

## 11.0 Utilization Methodologies

prepared and conducted by: LADWP and Ecosystem Sciences

Excerpted from the LORP Baseline Data Methodologies Report (Ecosystem Sciences, 2003)

### HERBACEOUS REMOVAL—Height-Weight Method

The Height-Weight Method involves the measurement of heights of ungrazed and grazed grass or grasslike plants to determine average utilization. Measurements of plant heights recorded along transects are converted to percent of weight utilized by means of a utilization gauge (Lommasson and Jensen 1943). The utilization gauge is developed from height-weight relationship curves. This method provides a mechanical tool, which can be used for training, checking personal judgment, and promoting uniformity of results between examiners, as well as for determining percent utilization.

a. *Areas of Use:* This method is adapted for obtaining utilization data where the key species are either bunch or rhizomatous/sod-forming grasses or grasslike species.

b. *Advantages and Limitations:* This method provides uniform, accurate, and reliable utilization determinations for perennial grasses and grasslike species. It is an objective method; however, some estimation is required. This method requires numerous ungrazed plants, which may be hard to locate without the use of a utilization cage. The development of the height-weight relationship curves and preparation of utilization gauges scales can be time-consuming. This method cannot be used for determining utilization of forbs and shrubs.

c. *Equipment:*

Study Location and Documentation Data form (see Appendix A)

Height-Weight form (see Illustration 12)

Utilization gauge (see Illustration 13)

Utilization scales for key species (see Illustration 13)

Tape measure or ruler

d. *Training:* This method does not require intensive training for field application, although examiners must be able to identify the plant species. Examiners need to know how to measure and record the height of grazed and ungrazed plants, determine the utilization of individual plants from the gauge, and calculate the average utilization by key species.

e. *Establishing Studies:* Careful establishment of studies is a critical element in obtaining meaningful data. Select key species and determine the number, length, and location of the transects.

(

(2) At the beginning of each study, determine the transect bearing and distance between observation points. Select a prominent distant landmark, such as a large tree, rocky point, etc., that can be used as the transect bearing point.

(5) Number studies for proper identification to ensure that the data collected can be positively associated with specific studies on the ground.

(6) Document the location and other pertinent information concerning the study on the Study Location and Documentation Data form.

f. *Sampling Process:* Sample ungrazed and grazed plants encountered along a transect to determine the average ungrazed plant height and the average percent utilization. A utilization cage will be placed in the vicinity of the key area to assist in locating ungrazed plants. To secure reliable utilization determinations, it is essential to measure heights for an adequate number of ungrazed and grazed plants. The greater the variation in utilization between plants, the more plants required to determine the average utilization.

(1) Measuring plant heights

(a) Best results are obtained by placing the measuring tape or ruler in the center of the bunch or turf circle, rather than along one side. The tape or ruler should not be forced down into the crown but should rest firmly on the cushioned portion of the plant.

(b) Where rhizomatous/sod-forming grasses or grasslike plants are the key species, use a circle of turf 2 inches in diameter as one plant.

(2) Sampling plants

(a) At each interval along the transect, select the plant of the key species (seedlings excepted) nearest the toe and measure the height of the plant to the nearest ½ inch. If plants are not evenly grazed, determine the average stubble height.

(b) If the selected plant has not been grazed, record the height for that sample in the Ungrazed Height Column on the Height-Weight form and the grazed column.

(c) If the selected plant has been grazed, record the height for that sample in the Grazed Height Column on the Height-Weight form.

(d) Measure at least 15 ungrazed plants to obtain a reliable cross section of ungrazed plant heights. If a sufficient number of ungrazed plants is not encountered along the transect, it may be necessary to extend the transect or measure plants within the utilization cage. In some cases, it may be necessary to select, in a subjective manner, ungrazed plants on an adjacent area to determine average ungrazed plant height.

(e) Use only one kind of plant. When 80 percent or more of the plants measured produce culms or when 80 percent or more are without culms, the remaining 20 percent or less may be disregarded without great error.

(f) When a combination occurs with 80 percent or more culm-producing plants, and a plant lacking culms is encountered nearest the sampling point, measure the nearest culm-producing plant of the species. Corresponding procedures should be followed when the kind of plant selected is without culms and a culm-producing plant is encountered. These two combinations are those most commonly encountered in the field.

(g) When approximately equal numbers of culm and culmless plants occur, measure plants of both kinds. The measurements for the plants with culms should be marked or kept separate on the form. Be sure to use appropriate ungrazed heights and the correct utilization scales for plants with and without culms.

g. *Calculations:* Calculate the percent utilization as follows:

(1) Divide the total of the ungrazed plant heights by the number of ungrazed plants sampled to calculate the average ungrazed plant height.

(2) Determine the percent utilization of the key species with the gauge by calculating the average plant heights of all the grazed and ungrazed plants. The sliding card in the gauge is pulled out of the envelope until the utilization scale for the key species appears in the window. The dial is then turned so that the number representing the previously calculated average ungrazed height is set at the arrow designated "Average Ungrazed Height." The percent utilization may then be read on the scale in the window opposite the number on the dial representing the average height of grazed plants. The utilization scale on the sliding card must fit the species being sampled. Utilization on individually sampled plants can be calculated by using the measured stubble height instead of the average height of the grazed plants. Use the culmless curve for the key species when seasonal utilization studies are conducted on early growth of the plants.

(3) Calculate the average utilization for a key species by totaling the percent utilization for the individual sampled plants and dividing by the number of sampled plants of that species.

(4) Record the average height of ungrazed plants, percent utilization of individual sampled plants, and average percent utilization for the key species on the Height-Weight form.

h. *Preparing Utilization Scales:* Utilization scales used with the utilization gauge are prepared from height-weight curves developed for individual grass and grasslike species. Previously prepared utilization scales must be checked to see whether or not these scales fit the species on the rangeland where they will be used. Where existing utilization scales do not fit, new scales will have to be prepared. Scales for a number of species are included on the same card.

(1) Developing Height-Weight Curves: Develop height-weight curves by collecting plants of a given species and determining the height-weight relationship for that species. The curve for any given species must be checked for variation between range sites and climatic regions. It is necessary to develop separate curves for culm-producing plants and culmless plants when a species only sporadically produces culms.

(a) Sampling Plants: Sample at least 15 plants of a given species. Select only those plants that have reached maximum growth.

At each interval along a pace transect, choose the ungrazed plant of the given species nearest the toe. Use 1 square inch as a unit area for sod-forming species, and a comparable number of stems as a unit area for single-stem species.

Remove all old leaves and stems of previous year's growth.

Clip the plant to within  $\frac{1}{4}$  inch of the ground.

Wrap the clipped plant with thread from base to top to retain all leaves and culms in their natural position.

Separate the plants with culms from plants without culms and consider each as a separate sample.

Measure heights of clipped plants to the nearest inch and determine the average height.

Calculate the number of plants that must be sampled to determine average height, with a standard error of  $\pm 3$  to 5 percent at the 95 percent confidence level (Barrett and Nutt 1979; Freese 1962).

Sample additional plants, if necessary.

Measure the maximum height of each plant.

Clip the top 10 percent by height of each plant and place the clippings in a paper sack labeled "0 to 10 percent." Clip additional height segments in 10 percent increments and place clippings in appropriately labeled sacks—11 to 20 percent; 21 to 30 percent; 31 to 40 percent; 41 to 50 percent; 51 to 60 percent; 61 to 70 percent; 71 to 80 percent; 81 to 90 percent; and 91 to 100 percent. A large paper trimmer with a guide to hold the plants in their proper position on the platform may be used to clip plants into segments. Label the sacks to show species, date, and location. Place a given height segment for all plants of a species collected in one paper sack.

Dry the clippings until a final dried weight is achieved. Leave clippings in the paper sacks for drying.

(b) Determining height-weight relationships.

Weigh and record the dry weight for each of the 10 height segments to the nearest tenth of a gram. Subtract sack weight before recording the dry weight of each height segment.

Total the dry weight of the 10 height segments and record the total dry weight of the collected plants.

Record the cumulative dry weight for each segment. This includes the weight of the segment plus the weights of all preceding segments starting from the top of the plant.

Calculate the cumulative percent height and weight removed at each height segment by dividing the cumulative height or weight for each segment by the total height or weight, and multiplying by 100.

Plot the cumulative percent height removed against the cumulative percent weight removed on graph paper. The resulting curve portrays the height removed-weight removed relationship for the species.

(2) Transferring Data from Curves to Scales: Transfer the height-weight relationship data portrayed on the height-weight curve to a utilization scale for use in the utilization gauge. The following text and Illustration 16 present a situation where the average height of ungrazed plants is 10 inches.

(a) Turn the dial on the utilization gauge so that 10 inches is set at the arrow designated "Average Ungrazed Height." With the dial set at 10, each inch increment from 9 to 0 on the dial represents 10 percent of the height.

(b) Slide a blank card into the utilization gauge.

(c) Use the height-weight curve to determine the percent height that would be removed when 10 percent, 20 percent, etc., of the weight is removed.

(d) From the height-weight curve, observe that for 10 percent of the weight to be removed, 46 percent of the height must be removed from the top of the plant. This means that 54 percent of the plant height remains, or 5.4 inches of a 10-inch plant. Find the 5.4-inch point on the circular dial, extend a horizontal line to the blank card, and write a "10" on the card (to show 10 percent utilization). Continue this procedure for 20 percent weight removed, 30 percent weight removed, etc., until all the points are plotted on the card.

(3) Documenting Scale Preparation: For each utilization scale prepared, maintain a record of the species, the data used to prepare the scale, the date the scale was prepared, and the areas of applicability.

i. *Data Analysis*: Calculate confidence intervals for both ungrazed and grazed plant heights.