GUIDELINES FOR RESIDUE MANAGEMENT ON ANNUAL RANGE

Annual-type ranges contribute about 80 percent of the range forage for California's livestock industry. Therefore, their improved management is important to the state's agricultural economy and the conservation of its natural resources.

Annual rangelands differ from perennial rangelands because they are occupied primarily by annual plants. Perennial range plants are influenced by conditions in current and preceding years which effect their root reserves and regrowth. Annual forage responds each year to conditions that influence plant germination and establishment in the fall. Fall weather has the greatest impact on early annual plant growth. This growth also is further influenced by the water-holding capacity of the soil and residual dry matter (the amount of dry plant material left on the ground from the previous year's growth). Residual dry matter provides favorable microenvironments for early seedling growth, soil protection, adequate soil organic matter, and a source of low-moisture fall forage for livestock feed. Residue is the variable in the fall that can be most controlled by management.

The following guidelines draw on research conducted at the San Joaquin Experimental Range, Hopland Field Station, and numerous other field plots by the University of California and the U.S. Forest Service.

SUGGESTED GUIDELINES

Amounts of residual dry matter per acre vary according to geographical, soil and livestock use situations. Areas with heavy rainfall, erosive soils, or steep hills need more residual dry matter than do flat, stable soils in drier climates. The following guidelines represent a range of *minimum* or lower threshold levels for California. Ranchers and range managers are encouraged to test these minimum level guidelines and develop their own levels to meet requirements of specific sites and conditions.

	Lower or flat slopes	Average–gentle slope	Upper or steep slope
	pounds per acre		
Southern California (less than 10 inches precipitation)	200	250	350
Central Coast and Central Valley Foothills (10 to 40 inches precipitation)	400	600	800
North Coast (more than 40 inches precipitation)	750	1000	1250

A livestock stocking rate that leaves too much residual dry matter reduces both forage and livestock production. The remaining forage is then utilized by other animals and "decomposers".

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Seeded annual legumes and filaree require adequate, but not too much, residual dry matter for their optimum growth. Residual dry matter is also important for soil protection. Observing the above guidelines for management should maintain soil erosion at natural levels.

Adjusting the cattle livestock rate according to residual dry matter available requires flexibility—livestock needs must be balanced against available forage. If rainfall is low, utilization may exceed established guidelines, although this situation should be the exception and not the rule. Periodic heavy grazing has short-term effects only. Heavy grazing over a long period reduces production and causes an increase in low-growing plants.

Using residual dry matter standards requires an ability to distinguish between the influences of grazing and environmental effects. This is difficult because the annual grassland is so responsive to weather, especially the amount and distribution of rainfall and daily temperature. Careful interpretations and even alterations of the general guidelines must be made for local situations. Criteria for evaluation of desired levels of residual dry matter for a specific situation includes herbage productivity, desired plant species composition, livestock performance and ground cover.

ESTIMATING RESIDUAL DRY MATTER

Visual determination. Ranch and agency needs for management information on annual-type ranges (ranches, fields, range sites, etc.) vary greatly and some may require taking many samples of residual dry matter to determine amounts of dry forage available. However, low intensity sampling methods are adequate for most range-management decisions. An easy and quick method is to visually check the residual dry matter left prior to the first effective fall rains, usually late September or early October. One way to do this is to use photos of the grazing intensity standards developed for Central Valley foothills at the San Joaquin Experimental Range. The "moderate" level of grazing has been recommended for the best livestock performance and range protection in this zone. Moderate grazing also provides more residual dry matter than listed in the minimum guidelines described earlier. The other grazing intensities described, "light" and "heavy", are examples of too much and too little utilization. Residual dry matter levels corresponding to these plots were collected for several years on the Experimental Range.

Light grazing leaves little or no patchy appearance. Unused plant matter averages 3 or more inches in height and small objects are masked. The residual dry matter is more than an average of 800 pounds per acre. *Moderate* grazing leaves an average of 2 inches of unused plant matter, a patchy appearance, and little bare soil. Small objects will not show at a distance of 20 feet or more and the residual dry matter ranges from 400 to 700 pounds per acre. *Heavy* grazing leaves less than 2 inches of unused plant matter. Small objects and areas of bare soil are visible at 20 feet or more and the residual dry matter is less than 400 pounds per acre.

Light grazing. Under-utilized. (Courtesy U.S. Forest Service.)

Moderate grazing. The recommended level.

Heavy grazing. Over-utilization.

Weight determinations. Residual dry matter weights may be estimated by direct clipping and weighing, double sampling (visual estimates with clipped herbage reference points) and, with experience, by visual estimates. The normal procedure for determining the weight of residual dry matter is to use either a square foot or 1/10 square meter frame and clip the herbage as close to the ground as possible (approximately 1/2-inch high). Include litter or shattered plant material at the ground surface, which can easily be picked up, in the sample to be weighed. Gram scales are recommended for weighing samples in the field, and air-dry weights are satisfactory under most summer and early fall conditions. Wet or green forage samples should be oven dried for dry matter determination. Grams per square foot multiplied by 96 gives the pounds per acre. Example: 12 grams per square foot × 96 = 1150 pounds per acre.

The variability experienced in most management units on annual range often requires a large number of weight samples for accurate estimates. However, adequate information for good management can be obtained by using judgement to select areas to sample that are "representative" or "typical" of the entire management unit. Ten to fifteen separate weights or weight estimates are usually enough for an apparant uniform representative area.

ESTIMATING FORAGE REMAINING FOR LIVESTOCK GRAZING USE

Range managers and ranchers often need to estimate the forage available for livestock before the new season starts. Forage loss due to shattering, trampling and leaching must be considered if evaluating ramaining forage early in the dry season (June to August). It is also a common practice to leave ample residual dry matter as a dry-feed source to mix with high-moisture new growth, thus insuring adequate levels of dry herbage at the start of the growing season.

By considering amount of available forage, number of cattle, daily amounts of forage consumed, and amount of residual dry matter desired, it is possible to anticipate necessary management adjustments in time of use or animal numbers. Available forage may be estimated visually or by weight, as previously described. Forage consumption per animal may also be estimated, using an average of 3 percent body weight—for example, a 600-pound cow will eat 18 pounds of dry forage a day. The residual dry matter guidelines can then be used to estimate how much forage should be left in the fall. The formula which follows will give you estimates.

$$\text{Days of grazing remaining or available} = \frac{(\text{lb of forage/acre–residual dry matter}) \times \text{acres}}{3\% \text{ Avg body wt of animals} \times \text{number of animals}}$$

$$\text{Example:} \quad \frac{(1{,}100\text{-}500 \text{ lb}) \times 1{,}000 \text{ acres}}{(600 \text{ lb stockers} \times .03 \times (300 \text{ animals})}$$

$$= \frac{600 \times 1{,}000}{18 \times 300}$$

$$= \frac{600{,}000 \text{ lbs}}{5{,}400 \text{ lb/day}}$$

$$= 111 \text{ days remaining}$$

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