

RESIDUAL DRY MATTER AS UTILIZATION STANDARDS FOR CALIFORNIA ANNUAL RANGE

W. James Clawson and Neil K. McDougald<sup>1</sup>

University of California  
Davis, California 95616

Annual-type ranges contribute about 80% of the range forage for California's livestock industry. Thus, techniques to improve its management are important to the state's agricultural economy and the integrity of its natural resources. Annual rangelands, occupied primarily by annual plants, differ from perennial rangelands in that early season growth responds to conditions influencing germination and establishment in the fall rather than root reserves and regrowth in the spring. Fall weather has the greatest influence on herbage production (coupled with the resident soil characteristics), but the variable that can be controlled to the greatest degree by management is residual dry matter in the fall. Residual dry matter provides favorable micro-environments for early seedling growth, soil protection and adequate organic matter levels.

The purpose of this paper is to synthesize previous range research and suggest levels of residual dry matter and range evaluation procedures. The term "residual dry matter" has often been described by others as "mulch".

The Case for Residual Dry Matter

Numerous studies have been conducted that support the benefit of residual dry matter to the new year's growth (Bentley and Talbot, 1951; Hedrick, 1948; Heady, 1956, 1966; Hooper and Heady, 1970; Bartolome et al., 1980). Early work on the San Joaquin Experimental Range (Bentley and Talbot, 1951) indicated that the dry vegetation (litter) left on the range at the beginning of the fall and winter growth promoted the growth of green forage. These studies used 6 to 12 millimeters depth of litter as a minimum rather than weight of residual dry material. Intensive mulch studies at the University of California's Hopland Field Station (Heady, 1956 and 1966) recommended a minimum threshold mulch level of 800 kilograms per hectare, under conditions at Hopland, to maintain desired forage production and botanical composition. Hooper and Heady (1970) evaluated the economic value of mulch and grazing level and found that under the climatic and economic conditions at Hopland of the late 1950's, the optimum mulch level was 560 kg/ha. Bartolome et al. (1980) studied mulch levels at eight other locations and Hopland varying in rainfall from nearly 200 cm in the north coast to less than 15 cm in the rain shadow of the south coast ranges. This study indicated that in areas of less than 25 cm of precipitation, more than 300 kg/ha of mulch did not increase annual plant growth, while in higher rainfall areas of more than 150 cm, 1,120 kg/ha of residual dry material was recommended at the beginning of the fall season.

Range managers and ranchers are often called upon to estimate the available forage remaining for livestock use prior to that expected to be produced in the next season. If evaluating remaining forage

early in the "dry" season (June to August) consideration must be given disappearance due to shattering, trampling and leaching. It is a common practice to leave ample residual dry matter as a dry feed source to mix with the high moisture new growth, thus insuring adequate levels of dry herbage at the start of the growing season.

The role of residual dry matter in soil protection is an extremely important management consideration. Cover rather than amounts of material is what is important. In annual-type range amounts of residual dry matter relate closely to surface cover such that the former can be used for most management decisions.

Guidelines and Procedures

The amounts of residual dry matter required for a given geographical, soil and livestock-use situation can be quite variable. Areas of heavy rainfall, erosive soils, and steep topography will require more residual dry matter than flat, stable soils in drier climates. The following guidelines are offered as reference points to minimum, or lower threshold, levels for California:

300 kg/ha	Southern California (<25 cm precipitation)
550 to 800 kg/ha	Central Coast & Central Valley Foothills (25 to 100 cm precipitation)
1200 kg/ha	North Coast (>100 cm precipitation)

Too much residual dry material or a dense mulch results in a thatch which inhibits early response of new forage growth. Maintenance of seeded annual legumes and filaree abundance require adequate but lower amounts of residual dry material. Managers are encouraged to test these minimum level guidelines and develop their own levels to meet the requirements of specific site conditions.

The extreme variability often experienced within management units (ranch field, range site, etc.) on annual-type ranges prohibits sampling to the degree of precision possible on more uniform range sites of the plains, for example, thus the acceptance of less rigorous methods are reasonable and realistic. The monitoring of residual dry matter in the fall offers such an approach.

The degree of livestock grazing has a direct bearing on the levels of residual dry matter in the fall. It follows that standards which describe grazing intensities would also be suitable to describe residual dry matter levels. Such standards were developed based on grazing studies on the U.S. Forest Service's San Joaquin Experimental Range (Hormay and Fausett, 1942). A "moderate" level of grazing intensity has been the recommendation from those from these studies. These grazing levels are really defined in terms of the residual dry matter in the fall. Three levels

<sup>1</sup>Range Specialist, Agronomy and Range Science Extension and Farm Advisor, Madera County, Madera, CA 93637

of grazing--light, moderate and heavy--have been used as the examples of both extremes and the recommended level (Hormay, 1944) and are reproduced here for ready reference. Light grazing (Figure 1) has a less patchy appearance, the unused plant growth averages 3 or more inches in height and small objects are masked. Moderate grazing (Figure 2) has an average of 2 inches of old, dry vegetation which will have a patchy appearance and will have little bare soil and small objects showing at a distance of 20 feet or more. Heavy grazing (Figure 3) has less than a stubble height of 2 inches with small objects and areas of bare soil visible at 20 feet or more.

Ranchers and managers interested in more detailed evaluation may develop photo standards and visual descriptions relating to specific conditions and amounts of residual dry matter. Of course, actual weights of residual dry matter may be collected by direct weighing, double sampling (visual estimates with clipped herbage) reference points and with experience, visual estimates. The variability referred to may require a large number of samples for the normally-accepted experimental accuracy ( $P < 0.05$ ). We reemphasize the need for judgment to use procedures that will provide information for the desired level of management making efficient use of time and resources.

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Figure 1. Light Grazing



Figure 2. Moderate Grazing



Figure 3. Heavy Grazing

(Photos courtesy of U.S. Forest Service)