Effects of Grazing and Drought on Range Grasses

East of the Oregon Cascades precipitation averages from as little as 6 inches on the desert plateaus to more than 30 inches in parts of the Ochoco, Blue, and Wallowa Mountains. The vast majority of the grasslands, sagebrush, and juniper rangelands receive less than 15 inches of annual precipitation. Range plants have adapted themselves to this arid environment. Perennial bunchgrasses form the staple diet of range livestock in central and eastern Oregon. Experience shows that modern-day grazing management has had no serious impacts on survival and production of important forage grasses under the usual variation in weather.

It is often thought that drought coupled with grazing seriously damages range grasses. Is this really true? From September, 1976, through the next 12 months, much of central and eastern Oregon, as well as the Pacific Northwest as a whole, experienced the lowest moisture on record. From 30 to 69 percent of normal precipitation occurred throughout the area. The low precipitation drastically reduced plant growth and stock water supplies in some areas, and average grazing pressures often were exceeded. This drought gave us an opportunity to try to evaluate the effects of grazing during a drought. Do grazed range plants really suffer in a drought? What are the recovery rates of grazed versus ungrazed plants? What can a manager who operates on rangelands do where range plants were damaged?

Not all of these questions have clearcut answers. In 1978 we undertook a study funded by special legislative funds to evaluate effects of past management on several perennial range grasses which had gone through the drought. Specifically:

(1) Do grazed plants recover or produce less after drought than do ungrazed plants?

(2) How does severity of past grazing affect grass growth and production?

(3) Are some species more tolerant of grazing than others under drought?

Based on the study results, management suggestions are offered.

Study Areas

Twelve areas in central and eastern Oregon were studied throughout the 1978 growing season (Figure 1). These were located in Wasco, Gilliam, Baker, Deschutes, Malheur, Harney, and Lake counties.

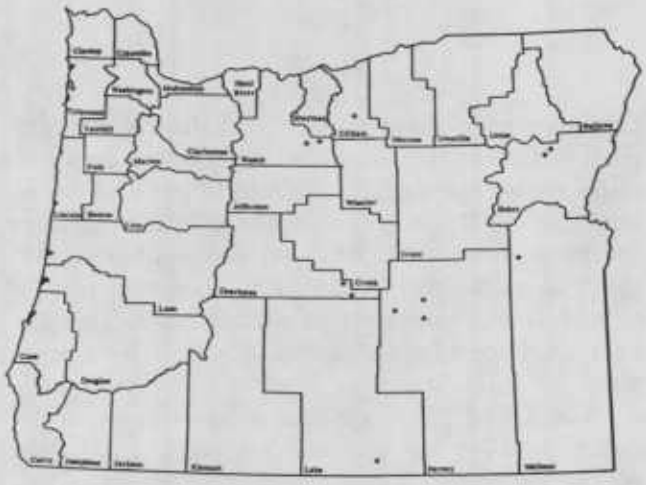

Figure 1. Location of study areas (•).

Grasses studied were bluebunch wheatgrass, crested wheatgrass, Idaho fescue, and Thurber needlegrass. Although many other grasses are common to Oregon's rangelands, these species constitute the mainstay of the range forage resource.

At each location measurements were made on grasses having a grazing history and on grasses having a history of non-use. In each case an exclosure was constructed on the grazed unit to prevent utilization during the 1978 growing season.

Forage utilization in 1977, by species, was estimated after the plot areas were identified. Before the 1978 growing season began, 10 ungrazed and 10 grazed plants of each species were paired up on the basis of similar basal diameters. During April, May, June, and July, height of the 10 tallest leaves or stems was measured on each plant. In July, seed stalks per plant were counted, diameters remeasured, and total annual growth per plant clipped and weighed. Canopy cover and density (plants per square yard) of each species were also measured in July. The measurements allowed determination of ecological range condition, of forage utilization, assessment of relative growth rate based on plant height, relative reproductive effects, and plant production adjusted to equal plant size.

Scientists do not agree that plant height is a good measure of plant vigor since vigor is a subjective term and somewhat abstract in meaning. Both height and weight were measured in order to give some indication of effects of past treatment (grazing, no grazing, and drought). Therefore, the term vigor will be used based on height, plant weight, and number of seed stalks, fully realizing its subjectivity.

Results and Discussion

Improved precipitation amounts and patterns combined with warm soil temperatures during March, 1978, provided great relief to plants on central and eastern Oregon rangelands. Precipitation at the study locations for the crop year September through June averaged 43 percent above normal (range of 7 to 71 percent). Soil moisture remained adequate for plant growth through mid-July, and 1978 became one of the best forage years on record.

Plant mortality

No significant plant mortality or bunchgrass breakup occurred on any of the study sites. An occasional dead bunchgrass was found in ungrazed locations but usually rodent burrows or diggings within plant crowns were the cause of death. Thus, it appears that these range grasses whether grazed or not are fully capable of enduring at least a single drought year without suffering significant plant mortality.

Plant vigor and production

Assessments of plant vigor and production, however, indicated that past grazing management was closely related to vigor and herbage production of individual bunchgrasses. Stands examined were placed in one of three utilization categories. Areas which appeared to have received greater than 70 percent utilization by weight each year were classified as heavily grazed. Moderately grazed areas received utilization ranging from 25 to 70 percent and lightly grazed ranges received less than 25 percent utilization.

Grasses were already 15 to 20 centimeters tall when the first measurements were made in early April. Growth probably started in early March due to above-average temperatures. Soil moisture did not become limiting to growth until mid-July on all sites so that the total growing season was approximately 4½ months.

Light grazing proved to be beneficial to vigor and production for both Idaho fescue and bluebunch wheatgrass (Figures 2 and 3). Lightly grazed range grasses exceeded their ungrazed counterparts in both plant height and weight per plant at the end of the growing season. Plants on

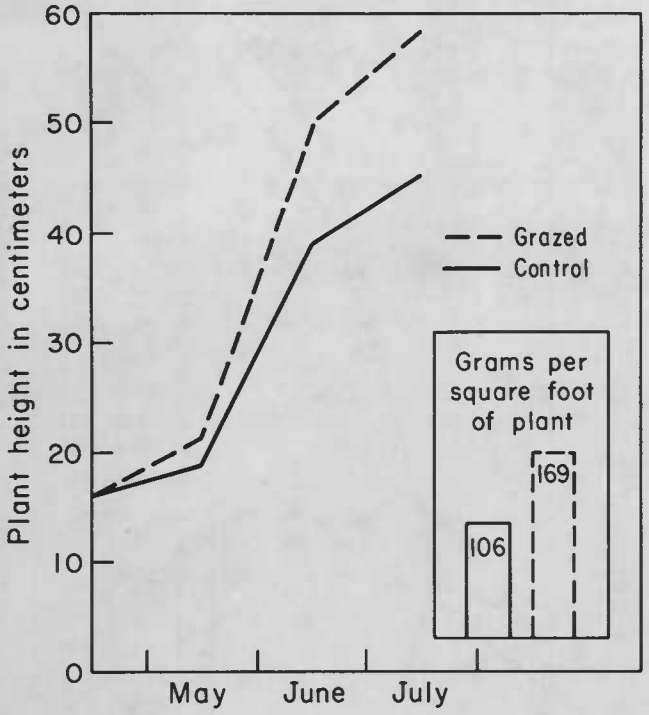

Figure 2. Seasonal height and final weight of lightly grazed Idaho fescue in 1978 (average of three locations).

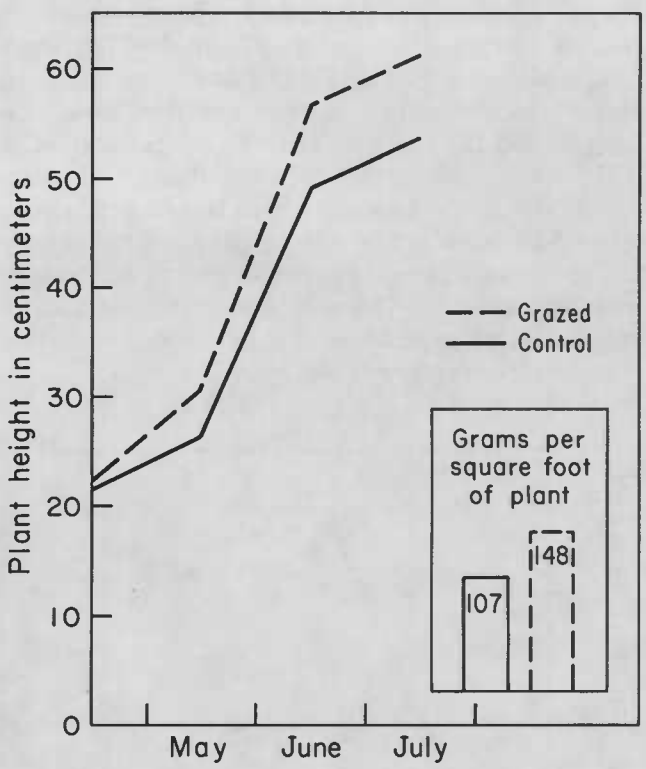

Figure 3. Seasonal height and final weight of lightly grazed bluebunch wheatgrass in 1978 (average of two locations).

grazed and ungrazed areas were essentially the same height on April 1, but by May 1 the grazed bunchgrasses were decidedly taller and maintained that difference throughout the entire growing season. Final weight of plants was approximately 60 percent more for lightly grazed Idaho fescue and 38 percent more for bluebunch wheatgrass compared to ungrazed plants.

These observations illustrated that light grazing produces a more vigorous plant than does absolute protection. The reasons for this are not clear. Since grazed plant heights were as tall as ungrazed early in the season, that level of use on both species apparently causes no significant reduction of energy for the plant to call upon in growth initiation. Why total heights of the lightly grazed plants increased at a faster rate and accumulated more weight could be due to several factors. Proper grazing may keep plants physiologically younger, which should increase their total production.

Two moderately grazed sites were observed, from which the information in Figure 4 was drawn. Height growth of Idaho fescue reached almost 70 centimeters (28 inches) by the last measurement on both sites. Although slightly more weight was produced on grazed plants, there was no statistical difference between final weights of grazed or ungrazed plants. More plant productivity occurred

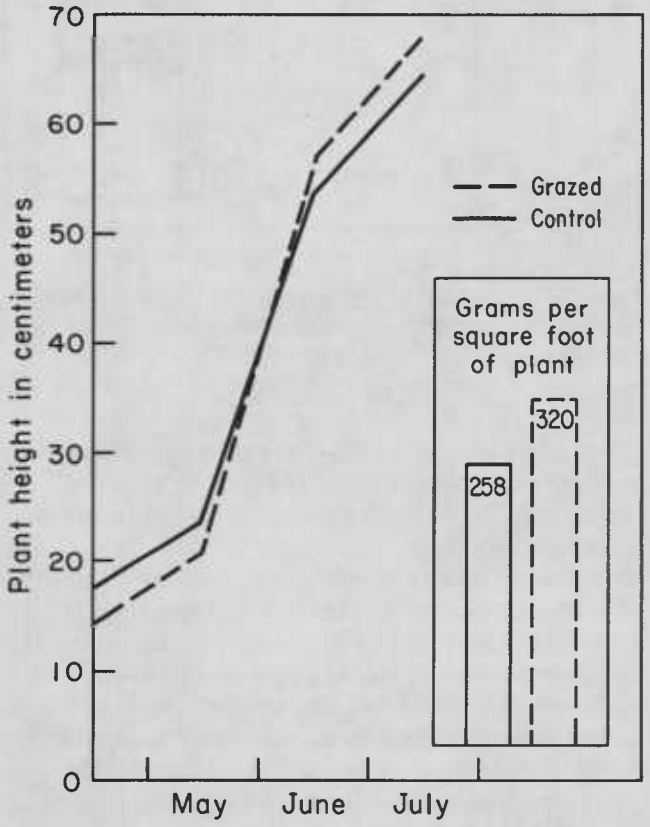

Figure 4. Seasonal height and final weight of moderately grazed Idaho fescue in 1978 (average of two locations).

on the Idaho fescue-bluebunch wheatgrass site in Wasco County than on the Wyoming big sagebrush-Idaho fescue site in Baker County, even though long-term average precipitation, precipitation during the drought year, and precipitation in 1978 were very similar between them.

At the single location where bluebunch wheatgrass had been moderately grazed (Condon), no differences occurred between ungrazed and grazed plants (Figure 5). This would indicate that heavier intensities of grazing would be necessary before any detrimental effects will occur.

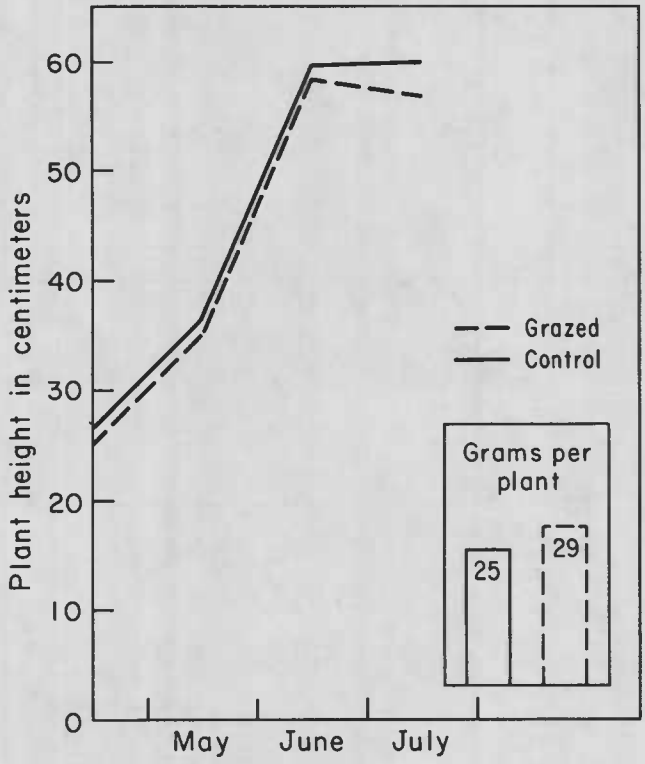

Figure 5. Seasonal height and final weight per plant of bluebunch wheatgrass on moderately grazed good-condition range near Condon, Oregon (Gilliam County) in 1978.

Moderately grazed crested wheatgrass was studied on two ecologically different sites—a Wyoming big sagebrush-bluebunch wheatgrass site near Keating (Baker County), and a Wyoming big sagebrush-Thurber needlegrass site near Hampton (Deschutes County). The Keating site received an average of 10.9 inches of precipitation during the crop year whereas the Hampton site averaged 9.7 inches. In 1977 the Keating site received only 5.36 inches whereas the other received 8 inches. Early in the growing season grazed plants on the Keating site lagged behind ungrazed plants. By mid-May, however, grazed plants overtook and surpassed the ungrazed plants (Figurue 6). Approximately 30

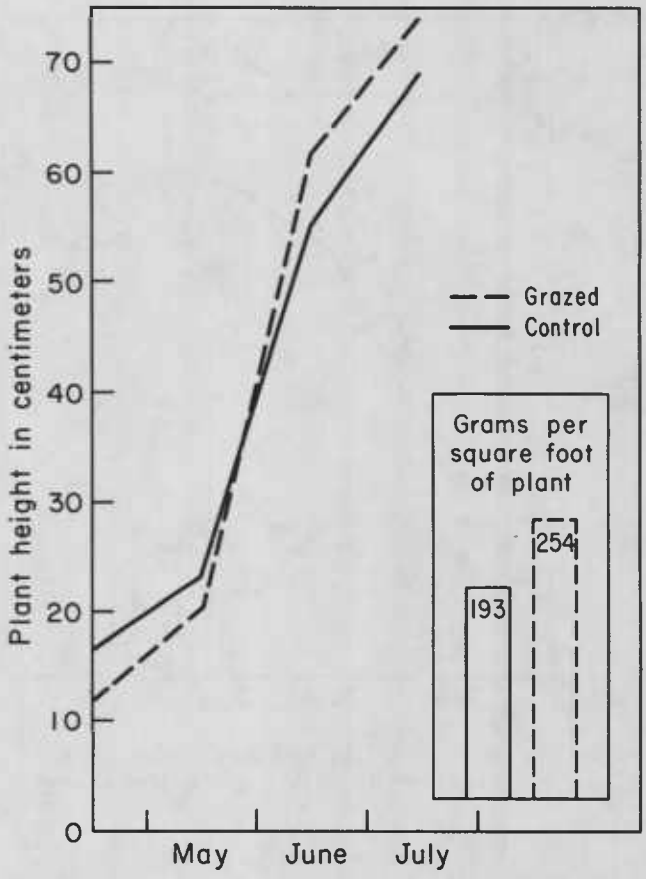

Figure 6. Seasonal height and weight of crested wheatgrass on moderately grazed range near Keating, Oregon (Baker County) in 1978.

percent more weight came from ungrazed plants. At the Hampton site ungrazed plants had a large height advantage early in the season, which was not lost. No difference in weights occurred, however, so heights do not give a consistent story with crested wheatgrass. The number of seed stalks per plant can give some clues regarding plant vigor or strength. At both sites the moderately grazed crested wheatgrass produced more seed stalks; almost triple at Keating, and twice as many at Hampton, as ungrazed plants.

Early height growth of moderately grazed plants, which lag behind ungrazed plants, suggests a weakened condition due to past moderate use. Both weight and height differences between grazed and ungrazed plants narrowed, and in some cases became reversed. This suggests that crested wheatgrass has the ability to recover rapidly. The 1978 growing season was exceptionally favorable and it is not known whether growth differences would have been smaller or larger in a more normal year. Since the productivity per equal area of plant was essentially the same or in favor

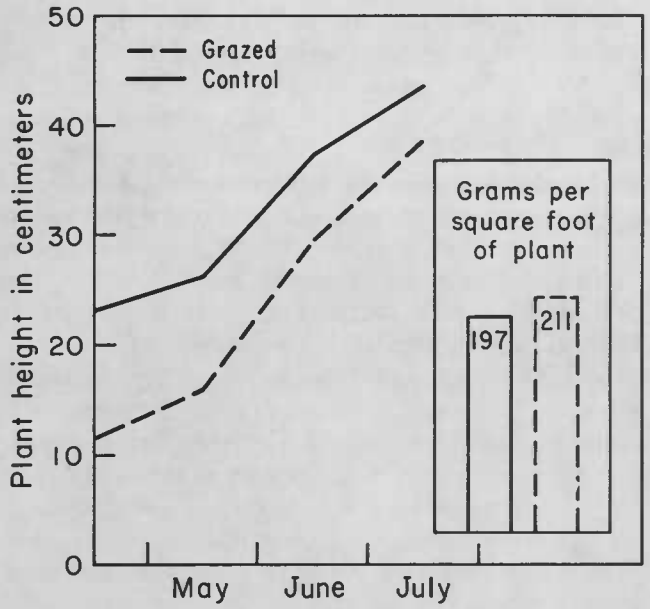

Figure 7. Seasonal height and weight of crested wheatgrass on moderately grazed range near Hampton, Oregon (Deschutes County) in 1978.

of moderate grazing, no detrimental effects are likely to be present due to moderate use.

Heavy grazing had occurred at three study locations, each on a different site. Both heavily grazed Idaho fescue and bluebunch wheatgrass showed similar effects when either height or growth rate was compared (Figures 8 and 9). Early leaf length was slightly less on grazed plants, but rate of leaf-height growth was similar so that

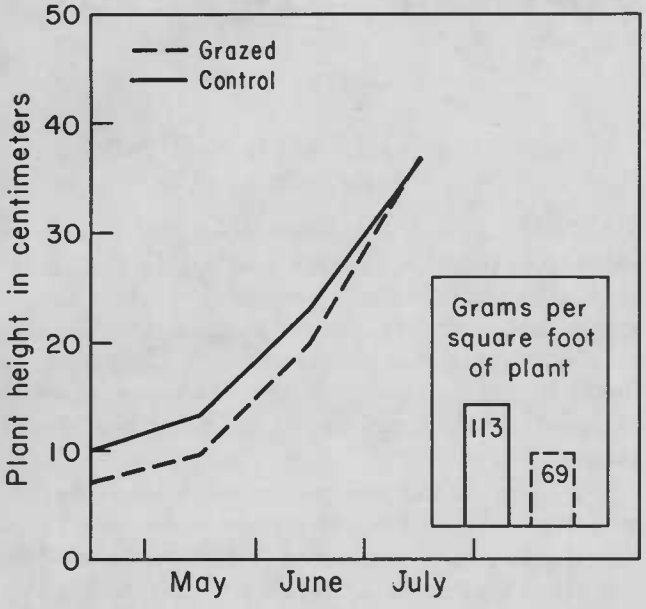

Figure 8. Seasonal height and weight of Idaho fescue on heavily grazed fair condition range near Hampton, Oregon (Deschutes County) in 1978.

height differences essentially disappeared by season's end. Idaho fescue weight per plant, adjusted for size, was statistically greater when ungrazed (Figure 8). There was no difference in weight with bluebunch wheatgrass at the Juntura site (Figure 9). Approximately 1 inch more precipitation occurred at the Juntura site, but the Hampton Butte site (Figure 8) was cooler and the effective environment should have been better. It is possible that Idaho fescue is simply more sensitive to the past heavy degree of use than was bluebunch wheatgrass. Plant sizes of the heavily grazed Idaho fescue were relatively smaller than ungrazed ones as compared with bluebunch wheatgrass, as a further suggestion of greater grazing sensitivity.

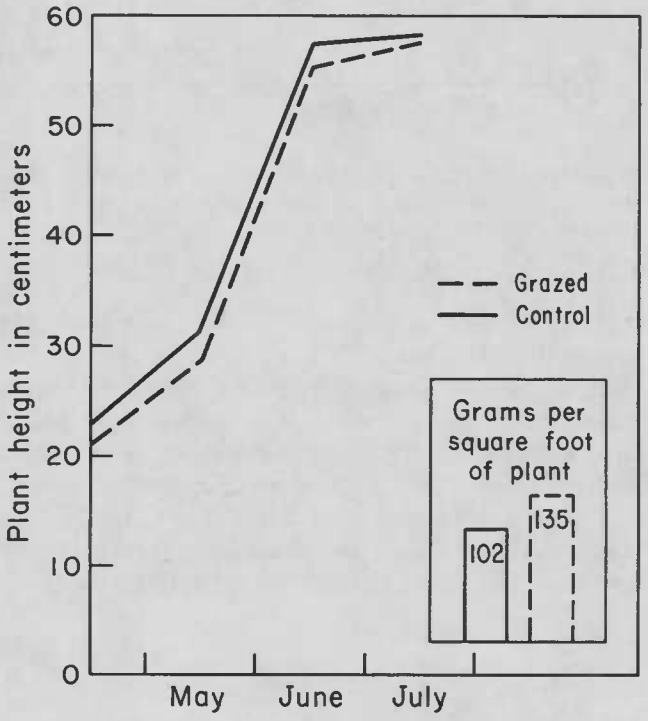

Figure 9. Seasonal height and weight of bluebunch wheatgrass on heavily grazed fair-condition range near Juntura, Oregon (Malheur County) in 1978.

Heavy grazing appeared to affect Thurber needlegrass to a greater extent than it did Idaho fescue and bluebunch wheatgrass. The grazed needlegrass either started growth slower or later than ungrazed plants. From April 15 to June 15, height growth rates were similar (Figure 10). Grazed plants reduced their growth rate sooner and to a greater extent than did ungrazed plants. However, plant weights adjusted for size were not different. Over 1½ times as many seed stalks occurred on the ungrazed plants as occurred on grazed plants. Dif-

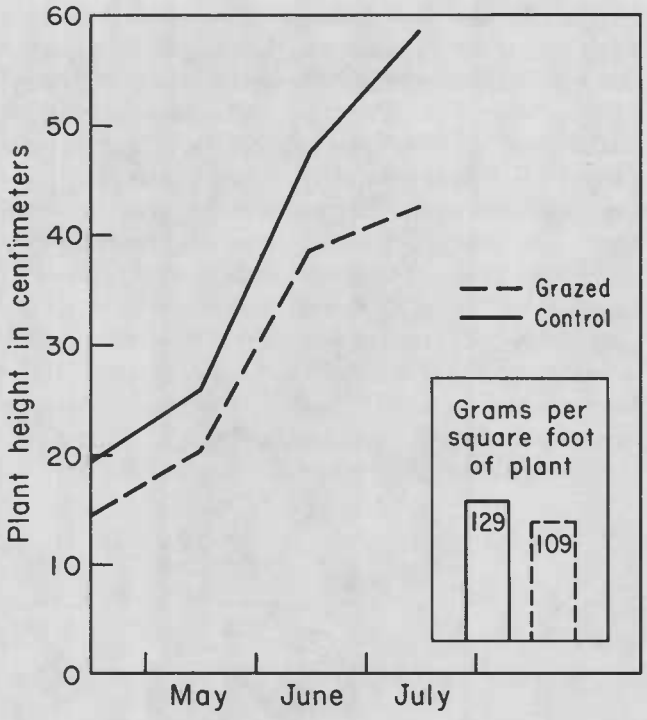

Figure 10. Seasonal height and weight of Thurber Needlegrass on heavily grazed fair-condition range near Adel, Oregon (Lake County) in 1978.

ference in root system size is the most probable reason for the height difference at the end of the season. Heavy grazing reduces plant size over time. Since soil moisture was sufficient to allow ungrazed needlegrass to grow 7 more centimeters from June to July, as compared to grazed plants, the root system on grazed plants probably was more shallow. On a per plant basis, not adjusted for size, ungrazed plants were 1½ times heavier.

Summary

No strong evidence existed to prove that these grasses were stressed by drought alone. Even when heavily grazed, no plant mortality occurred with 1 year of drought followed by 1 year of above-average moisture. The measurements do indicate, however, that past grazing can have an effect.

Of the 13 grazed-ungrazed comparisons only in 2 could any substantial impact of grazing stress be clearly seen by the end of the season. Heavily grazed Idaho fescue did not produce as much herbage per plant and heavily grazed Thurber needlegrass made less total height growth especially when some soil moisture stress appeared in summer. Thurber needlegrass appears to be more sensitive to heavy grazing than the other species studied. On needlegrass dominant range as opposed to the other species, management should include either some growing season rest or light use to maintain good vigor and production. This probably will be true even in non-drought situations.

Since on most of the moderate and heavy grazing comparisons height was less at the first measurement and often at the second, some energy or vigor difference was showing itself. Further, the previously grazed plants had to be protected in 1978 in order to make the measurements, so these plants had maximum opportunity to express themselves. Therefore, no comparable measurements could be made for plants undergoing current grazing. In most cases, one growing season's rest was sufficient for grazed plants to make enough growth to equal or exceed that of ungrazed plants. Possibly a shorter period than one season's rest or even light grazing during the growing season would have allowed these plants sufficient opportunity to restore their energy, but this was not measured. Heavily grazed plants with the exceptions cited have probably restored their full complement of energy with one season's rest. Moderately grazed plants probably will do as well as their ungrazed counterparts, and therefore would benefit from grazing season rest only under unusual circumstances or at irregular intervals. Lightly grazed plants very well could equal or exceed ungrazed plant growth without spring rest. Both native and successfully introduced perennial grasses have survived to this day by tolerating climatic and environmental extremes. It is important to remember, however, that excessive or untimely grazing can provide sufficient stress to affect plant health.

Grazing Management Suggestions Following Drought

The following suggestions can be applied to more than just the growing season following a severe drought. Periodic very dry periods occur rather frequently in central and eastern Oregon, so that management that contains flexibility in intensity and times of grazing will have great merit in maintaining acceptable range plant health and production.

(1) For heavily grazed ranges, defer grazing of native perennial bunchgrasses, especially Thurber needlegrass, until seed maturity or as late into the season as is possible. This will allow grasses the opportunity to regain their vigor, reestablish a healthy root system, and accumulate adequate carbohydrate reserves.

Deferment of native grasses can be accomplished through early reliance on crested wheatgrass pastures. The early root and top growth and advanced accumulations of necessary carbohydrate reserves by crested wheatgrass enables it to tolerate grazing earlier than native species. Crested wheatgrass can also better tolerate extremely heavy grazing without dying.

Other sources of early forage are ranges supporting large amounts of annual grasses. Cheatgrass and medusahead ranges are best used early in the year, when forage is still palatable and of higher nutritional value. After seed set nutritional quality declines rapidly and seeds may prove troublesome to livestock.

(2) If deferment is impossible, graze those pastures that were rested or deferred during the drought first. While all plants may be stressed to some degree by drought, those which were not grazed during drought should be most tolerant of early use the next year. Also, the carryover forage will permit less stress on individual plants. Pastures that went ungrazed during the drought, due to stockwater deficiencies, could be used first, especially if stockwater is again expected to be a limiting factor later in the growing season.

(3) Avoid early sustained use of pastures that received heavy use before and during the drought. Early growth of stressed plants will lag behind that of more vigorous grasses. For this reason stressed bunchgrasses will require more time to restore depleted carbohydrate reserves. In addition, the lack of standing litter in these units enhances the availability and palatability of young growth. If grazing is necessary, either graze early and remove stock or stock lightly. If light grazing is practiced, recognize that animals will graze selectively, often returning to preferred plants and areas repeatedly. This can result in patchy grazing, with some plants rather seriously damaged even though the unit as a whole will be grazed only lightly. Animals will intensively graze these areas and further stress already weakened grasses unless forced to move. This may be especially true around water facilities, where animals tend to congregate. In large allotments, portable watering facilities, salt, and/or riders should help in encouraging movement onto less used areas.

(4) Whatever the range use, whether season-long or under some rotated grazing program, strive for maximum animal dispersion and uniform forage use. This will place a lighter grazing load on individual plants and give them a chance to catch up during the early growing season.

(5) If past grazing use had been heavier than some plants can tolerate effectively, and especially if animal numbers were reduced during drought, resist the temptation to restock to former levels the first year following drought. Plants must have an opportunity to regain strength and re-establish depleted root systems. Unused forage is not necessarily a loss if plant vigor is improved. Putting some extra standing forage in the "bank" during the growing season by grazing lightly or by resting more heavily grazed pastures will result in faster improvement of plant vigor and, therefore, additional forage production.

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OREGON STATE UNIVERSITY
EXTENSION SERVICE

Extension Circular 1006 June 1980

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