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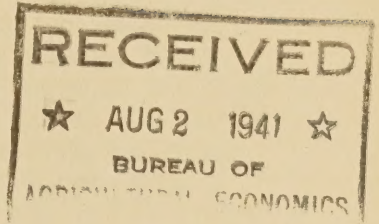
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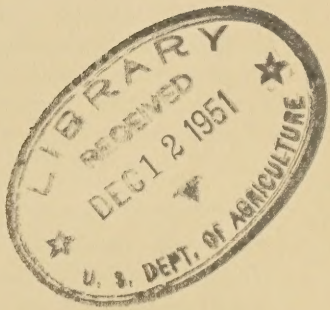
2. ¹ UNITED STATES DEPARTMENT OF AGRICULTURE
U.S. Bureau of Agricultural Economics



3. FEED-LIVESTOCK RELATIONSHIPS IN THE WESTERN RANGE STATES //

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Robert, 1912-
By

HA R. Hochmuth,
Assistant Agricultural Economist



5a Berkeley, California
July 1941

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THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY

MEMORANDUM FOR THE RECORD
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TO: [illegible]
FROM: [illegible]
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FEED-LIVESTOCK RELATIONSHIPS IN THE WESTERN RANGE STATES^{1/}

The western range region contains a total land area of about 975 million acres lying west of an irregular north-south line through North and South Dakota, Nebraska, Kansas, Oklahoma and Texas.^{2/} Most of the land in the so-called range States is used for the grazing of livestock. In the early years of settlement dependence was placed almost entirely on range forage to maintain the herds and flocks, with very little forage coming from cultivated fields. Later farmers began to cut wild hay to winter the stock. This process culminated in the development of many irrigated areas and reclamation projects. Today, outside of the short grass and desert grass ranges of the southwest, few areas exist that are not dependent upon some irrigated or cultivated lands to round out the yearly forage requirements for the livestock. Some exceptions for sheep are noted later.

Feed-Livestock Relationships from Census Data

A generalized picture of feed-livestock relationships existing in the west can be obtained from census data by counties. (See map.) The census of 1930 was used in calculating the hay equivalent per animal unit by counties. The census indicates all hay produced in tons, including wild hay, tame hay, alfalfa, etc. For purposes of this report all hay produced was considered as equal in feeding value and no corrections were made for differences existing in various kinds of hay. Other forage crops are largely small grains cut for hay, corn cut for fodder, corn silage, corn hogged or grazed off, root crops for forage and others, depending upon the locality.

Some of the figures were given in acres which required an estimation of average yield so that conversion to tons could be made. These forage crops were converted to hay equivalent from sources of information such as Morrison's "Feeds and Feeding" and various experiment station publications on relative feeding value of forage crops.^{3/} In ascertaining the number of animal units in each county, only mature animals or their equivalents were

1/ Acknowledgment is given for the assistance of Marion Clawson, Principal Field Representative, who initiated the study, and to C. E. Neumeier, who prepared most of the statistical information from which the attached map was developed.

2/ United States Forest Service. The Western Range . . . Washington, D. C. (U. S. Cong. 74th, 2nd Sess., S. Doc. 199) 620 pp., illus., p. 3.

3/ The equivalents used to equal 1 ton of hay were: 3 tons of corn silage, 4 tons of root crops, 1 ton of sorghums cut for silage, hay, or fodder. Oats cut and fed unthreshed were reported in acres only, so the yield was taken as the yield of small grains cut for hay and considered as equal to 1 ton of hay.

counted. An animal unit was arbitrarily assumed as 1 mature cow, or horse, 5 sheep, or 7 goats.^{4/}

This method of calculating hay equivalent produced per animal unit by counties, and drawing conclusions on livestock-forage relationships, is subject to numerous inequalities. Most forage, because of its bulkiness, is fed where grown; therefore it can be assumed that hay equivalent produced largely is synonymous with hay equivalent fed. The greatest weaknesses are: (1) The difficulty of reducing all forage to hay equivalent because of the wide range of quality or yield of cultivated forage; (2) the lack of data on agricultural by-products which, in some areas, are important constituents of livestock rations; and (3) the fact that in some areas migratory sheep operations may distort the census picture. The 1930 census was taken as of April 1, and those counties in range areas with much spring-fall range would have a high sheep population at the expense of counties with considerable winter range. This in turn would affect the number of animal units per ton of hay equivalent produced in the county.

Definite Pattern is Apparent

Despite all the discrepancies involved in ascertaining certain feed-livestock relationships from census information by counties, a definite pattern appears (see map). The relationship between livestock numbers and feed consumed might possibly be carried further by comparing it with vegetation type maps, grazing capacity maps, and others. The attached map indicates that very little feeding of livestock is done in the southwestern States. Counties in the southwestern States which have a higher than average hay equivalent per animal unit contain irrigated areas or areas of good dry farming. In Maricopa and Yuma Counties, Arizona, considerable alfalfa is raised on irrigated land, in rotation with cotton. Curry County, New Mexico, has a high hay equivalent per animal unit in comparison with the rest of the State, because of the concentration of grain and forage sorghums. Generally, however, the southwestern States offer year-long grazing for cattle on the short grass and semi-desert grass ranges.

The western portions of the great plains States of North and South Dakota, and Nebraska have a high hay equivalent per animal unit (table 1). Most of the forage is in the form of corn silage and sorghums. These States have less range and more cropland in comparison with the public range States. Idaho has the highest hay equivalent per animal unit of the mountain States and Wyoming the least. The large area in Wyoming

^{4/} Animal units were calculated as follows: Horses--horses and colts on farm April 1, 1930 born before January 1, 1930, minus colts born in 1929. Same for mules. Cattle--cattle on farms April 1, 1930 born before January 1, 1930, minus steers and bulls, and heifers born in 1929. Sheep--sheep and lambs on farms April 1, 1930 minus lambs born since October 1, 1929 and on hand after April 1, 1930, divided by 5. Goats--goats and kids on farms April 1, 1930, divided by 7.

Table 1.- Hay equivalent available for feeding per forage consuming animal unit, 17 western states, census of 1930

State	Hay equivalent	Forage consuming animal units ^{1/}	Hay equivalent per animal unit
	Tons	Number	Tons
Arizona	169,460	792,851	.21
California	4,268,635	2,126,791	2.01
Colorado	3,219,139	1,663,355	1.94
Idaho	2,364,728	991,606	2.38
Kansas ^{2/}	703,064	396,590	1.77
Montana	2,380,760	1,912,295	1.24
Nebraska ^{2/}	2,989,144	1,002,959	2.98
Nevada	545,343	439,948	1.24
New Mexico	415,983	1,276,065	.33
North Dakota ^{2/}	1,602,661	806,108	1.99
Oklahoma ^{2/}	399,654	338,892	1.18
Oregon	1,908,011	1,151,776	1.66
South Dakota ^{2/}	1,721,899	769,917	2.24
Texas ^{2/}	2,112,473	4,996,530	.42
Utah	686,839	961,178	.71
Washington	1,541,913	728,219	2.12
Wyoming	1,379,105	1,292,795	1.07

^{1/} Includes cattle, sheep, goats, horses and mules. Converted to animal units on a basis of 1 cow, horse or mule, 5 sheep or 7 goats.

^{2/} Only the western portions of these States are included (see map).

known as the Wyoming Basin, which contains the Red Desert, is almost entirely rangeland, and relatively little forage is cultivated.

Nevada, well known as a range livestock State, has some areas where cattle feeding is heavy. In Elko County considerable hay is produced and the winter feeding period generally is long. In the southern part of the State, sheep predominate in the use of range forage, and the hay that is produced is consumed by relatively few cattle. Over much of Nevada sheep obtain very little cultivated forage, being operated almost entirely on a grazing basis. The high hay equivalent per animal unit in Churchill County, Nevada is accounted for by the extensive irrigation development and the fact that many Nevada cattle are fattened here before trans-shipment to the west coast markets.

Montana's heaviest feeding areas are in or near the mountains of the western part of the State. The eastern dry-farming, range-livestock area has a relatively small hay equivalent--animal unit ratio. Most of eastern Montana, as shown on the map, averages about 1 ton of hay per animal unit. This figure is in accordance with the tradition of this region that 1 ton of hay and fodder should be provided per head of mature cattle.^{5/}

Other Factors are Important

If the hay equivalent produced per county, without regard to livestock numbers, were mapped, the pattern would not differ materially from that in the accompanying map. The quantities of hay or other feedstuffs that are grown and fed to livestock in the various production areas of the West are dependent upon a combination of several factors, the most important of which are: (1) the environmental conditions necessary to grow forage crops; (2) the conditions which necessitate feeding livestock; (3) the amounts and grazing capacity of the available range and pasture; and (4) the numbers, kinds, and methods of production of the livestock maintained in the area.

The environmental conditions obtaining in western areas chiefly determine the feed-livestock relationships. Of all the growing conditions necessary to produce forage crops, moisture seems to be the most important in the subhumid areas of the West. Regardless of the length of the frost-free period, or the total number of heat units obtained during the growing season, the production of most forage crops in subhumid areas is definitely limited by availability of moisture. Accordingly, the development of reclamation projects or other means of conserving or using water for irrigation has lengthened the growing season at lower elevations. These areas of irrigation are reflected in the greater feed production along the mountains of the West.

^{5/} Gilman, Virgil D., Types of Farming in Southeastern Montana. Montana Agr. Exp. Sta. Bul. 287, 61 pp. illus., 1934, p. 28.

Elevation Limits Crops

The existance of irrigation facilities in many areas does not necessarily indicate that forage will be the principal crop grown. If areas have very favorable growing seasons, other crops may exceed forage crops. But large areas of the West are at elevations above 5,000 feet and, as the elevation increases, the length of growing season is decreased. Accordingly, the number of crops that can be successfully grown at these higher elevations are limited by temperature.

Crops that must mature seed every year, such as the cereal grasses, must be grown at the lower elevations. Maturing of seed is not necessary for the perennial grass and legume forage crops, so they generally are the major crops in the mountainous areas.

Feeding of Livestock Necessary

It does not necessarily follow that because it is possible to grow forage crops to advantage that such crops will be grown or fed to livestock. The quantity of hay or hay equivalent that is fed to livestock in various areas will also depend upon the necessity for feeding the animals. In many areas of the West a winter feeding season is necessary because of climatic conditions. This may vary from a few weeks to six months. In some irrigated areas, the necessity for feeding hay is not so great, and much of the forage produced is grazed off by livestock rather than cut for hay.

The amount of hand feeding required is also related to the quantity and quality of available range and pasture. Feeding is done extensively in many western areas because not enough range is available for the animals or because the range is already overstocked and overgrazed.

Tremendous fluctuations, annually and seasonally, in range forage production due to climatic conditions, usually reduce grazing capacity and bring range and pasture shortages. Even though hay is a high cost feed, it is frequently used to offset fluctuations in range forage production.

Increasing Importance of Irrigation

The effect of reduced range grazing capacity has been cushioned considerably by increased production of feedstuffs on irrigated areas. With the large expansion of irrigation in the last 20 or 30 years, the downward trend of the range cannot be fully observed by making past and present comparisons of livestock populations in range areas. The use of rangelands is becoming more dependent on the production of supplemental feeds from irrigated lands. Real thought is now being given to the proper relationship between rangelands and forage croplands in deciding upon public range grazing privileges.

Most of the forage harvested is fed to cattle; horses, sheep, and swine receive much less in proportion to cattle. The quantity fed to cattle is affected by the factors mentioned previously, the numbers of animals present, and the methods of production. The age at which the cattle are marketed, and whether they are produced as stocker, feeder, or finished animals will determine to some extent the quantity of forage fed per animal unit.

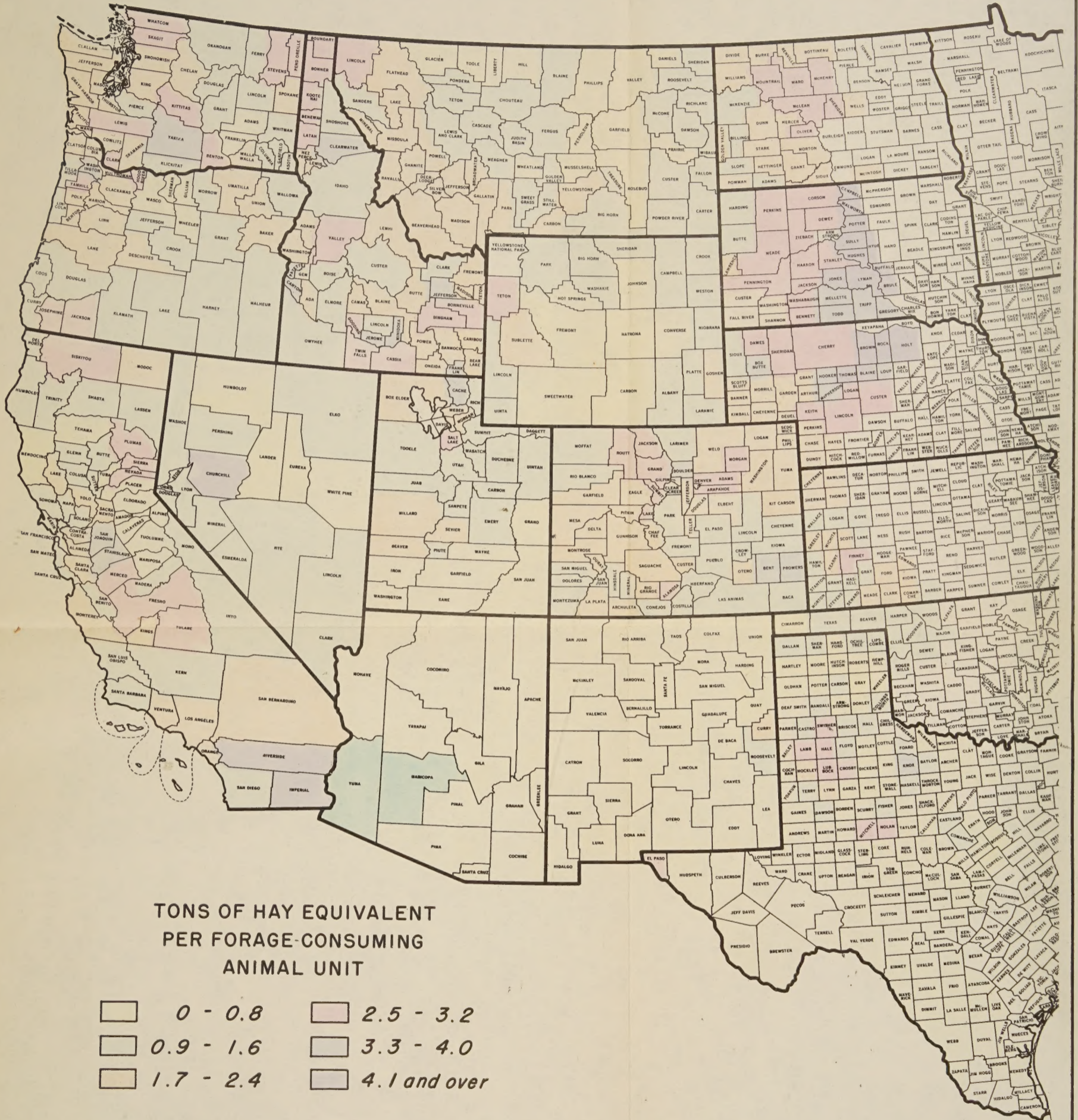
In the case of hand feeding of sheep, the quantities fed are almost entirely dependent upon available range of the proper seasonal adaptability, and whether cultivated forage can be substituted for shortages in one or more seasonal ranges. Such a situation is illustrated by the development of a large irrigated area along the Snake River in Idaho. The range flocks are winter fed and pastured rather than grazed on the open winter range, of which very little is now available there. This adaptation to irrigation development has allowed the Idaho sheep operator to plan for early lambing in sheds, and differentiates his operation from the majority of range sheep operators of the Intermountain Region.

Summary

Certain area relationships between feed and livestock are evident from calculations of census information. These relationships are more apparent when related to rangelands and their forage production. The extreme fluctuations in climatic conditions constantly change the balance between feed and livestock. This balance is more evenly maintained in irrigated areas, as the forage production does not fluctuate so widely as on rangelands.

In most western areas, any sustained increase in livestock numbers in the near future must depend almost wholly upon the production of additional feed. It is generally agreed that the ranges are fully stocked, and expansion of animal units on the range is unlikely -- in fact, the trend may be the reverse and range use may decrease. In this case, more animals will be maintained on cultivated forage. The importance of irrigated lands and other sources of supplemental feeds in the economy of range livestock areas is constantly increasing.

TONS OF HAY EQUIVALENT PRODUCED PER FORAGE-CONSUMING ANIMAL UNIT, BY COUNTIES, 17 WESTERN STATES, CENSUS OF 1930



TONS OF HAY EQUIVALENT PRODUCED
ANIMAL UNIT, BY COUNTIES,
CENSUS OF 19

