TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

Box 2007, Albuquerque, NM 87103

Range Technical Note No. 52

June 12, 1972

Re: Proper Grazing Use

This Range Technical Note transmits University of Arizona Bulletin, A-73 on "Estimation of Range Use With Grazed - Class Photo Guides."

The information in this bulletin is useful in training for and judging proper grazing use by ocular estimate method.

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	Initials
~~Deska~~	
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~~McDonald~~	
~~Merkel~~	
~~Sylvester~~	
~~Swenson~~	
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Attachment

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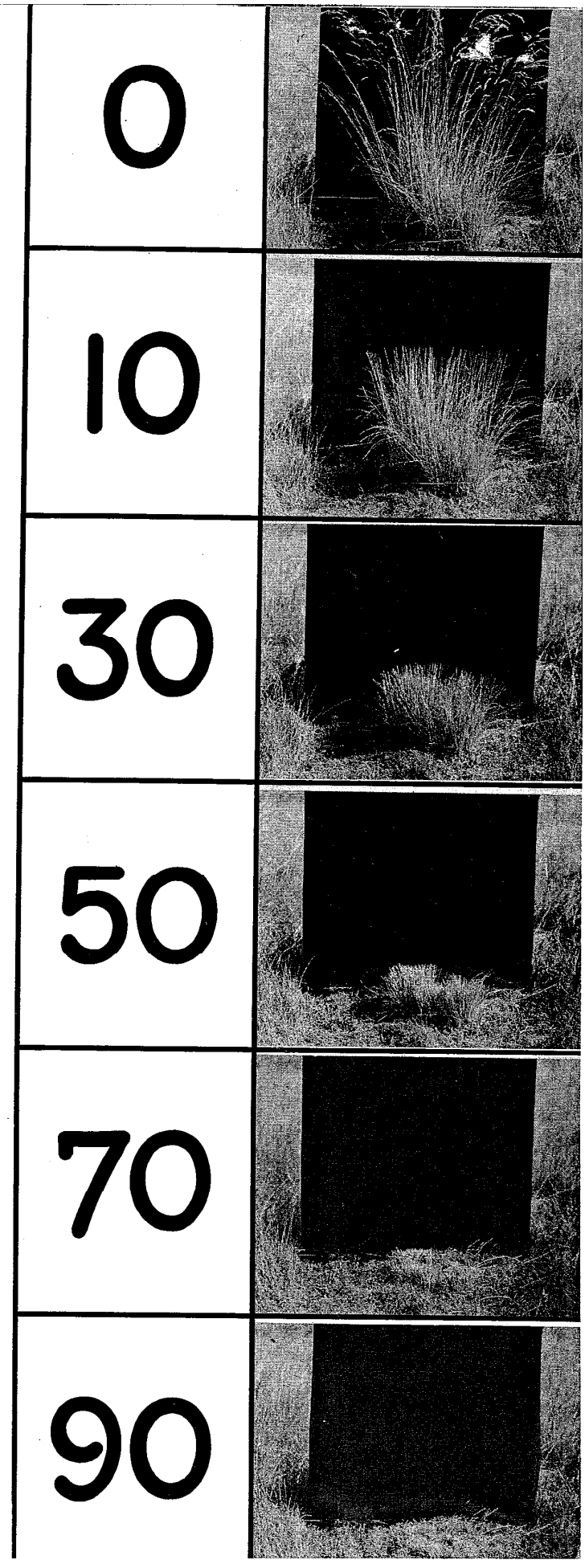
Area Range Conservationists - 1
Adjoining States - 1
RTSC - Portland - 2
D. M. Whitt, Director, Plant Science Div., Washington, D.C. - 1

Estimation of Range Use with Grazed-Class Photo Guides



Bulletin A-73

The University of Arizona

Cooperative Extension Service
&
Agricultural Experiment Station

Estimation of Range Use with Grazed-Class Photo Guides

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Bulletin A-73

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INTRODUCTION

Proper use or proper stocking of the range is the key that opens the door to good range management. Without proper use, plant vigor and forage production will be low, the trend of range condition will be down, and improvement practices such as seeding, brush control and gully control will be unsuccessful or short lived. With proper use, the food-manufacturing leaf surface will be greater, litter cover improved, runoff and evaporation reduced, and the quantity and quality of the forage increased.

The problems of estimating proper use are complex. Most systems measure utilization only at the end of the grazing season after it is too late to make needed adjustments. The height of plant growth and the volume of production varies from year to year making stubble-height or weight methods variable. The amount of grazing a plant can withstand varies with such factors as vigor of the plant, soil fertility, season of grazing, duration of grazing, intensity and frequency of grazing, pattern of grazing, and life form of the plant. The amount that the plant should be grazed can be affected by the associated species, the topography, the range condition, and the susceptibility of the soil to erosion. With these problems in mind the grazed-class method was devised to estimate current forage utilization and proper annual stocking rates. The method can be used by ranchers, technicians or research personnel in management of rangelands or in research.

THE GRAZED-CLASS METHOD

The grazed-class method was designed to give consistent, accurate and rapid estimates of current forage use (Schmutz, Holt, and Michaels 1963). To make utilization estimates, photo guides of key species are used to place the sample plants into six grazed classes – 0, 10, 30, 50, 70, or 90% use. Data obtained can be used to calculate the degree of current forage use, relative proper use of species, annual proper grazing capacity, distribution of grazing and the economics of range improvements.

The grazed-class method uses the key species concept, which assumes that when one or more key species of an area has been properly utilized in relation to the associated species and the conditions on the range, the best possible use of the area has been made. The method can be used on key areas to estimate utilization of the pasture as a whole or over the entire pasture to estimate distribution of grazing. The method has been tested and developed for use on grass and grass-forb ranges. Its adaptability to shrub ranges is being investigated.

Satisfactory photo guides have been developed for 12 key southwestern species (see page 11) and more are planned.

Use of Photo Guides

The use of photo guides to place plants in the six grazed classes gives accurate estimates (from 0 to 90% use) and reduces mathematics to a minimum. The photo guide provides a standard for comparison and increases consistency and accuracy in estimation of utilization. Errors in judgment are compensating. For bunchgrasses, estimates are made on individual plants; for sodgrasses, estimates are made on 6, 8, 10, or 12 inch squares of sod, whichever is more convenient. The guide makes possible the estimation of utilization based on forage removed (but also shows herbage remaining) and facilitates estimation of irregular use of plants.

Estimates of utilization are based on growth form of the plant. Therefore, variations in height growth due to site characteristics or seasonal precipitation can be disregarded since variations in height are automatically adjusted for by the eye.

Training Needed. Minimal training of personnel is needed to use the method. Consistent results can be obtained after two hours experience. The major problem with inexperienced personnel, and personnel who haven't used the method for some time, is that they underestimate use of the heavier grazed plants.

Sampling Procedure. The method is fast. A 100-plant sample requires from 30 minutes, where species are easily found and identified, to about one hour where plants are scattered or difficult to identify. Sample size will vary with accuracy desired and variability of soil and vegetative conditions. Generally 50 plant samples should be taken where several estimates are to be made and 90% accuracy is desired, and 100-plant samples should be taken where single estimates are to be made or 95% accuracy is desired.

Normally, sampling is done after seasonal growth is completed. In general, the best sampling procedure is to separate areas into uniform soil units or sites. Then, as far as possible, sample the areas crosswise to drainages, soils, slopes and trails to obtain a representative sample. To get good distribution of samples they should be taken at paced intervals in straight lines. To facilitate location of plants, select plants nearest the toe within a 2 to 3 foot strip on each side of the sample line and ahead of the examiner.

Use in Estimating Current and Proper Use

To calculate the current use of a key species on an area, sampled plants of the species are recorded in each grazed class by dot-dash tally (Fig. 1). After the desired number of plants are sampled the dot-dash tallies are converted to percentage of grazed plants by classes. If 50-plant samples are taken, the dot-dash tallies can be doubled to determine percentage of grazed plants by classes. If 100-plant samples are taken, the dot-dash totals equal percentage of grazed plants by classes. Then, the percentage of current use can be determined by multiplying the percentage of grazed plants in each class by the respective grazed-class percentage and totaling the products. To multiply, reduce percentages to hundredths, then multiply the products by 100 to convert them back to percent.

Comparison of total current species use with the proper use guides for the species will indicate relative use (under, proper or over) for the species and the range. Studies of relative utilization of key species over a period of years can be used to verify proper use guides for individual species on a given range.

RANGE UTILIZATION ESTIMATES

GRAZED-CLASS METHOD

PROJECT _____ DATE _____

PASTURE _____ SURVEYOR _____

LOCATION: KEY SPECIES:				LOCATION: KEY SPECIES:			
GRAZED CLASSES	DOT-DASH TALLY	GRAZED PLANTS-%	CURRENT USE-%	GRAZED CLASSES	DOT-DASH TALLY	GRAZED PLANTS-%	CURRENT USE-%
0	⊠⊠	20	0	0			
10	⊠⊠⊠⊡	36	3.60	10			
30	⊠⊠⊠	30	9.00	30			
50	⊠··	12	6.00	50			
70	··	2	1.40	70			
90				90			
TOTAL CURRENT SPECIES USE - %			20	TOTAL CURRENT SPECIES USE - %			

LOCATION: KEY SPECIES:				LOCATION: KEY SPECIES:			
GRAZED CLASSES	DOT-DASH TALLY	GRAZED PLANTS-%	CURRENT USE-%	GRAZED CLASSES	DOT-DASH TALLY	GRAZED PLANTS-%	CURRENT USE-%
0				0			
10				10			
30				30			
50				50			
70				70			
90				90			
TOTAL CURRENT SPECIES USE - %				TOTAL CURRENT SPECIES USE - %			

Fig. 1. Form for recording and calculating the current use of key species by the grazed-class method.

Use in Estimating Proper Stocking Rate and Grazing Capacity

In the past a great deal of emphasis has been placed on range survey systems that set up conservative grazing capacities based on average annual forage production. However, these average grazing capacity estimates were just general guides and actual grazing capacities varied from year to year due to variations in the amount and distribution of precipitation, temperature, etc. With the grazed-class method of estimating utilization, interim seasonal adjustments can be made in the current stocking rates so that the ranges can be more nearly grazed to their full proper grazing capacities. Also final estimates of forage utilization may be made to determine proper annual grazing capacities.

Estimation of Proper Current Stocking Rate and Grazing Capacity. To make interim estimates of proper current stocking rates on southwestern ranges, utilization surveys must be made between full forage growth and the end of the grazing season. The utilization estimates, plus the animal unit months grazed, can be used to estimate the proper number of animal unit months remaining in the current grazing year by the formula:

$$\text{Animal unit months remaining} = \frac{\text{Proper forage use (\%)} \text{ Minus } \text{Current forage use (\%)}}{\text{Current forage use (\%)}} \times \text{Animal unit months used}$$

The animal unit months remaining divided by the calendar months remaining gives an estimate of the stocking rate necessary to properly use a range for the remainder of the grazing season. Addition of the animal unit months used to the estimated animal units months remaining gives an estimate of the current year's total grazing capacity.

Estimation of Proper Annual Grazing Capacity. At the end of the grazing season a utilization survey can be made on a given area to determine the proper annual grazing capacity in relation to the animal units actually grazed.

$$\text{Proper annual grazing capacity in animal unit months or years} = \frac{\text{Proper forage use (\%)}}{\text{Actual forage use (\%)}} \times \text{Actual animal units grazed (months or years)}$$

Accumulation of proper use data for several years will give an estimate of the average annual proper grazing capacity of the pasture or allotment.

Effect of Plant Growth on Use Estimates. In poor years where plants don't mature the guide won't distinguish between use and non-growth. In these circumstances the method can be used to estimate proper use at the end of the grazing season but interim estimates of annual capacity will be low. Where regrowth is an important factor, proper use and proper annual grazing capacity can be estimated at the end of the grazing season but interim estimates of annual grazing capacity will be high.

Use in Estimating Distribution of Grazing and Economics of Range Improvements

The speed and accuracy of the method makes it extremely useful for analyzing the distribution of grazing on a pasture. A survey over the whole pasture showing relative use by 10% use differentials will spotlight the grazing problems due to water distribution, soil or slope differences, etc. Using the utilization pattern as a guide, treatments such as the location of new water developments, fertilization of little used areas, etc., can be planned and the increase in grazing capacity estimated. Then, based on the estimated increase in grazing capacity, the economics of the proposed treatments can be evaluated. If proposed treatments are applied, follow-up utilization surveys can be made to determine the effect of the treatments and to evaluate the need for further treatments. In some cases, temporary treatments such as hauled water, can be applied to test the effect of the proposed treatments before permanent treatments are installed.

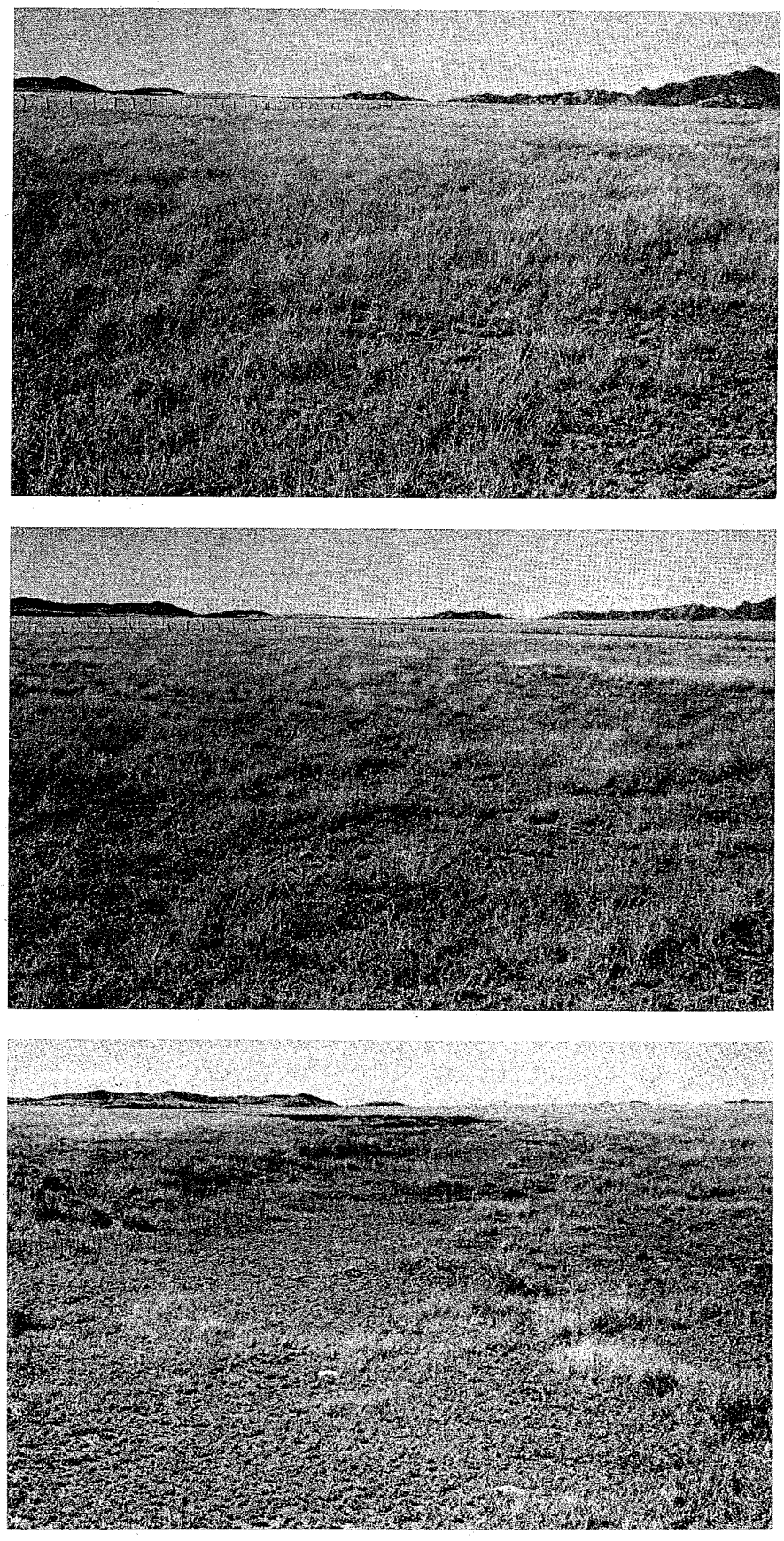


Fig. 2. Examples of range use in the Sonoita desert grassland — Top 40%, center 50%, and bottom 70%.

KEY AREAS, KEY SPECIES, AND PROPER USE

Selection of Key Management Areas

Key management areas are accessible areas at intermediate distances from water but are not areas where livestock naturally concentrate. The areas are usually one-fourth to one mile from water. They are located on the better soil areas, on level to intermediate slopes, and have no important obstructions to grazing. Size of the key area will usually range between 100 and 500 acres but may be larger.

Selection of Key Management Species

Key species will usually be perennials that are good forage producers for the major livestock or game utilizing the area, and that will provide good protection for the site. Species selected as key management species are of several types. One type is a highly palatable species that is dominant on the area or that may become dominant with improved management. To be used to estimate utilization, the species must furnish substantial grazing and plants must be present in sufficient numbers that they can be easily found to estimate utilization. Proper use of the species will be the maximum grazing that the plant can withstand, approximately 50%, and retain good vigor and reproduction.

Another type of key species is the moderately palatable species that is now abundant on the range but which will decline in abundance as the range improves. These are usually increaser species on the site and are used temporarily to measure utilization until more desirable species can be established on the site. In order for range improvement to occur, these species must be grazed light enough that the more desirable and more palatable species will be properly utilized and increased on the range. When the more desirable species becomes abundant enough, it can be used as the key species for the area.

A third type that may be used as a key species is the introduced seeded species, such as one of the lovegrasses or wheatgrasses. If it is seeded alone, the maximum proper use will be the highest degree of use it can stand and maintain good vigor. If seeded with other species, the degree of proper use will be determined by the relative use that can be made of the species and still maintain or improve the desirable associated species.

Proper Species Use

As indicated above, the proper use of a key species varies with (1) the amount of grazing it can stand and still maintain good plant vigor and reproduction and (2) the relative use that can be made of the species and still maintain or improve the desirable associated species. This means that the most palatable of the desirable species on a given range will determine the maximum proper use of the range and the less palatable associated species will be grazed at lesser rates, depending on their palatability in relation to the most palatable key species.

The season of grazing also affects proper use. Most plants can be grazed closer during the dormant season than during the periods of rapid growth and seed production. If the range is grazed on a seasonal basis, the amount of grazing that the plants can stand during that season will determine the degree of proper use. If grazed on a yearlong basis, proper use will be determined by the maximum degree of use that can be made of the key species by the end of the grazing season and still maintain good plant vigor and reproduction. Similarly, where a mixture of species is grazed on a seasonal basis, maximum permissable use of the most palatable species will determine the proper degree of use. If grazed yearlong, proper use of the range will be determined at the end of the grazing season by the maximum use that the most heavily grazed species can stand and still maintain good vigor and reproduction regardless of the season in which the plants were grazed.

Life form of the plant can also affect proper degree of use. Most grasses can stand 40 to 50% use on a total weight basis while many shrubs can stand 60 to 70% use or more of the current year's twig growth within reach of animals. The major reason for this difference is that proper use of shrubs is usually evaluated on the basis of current twig growth. Older twigs and twigs out of reach also produce leaf growth and these leaves carry on much of the food manufacturing necessary for plant growth, seed production and food storage. In grasses and forbs, proper use is evaluated on the basis of the whole plant and the leaf surface left during the growing season must be proportionately greater to manufacture the food necessary for growth, reproduction and food storage. Use during the dormant season must be limited to provide a plant-mulch layer to protect the soil, increase water infiltration, reduce evaporation, promote seed germination and provide decaying organic matter for plant food.

Also, when needed, the normal degree of use must be reduced to protect steep slopes or erosive soils, and to speed up range improvement. In contrast, the degree of use may be increased where the range is to be grazed for short periods or rested during the growing season following grazing.

Proper Range Use

Examples of 40, 50 and 70% range use are shown in Fig. 2. The areas were grazed during the summer and fall and the degree of range use was estimated by using the dominant blue grama as the key species. Corresponding use of curlymesquite on the same areas was approximately 20, 35 and 50%, respectively. Use on the lightly grazed range was irregular and spotty as compared to the fairly uniform patchy grazing on the moderately used range and the almost mowed appearance on the closely grazed swale.

A three-year study on these areas indicated that 40% use of blue grama was too light and old stems accumulated in the plants increasing the spotty use in subsequent years. The plants grazed at 50% use remained vigorous and utilization in subsequent years was quite uniform. Plants grazed at 70% use were greatly reduced in vigor and many plants died. Under the conditions of this study, proper use of blue grama was between 50 and 60%, and relative proper use of curlymesquite in association with blue grama was between 35 and 42%.

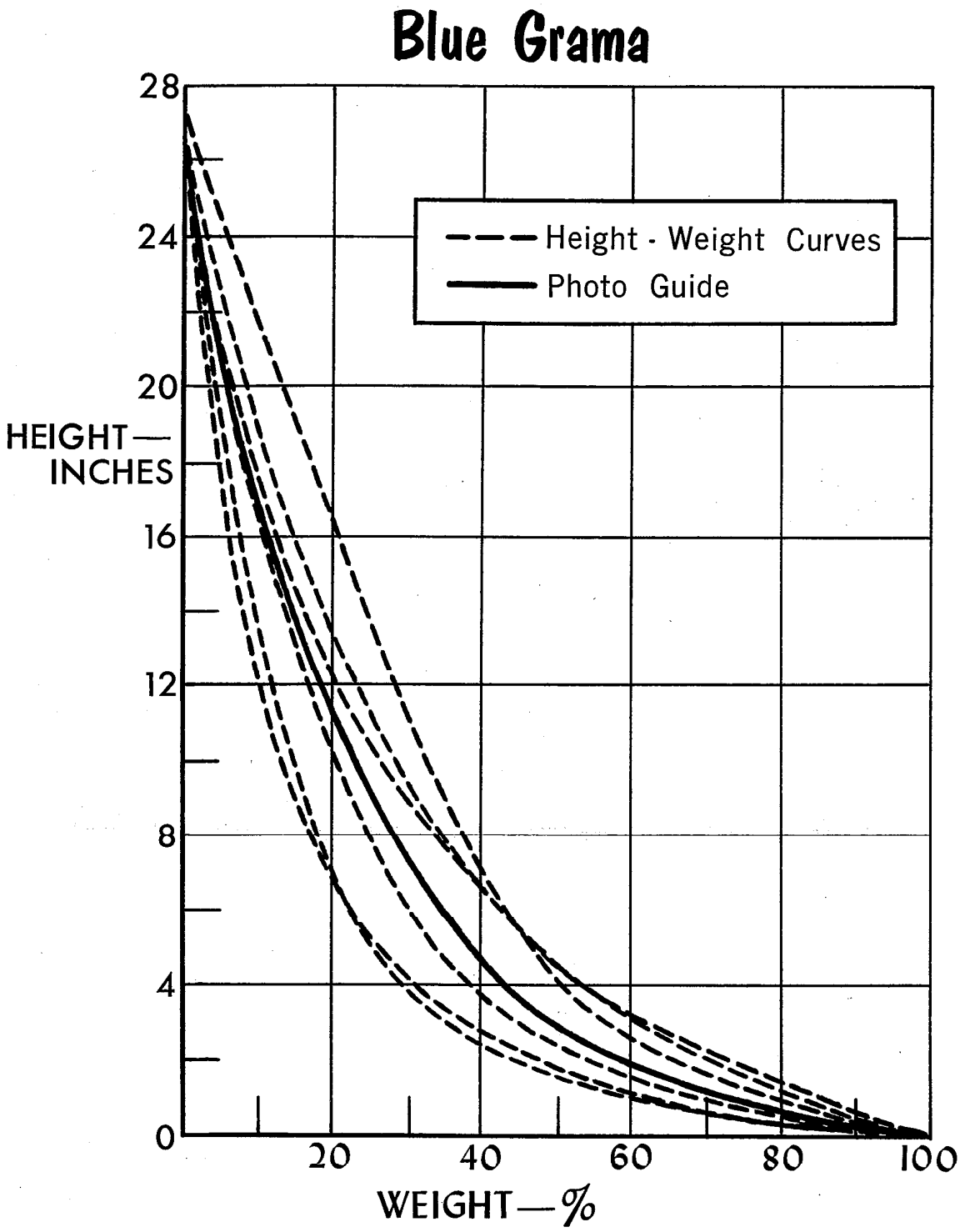


Fig. 3. Height-weight curves for blue grama collected on Herschede Ridge near Springerville, Arizona. Plants were selected for extremes in growth form to show variation in growth form on a given site. The photo guide curve shows the average plant form needed for the photo guide plant.

PHOTO GUIDES

Development of Photo Guides

Photo guides must be developed that have a close fit between the grazed-class percentages of the guide and the height-weight curve of the plant photographed (Schmutz, Holt, and Michaels 1963). Guides can be developed by the following procedure:

1. When plants are in full growth collect 5 to 10 representative plants from a typical site. Then, beginning at the top of the plant, clip each plant at 4 to 10 inch intervals at the top, and 2 inch intervals at the bottom, and place in individual paper sacks. Make all height measurements from the base of the plant.
2. Oven dry and carefully weigh each plant portion and calculate the percentage of the total plant weight removed in each section.
3. Beginning at the top of the plant, total the cumulative weight for each clipped section and calculate the cumulative weight percentages for each section.
4. Beginning at the base of the plant, total the cumulative height for each clipped section. Then determine the average height of clipped plants and adjust the height increments of each individual plant to average plant-height increments with the following formula:

$$\text{Adjusted individual plant-height increment} = \frac{\text{Total height of average plant}}{\text{Total height of individual plant}} \times \text{Height increment of individual plant}$$

5. Plot the cumulative weight percentages of the individual plants against the adjusted average plant-height increments (Fig. 3). Use the lower left hand corner as zero on both scales and plot 5 or 6 clipped plants of a given species on the same chart.
6. From the chart curves, determine the average plant height for the six grazed-class percentages — 0, 10, 30, 50, 70 and 90.
7. Return to the field and select 4 to 6 average plants to be used in making a photographic guide for the key species. Using the heights read from the average curve adjusted to the height of the new plants, photograph each plant in sequence at unclipped and 10, 30, 50, 70, and 90% clipped heights. Keep the plant clippings, dry them in an oven to determine if the curve of at least one plant is average and the percentages of the plant clipped closely match the grazed-class percentages, within 2 or 3 percentage points. If a close match is obtained, trim the photos and photograph on a grazed-class photo guide background. If not, repeat the photographing of average plants until a close fit is obtained.

Range of Photo Guide Use

A three-year study in the desert grassland of Southern Arizona near Sonoita on the effects of season on plant growth of four species showed that above average, average and below average years produced marked differences in height growth but little variation in growth form. A similar study showed that soil and site differences had considerable effect on height growth but small effect on growth form. In general, apical growth was average or greater on deeper soils and average or lower on shallow soils. Similarly, fertilization had a marked effect on height growth but the effect on growth form was small and varied by species. On curlymesquite and black grama fertilization had no effect or increased basal growth; on blue grama and sideoats grama fertilization had no effect or increased apical growth.

Comparison of height-weight curves for blue grama and sideoats grama collected near Sonoita, Flagstaff and Springerville in Arizona and Santa Rosa and Tucumcari in New Mexico showed that when adjusted for height the growth forms of these species were similar.

These studies indicate that a single guide for a given species properly developed for a typical site can be used throughout the Southwest on all sites in good and bad years without serious error. There is usually as much variation in plant form on a given site (Fig. 3) as between sites and these variations are averaged out with the large sample taken. Therefore, it is necessary to develop photo guides for each key species that is based on an average plant on a typical site (Fig. 3) and that has a good photo-height-weight fit.

CONCLUSIONS

The method is rapid, statistically sound and easy to learn and use. It can be adapted for use by ranchers or technicians in management or research simply by varying the size of sample taken. Generally, 50-plant samples can be used where 90% accuracy is desired and 100-plant samples for 95% accuracy. To properly sample an area, so far as possible sample uniform soil areas crosswise to drainages, soil patterns, slopes and trails; sample at paced intervals to get good distribution of samples; and select plants nearest to the toe on a straight line, within a 2 to 3 foot strip on each side of the line.

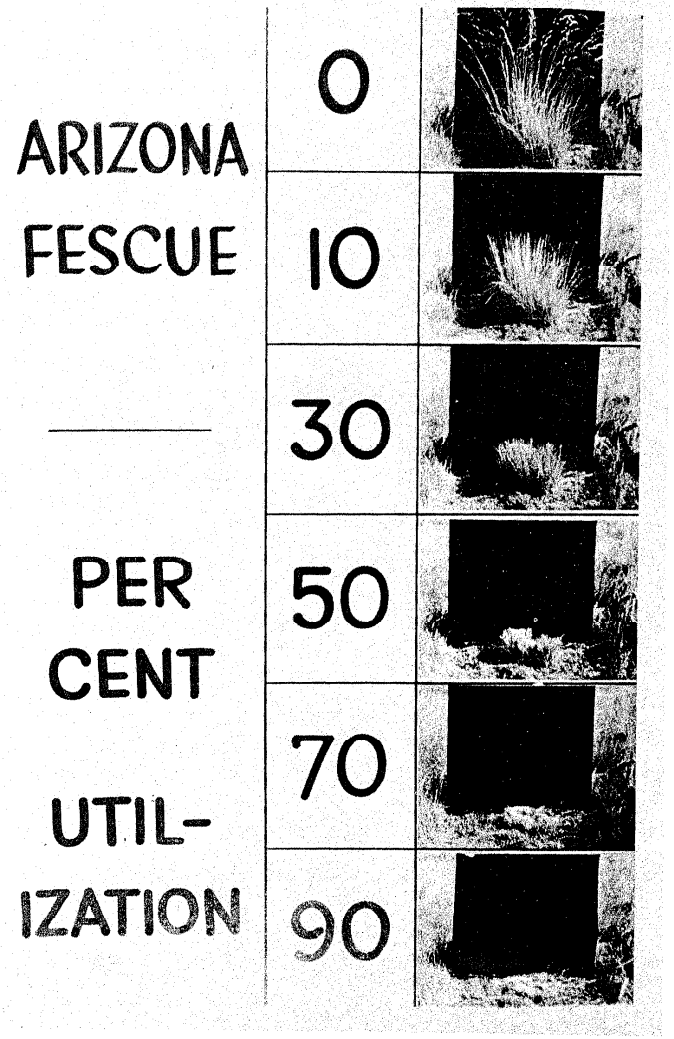
The difficult job is the development of photo guides that are based on average plants and that have a good photo-height-weight fit. One guide properly developed for a given species and typical site can be used throughout the Southwest on all sites in good and bad years without serious error.

The method is designed for use on ranges after seasonal growth is completed. In poor growth years where plants don't mature, the guide won't distinguish between use and non-growth. In these circumstances, the method can be used to determine proper use at the end of the grazing season but interim estimates of grazing capacity will be low. Where regrowth is an important factor, proper use and proper annual grazing capacity can be estimated at the end of the grazing season but interim estimates of grazing capacity will be high.

The method can be used to estimate seasonal and annual degrees of use, proper seasonal stocking rate, proper annual grazing capacity, relative proper use of species, and distribution of grazing in the pasture. Also, it can be used to evaluate the effects and economics of range treatments and practices, such as salting, water development, fertilization, fencing, deferred and rotation grazing, and changes in class of livestock grazed.

REFERENCE

Schmutz, E. M., G. A. Holt and C. C. Michaels. 1963. Grazed-class method of estimating forage utilization. J. Range Manage. 16:54-60.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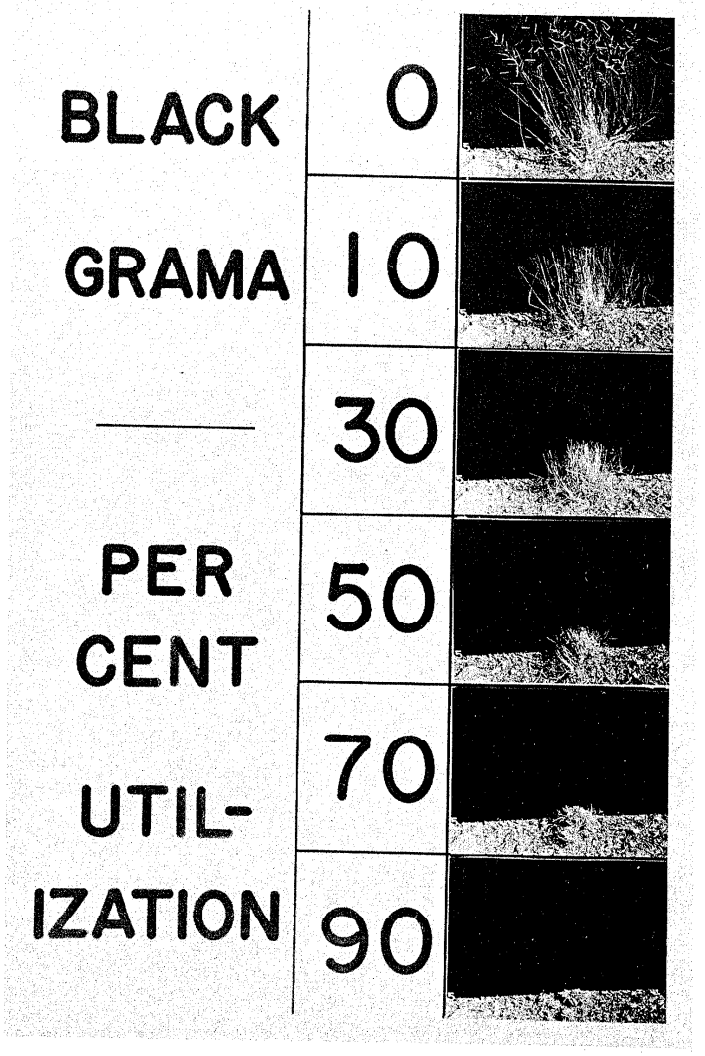
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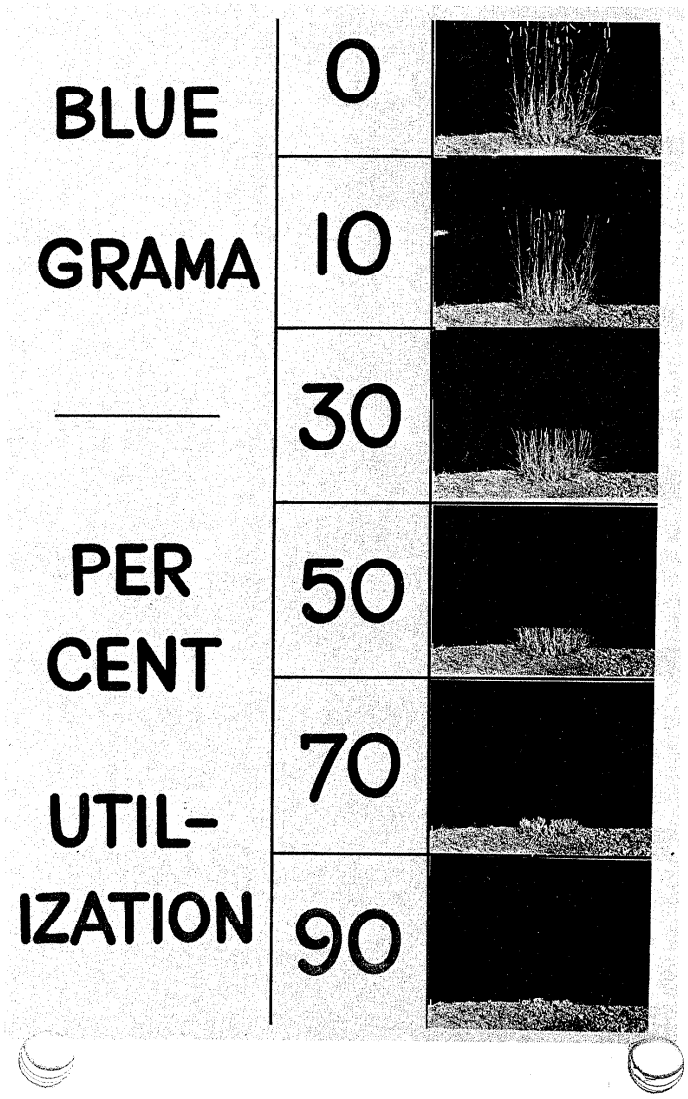
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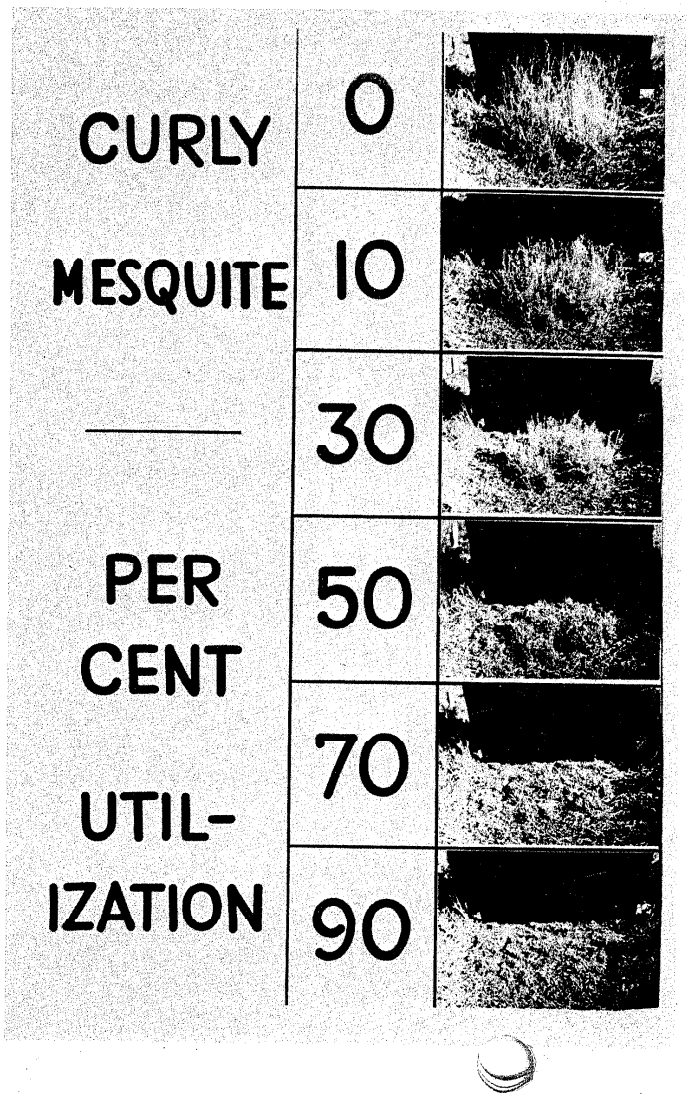
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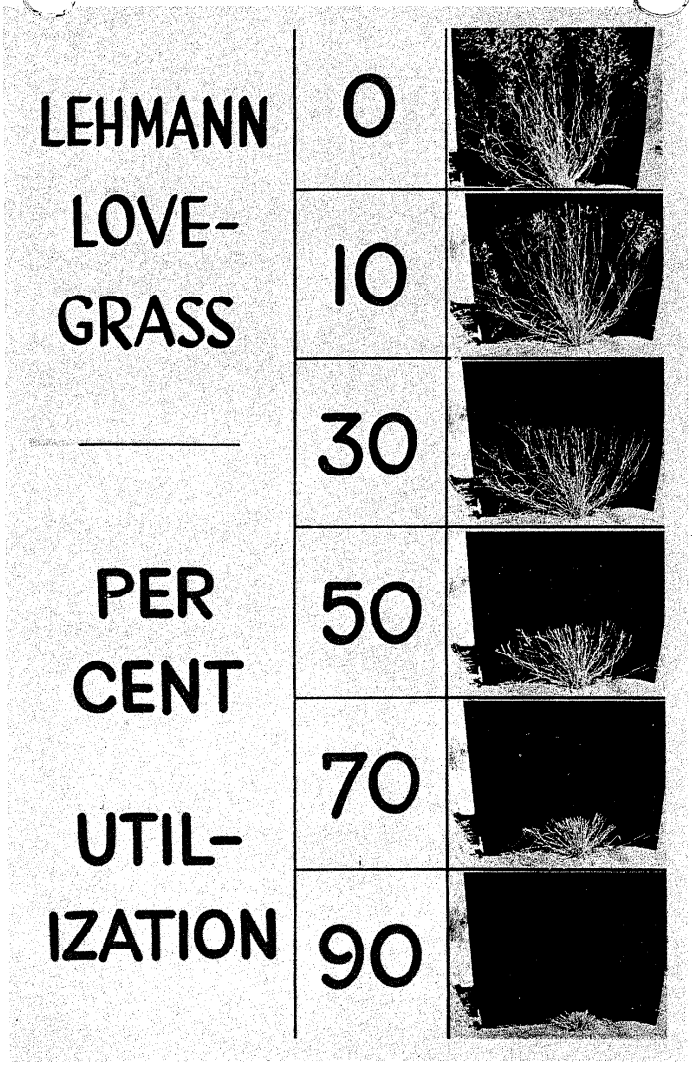
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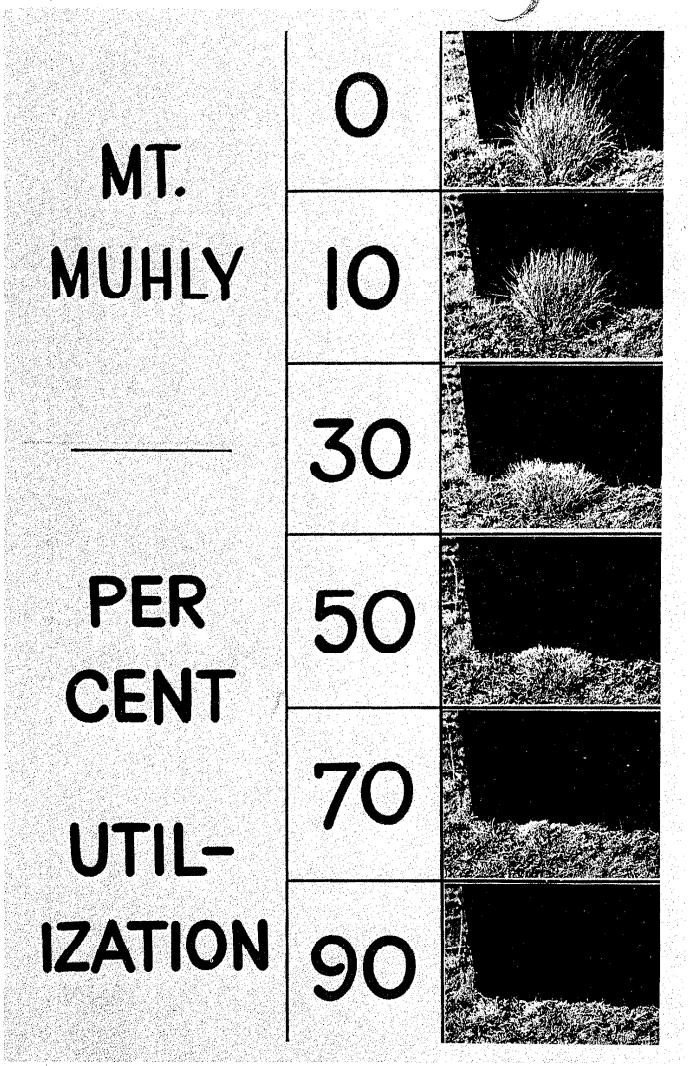
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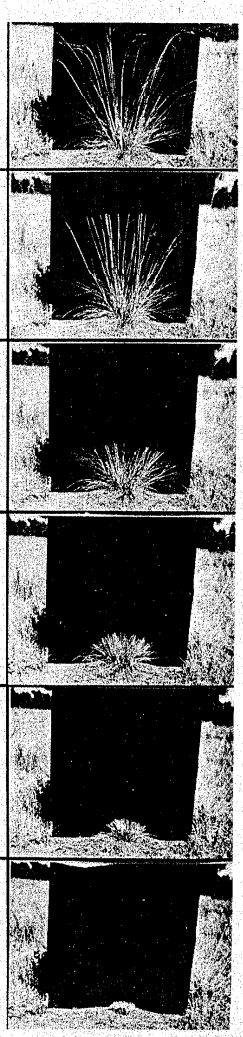

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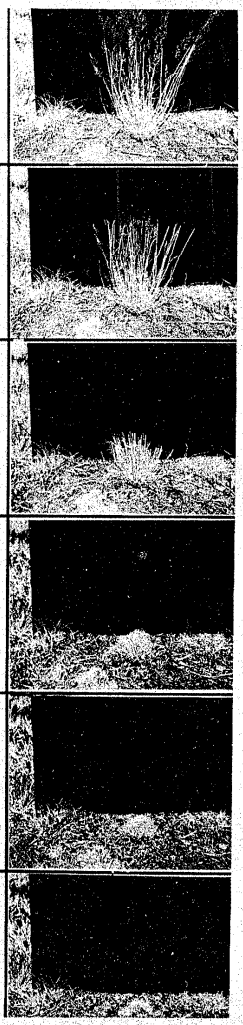

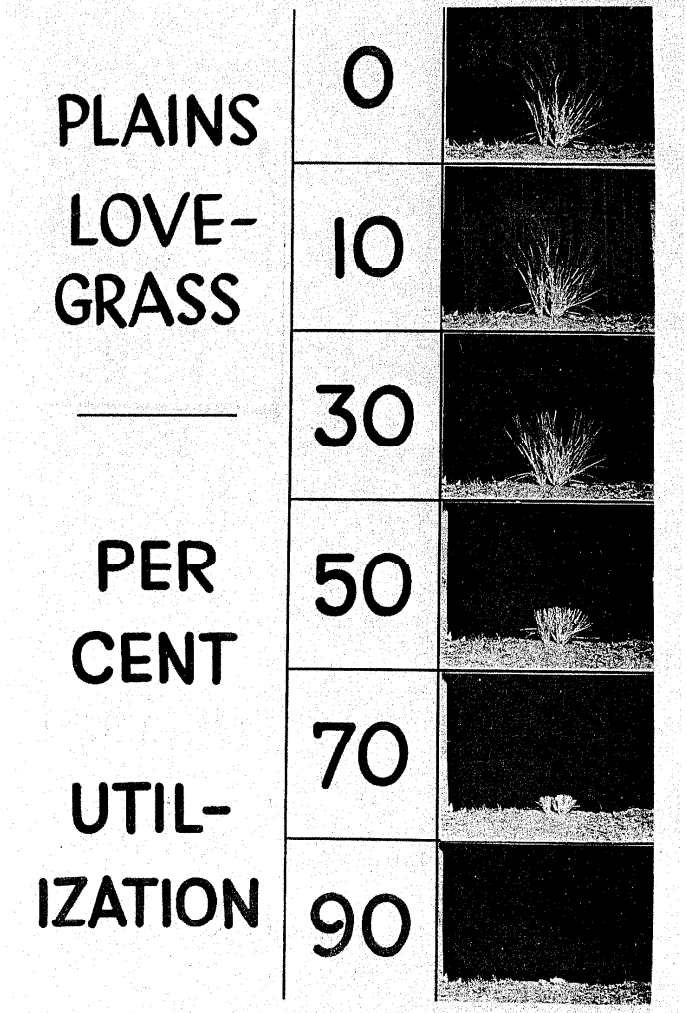
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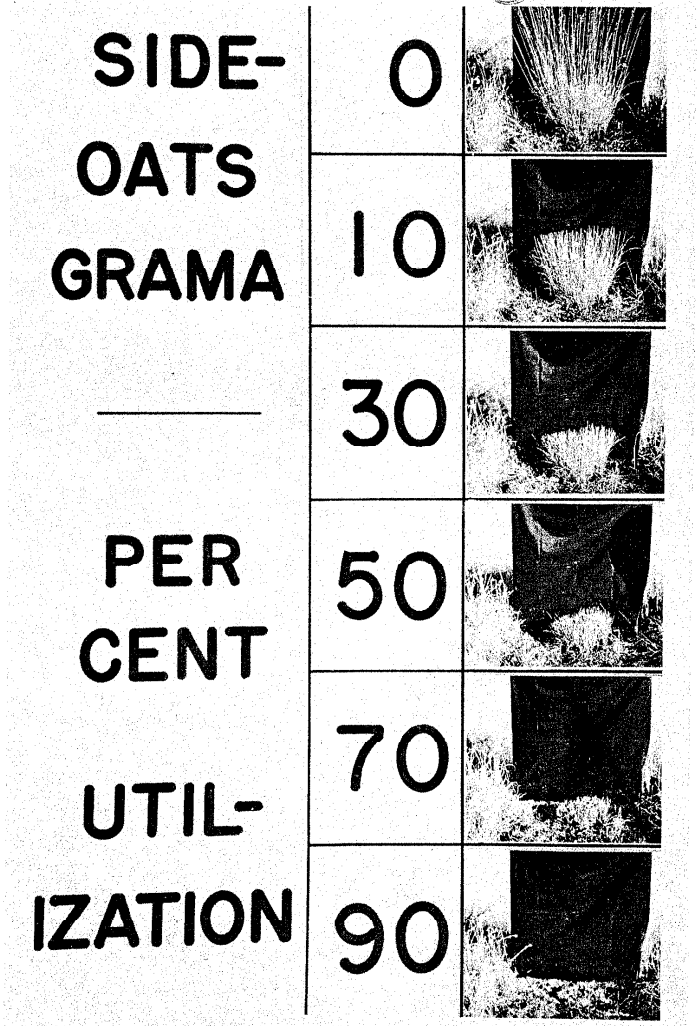
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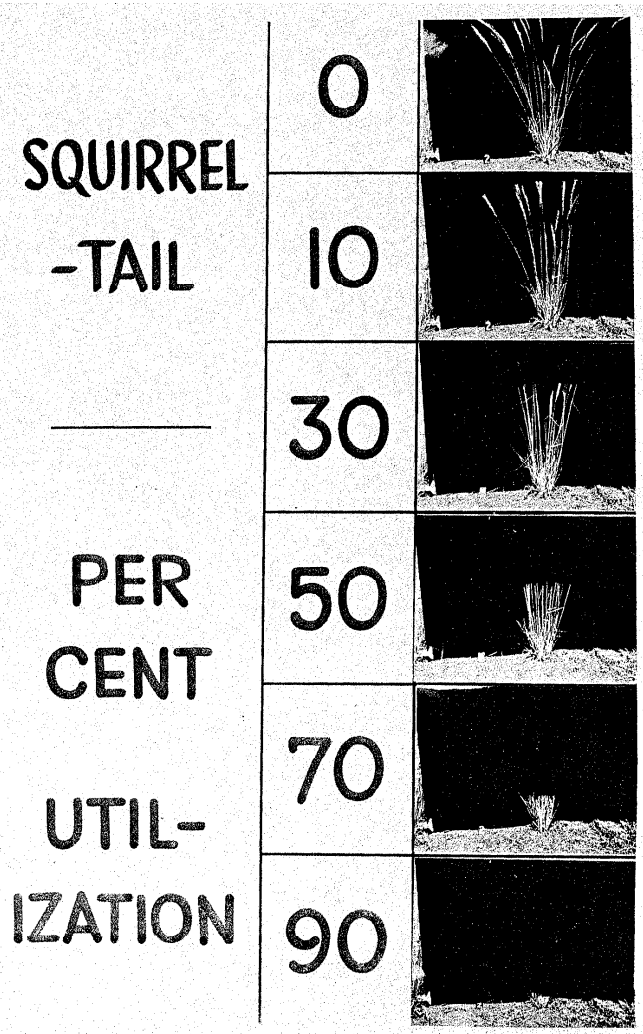
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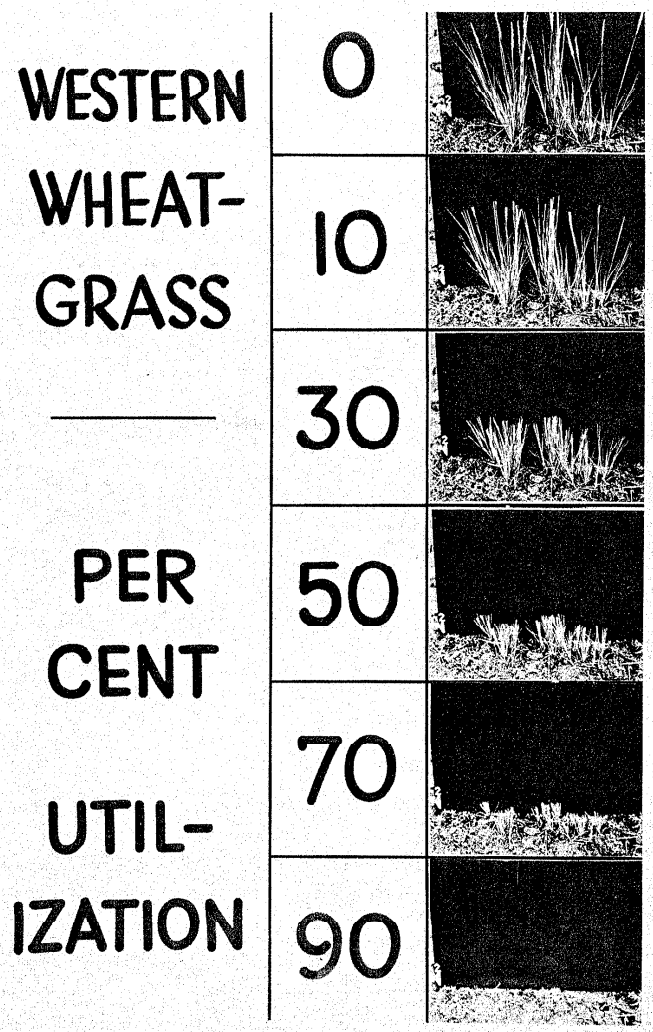
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