

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.

Related studies are made on how to fit the forage crop into a rotation and what effect it will have on the yield of subsequent crops. Other research is concerned with the effect of grass on soil properties. A growing appreciation of the value of legumes has given importance to investigations into the production of legume seed. Studies are made of the influence of environment, variety, and disease, and the effect of both beneficial and destructive insects. Special attention is given to the development of varieties and methods of management that will produce more satisfactory and reliable yields of seed.

Our Government, in cooperation with State agricultural experiment stations, also carries on intensive research in soil and water conservation, in which grass is an effective tool. There is progressive need to know just what combination of practices best suits each location under widely different conditions of soils and climate. Much of the work with the experiment stations is on a plot basis, and countless types of experiments are conducted under controlled conditions. The more promising experiments are carried to field trials and then to the final stage of testing under farm conditions. Only after results have been verified thus is a practice recommended for wide adoption.

In 29 conservation nurseries, agencies of the Department cooperate with State workers in testing the possibilities of native and introduced grasses, shrubs, and trees. Typical is the nursery at Pullman, Wash., where 500 to 1,000 varieties have been tested each year for the past 10 years. Seeds of the improved strains of soil-conserving crops are produced in volume at the nurseries and distributed to farmers. Work is carried on to determine the best methods of producing and processing legume seeds; this knowledge is made available to farmers, who can produce crops of seed for their own use or for sale.

In studies in more than 30 States,

various sod crops have been introduced into farming systems for one or more years to determine the soil-building and soil-conserving values of different crop rotations. So, farmers are generally able to select from a number of tested systems the one that best fits their own needs.

Pasture renovation is studied intensively in all parts of the country. Attention is directed to the grasses that are best suited to pastures under different conditions of soil and climate, to methods of getting good stands, pasture management, and restoration of overgrazed pastures. Where water removal is a problem, special studies have been made to determine the suitability of different grasses for the construction of grassed waterways.

In scores of places a comprehensive program of economic research is conducted to evaluate developments associated with improvements in kinds and quality of forage and in breeding, feeding, and care of forage-consuming livestock. Methods of harvesting hay that reduce labor and preserve the quality of the crop are tested for their effects on the farmer's pocketbook. The economic implications of advances in the control of internal parasites, the elimination of insect pests of livestock, of the breeding of new types of livestock better adapted to southern climates, and of the extension of farm refrigeration by the use of cheap power are studied. Attention is also given to the current organization and the operation of farms, the amounts of capital required to make desirable adjustments, the market outlets for livestock products, income possibilities, and to long-time stability under new systems of farming. These analyses are designed to help the agricultural economy keep pace with changing physical developments and to reduce the costly trial-and-error experiments farmers have so often had to make for themselves.

The Government sometimes develops special programs to speed the correction of long-standing abuses.

Reconnaissance surveys in the early 1930's, for instance, gave a rough idea of the extent and rapidity of soil depletion and indicated where restorative work was urgently needed. Problem areas were outlined, technical staffs assembled, research and educational programs initiated, demonstration areas established, and aid given individual farmers and ranchers for carrying out conservation practices.

Now about 7 out of every 10 farms in the United States, and more than 5 out of every 10 acres of farm land are within soil conservation districts in the 48 States. The farmer-managed districts are organized under State laws and are empowered to deal with the Secretary of Agriculture in obtaining various kinds of technical assistance for conserving the agricultural plant. Heavy equipment may be loaned to build terraces, assistance given to establish contour lines, planting materials supplied, advice offered regarding the most effective combinations of erosion-control practices, or aid given in developing annual and long-time farm plans.

The fields in which soil technicians operate are many and varied. They group soil types according to adaptability to various crops and methods of land management. They help farmers use both vegetative and mechanical measures to solve conservation problems. Methods of handling farm wood lots are demonstrated, and farmers are helped to develop a sustained yield of forest products. Farmers come to a better understanding of water in its relation to land, whether the problem is one of excess supply or of deficiency.

As part of a program that has been operating since 1936, through locally elected county and community committees in every county, Congress made more than a quarter of a billion dollars available to farmers and ranchers to encourage agricultural conservation practices in 1946. Forty-one percent of this sum was spent to lime soils and fertilize pastures, hay lands, and cover crops. More than 14 million

acres were limed, about 20 million acres had applications of phosphates, and more than 6 million acres were treated with potash in the 1946 program. Farmers were given purchase orders for these materials and the Government furnished part of the cost of carrying out the practices.

Next to the program for improving soil fertility was that of erosion-control practices. Payments in 1946 were made for such practices as terracing a million and a half acres of cropland, contour farming more than 10 million acres, strip farming more than 6 million acres, and using special measures to protect from erosion the 14 million acres of summer fallow. Conservation funds were used to encourage the use of green manure and cover crops to protect soil from water and wind erosion, to restore plant food to the soil and to improve its texture. The latter program covered more than 18 million acres in 1946 and is especially important in East Central, North Central, and Southern States. Other conservation payments were used for practices designed to improve range and pasture lands.

In the 1946 appropriation for conservation, Congress provided special funds to encourage the harvesting of legume and grass seeds, many types of which have been in short supply. Payments were also made for control of perennial noxious weeds, improving or maintaining a stand of forest trees, clearance of land, and other miscellaneous conservation practices. The emphasis on these conservation practices varies widely from county to county. Local committees of farmers and technical workers determine from year to year the combination of practices they consider the most effective for conservation of soil and water resources in the locality and those for which payments will be offered.

Since 1933 the conversion from row crops to grassland agriculture has been particularly emphasized in the seven States of the Tennessee Valley. The shift to grass, livestock, and dairying is

part of a larger program for water control and better use of resources. The principal instruments in this conversion are new phosphate fertilizers produced in the area, which in cooperation with Federal and State extension services have been tested and demonstrated on approximately 30,000 farms. The influence of this regional program extends beyond the Tennessee Valley, since nearly 6,000 test demonstration farms are scattered throughout 26 other States.

In a 10-year period, the total hay acreage of the 125 counties in the Tennessee watershed increased 136,000 acres, or 8 percent. Alfalfa accounted for 73,000 acres of this increase, expanding 226 percent from the 1934 acreage. In 15 counties in northern Alabama applications of phosphates and lime have made possible extension of improved pasture of from 10,001 to 111,214 acres in 10 years; perennial legumes have increased from 2,312 to 61,477 acres; and winter legumes from 79,930 to 288,392 acres. The production of legume seed increased similarly.

The results of this program have gone beyond increased acreages and yields. An improved grassland agriculture has been developed through good land use and soil, water, and crop management in which phosphate fertilizer has played an important part. Livestock enterprises have been added, together with necessary additions to power, machinery, and equipment. This has been accompanied by increases in the skill, knowledge, and judgment of the farmer and his family and by development of many kinds of cooperative community action.

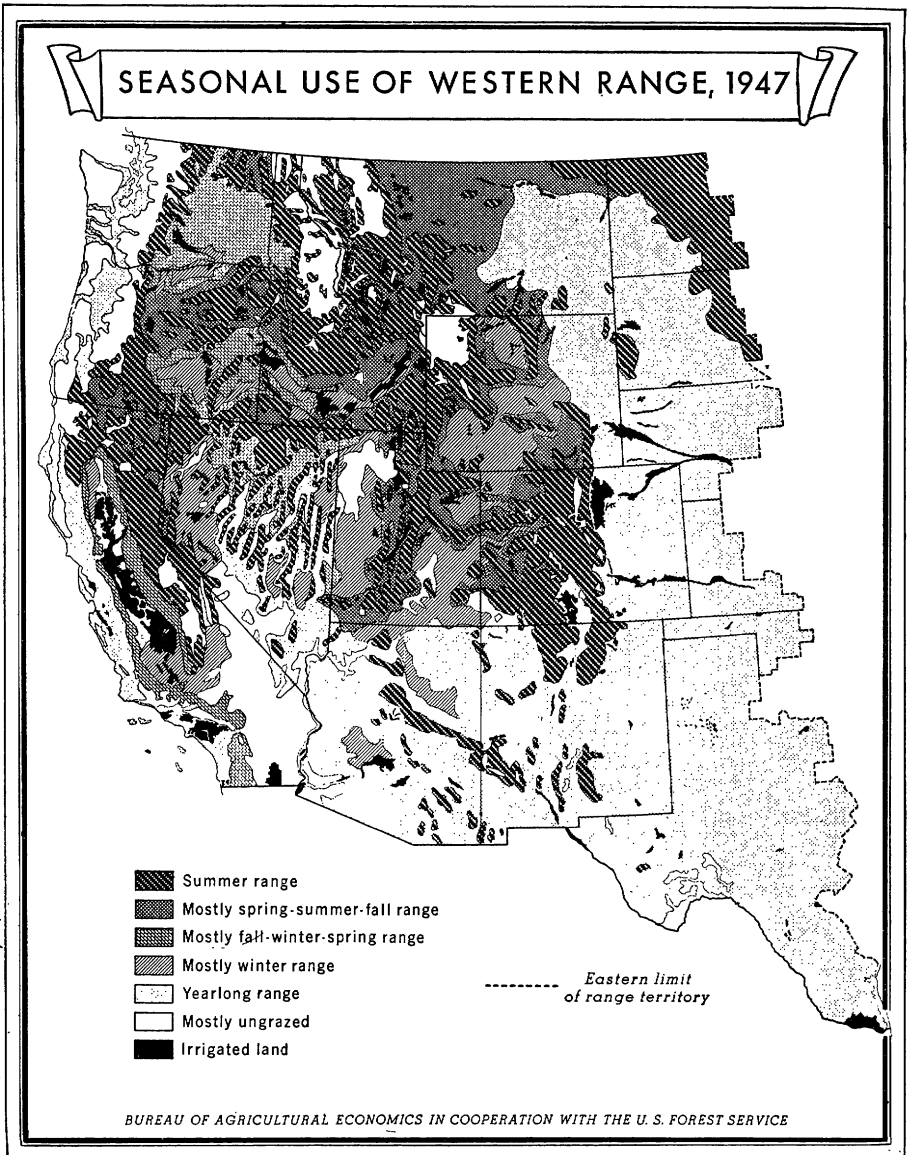
Scientific interest in range lands goes back to journals of botanists attached to the Lewis and Clark expedition and to other military explorations shortly after the turn of the nineteenth century. Over the years, scientists of the United States Department of Agriculture have added to the growing fund of knowledge on how to use our native forage-producing lands—brush and grazed forest as well as true

untimbered range. At present, the work is centered in a group of regional departmental experiment stations in cooperation with the various State agricultural experiment stations.

Underlying all range research must be an intimate knowledge of range plants—their identification, habits of growth, life cycles, forage values, resistance to drought and grazing, soil-building and soil-binding properties, and their values in watershed control. Department agencies cooperating with the United States National Museum have built up the world's largest herbarium of range plants. Work continues in assembling and classification of specimens as well as in the publication of findings.

Research on grazing management seeks to develop the principles and practices of good husbandry of range land. These include grazing at the proper season of the year, grazing the kind of livestock best adapted to the range, balancing numbers of livestock with the forage-producing capacity, and encouraging uniform grazing and preventing localized damage to the range through better distribution of livestock watering places and salt. Poisonous plants are identified, methods are devised for their eradication, and grazing systems are worked out to reduce losses.

In cooperation with State agricultural experiment stations, livestock are placed on experimental ranges, and studies are made of the rates of stocking that permit most efficient use of the forage supply under varying climatic conditions. Death losses, calf and lamb crops, net turn-off of beef and mutton, fleece weights, and other data are recorded year by year and related to maintenance and improvement of the range as a means of increasing the net income. Feed concentrates and pastures needed to supplement range grazing are investigated. Studies are made of soil texture, structure, and fertility in relation to the erosion problem on range land, to the water-holding capacity of the grass cover, and to



its ability to recover after periods of depletion. Most of this work has been concentrated in the 17 Western States, but in 1940 it was extended to the South and Southeast, especially to forest ranges in the Coastal Plain.

Research in revegetation aims to find good species and planting methods to speed the rehabilitation of depleted ranges and those mistakenly plowed

and later abandoned, which are characteristically slow in developing a desirable perennial grass cover.

Numerous attempts have been made to adapt cultivated forage plants to range use, but these have succeeded only under the most favorable conditions. A more fertile field has been that of studying the growth habits of plants native to the range, both in this

country and abroad, and the conditions under which they can be reseeded. Attention is given to plants that can restore or increase the range forage and to those that aid in watershed protection. The work involves selection of superior strains and improvement through breeding. Studies of how to evaluate sites on which reseeding is needed and justified are basic to the program. In recent years the work has been reinforced in its western locations and extended into the South and Southeast.

We have learned through the years that loss of life and property through floods frequently may be traced to unwise use of ranges and forests many miles from the scene of the worst damage. The water supply of cities may fail and crops dependent on irrigation wither for the same reasons. So-called natural disasters are thus seen to be but the delayed results of the acts of man. Engineers design scientific upstream controls, and these have proved effective, but only at costs that need not have been incurred if abuse of natural resources had not occurred in the first place.

Studies of range and forest watersheds are the medium through which we come to understand these relationships. Investigations are made of the influence of cover afforded by different types and amounts of vegetation on soils, run-off, percolation, and storage of water for irrigation, power, and domestic use. Then the rates of stocking that can be sustained without impairing the water-holding and soil-binding functions of the vegetative cover are determined. Torrential rains in some areas of long-standing abuse have caused the surface of whole hillsides to descend upon fertile farm lands on the valley floor. Range research has devised the means of preventing recurrence of such damage, but the methods are costly. Emphasis accordingly is placed on using the range in ways that will maintain or improve rather than destroy its many values.

Prairie dogs, ground squirrels, and

other rodents can seriously affect the supply of range forage available to livestock so much that rodent control is an important activity in many range areas. Elk and deer make their demands on the supply of native grasses. Coyotes, cougars, and other predators must be kept in check to prevent serious losses to flocks and herds. Research in this field studies the life cycle of the animals, their habits of feeding and breeding, the diseases and insect pests to which they are susceptible, and methods for their extermination or control.

Economic problems confront the researcher in nearly all the fields previously described. What does it cost to control range rodents and predators by different methods? Will the benefits exceed the costs? How many dollars can we afford to invest in restoration of depleted range lands? How should these costs be distributed between private users of the range and public beneficiaries of the work? What are the costs and returns from various processes of brush removal or of artificial revegetation of the range? What system of range management results in the greatest margin of profit to the rancher over the long pull?

Closely allied to these considerations of the costs and returns from various practices are the economic questions that confront the producer of cattle and sheep in the organization and operation of his ranch enterprise. The business side of ranch operation and the profitable marketing of range-livestock products are broad fields of economic research in which the Department of Agriculture engages, usually in cooperation with the land-grant colleges in States where range-livestock production is important.

For the private stockman, the importance of public land programs comes from the fact that Uncle Sam owns a great deal of the land used in private ranch and livestock operations. The Federal Government owns approximately 458 million acres of land in the United States, most of it in the 17 range States of the West. Less than

1 percent of this area is classed as cropland, and most of that is located in Indian reservations. Approximately 9 percent is classified as barren land, absolute desert, sand dunes, brushland, swampland, marshes, and other types of wasteland useful only for recreation, wildlife, and watershed protection. About 40 percent is forested or wooded land, largely administered as national forests and national parks and located in both Eastern and Western States. The remainder—approximately half of all Federal land—is untimbered range land, principally in the arid and semi-arid regions of the West.

Grazing is an important use on about 304 million acres of Federal land. Taylor grazing districts, Indian reservations, and other lands administered by the Department of the Interior account for 204 million acres. The Department of Agriculture administers about 158 million acres of national forest land, exclusive of that in Alaska and Puerto Rico. Of this area about 83 million acres is used for grazing. Other Federal lands used for grazing account for an additional 17 million acres. In other words, about two-thirds of all Federal land in the continental United States contributes to livestock production and is used by stockmen and ranchers in connection with their private livestock operations. The area so used is roughly equivalent to the combined land area of Montana, Wyoming, Idaho, Oregon, and Washington. The public land programs, accordingly, play a dominant role in the range-livestock industry of the West.

A distinction must be made between public lands devoted exclusively to a public use and those used wholly or partly for private uses like grazing. The national parks and monuments, for example, are administered primarily for the preservation of scenery, wildlife, and natural historic objects. All other uses, including grazing, are restricted in accordance with the purpose for which the withdrawals were made. The unreserved public grazing lands and the Federal lands in grazing

districts and national forests, on the other hand, are administered for conservation, improvement, and development of range watershed resources; orderly grazing by livestock and wildlife; stabilization of the livestock industry; and equitable distribution of grazing privileges.

The most important sources of grazing privileges are found in three types of public land: (1) The unreserved public grazing land and the Federal land in grazing districts administered under the provisions of the Taylor Grazing Act; (2) more than half of the total area of national forests, and (3) submarginal lands acquired for land use adjustments under the Federal soil conservation program. In most respects, the management objectives for these different lands are similar. They are designed to promote sustained yields of range forage, and they incorporate the findings of the many range-research activities described above.

Grazing privileges on Federal land are generally granted in the form of permits which authorize livestock operators to graze a certain number of livestock for a prescribed period. The fees paid by the individual operators are based on an animal-unit-month charge. Grazing permits often grant grazing privileges in common pasture areas used by two or more stockmen, although in many areas permits are given in individual allotments. Privileges are distributed among individual applicants on the basis of their qualifications; factors usually considered are priority of use, dependence on Federal range, and ability to provide sufficient feed and forage to care for permitted livestock during the period it is off the Federal range.

In the national forests and in the Taylor grazing districts, local groups of stockmen act in an advisory capacity with regard to allocation of grazing privileges and details of administration. In the submarginal land purchase projects, grazing privileges are granted to cooperative grazing associations and to soil conservation districts. These

groups, in turn, grant privileges to individual operators within the districts.

The Federal land agencies are charged with the responsibility of conserving and improving forage and watershed resources on public lands. Grazing privileges are restricted to a long-time grazing capacity as determined by careful range surveys. Although grazing is thus restricted in areas subject to overgrazing, the total amount of available forage is increased by programs designed to improve livestock distribution and range use. Among these may be listed development of such stockwater facilities as dams, wells, dugouts, and tanks; construction of corrals, fences, and access roads; rodent eradication; and fire protection organization to control range and brush fires.

On deteriorated range, major emphasis is given to reseeding and restoration of perennial grass cover. A newly developed method for sowing grass seed from airplanes was tried in 1946. The seed is enclosed with plant food in small clay pellets, which protect the seed when it is first sown and give it a start when the rains come. The method may prove effective in reseeding some areas of semiarid range land.

Our Government also encourages conservation on privately owned range lands. Ranchers in soil conservation and grass conservation districts are given technical and other assistance in developing and carrying out management plans designed to prevent soil erosion and achieve a better balance between range forage and nonrange feed supplies. Such assistance has been extended to ranchers on nearly 50 million acres of privately owned range lands, largely in the 17 Western States. Moderate rates of stocking, together with supplemental conservation practices, offer a means of controlling erosion and increasing production.

In the practice-payment program of the Government, assistance is offered in supplying conservation materials such as fertilizer, lime, plants, and seeds, or in the form of direct payment

of a part of the cost of performing certain practices. After consulting with agricultural workers in the land-grant colleges and with technicians in other agencies, local county committees select the practices that have greatest application to the conservation needs of the county and, working with the State conservation committee, they determine rates of payment for these practices.

Nearly 40 million dollars of conservation credits were earned by participating ranchers in 1946 for carrying out various range and pasture practices. Practices for which payments were made in 1946 included construction of dams and reservoirs, deferred grazing to permit natural reseeding, eradication of destructive plants, development of springs and seeps, rodent control, and establishment and maintenance of fireguards.

To carry the benefits of research and action programs to people wherever they live, the Government conducts extension and educational activities, mostly through local committees of farmers and ranchers. The purpose is to make available the findings of technical and scientific research, outline the steps that farmers and ranchers can take on their own farms and ranches, and show how they can participate in and benefit by the various Government action programs.

Every effort is made to gear the extension program to the needs of the community. National and State extension organizations exist for the purpose of throwing the full weight of governmental and private support behind the program, but local committees and the county agricultural agents working together determine lines of local action.

In Nebraska, for instance, after the drought of 1934, the State outlined a pasture-forage-livestock program designed to promote well-balanced diversified farming, with particular attention to the maintenance of soil fertility, feed reserves, and quality livestock. It was decided that the program should stress improvements in pastures, forage and

feed grains, livestock management, control of animal and crop disease, pest control, weed control, and windbreaks. Within this framework, the counties select the lines of the work to be advanced year by year in their individual county programs. Individual farmers are given advice and assistance with the specific problems that are of greatest interest to them.

Basically, the extension program is carried on by the dissemination of information and by the exchange of ideas and experiences between cooperating farmers and ranchers. Individual operators, by means of bulletins and circulars, discussion groups, moving pictures, and talks by agricultural experts, are given the latest information regarding their problems of farm and ranch operation. They are encouraged to try new methods and keep records by which their neighbors can profit from the experiment. By means of tours and discussion groups, other farmers are kept informed of the results. By demonstration, farm and ranch operators can see in their own neighborhoods what progress is being made in the solution of their problems.

One of the most important aspects of the extension programs is the opportunity for concerted action by Federal, State, and private organizations. County agricultural agents are joint employees of the State extension services and the Federal Government, and the research and extension facilities of Federal and State Governments are available to the local program. With experiment and demonstration activities organized at the local level, the extension program is also closely related to the Government programs of greatest local interest.

In the Tennessee Valley, for instance, the Government furnishes fertilizer for the program described earlier in this article. In the range country, several Government agencies cooperate in emphasizing range management and improvement. Private as well as public organizations cooperate in these educational activities. Private corpora-

tions, for instance, may provide supplies for farm demonstration projects. Meetings, tours, and discussions are frequently sponsored by chambers of commerce and other civic organizations.

Research often points the way to adjustments farmers need to make for increased incomes under stable systems of farming. Farmers may be powerless to make these changes, however, because of lack of capital for the initial investment and for living expenses during the adjustment period. Shifts from cash-crop farming to greater emphasis on forage and livestock production are particularly of this type. Funds may be needed for application of lime and fertilizer to improve stands of legume hays and pasture, hay harvesting equipment may be needed, and the operator may have to make investments in livestock, together with buildings and equipment to care for them. Several years may elapse before these adjustments are reflected in increased income.

Farmers and stockmen obtain most of the credit required to finance the acquisition, operation, and improvement of farms by borrowing from individuals, commercial banks, life insurance companies, and other private agencies. Federal Reserve banks are authorized within certain limitations to discount agricultural loans submitted to them by State and national banks that are members of the Federal Reserve System. Two Department of Agriculture agencies also serve as suppliers of credit. One of these agencies supervises a Nation-wide system of credit for farmers, stockmen, and their cooperatives who can qualify for credit on the usual business basis. The other agency, by close supervision of the farm and home operation, makes loans to low-income farmers who are unable to obtain credit from other sources. Loans are usually made for the operation or purchase of a farm, and as such affect the entire farm business, including forage and livestock production.

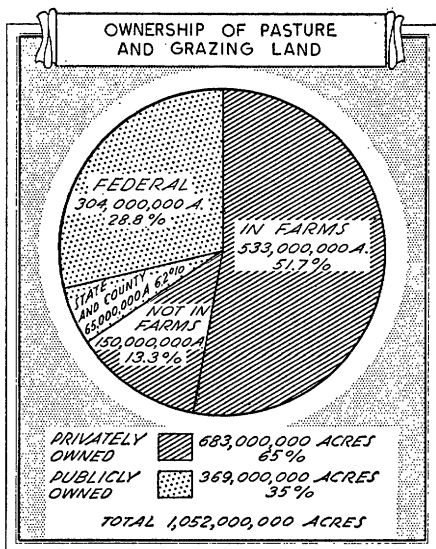
Cooperative credit on a sound basis is available on terms and at rates of

interest adapted to the needs of the individual farmer, stockman, or cooperative. Long-term loans secured by first mortgages on farms or ranches are available from the 12 Federal land banks. Such loans are made through local cooperative national farm loan associations and are based on the normal agricultural value of the land, including improvements thereon.

Short-term or production credit is available through local production credit associations. Farmer borrowers are shareholders in the associations, which are organized on a cooperative basis. The associations obtain their loan funds by discounting farmers' notes with the 12 Federal intermediate credit banks. These banks also discount agricultural paper for State and national banks, privately capitalized agricultural and livestock credit corporations, and other similar institutions.

Farmers' cooperatives may obtain loans suited to their needs from the 13 banks for cooperatives. The borrowing cooperatives are required to be shareholders in the banks, which may obtain needed loan funds by rediscounting notes with the Federal intermediate credit banks or by borrowing from other sources.

Loans supervised by the Department are designed to offer credit to operators who cannot ordinarily furnish security for other types of loans. The supervised loans are of three types—those for farm ownership, those for production and subsistence, and those for water facilities. The farm-ownership loan enables the borrower to acquire and improve a farm or to buy additional land to make a more efficient family-sized unit. This loan may include funds for land development such as fencing, clearing, terracing, draining and irrigation systems, development of permanent pasture, wood lots and orchards, and the application of soil amendments and fertilizers not normally applied each year. Production and subsistence loans enable the borrower to purchase machinery, livestock, farm supplies such



as feed, seed, fertilizer, and family subsistence needed to carry out the annual farm program.

Water-facility loans, available to farmers in the 17 Western States, are frequently used to enable the borrower to diversify and stabilize an otherwise risky farm program by developing pastures and forage crops and feeding livestock. The installation of a water facility on the range may encourage proper distribution of grazing and thereby promote the conservation and production of natural grasses. The best use of grazing privileges on national forests or the public domain may be promoted by an irrigation facility installed on a nearby unit to develop a winter feed base for stock carried on the forests in the summer.

All three types of supervised loans as a rule are based on farm and home plans developed by the borrower in consultation with the agency's local supervisor. These plans represent the kind of program the borrower expects to follow in the years to come and are of value as a guide to farm operations. They also assist in determining the soundness of the loans. Any farmer who obtains one or more of these supervised loans is entitled to receive advice and guidance from the local supervisor

about any phase of his farming program. Most of the advice given concerning the establishment and care of pastures or hayfields is based upon recommendations of the Department, State agricultural colleges, and experiment stations. Hence the programs of other agencies relating to grassland agriculture are further drawn upon in the farm planning and supervisory phases of this loan program.

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[A directory of Federal agencies whose work includes activities pertaining to grasslands and a list of State agricultural experiment stations are given at the end of the book.]