0.64	5.39	1.98	0.96
July	3.30	0.33	3.81	1.39	2.31	1.75	2.89	1.98
August	1.20	1.86	1.33	0.32	2.02	0.68	0.70	1.73
September	1.98	3.56	0.36	3.05	0.51	0.00	0.12	--
October	0.73	4.10	0.56	1.01	0.15	0.49	0.23	--
November	0.93	1.09	0.45	0.54	t	0.28	0.10	--
December	0.28	0.33	0.21	0.24	0.03	0.55	0.25	--
Total	15.83	23.59	15.68	16.72	11.96	15.70	11.59	--
Previous fall, Sept.-Oct.	3.28	2.71	7.66	0.92	4.06	0.66	0.49	0.25
Winter, Nov.- Feb.	1.52	2.74	1.91	1.06	1.14	1.66	1.48	0.83
Spring, March- May	5.46	9.01	6.41	8.52	5.94	4.93	4.67	9.43
Summer, June- Aug.	5.59	3.97	7.20	2.96	4.97	7.82	5.57	4.67
Cool, Sept.-May	10.26	14.46	15.98	10.50	11.14	7.25	6.64	10.61
Vegetation year, Sept.-Aug.	15.85	18.43	23.18	13.46	16.11	15.07	12.21	15.28

During 1973-74, pastures were grazed from mid-May to early or late October. However, all pastures had approximately the same stocking rate. In 1975-1977, the grazing season was approximately June 1 to August 31, and the pastures were grazed for full use. Put-and-take animals were used to obtain the desired utilization throughout the study.

Steers were weighed monthly with an overnight shrink. Utilization was determined by comparison with a guide to degree of use (table 2) by clipping inside and outside exclosures in the fall and by mapping visual estimates of degree of use in each pasture. Range condition was determined from reconnaissance and will be determined from the clipped weights of vegetation.

Table 2. Table of Use Rating<sup>a</sup>

Use rating	Description
Unused	No livestock use.
Slight	Appears practically undisturbed when viewed obliquely. Only favored areas near water, trails or shade and choice plants are grazed.
Moderate	Most all of accessible range shows grazing. Little or no use of poor forage. Little evidence of trailing to grazing.
Full (This or less use is Proper Use)	All fully accessible areas are grazed. The major sites have key forage species properly utilized (about one-half taken and one-half left). Points of concentration with overuse limited to between 5% and 10% of accessible area.
Close	All accessible range plainly shows use and major sections are closely cropped. Livestock forced to use much poor, dry and stemmy forage considering seasonal preference.
Severe	Key forage species almost completely used. Low-value forage carrying grazing load. Trampling damage is widespread in accessible areas.
Extreme	Range appears stripped of vegetation. Key forage species are weak from continual grazing of regrowth. Poor quality forage closely grazed. Livestock trail great distances for forage.

<sup>a</sup> From Dyksterhuis, E. J. 1964. Proper Range Use. S.D. Ext. Service Fact Sheet 220, 3 pages.

Steer Gains

In 1971 and 1972, the pastures were stocked for full use from early or mid-May through October (table 3). Stocking rates were higher in the low excellent range condition pastures with gains per head similar, resulting in higher gains per acre. Replicate 1 in low range condition was very productive, probably because of a more favorable combination of range sites. This replicate supported a stocking rate in 1972 50% higher than replicate 2 with a similar degree of use. The higher stocking rate in this pasture in 1972 reflected the extremely favorable cool season precipitation for that growing season (75% above average).

Table 3. Livestock Production From Mixed Prairie Ranges in Different Range Condition Classes Grazed From Early May Through October by Yearling Steers for Full Production, Cottonwood, 1971-72

Year	Range condition	Stocking rate AUM/A	Animal gain		Utilization	Grazing season
			Per head Lb./day	Per area Lb./A		
1971	Fair -	0.38	1.4	23	Full	May 14-Nov. 4
	Good -	0.38	1.6	25	Full -	
	Excellent -	0.46	1.4	27	Full -	
1972	Fair -	0.48	1.3	27	Full	May 3-Nov. 2
	Good -	0.38	1.5	25	Full -	
	Excellent -	0.51	1.5	33	Full	
Mean	Fair -	0.43	1.4	25	Full	
	Good -	0.38	1.6	25	Full -	
	Excellent -	0.49	1.5	30	Full	

In 1973 and 1974, approximately the same stocking rate was maintained in all pastures resulting in degrees of utilization which were inversely proportional to range condition (table 4). Gains per head and per acre were similar but somewhat higher from the pastures in high range condition in 1973. Gains were very good in all pastures until the range began to dry up. Feeding 1 lb. per head daily of a 40% protein supplement to these cattle doubtless improved the gains in late summer and fall. Yet there was a sharp drop in rate of gain after the range vegetation cured. The vegetation in the pastures in low range condition browned up quicker and more completely in low than in high range condition. In both of these years, but especially in 1974, the cattle concentrated on ridges and drainageways and avoided the gently sloping uplands where Japanese brome was very thick until August or September. Water, salt, shade and location of feed bunks for protein supplement helped distribute the grazing but did not prevent concentration areas, especially in the pastures in low range condition.

Table 4. Livestock Production From Mixed Prairie Ranges in Different Range Condition Classes Grazed From Early May to Early or Late October by Yearling Steers at the Same Stocking Rate, Cottonwood, 1973-74

Year	Range condition	Stocking rate AUM/A	Animal gain		Utilization	Grazing season
			Per head Lb./day	Per area Lb./A		
1973 <sup>a</sup>	Fair	0.34	1.8	21	Full	May 9-Oct. 2
	Good	0.36	2.0	26	Moderate +	
	Excellent -	0.34	2.1	25	Moderate	
1974	Fair	0.40	1.4	23	Full	May 15-Oct. 31
	Good	0.36	1.5	24	Full -	
	Excellent -	0.39	1.4	24	Moderate +	
Mean	Fair	0.36	1.6	22	Full	
	Good	0.36	1.7	25	Full -	
	Excellent -	0.36	1.8	25	Moderate +	

<sup>a</sup> The shortgrass vegetation in the pastures in low range condition (especially in replicate 2) was flattened by a severe rainstorm on September 23. Because very little forage was left within reach of the cattle (0.4 inch), they began to lose weight and were removed from low range condition, replicate 2, on October 2. The other pastures were grazed until October 31. Stocking rate and utilization are for the full season while animal gains are to October 2.

In 1975, 1976 and 1977, pastures were grazed for full production during the summer (table 5). Because of the threatened increase in range condition in the pastures in low range condition in 1975, 0.36 AUMs of grazing were removed from replicate 1 in May and 0.17 AUMs from replicate 2, resulting in close utilization, an increased stocking rate and increased gain per acre with little effect on gain per head that year. In 1976, stocking rates and gains per acre were directly proportional to range condition, while gains per animal were similar in all three range condition classes.

Seven year means must be used with caution since the grazing seasons differ. However, comparisons between range condition classes should be valid (table 6). The higher stocking rate in fair than in low good range condition is mainly due to the additional grazing in the low range condition pastures in May, 1975, and the higher stocking rate used in replicate 1 in 1972. Heavier stocking rates were used in the high range condition pastures with lower degrees of use. Gains per head were similar.



Table 5. Livestock Production From Mixed Prairie Ranges in Different Range Condition Classes Grazed by Hereford x Angus Yearling Steers During the Summer (June through August) for Full Production, Cottonwood, 1975-77

Year	Range condition	Stocking rate AUM/A	Animal gain		Utiliza- tion	Grazing season
			Per head Lb./day	Per area Lb./A		
1975	Fair <sup>a</sup>	0.55	2.1	32	Close -	June 2-Sept. 3
	Good -	0.41	2.2	26	Full	
	Good +	0.49	2.1	30	Full -	
1976	Fair	0.33	1.4	19	Full	June 1-Aug. 30
	Good	0.39	1.4	22	Full -	
	Excellent -	0.42	1.4	24	Full +	
1977	Fair	0.37	2.0	29	Close -	June 1-Aug. 31
	Good	0.41	2.3	37	Full	
	Excellent -	0.45	2.1	38	Full -	
Mean	Fair	0.42	1.8	27	Full +	
	Good	0.40	2.0	28	Full	
	Excellent -	0.45	1.9	31	Full	

<sup>a</sup> In order to maintain fair range condition following a series of wet springs which resulted in increased western wheatgrass, 0.36 AUM/A were removed between May 5 and 26 in replicate 1 and 0.17 AUM/A were removed between May 5 and 22 in replicate 2 of low range condition.

Table 6. Mean Livestock Production From Mixed Prairie Ranges in Different Range Condition Classes Grazed by Yearling Steers During the Growing Season, Cottonwood, 1971-77

Range condition	Stocking rate AUM/A	Animal gain		Utiliza- tion
		Per head Lb./day	Per area Lb./A	
Fair	0.41	1.6	25	Full
Good -	0.38	1.8	26	Full -
Excellent -	0.44	1.7	29	Full -

Replicate values for range condition, stocking rates, utilization, herbage residue, steer gains by months and gain per acre are shown for 1976 (table 7). Stocking rates were proportional to range condition with similar degrees of use. The height of grazed and ungrazed western wheatgrass plants were directly proportional to range condition. Total herbage residue was directly proportional to range condition except for replicate 1 of the low range condition treatment. Steers gains were similar in all pastures and exceeded 2 lb. per head daily in all pastures during June. Gains per acre were directly proportional to range condition.

### Conclusions

The importance of this study as well as its continuation are quantitative evidence provided to allow the rancher to make more knowledgeable management decisions. Mixed Prairie ranges in low range condition are much more productive when grazed for proper use, especially in dry years, than when overutilized. However, under proper use, pastures in low range condition are less productive of steer gain than those in excellent range condition. Seasonal distribution of precipitation can induce strong upward or downward trends in range condition which require careful grazing management to overcome.

When vegetation is actively growing, gains of yearling steers in excess of 2 lb. per head daily can be expected under good management. Following maturity or drought induced dormancy, gains less than 1 lb per head daily can be expected even with 1 lb. per head daily of a 40% protein supplement and access to a 10% phosphorus supplement. This very predictable decrease in gain should not be ignored in grazing management.

Proper grazing management of pastures in low range condition provides an alternative to a range improvement program, especially if the grazing season matches the time of growth of the warm season shortgrasses, buffalograss (Buchloe dactyloides) and blue grama (Bouteloua gracilis). However, since livestock production is less from ranges in low range condition even under proper use, management to improve the range to low excellent range condition is recommended for most situations.

Table 7. Livestock Production From Mixed Prairie Ranges in Different Range Condition Classes  
Grazed by Hereford x Angus Yearling Steers, Cottonwood, June 1-August 30, 1976

Relative range condition Replicate	Low			Medium			High		
	1	2	Mean	1	2	Mean	1	2	Mean
Range condition									
Estimated	Fair	Fair-		Good+	Good		Excel-	Excel-	
Percent (SCS <sup>a</sup> )	43	31	37	65	57	61	78	79	78
Number of acres	72	80		133	141		183	183	
Stocking rate, AUM/A	.36	.30	.33	.40	.38	.39	.43	.41	.42
Utilization									
Class, reconnaissance	Full	Full		Mod+	Full+		Full+	Full+	
Weighted by area, %	46	41	44	45	47	46	50	45	48
Index on key use area <sup>b</sup>									
AGSM, ungrazed ht., in.	7.0	6.8	6.9	8.0	7.4	7.7	8.3	8.3	8.3
AGSM, stubble ht., in.	2.8	2.7	2.8	4.5	3.2	3.8	4.5	4.4	4.4
AGSM, plants grazed, %	57	43	50	54	64	69	44	62	53
BUDA-BOGR, plants grazed, %	57	49	53	40	43	42	37	41	39
Total herbage residue, lb./A	700	435	568	750	580	665	815	830	882
Number of record steers	8	7		21	21		25	23	
Initial steer wt., lb.	615	625	620	625	641	633	629	623	626
Average daily gain of steers, lb.									
June	2.3	2.2	2.2	2.2	2.6	2.4	2.1	2.0	2.0
July	0.8	1.9	1.3	1.1	-.2	0.4	0.9	0.8	0.9
August	0.7	1.1	0.9	2.0	0.9	1.5	2.1	0.8	1.4
Summer	1.2	1.7	1.4	1.7	1.1	1.4	1.6	1.2	1.4
Gain per area, lb./A (calculated)	16.9	20.4	18.6	27.1	15.9	21.5	27.8	19.4	23.6

<sup>a</sup> Soil Conservation Service.

<sup>b</sup> AGSM = western wheatgrass, BUDA = buffalograss and BOGR = blue grama.

<sup>c</sup> Gain per acre was calculated as total gain of record steers ÷ number of acres x (total AUMs grazing furnished ÷ AUMs grazing for record steers).