

Fluctuations in Forage Utilization on Ponderosa Pine Ranges in Eastern Oregon

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FLUCTUATION in range forage utilization resulting from annual variation in forage production presents the rancher or range administrator with a difficult choice. He must either adjust livestock numbers to the fluctuating forage supply, or stock the range at a conservative level which will provide a reserve of forage in all but the extremely dry years. On many ranges livestock numbers cannot be adjusted from year to year because of the lack of information on range plant responses to weather, and the inability to accurately forecast the level of forage production in the following year. Furthermore, adjustments in livestock numbers which require large reductions generally are financially undesirable to the rancher (Hochmuth, 1952). The most practicable solution is conservative stocking.

The results here presented show the forage use by cattle from 1940 through 1949 on the conservatively stocked Starkey Experimental Forest and Range, southwest of La Grande, Oregon, which is maintained by the Pacific Northwest Forest and Range Experiment Station. These results suggest a basis for stocking that should be of benefit to ranchers using similar ranges and management practices.

The Study Area

The Starkey Experimental Forest and Range is a 21,000-acre summer cattle allotment on the Wallowa-Whitman National Forest. Forage

types commonly found on ponderosa pine ranges of eastern Oregon occur in mixture over the experimental range. Approximately 3,600 acres are grassland containing intermingled bunchgrass and dry meadow types with a predominant cover of Sandberg bluegrass (*Poa secunda*), bluebunch wheatgrass (*Agropyron spicatum*), prairie junegrass (*Koeleria cristata*), and one-spoke danthonia (*Danthonia uni-spicata*). Two usable timbered range types—pine-bunchgrass and pinegrass-elk sedge—occur on approximately 13,200 acres. The pine-bunchgrass type is characterized by rather open stands of ponderosa pine (*Pinus ponderosa*) with appreciable amounts of bunchgrasses and other forage species on the forest floor. Bluebunch wheatgrass, prairie junegrass, Idaho fescue (*Festuca idahoensis*) and elk sedge (*Carex geyeri*) are the most important forage species in this type. The pinegrass-elk sedge type occurs under a denser, shadier forest of ponderosa pine, Douglas-fir (*Pseudotsuga menziesii*) and western larch (*Larix occidentalis*). Here, shade-loving grasses and grasslike plants, such as pinegrass (*Calamagrostis rubescens*) and elk sedge, provide worthwhile forage. About 4,200 acres are so densely forested that they have little if any value as cattle range but do provide considerable forage for deer and elk.

The topography is varied and is typical of many summer cattle ranges in the Blue Mountain area. The range is cut by three live and several intermittent streams with relatively steep adjacent slopes.

Ridge tops are broad and rolling. Elevations vary from 3,500 to 5,000 feet.

Range Management, 1940-49

Seven hundred and fifty cattle, predominantly cows with calves, belonging to five national forest permittees, grazed the range from June 16 to October 15 each year. This conservative rate of stocking, approximately 5½ acres of usable range per head per month, was maintained for all years of the study except 1947. In 1947, the rate of stocking was unavoidably lowered to 7 acres per head per month.

In 1940 and 1941, the cattle grazed season-long on the entire range since only the boundaries were fenced at the beginning of the study. In the spring of 1942 a cross fence was built to provide two grazing units. Thereafter the range was grazed under a deferred-rotation system. Grazing on one unit was deferred until the last half of the season each year, and this unit was grazed first the following year.

Water for cattle was supplied by three live streams and by nine developed springs. During the first half of the grazing season intermittent streams provided some stockwater, but during the last half of the grazing season inadequate water caused concentration of cattle on the range adjacent to springs and live streams.

Approximately 7,000 pounds of salt were distributed each grazing season at 28 locations. Ground salt was used from 1940 through 1943, and block salt from 1944 through 1949. In 1948 the salting plan was revised by adding several new locations for salt grounds and changing the locations of many of the old ones.

Cattle on the experimental range were handled in much the same manner as on other summer ranges in eastern Oregon. The permittees, who form the Starkey Cattle and Horse Association, employed a

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rider during the four-month grazing season. He was responsible for keeping the cattle well distributed, placing sufficient salt at suitable locations and maintaining fences and water developments.

Methods of Study

To study utilization of the important forage plants and the distribution of use on the two major types—grassland and timbered range—a utilization survey was made at the end of the grazing season each year, except 1943, on the entire 21,000-acre range. In 1943 utilization estimates were obtained on 8 representative grassland areas.

The amount of utilization was estimated for each species occurring on 100-square-foot plots by the ocular-estimate-by-plot method (Pechanec, 1937). For each section, utilization plots were spaced at 8-chain intervals on lines one-half mile apart. This spacing gave a sampling intensity of 20 plots per section, or slightly more than 600 plots for the entire range each year.

Precipitation records for the period 1940 to 1948 were obtained from the Cooperative Weather Bureau Station at Starkey, Oregon, approximately 5 miles east of the experimental range at an elevation of 3,400 feet. This station was abandoned in January 1948. Records during the remainder of the period were collected at the headquarters site of the Starkey Experimental Forest and Range, elevation approximately 4,000 feet.

Results

Forage utilization fluctuated widely during the 1940–49 period. Fluctuations in use occurred on all range types and were largely due to varying amounts of seasonal precipitation which provided more forage in some years than in others. During some years of the study, fluctuations in utilization were modified somewhat by changes in range condition and the use of

Table 1. Annual and seasonal (Apr. 1–June 30) precipitation at the U. S. Weather Bureau Cooperative Station, Starkey, Oregon, 1940–49

Period	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	Average
<i>Inches</i>											
Annual	14.49	29.69	24.25	18.02	10.26	15.07	17.80	20.94	29.62	18.08	19.83
Seasonal	2.72	11.26	8.98	5.09	3.91	6.21	5.71	6.56	9.36	4.32	6.41

improved range management practices.

Precipitation, 1940–49

Influence of precipitation on forage production has been observed on many western ranges (Craddock and Forsling, 1938; Nelson, 1934; Clawson, 1948), but very few records are available as to the effect of fluctuating production on actual use by livestock. This study shows the influence of precipitation on forage utilization of important species from year to year.

Average precipitation at the Starkey Experimental Forest and Range was 19.83 inches for the seasonal year (September 1 to August 31) during the 1940–49 period (Table 1). On the average 6.84 inches fell as snow from December through March, and 12.99 inches principally as rain during the remainder of the year. The wettest year was in 1941, with 29.69 inches, and the driest in 1944, with 10.26 inches. Four of the years of the study received above average precipitation and the other six were below average.

Although many factors are correlated with plant growth, the dominating factor on the Starkey range seems to be the amount of rainfall during the spring period—April, May and June. For example, grassland areas on shallow soils and in poor range condition produced 533 pounds of herbage per acre in 1948 when spring precipitation was 9.36 inches (Fig. 1). In 1949, when spring precipitation was only 4.32 inches, these grasslands produced only 287 pounds per acre. The production of grasses was 246 pounds per acre in 1948, but 155

pounds per acre in 1949, or 37 percent less. Herbage production data are not available for correlation with precipitation in all years of the study.

Grassland Utilization

More than 25 grass species are found on the grasslands, but only 5 occur in sufficient quantities to be of any forage value. These species are bluebunch wheatgrass, prairie junegrass, Idaho fescue, onespice danthonia and Sandberg bluegrass. Studies in 1941 and 1942 showed that these 5 species produced 30 percent of the total herbage and provided 46 percent of the forage taken by cattle (Pickford and Reid, 1948). Bluebunch wheatgrass, the most important forage species, produced only 10 percent of the total herbage, yet furnished 25 percent of the entire forage grazed. Sandberg bluegrass, the most abundant forage species, produced 16 percent of the total herbage and supplied only 11 percent of the forage.

The degree of utilization on these grassland species varied greatly from year to year (Table 2). Utilization of bluebunch wheatgrass, for example, was almost twice as great

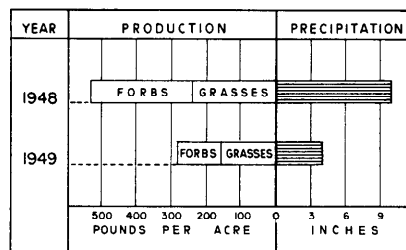


FIGURE 1. Herbage production (green weight) and precipitation during April, May and June, poor-condition grassland range, 1948–49.

Table 2. Utilization of major forage species on grassland and timbered range, 1940-1949

Range Type and Species	1940	1941	1942	1943 ¹	1944	1945	1946	1947	1948	1949	Ave.
<i>Percent</i>											
<i>Grassland</i>											
Bluebunch wheatgrass	68	69	41	53	63	39	42	38	38	64	52
Prairie junegrass	40	55	32	38	52	16	40	36	16	58	38
Idaho fescue	50	52	35	52	40	37	28	26	27	67	41
Onespike danthonia	59	44	34	26	76	33	41	18	32	71	43
Sandberg bluegrass	32	18	9	7	34	4	10	11	6	22	15
<i>Timbered</i>											
Bluebunch wheatgrass	60	43	30	—	50	38	37	30	38	45	41
Prairie junegrass	34	35	17	—	38	10	14	20	13	19	22
Idaho fescue	48	43	28	—	34	28	24	15	25	47	32
Elk sedge	40	29	28	—	25	19	18	18	38	38	28
Pinegrass	10	12	4	—	5	7	16	7	19	11	10

¹ Based on an inventory of eight grassland areas; no inventory was made on the timbered range.

in 1941 (69 percent) as it was in 1948 (38 percent). The utilization of Idaho fescue was only 27 percent in 1948, but in 1949 the utilization was 67 percent, 2½ times greater. Prairie junegrass received 3½ times as much use in 1949 as in 1948.

At the beginning of the study in 1940, the range was in poor condition and the rate of stocking had just been reduced to a conservative level. Very low rainfall during the spring season resulted in low herbage production and 68 percent utilization of bluebunch wheatgrass (Fig. 2 *Left*). In 1941, the wettest year ever recorded in eastern Oregon, utilization of bluebunch wheatgrass remained at a high level. Production of herbage was greatly increased that year, but the increase was largely in Sandberg bluegrass. Cattle do not graze it readily except in spring and early summer, before it dries. By 1942, however, the production of the more valuable grasses had increased as a result of two successive favorable growing seasons, and the utilization of bluebunch wheatgrass over the range dropped to 41 percent. Below-average spring precipitation in 1943 and a severe drought in 1944 again reduced the production of herbage, and forage utilization rose sharply.

A comparison of range inventories

made on the range in 1939 and again in 1944 showed that by 1944 the range vegetation was beginning to improve. The density of bluebunch wheatgrass on the grassland areas had increased by 98 percent. Sandberg bluegrass, an abundant species on ranges in poor condition, showed a 37 percent reduction during the same period.

Additional evidence of range improvement was provided in 1945 when the utilization of bluebunch wheatgrass dropped sharply. This decrease in utilization was in decided contrast with the slight increase which occurred in 1941 when precipitation was the highest on record. In 1941 the more valuable forage species were in such a deteriorated condition and in such relatively small numbers that they were unable to produce enough forage for a substantial reduction in use. In 1945, however, the better forage plants were present in sufficient numbers to furnish considerable forage as soon as precipitation was adequate for average growth.

Spring precipitation during 1945, 1946 and 1947 remained relatively constant, and utilization of bluebunch wheatgrass varied little during these years. The grasslands continued to improve. In 1947 a range inventory showed that the density

of bluebunch wheatgrass had increased 252 percent between 1939 and 1947. Sandberg bluegrass showed a reduction of 48 percent for the same period.

In 1948 the utilization of forage on the grassland areas was at an all-time low under the prescribed rate of stocking. Bluebunch wheatgrass was utilized 38 percent. Precipitation during April, May and June totaled 9.36 inches, the wettest growing season since 1941.

Forage utilization in 1949 was the highest since 1941, and spring precipitation was the lowest since 1944. Rainfall in April and June was the lowest ever recorded for those months. This resulted in very low herbage production (Fig. 1) and heavy use of forage over the entire range.

Utilization of Timbered Range

The most important forage species on timbered range are the grasses and grasslike plants. They provide more than half of the forage taken by cattle on pine-bunchgrass range, and nearly three-quarters of the forage on pinegrass-elk sedge range (Pickford and Reid, 1948). Of the grasses and grasslike plants, Idaho fescue, bluebunch wheatgrass, elk sedge and pinegrass are the most valuable.

Utilization of forage species varied considerably from year to year, although not as much as utilization on the grasslands (Table 2). Heaviest utilization occurred in 1940 when bluebunch wheatgrass was grazed 60 percent, Idaho fescue 48 percent and elk sedge 40 percent. Lowest use occurred in 1947 when the stocking rate was reduced over the entire range. Bunchgrass species generally showed the same pattern of use from year to year as occurred on the grasslands, but the utilization of elk sedge did not fluctuate inversely with spring precipitation (Fig. 2 *Right*).

Elk sedge received its highest use in 1940 when grassland production

was low. Apparently, during this drought year the cattle were forced to use more timber forage to satisfy their needs. In 1941 when grassland production went up with increased precipitation, the use of timber forage dropped sharply, and the cattle probably grazed the timbered range only to the extent required to escape heat and flies. Utilization of elk sedge continued to drop in 1942, decreasing still further in the dry year of 1944. The increased use on bluebunch wheatgrass and Idaho fescue in 1944 indicates that their production was lowered as a result of the drought. Elk sedge, on the other hand, received less use during this year, which would indicate that its production increased. Both of these events probably occurred, since the bunchgrasses are usually found on the shallower, drier soils, while elk sedge usually occupies areas of deep and relatively moist soils. Furthermore, elk sedge is an evergreen plant, its leaves sometimes persisting for as long as two or three years. Thus, it is a more stable producer of forage from year to year and is less dependent upon current precipitation for average production.

The utilization of all species gradually decreased during 1945 and 1946, and in 1947, under reduced stocking, elk sedge was used only 18 percent, Idaho fescue 15 percent and bluebunch wheatgrass 30 percent. In 1948, a year of high precipitation and herbage production, utilization increased in sharp contrast to the grassland trend toward decreased use in years of above-average precipitation and forage production. Elk sedge utilization rose to 38 percent, the highest since 1940, while utilization of bluebunch wheatgrass and Idaho fescue also increased to 38 and 25 percent, respectively.

The increased use of timbered range during the 1948 season probably resulted from efforts to obtain

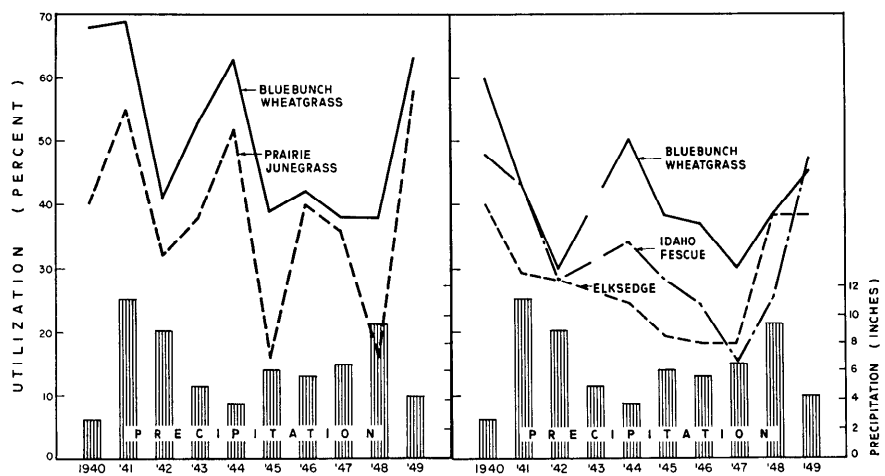


FIGURE 2. Left. Forage utilization on grassland range and precipitation during April, May and June, 1940-49. Right. Forage utilization on timbered range and precipitation during April, May and June, 1940-49.

better livestock distribution and more efficient use of the herbage. During this grazing season additional salt grounds were established in timbered areas and some salt grounds next to grassland areas were abandoned. Furthermore, when the cattle were distributed at the beginning of the grazing season in each unit, an effort was made to place the cattle in timbered areas where forage, salt and water were available.

Drought conditions in 1949 brought about increased utilization of timbered range, but to lesser extent than on the grasslands. Bunchgrass species were utilized most heavily. The use of Idaho fescue in 1949 was 47 percent, almost double that of 1948, and the highest recorded since 1940. Utilization of elk sedge in 1949, on the other hand, remained the same as in 1948.

Comparative Use of Grassland and Timbered Range

Although utilization varied widely from year to year in each type of range, the cattle grazed the grasslands more intensively than the timber. The average use of bluebunch wheatgrass was 52 percent on the grasslands, and 41 percent on timbered range (Fig. 3). Similar trends were shown for Idaho fescue

and prairie junegrass, which occurred on both types of range.

Grazing on timbered range resulted in similar use of the pinebunchgrass and pinegrass-elk sedge types. Cattle showed no preference for forage growing under the open stands of ponderosa pine to that under the mixed forest stands. During the 10-year period, elk sedge was utilized 29 percent on pinebunchgrass range and 28 percent on pinegrass-elk sedge range. Pinegrass, which is abundant on pinegrass-elk sedge range and relatively scarce on pinebunchgrass range, was also used equally on both areas, although to a much lesser extent. The choice bunchgrasses received similar use on pinegrass-elk sedge range, where they comprise less than 4 percent of the herbage, and on the pinebunchgrass range, where they make up 20 percent of the total vegetation.

Discussion

Fluctuations in range forage utilization from year to year during the 1940-49 period demonstrate that utilization in any one year is a poor basis for making adjustments in cattle numbers. Differences in the degree of utilization between the grassland and timbered range are sufficient to influence the rate of

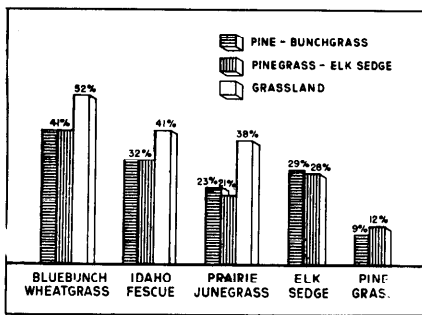


FIGURE 3. Average utilization of the major forage species on grassland, pine-bunchgrass and pinegrass-elk sedge ranges, 1940-49.

stocking, the management practices and the method of making utilization inspections on summer ranges.

Cattle numbers would have been increased after five years and decreased after four years if annual utilization had been used to adjust the stocking rate. Only in 1943 would the range inspector have been satisfied with the level of stocking on the range. Utilization provides a reliable basis for adjusting stocking rates only when averaged over a period of years and when evaluated in relation to other factors. The range inspector needs additional information on precipitation and its effect on herbage production. Adequate evaluations of utilization records which are used to prescribe the need for, and degree of adjustment also require knowledge of range condition and the management practices which have been used.

Since cattle utilize the grasslands more closely than the timbered range, summer ranges should be stocked at a level which will insure sustained production of the important grassland species. On the Starkey range, a level of 50 percent utilization is generally considered proper for bluebunch wheatgrass. Proper use for this species may vary considerably, however, depending upon the season during which the forage is removed, the thriftiness of the plants, degree of slope, and

soil and range condition. A comparison of 50 percent proper use for bluebunch wheatgrass with the actual use during the 10-year period shows that the utilization greatly exceeded 50 percent in 1940, 1941, 1944 and 1949, was slightly above in 1943, and was under during the other five years. Except in 1941, when the range was just recovering from a period of very heavy use, the utilization of bluebunch wheatgrass greatly exceeded 50 percent only during the years of drought. If the stocking rate had been at a level to obtain 50 percent use of bluebunch wheatgrass on timbered range, the utilization on the grassland would probably have equalled or exceeded this amount during all years except 1947 and 1948, and would have exceeded 70 percent in the drought years.

The extent to which cattle graze timbered range when given free choice is dependent upon many factors. When there is an abundance of forage on the grasslands, cattle may graze the timbered range only to the extent required to escape heat and flies. When grassland forage dries early in the season, cattle may use the greener, more succulent timber forage. Cattle can be attracted to timbered range by such common management practices as salting and riding. This is best illustrated by comparing the use of elk sedge during the 1945 and 1946 grazing seasons with the use during 1948 and 1949. During 1945-46, spring precipitation and herbage production were average and elk sedge was used approximately 20 percent. In 1948 and 1949, a wet and dry year respectively, the use was 38 percent. This difference is believed to be largely due to improved salting and riding practices carried out in the latter period.

Inspection of range utilization is usually restricted to a few areas representative of the grasslands because cattle prefer grasslands to

the timbered range. If bluebunch wheatgrass on the grasslands is properly used, it is likely that the timbered range has received a lighter degree of use. However, this type of inspection does not tell the rancher or range administrator if his management practices are effective in getting efficient use of the timber forage. For this reason forage utilization inspections on summer ranges with intermingled grassland and timbered types should include the inspection of representative timbered areas as well as grasslands. Unused forage in timbered areas may indicate the need for additional or different salt ground locations; the need for distributing a group of cattle in the area at the beginning of the grazing season; additional range riding throughout the season; or the need for additional water developments.

Summary

Forage utilization of the principal grass and grasslike species on eastern Oregon summer range fluctuated widely from year to year. During the 10-year period, 1940-49, utilization of bluebunch wheatgrass, a major forage-producing species, varied on the grasslands from a high of 69 percent to a low of 38 percent. This indicates that forage utilization during any one year is an unreliable basis for making adjustments in stocking numbers. An average of utilization over several years, together with information on herbage production and management practices, would provide a more reliable basis for evaluating stocking rates. Forage on timbered range types was used less than that on the grasslands. Cattle utilized elk sedge approximately 20 percent when given free choice of range during years of average precipitation and herbage production. This amount of use was increased to 38 percent during two years of the study by salting and riding practices designed to get more efficient

use of the range in the timbered types. Utilization studies of pine-bunchgrass and pinegrass-elk sedge ranged over the 10-year period showed that the important forage species received similar use on the two types of range.

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