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necessary. In the early development of farming communities the relatively small acreage in crops led to the requirement that the crops rather than the range be fenced, but as communities became well settled this practice was usually reversed. Even in the colonial period, this situation with regard to fencing resulted in fence wars.

The limitations and failures of the grass supply led to range wars between ranchers or groups of ranchers and also between cattlemen and sheepmen. Incident to such clashes, associations were formed which, among other things, divided the range into zones of priority for the various herds. Each rancher had to give attention to the water supply needed for his herds. A group of buildings to use as headquarters for the range operations was also necessary. Probably the earliest record in United States history of such headquarters is a court judgment on the Eastern Shore of Virginia in 1634 which refers to the "cowpens" of that time. Except in the southern latitudes, the problem of winter feed shortly pressed for attention. At first this was usually met by making hay of the natural grass. Later fields of tame grasses, legumes, or fodder plants were developed for the purpose. In the end the operations were shifted from the

open range on the public domain to ranches on privately owned land. In other words, the range industry became a ranch industry.

Sooner or later individuals who wished to develop farms invaded the domain of the range industry. The result was friction and conflict until one or the other way of life prevailed. The interests of the rancher and the nester clashed inevitably not only along the Atlantic coast in the seventeenth century but in the Great Plains as late as the early twentieth century. Ultimately the issue was usually resolved according to the economic returns from the land. Farming of some sort prevailed in the humid regions and also in semiarid regions where irrigation and dryland methods could be used. In the semiarid regions ranching as the most profitable occupation continued on private holdings and on public grazing districts where geographical factors gave it the necessary advantage.

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A BILLION ACRES OF GRASSLANDS

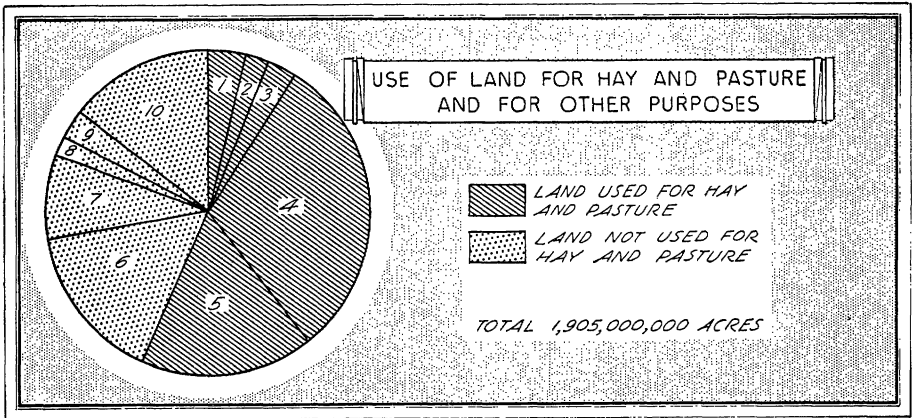
H. H. WOOTEN, G. P. BARNES

THE GRASSLANDS, hay lands, and forested range lands of the entire United States cover more than a billion acres, nearly 60 percent of the total land area. They furnish about half of the feed for all livestock. Two-thirds of this land is privately owned. The rest, mainly in the dry and mountainous parts of the Western States, is publicly owned. More than half of the farms and ranches of the country depend largely on grassland for feed.

Originally about 700 million acres

in the United States were covered with grass, usually mixed with other herbaceous plants. Nearly 250 million acres of that grassland have been plowed up and used for crops or for pasture in rotation with crops, including about 10 million acres of irrigated land.

The grasslands of the central prairies formed the largest body of highly productive soils in America; they have been converted almost entirely to cropland. Semiarid, desert vegetation characterized about 400 million acres, of



LAND USED FOR HAY AND PASTURE

	Million acres	Percent
1. Hay-----	74	3.9
2. Cropland used for pasture-----	48	2.4
3. Other plowable pas- ture-----	61	3.3
4. Other nonforested pasture and graz- ing (chiefly non- arable)-----	598	31.3
5. Woodland and forest pasture-----	345	18.1
Total land used for hay and pasture-----	1,126	59.0

LAND NOT USED FOR HAY AND PASTURE

	Million acres	Percent
6. Woodland and for- est not pastured--	257	13.5
7. Urban, service, and other land areas--	149	8.0
8. Farmsteads, f a r m roads, etc.,-----	44	2.3
9. Crop failure, idle and fallow-----	50	2.6
10. Grain, fiber, vege- tables, fruit, and other crops-----	279	14.6
Total land not used for hay and pasture-----	779	41.0

Grand total — 1,905 million acres in 1945

which about 12 million acres have been reclaimed by irrigation.

Forests (not including semiarid woodland like pinyon, juniper, mesquite, and chaparral) originally covered about 800 million acres; about 350 million acres have been cleared at one time or another for agriculture, of which probably more than 50 million acres have reverted to forest cover and about 25 million acres have been converted to other uses. More than half of the present area of forest and cut-over land is pastured.

The country has probably more than 175 million acres of improved pasture on fair to good land, some of which compares favorably with cropland in productivity, but most grazing lands

are arid or rough, uncultivated, unfertilized, and relatively poor land as compared with cropland.

Pasture and grazing lands, excluding hay land but including forested land that is pastured, cover considerably more than half the area of continental United States—approximately 1,052 million acres—about 513 million acres in the West, 242 million acres on the Great Plains, 116 million acres in the North, and 181 million acres in the South. About 707 million acres are open pasture and 345 million acres forest or woodland pasture.

Only about 10 percent of the pasture land, 100 to 110 million acres, is suitable for regular cultivation in its present condition. The rest generally

is too dry, rough, wet, or steep or too high in elevation for field crops, although some of it could be made fit for tillage by irrigation, drainage, clearing, or better management.

Approximately 683 million acres, or two-thirds of the pasture and grazing lands, is privately owned. Of the other 369 million acres, about 304 million acres is federally owned. The rest belongs to States and counties.

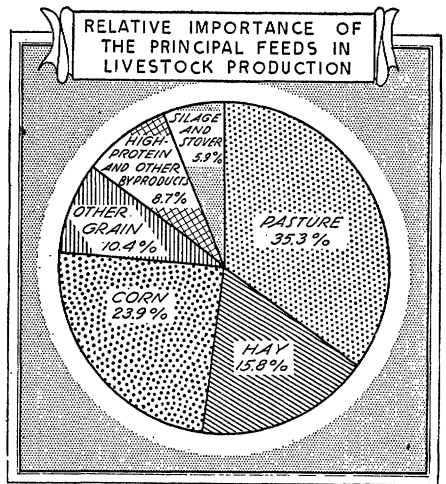
The principal native grazing lands are in the West and lower South. Those in the West are predominantly grasslands or desert shrub lands too dry for arable farming, although an important part is mountain woodland, moist enough for trees but generally too rough for cultivation. Those of the South are principally forested grazing lands, wet prairie, and marsh.

The western and Great Plains pasture and grazing lands occupy approximately 755 million acres. They form the largest and most important grazing area in the Nation.

The six Great Plains States include a grassland area of about 242 million acres, approximately 30 percent of the western grazing land. Here grazing is primarily of native shortgrasses, principally grama grass and buffalograss, although tall grasses predominate toward the eastern margin of the area and on deep, sandy soils. The only extensive area of native grazing land remaining in the humid, tall-grass, prairie region is the Flint Hills, in eastern Kansas.

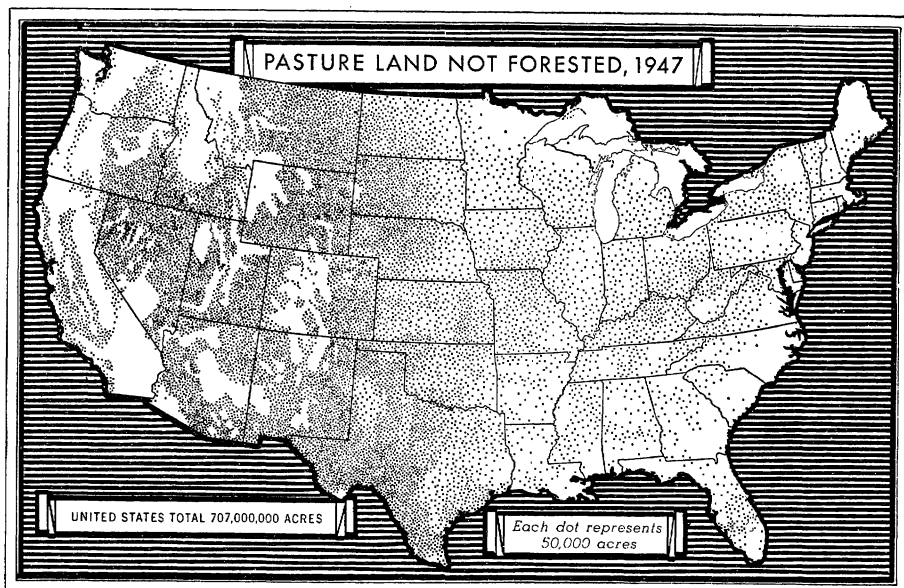
Formerly much of the western Great Plains was used for grazing all year. Subdivision of land into farms and ranches, and fencing have now reduced the grazing area open to stockmen in many sections until it has generally become necessary to shorten the grazing season and substitute more winter feed. Weather conditions, deterioration of grass cover, and lack of brush for shelter also have induced a shift from yearlong grazing. The Great Plains grazing lands are mainly in privately owned ranches.

The six northern Mountain and In-

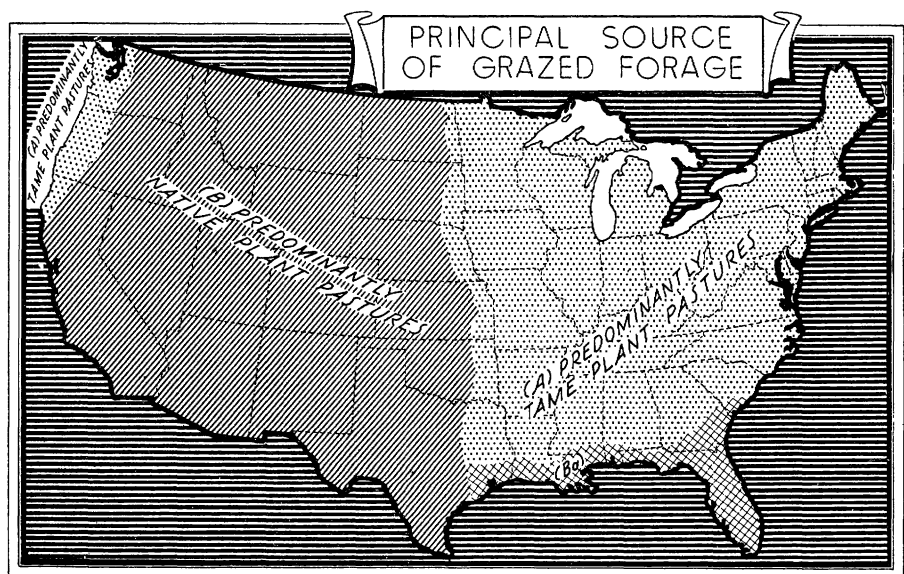


termountain States contain approximately 295 million acres of grazing land. Much of it is covered with forest or sparse woodland, although open, grassy "parks" and sage-covered basins are numerous in the forested areas. Grass is the principal type of forage. The higher mountains furnish from 3 to 6 months of grazing in summer. Cattle and sheep are driven from these summer ranges to the lower valleys in winter, where they are grazed or fed forage produced mainly under irrigation. Some intermediate elevations afford grazing during most of the year, but the forage is generally not sufficient to carry the animals more than 6 to 8 months without a change of pasture. A large part of the mountain grazing lands is in public ownership.

The southwestern arid division of the western grazing lands occupies about 125 million acres of grazing land, mainly in Arizona and New Mexico. The dominant vegetation is desert shrub—sagebrush, shadscale, creosotebush, greasewood, mesquite, and many others. Some are not palatable and are not grazed, but others, like winterfat or mesquite, are grazed or browsed. Associated desert grasses furnish some of the grazing. Much of this arid range is used in winter, when the summer ranges are snow-covered. Some of the Mohave Desert region of Arizona and



The general location of the 707 million acres of nonforested pasture land is indicated; approximately 10 percent of this land is suitable for regular cultivation as it stands.



Although native forage plants may furnish most of the feed in Region (Ba), tame grasses and grazed crops have increasing importance and may furnish more feed in some areas.

southern California is practically unusable for livestock because of lack of water. Most of this arid division of the western grazing lands is in public ownership.

The Pacific Coast States have nearly 100 million acres of grazing land, open and forested. The range of forage types is remarkably wide. Humid pastures in farms in the Northwest contain about 5 million acres. Irrigated pastures in all the Western States cover about 2 million acres, much of it in the Pacific Coast States.

In all four divisions of the western grazing lands, about 590 million acres may be classed as semiarid and arid range, an area nearly equal to the national acreage used for crops and humid pasture combined. It is an area of relatively low carrying capacity. Even if cropland were pushed virtually to its physical limits, there would still be almost 500 million acres left for grazing in this region.

Because of the low capacity, large acreages are required for an economic operating unit. In western Texas many ranches have 20,000 or more acres; in Arizona and New Mexico many have 30,000 to 40,000 acres. Many ranchers graze their animals under permit over large acreages of public land and national forests.

Even though the carrying capacity is often low, the western grazing lands are excellent for grazing because many of the grasses and other plants are nutritious; some of them cure on the ground and make winter feed.

The other important region of native grazing extends from central Texas to North Carolina.

It consists primarily of the southern pineland, but includes also the oak forests of eastern Texas and Oklahoma, the hardwood region of the southern Mississippi Delta, and extensive, poorly drained prairies or marshlands along the Gulf coast in Texas and Louisiana and in central and southern Florida.

A great variety of native plants, including wiregrasses, bluestem or broomsedge grasses, panicums, reeds,

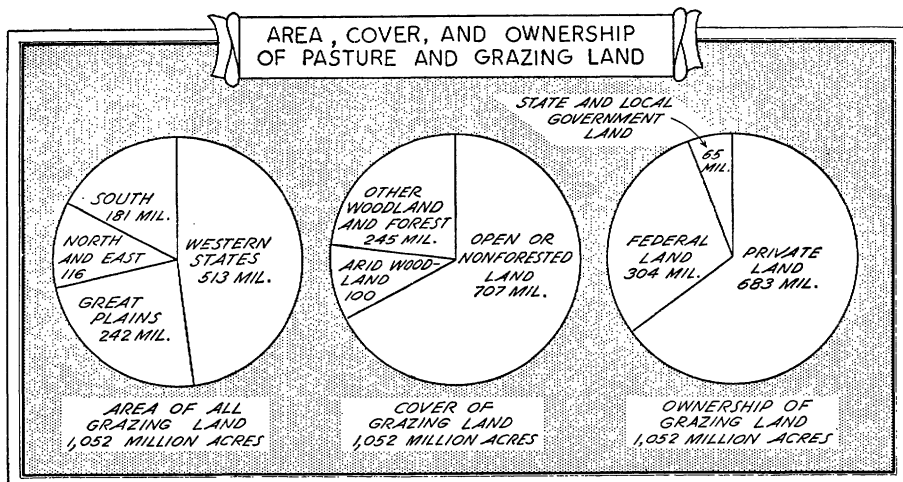
and browse plants furnish grazing. Carpetgrass has spread also into the woods in many places. The acreage of improved tame pasture is increasing.

Within the Southern States is 180 million acres or more of uncultivated forage-producing land available for grazing use. Besides the grazing in open woods and natural prairies, there is much grazing of cut-over tracts and abandoned fields that have not been restocked fully with timber.

Grazing in the north-central and northeastern sections is mainly of tame plants in improved farm pastures; there is some grazing of abandoned cultivated farm fields and farm woods. About 116 million acres of pasture is in the region. The humid part of the Pacific Northwest is another region where improved tame pastures afford a large share of the grazing.

In these humid areas, pastures are predominantly grasses and legumes, introduced from abroad. Pastures in these parts of the country generally have been made by preparing the land and seeding it to one or more of the introduced plants, some of which (such as bluegrass and white clover) spread naturally to favorable open or cleared land and are regarded by some as wild or native plants. Of improved tame pastures in 1945, about 130 million acres was permanent pasture and 48 million acres rotation pasture. Between 5 million and 7 million acres of this rotation pasture produced a harvested crop that year besides the pasture.

In some places an acre of pasture furnishes all the roughage a dairy cow or steer can eat the whole year. In other places a steer cannot get enough to eat from 50 acres. The main geographic differences that explain this disparity have to do with long seasons, plenty of moisture, and fertile soil. That is why the most productive pastures are in mild humid regions like the Mississippi Delta, on alluvial soils along the coast of Oregon and Washington, or in the mild-climate regions where irrigation is practiced.



About one-fourth of western pasture and grazing land is forested; the larger part of this is arid woodland and open areas within forests. About 70 percent of the southern grazing land is cut-over woodland and abandoned brush-grown fields. More pastures in the North Central and Northeastern States are improved than in the South and West.

Another item, besides the fertility of soils, is their capacity to supply moisture. Steep soils, however fertile, are not the best pasture soils because so much of the water that falls on them runs off instead of entering the soil. That is why the Blue Ridge of North Carolina and Georgia does not afford a large amount of grazing per acre, even though the climate is well suited to pasture. A favorable climate and fertilization can offset the effect of infertile soils in making good pasture if the soils have good moisture-supplying capacity. The soils of the Southeast, for example, generally do not make good pasture unless they are fertilized. When they are fertilized, seeded to good grasses and legumes, and properly grazed, the long grazing season provides as much forage per acre as many of our colder regions where the soils are more fertile. Where the soils do not hold enough water for the grass, however, an acre of pasture will produce little forage even though the climate favors grazing. For example, the deep sands of the Carolina sand hills and those of central Florida are so porous they do not hold and sup-

ply enough moisture for good pasture.

Generally speaking, the lands giving the greatest amount of grazing per acre are not the ones used most for grazing. This is because such lands are also the most productive for cultivated crops, whereas dry and steeply sloping lands can be grazed but are not suited to cultivated crops.

There are broad differences in the productivity of improved tame pasture in the different regions. They reflect principally rainfall, length of pasture season, and productivity of soil. By productivity of soil we mean not merely its fertility but its ability to produce, which depends also on its capacity for taking in and supplying moisture.

Unimproved native pastures on the whole have a much lower carrying capacity than improved tame pastures. Some of our most productive improved pastures will carry two cows or steers on an acre for a grazing season 8 months long. Native grazing land that will sustain a cow on less than 8 acres is rare. The increase in carrying capacity from pasture improvement is greatest on productive soils where

moisture is abundant and available.

The harvested acreage of all hay is around 75 million acres a year. Of the hay acreage, about 60 million acres is tame hay and 15 million acres wild or natural grass hay. The acreage of tame hay has increased in the past few decades from 50 million acres to 60 million acres. About 8 million acres of the increase occurred between 1915 and 1924. From 1925 to 1939 severe droughts brought a moderate decrease; by 1940 the acreage reached the 60-million-acre level, where it has stayed since.

In the 1920's nearly 60 percent of the tame hay acreage was in clover and timothy. Now clover and timothy represent but a third of the tame hay, while legumes reported separately total about 50 percent of all hay. Wild hay has declined from 16 to 11 percent.

Higher yielding, more nutritious, and better adapted legume forages are replacing timothy, bluegrass, white clover, and other grasses and legumes that under certain conditions do not yield well. Recently there has been a trend, however, toward growing legumes in mixture with new and improved grasses. Despite an increase in the number of dairy cows and beef cattle, the number of roughage-consuming animal units is now only slightly higher than in the early 1920's—about 75 million in 1940-44—as compared with 74 million roughage-consuming animal units in 1920-24, because of the decline in numbers of horses and mules. The quantity of hay available per unit, however, excluding horses and mules, is about one-third greater.

Higher yields made it possible for us to produce all the hay we needed and still use about 6 million fewer acres for hay than would have been required if yields had been no higher than in 1925-29. Of even greater importance were the changes in quality. If the composition of all hay had not improved from 1925 to 1944, nearly 18 million more acres would have been needed to provide the same amount of digestible feed nutrients. The shift to higher yield-

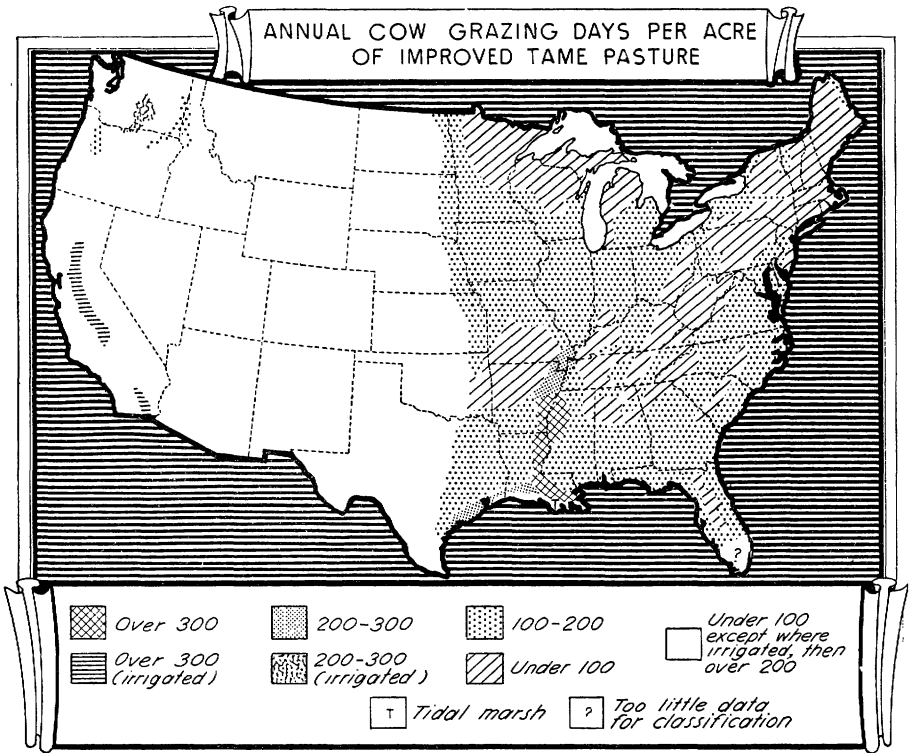
ing types of hay contributed to the wartime food output by making acres available for other food crops.

The acreage in pasture, grazing, and hay declined about 5 percent, or 64 million acres, from 1910 to 1945. In all, about 35 to 40 million acres was developed for crops; the rest was changed to various other uses. Of this reduction, nearly all was open land or nonforested grazing land in the Western States. Pastured woodland increased in part to make up for the decrease in open grazing land. Tame hay, mostly legumes, increased 10 million acres. Because of the drop in the wild hay acreage, the net increase in acreage of all hay was only 6 million acres.

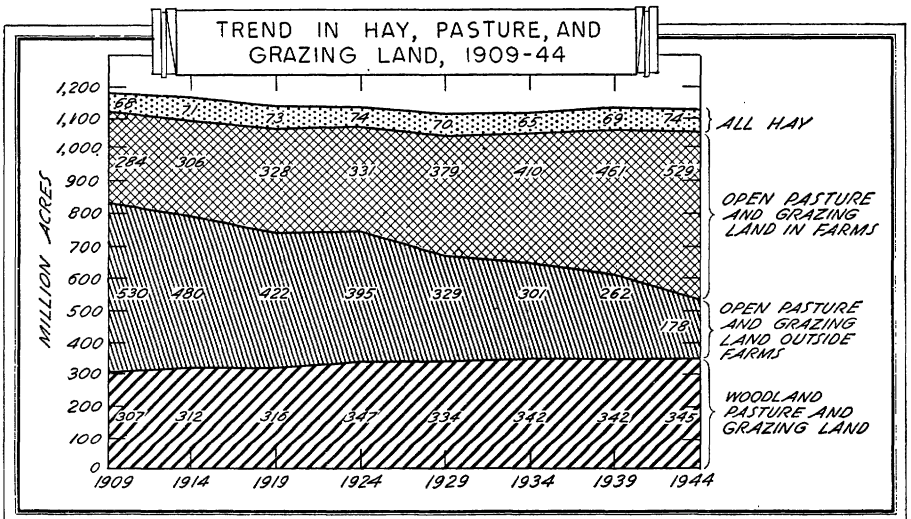
Open or nonforested pasture covers 529 million acres, and hay 74 million acres on farms. Altogether 603 million acres of hay and open pasture is in farms. Woodland pasture in farms covers 95 million acres. Thus, 698 million acres of pasture and hay land are in farms, or 62 percent of the total pasture, grazing, and hay land acreage.

Agricultural census data indicate that more than 200 million acres of open pasture and grazing land in farms were leased in 1945 by tenants and part owners. Pasture and grazing land make up nearly half of the farm land rented. A large proportion of the grazing land rented is by part owners in the Western States. In addition to rented land, much larger acreages are used under grazing permits. With the rented acreage of 200 million and the approximate 300 million acres used by permit, farmers and ranchers graze their livestock on 500 million acres or more of private and public land that they do not own.

In 1940 on farms operated by tenants, not including part owners, more than half of the open pasture was on farms rented for cash, at least in part, and the remainder on farms rented on shares. Frequently the pasture is rented for cash on the same farms where the cropland is rented for a share of the crop. Consequently, the rental values



Long seasons, sufficient moisture, and fertile soils explain differences in cow grazing days per acre of pasture land. The most productive pastures are in mild humid regions on alluvial soils of the Pacific coast area and in irrigated regions of mild climate.



From 1909 to 1944, hay, pasture, and grazing acreages declined about 64 million acres, largely because of development of the land for other uses. Open pasture and grazing land declined about 107 million acres and woodland pasture increased 38 million acres.

for pasture usually fluctuate less than those of cropland.

An estimated 60 million acres of the open pasture reported in farms and ranches was publicly owned land under State or Federal administration, leased or used by farmers under individual permits and allotments, and about 40 million acres was Indian lands. A large part of the State land is leased to individual livestock operators.

One of the most noticeable changes in reported ownership of grassland since 1910 has resulted from reporting as in farms and ranches nearly all the open or nonforested privately owned grazing land, along with a considerable acreage of publicly owned land. This is due to the development of new farms and ranches in the Western States and to the leasing by farmers of tracts of State and Federal land, which is then reported as being in farms, whereas formerly such land was not considered in farms. Much of the Indian land also is now reported by the Census Bureau as in farms and ranches.

Comparatively few livestock operators in the Western States own all of the range land required by their livestock. Use of leased land or of grazing permits in connection with one's own land is common throughout the West. Tenure and control of grazing land vary widely from that of the stockman who owns no land to that of the operator who owns a home ranch and all necessary range land. In between are many combinations of ownership, leases, permits, and unauthorized use. The most common type of tenure is that of an operator who owns some farm and range land, leases some of both from private owners, and uses public lands under permit at certain seasons.

State land is important in several States. Ten Western States have substantial acreages, ranging from 1 to 10 million acres each. The operators of these lands pay rentals to the States. For example, on the 11 million acres of State-owned grazing lands in New Mexico are hundreds of ranches. Graz-

ing leases there are limited to a term of 5 years but may be renewed.

About 428 million acres of grazing land is outside of farms. Of such lands, 178 million acres is open or nonforested and 250 million acres is woodland and forest. Practically all of the 178 million acres is publicly administered, although most of it is used by private farmers and ranchers. Of the forested land grazed outside farms, about 100 million acres is publicly owned and administered by Federal, State, or local governments. Nearly all grazing land outside farms is used by private parties under a grazing-permit system. Payments are based on the number, kind, and age of livestock grazed. Local farmers, with only a few head of livestock for home farm use, are permitted free grazing under certain conditions. The commercial livestock man, however, pays for the grazing on public land.

In parts of the lower South and in the Ozarks, privately owned land on which there are no restrictions against grazing is "free" range. Here free range areas include mostly timbered nonfarm lands, but also some farm lands that are not fenced. Farmers in free range areas normally fence only the fields used for cultivated crops and depend almost entirely on the unfenced land for pasture, particularly from April through October. In several Southern and border States a relatively large percentage of the total unimproved land area is subject to free grazing.

The free range areas, which are determined by an elimination process, include areas where livestock laws or stock law improvement districts do not prohibit livestock from running at large. Areas in which free grazing is prohibited are known generally as closed range.

Under the homestead laws and the various other means of disposing of the public lands (such as the railroad grants) approximately 385 million acres, or more than 50 percent, of the western range land passed into private ownership. By various processes, States

and counties acquired about 65 million acres of grazing land.

In contrast to the laws which encouraged the passing of public lands to private ownership were the various Federal reservation acts. Under these acts the remaining unappropriated lands were set aside for public use in national forests, grazing districts, and reclamation and other reservations. These public reservations, together with lands bought by the Federal Government in recent years, include some 304 million acres useful for grazing.

Of the federally administered grazing land, including Indian lands, about 202 million acres is open or nonforested grazing land and 102 million acres woodland and forest. Multiple-use values are found especially in the forested parts of the federally owned or administered lands where lands

serve not only for timber production but also for grazing, recreation, wildlife, and watershed protection.

Of the federally administered grazing land, nearly half is in grazing districts. More than one-fourth is in national forests and about 15 percent in Indian landholdings. Altogether, more than 20 million head of livestock are grazed part of the year on Federal and Indian lands under Government administration.

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THE HELP THE GOVERNMENT OFFERS

NEIL W. JOHNSON, CHARLES W. LOOMER

IN EVERY State, in every county, on every farm in the United States men and women are constantly at work to extend their knowledge of grasslands.

The workers are the farmers and ranchers, whose questions about grass reflect their growing interest in it; State and Federal research scientists, who try to find the answers to the questions; and the persons in public and private agencies, who administer educational, financial, and other programs that have been established to improve grazing uses and to encourage the adoption of improved practices on public and private grasslands.

Several Government agencies carry on many types of research on problems related to farm grasslands, often in cooperation with State agricultural experiment stations.

The research worker seeks to know how each grass and hay crop is adapted to a wide range of soil and climatic conditions, what its growth habits are

in different localities, how it propagates itself, how palatable it is to various kinds of livestock, what its nutritive values are, how well it stands up under grazing, how many tons of hay it will yield, how many head of livestock it will carry when pastured, how to establish and maintain a grass cover. Knowing these things, he can help answer the intensely practical questions that farmers ask.

A whole series of studies tries to determine the losses of dry matter and feed nutrients during harvesting and storage. They inquire into changes in chemical composition and in color and leafiness of forage, and into the labor and machinery requirements for putting up the crop by different methods. Comparative feeding experiments are conducted to determine the value of each roughage for meat and milk production, its effect on the vitamin A content of milk, and on other nutritive properties of livestock products.