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Land-use problems in the Great Plains.

Further effort should be made in this high-risk area to retire certain low-grade cropland to grass, adapt agriculture to the variable climate, adjust production of wheat to market demand, apply recommended farming practices, adjust sizes of farms, conserve water, adapt crops, improve the range, and adjust institutions. By *John Muehlbeier*, agricultural economist, Farm Economics Research Division, and secretary, Great Plains Agricultural Council.

THE GREAT PLAINS, a vast region with its own characteristics and problems, is about 1,300 miles long and 200 to 700 miles wide. It extends from Canada nearly to Mexico. The Rocky Mountains form its western boundary. There is no clear demarcation for its eastern boundary, which is a transition zone through eastern North Dakota, South Dakota, Nebraska, and Kansas, through central Oklahoma, and into Texas. Parts of New Mexico, Colorado, Wyoming, and Montana are also in the Plains. A delineation of the Plains commonly used is the one shown in *The Future of the Great Plains* (Report of the Great Plains Committee, 1936).

Many of the land-use problems of the Great Plains arise from the nature of its climate. Rainfall is low and variable. The average rainfall in a wide zone running north and south is near the critical limits for the production of crops. In many years, crops are good, but years in which rainfall is below average follow, and crops fail. The more humid regions do not have this problem, or, if they do, it is in a lesser degree. Arid regions do not have it at all. C. W. Thornthwaite, in *The Great Plains*, attaches a great deal of significance to variation in precipitation in the transition area.

Extremes of temperature, periods of high temperature, a short growing sea-

son in the Northern Plains, and high wind velocities are serious hazards to crops. The wind increases evaporation of scarce water, intensifies drought, and causes erosion of soil.

The soils form a complex pattern. That further complicates the problem of adapting agriculture to the Plains. The soils differ in their capacity to absorb and hold water, resist erosion, and produce crops. They differ in the treatment they require and in the use that can be made of them in the production of crops.

Grasses are important in the Plains. The predominant species—buffalo, grama, and western wheatgrass—withstand or survive severe drought. Some of the taller grasses are present also, but they do not do so well in the dry years as the short grasses.

Compared to regions farther east, the Plains has relatively few trees, although many windbreaks and shelterbelts have been established. With proper care, they survive the rigors of the climate remarkably well.

The major types of agriculture in the region are livestock ranching, wheat farming, and a combination of grain and livestock production. The land area of the Plains totals about 363 million acres. About 331 million acres (91 percent) are in farms. Of the land in farms, 133 million acres (40 percent)

are cropland, 195 million acres (60 percent) are pastured, and 11 million acres (4 percent) are woodland. Some cropland and woodland are also reported as pastured. About 7 million acres (2 percent of the land in farms) are irrigated. The Great Plains has fewer than 400 thousand farms and ranches. The average size is about 240 acres in some areas and more than 4 thousand acres in others. About two-fifths of them are cash-grain farms.

The population is sparse. About one-fourth of the inhabitants live on farms. Denver is the only large city, and it is on the western edge of the Plains. Distance is a major factor in the development of institutional arrangements that are adapted to Plains conditions.

The Great Plains contains about a fifth of the Nation's land and nearly a third of its cropland. It produces nearly two-thirds of its wheat and more than one-third of its cattle.

Farm income is highly variable. In a period of favorable weather, especially if it coincides with a period of high prices for farm products, income is high. Farm income drops sharply in dry years.

Many of the problems of the Plains may be traced back to the pattern of settlement, when the climatic limitations of the region were not given due consideration. The agriculture and institutions that settlers brought from more humid regions needed to be modified, and that has been a slow and painful process.

Progress has been made in adapting agriculture to the peculiar characteristics of the Plains. As evidence, one can list certain changes in size of farm and in land use, better farming, land treatment, development of water resources, improved varieties of crops and grasses, improvement of the range, better living conditions, more stable landownership, adjustment in institutional arrangements, supplemental off-farm employment, and the like.

A number of land-use problems require further attention, however.

Cropland with a very low average

production that is cultivated at great risk or that deteriorates when farmed should be retired to grass. The average yield of wheat, for example, in some areas is less than 8 bushels per acre. Many years the crop is a total failure. Farmers are in economic distress in the dry years, and land deteriorates through wind erosion.

A detailed delineation of lands unsuited to continued cultivation is not available, but 15 million to 30 million acres may be in this category. But one has to be careful when he puts land in this category: Unless yields are extremely low, the land may produce more in wheat or in a drought-resistant feed crop than in grass. Risk and deterioration in the long run may be sufficient reason, however, to retire the land to grass, even though the return in the short run may favor wheat. Although some land may do well in wheat in favorable years, it is not practicable to shift it back and forth between wheat and grass because of the problem of establishing a stand of grass.

To locate the lands that should be retired to grass more precisely than has been done thus far will require further study of the occurrence and economic effects of drought, plus completion of soil surveys.

Various aids are available to help landowners and operators retire low-grade cropland. Among these are programs of research, extension, and technical aid to show how the job can be done and programs for cost sharing to ease the financial burden. For years, cost sharing for regrassing has been part of the Agricultural Conservation Program. A more recent addition is the Conservation Reserve of the Soil Bank. In the 2 years of its operation, nearly 3 million acres in the Southern Plains have been placed under long-term contract for regrassing. This is a significant shift in major land use in a short time. The drought undoubtedly was a motivating factor. Another new program that started in 1957 is the Great Plains Conservation Program (Public Law 1021). It also was de-

signed to facilitate changes in land use through long-term contracts.

Still other steps could be taken to accelerate the retirement of low-grade cropland to grass. In the 1930's, several projects were established in the Plains in which submarginal land was purchased by the Federal Government, regrassed, developed, and then leased out under controlled grazing.

A study in 1957 by Loyd Glover, of the South Dakota Agricultural Experiment Station, showed that these projects were successful in bringing about necessary adjustments in land use, number of operators, and local institutions. To eliminate the need for long-term management by Government, it might be possible for it to buy land, correct the misuse, and resell the land with restrictions in the deed against cultivation. A step that could be taken to discourage misuse of land would be to give notice that the operators in certain areas would be denied the benefits of certain programs, including emergency programs, unless they followed recommended land-use practices.

There is reason to believe that at times some of the programs have contributed to expansion of wheat into areas not adapted to farming, or made it possible for production of crops to continue on land not suited to cultivation. This, of course, was not the intention of the programs, but it does mean that national programs must be studied continuously to assure that they will fit local conditions.

THE CONTROL OF WIND EROSION during severe drought is in the interest of landowners and the public alike in order to protect the land and keep blowing soil from damaging nearby farms and from endangering health. The Soil Conservation Service estimated that from 10 million acres to more than 15 million acres of land were damaged by wind each year during the blow season (November-May) in 1954-1955, 1955-1956, and 1956-1957; 1 million acres to nearly 5 million acres of crops were destroyed each year. In addition,

from 10 million acres to more than 25 million acres were at times in condition to blow. Although the duststorms were more awesome in the 1930's than in the 1950's, the acreage damaged was about equal in the two periods.

At least two States, Kansas and Colorado, and possibly others, have granted county governments authority to control wind erosion when owners, after due notice, fail to do so. The costs of emergency tillage are assessed against the land. The mere fact that such authority exists is a stimulus to better care of the land. Another remedial measure available is a land-use regulation under authority of a soil conservation district. Such a regulation developed by local people, and voted on by them, could specify farming practices that may be required to prevent wind erosion.

ADJUSTMENT to market demand is difficult here. The Plains contains nearly three-fourths of the Nation's acreage of wheat and produces nearly two-thirds of the Nation's total supply. Furthermore, wheat is the principal crop in the Plains, and alternatives are limited primarily to grain sorghum in the Central and Southern Plains and barley and flax in the Northern Plains. With a supply of wheat that is large in relation to market demand, the region faces a difficult problem of adjustment.

We need studies of how the farm business can be adjusted to market demand, alternative cropping systems, and the effect of acreage-control and price-support programs on agriculture in the Plains.

While 100 million acres are suited to crop production, drought is always a threat. The farm business must be organized so it can survive the dry years and recover quickly when more favorable years return. Some of the effects of drought can be reduced by such measures as crop insurance and the use of recommended soil and water conservation practices. The saving in moisture is available for crops; better handling of the land reduces erosion.

WATER IS SCARCE in the Plains. In the drought of the 1950's in the Southern Plains, many communities were short of water for domestic purposes and for livestock. In many areas, farm operators who use underground water for irrigation have found their supplies sufficiently depleted so pumping has become more costly or impossible. In time, other areas will experience the same problem.

Opportunities exist for further development of water resources, but cost is an important factor, especially the cost of some of the larger irrigation projects. There is need for more comprehensive State water laws to protect investments in water development, particularly irrigation from ground water, and to direct new development in the public interest.

A LARGE ACREAGE of range is one of the resources of the Plains. In the Southern Plains, however, during the long drought of the 1950's much of the range deteriorated and is in need of rehabilitation. Some of it may need to be reseeded. Deferred grazing would facilitate recovery of the grasses. Cost sharing for deferred grazing is one of the practices authorized under the Agricultural Conservation Program.

Management of the range, including the proper rate of stocking, reseeding, water development and water spreading, brush eradication, and production of adequate supplemental feed, require the constant attention of the ranch operator. This determines the condition of the range and, in large measure, how well the rancher fares in the drier years. Research can help with all these problems, including determination of the lowest cost alternatives.

RESERVES should play an important part in the management of the farm business in an area such as the Plains, where good years may be followed by crop failure. These reserves can take various forms, such as water supplies, feed, soil moisture, equity in land, machinery and livestock, crop insurance,

liquid assets, and the like. In planning reserves, however, their cost needs to be taken into account. There is a limit, for example, to the amount that may be profitable for a rancher to invest in feed for protection against a prolonged drought, not knowing when the drought may strike. Certain reserves involve carrying and opportunity costs. In localities where drought may run 5 years or longer, very large reserves would be necessary to carry the livestock enterprise without drastic reductions.

MANY UNECONOMIC UNITS disappeared as the number of farms in the Plains dropped from more than 500 thousand in 1940 to fewer than 400 thousand in 1955, but quite a number remain, especially in some of the transition areas. For a fourth of the farms in the Plains, the annual value of products sold is in excess of 10 thousand dollars; for half the farms, the annual value is from 2,500 dollars up to 10 thousand dollars; and for the remaining fourth, the annual value of products sold is less than 2,500 dollars. Although many of the smaller farms are occupied by older or less active people who do not want larger farms, many are run by young families, who are eager and able to operate larger units and need credit and other help.

Some credit from the Farmers Home Administration, the Farm Credit Administration, banks, and other private institutions is available. Constant attention needs to be focused, however, on the particular needs of families in the lower income group. Furthermore, the loans must be adapted to conditions in the Plains. Care needs to be exercised to assure that credit is not used to perpetuate uneconomic farms nor improper land use.

GRASSHOPPER NUMBERS in the Plains frequently build up until serious infestations exist, especially during periods of long drought. Crops and grasses in large areas are sometimes eaten into the ground. Fields thus laid bare are subject to wind erosion. Some species

of grasshoppers migrate and become a threat to the neighboring areas. This makes control of grasshoppers a matter of interest to the public as well as to the individual farmers whose crops they are destroying.

In 1957, after a long drought, nearly 24 million acres of land were seriously infested by the grasshoppers. Control measures were required on 12 to 15 million acres in order to protect crops and grass.

A large-scale program, under the supervision of the Agricultural Research Service, is available for control of grasshoppers on rangeland. One-third of the cost is paid by the Federal Government. Cropland is excluded from the grasshopper-control program.

A grasshopper-control program in the Plains needs to be based on accurate forecasts of infestations. It should be flexible so it can be put into operation quickly in areas in which an outbreak threatens; in drought disaster areas in which infestations become serious, it should include both cropland and range.

WEATHER-AGRICULTURE RELATIONSHIPS are important in a region in which climate is a limiting factor. Areas that differ with respect to the occurrence of drought need to be delineated. That is, each area thus delineated should be relatively uniform within its own boundary, in frequency, duration, and intensity of drought. This involves research on the weather patterns of the region.

Equally essential is the completion of the soil survey work, which would make it possible to delineate areas that are relatively uniform with respect to climate and soils. From work of this kind, the people of the Plains would acquire a better understanding of the farming hazards or risks in each area, and the differences between areas. It could become an important guide to agricultural programs.

The Soil Conservation Service accelerated its soil survey and land-classification work in 1955 and gave priority

to the part of the Plains that is most in need of land-use adjustment. This land classification indicates the physical conservation needs of the land.

Land can be classified in various ways, depending on the purpose to be served. Additional classifications that take into account physical and economic factors need to be developed. They would be useful for taxation purposes, as aids in credit programs, and for other purposes.

CROP FAILURES are common in the Plains because plants are unable to survive such natural hazards as severe drought and extreme temperature. From 10 to 20 percent of the cropland is often abandoned. In parts of the Plains, abandonment sometimes has reached 50 percent. Progress has been made in improving crops and cropping systems. This has reduced the risks of farming, but much remains to be done. Further research on the mechanism of plant growth is essential to progress in the adaptation of plants, cropping systems, and cultural practices to Plains conditions. The result would be more stability in production of crops and less economic distress in the dry years.

About two-thirds of the precipitation in the Plains is lost by evaporation alone. Reducing this loss by 25 percent in a 20-inch rainfall zone would result in a saving of moisture equivalent to 3 inches of rainfall. This could be the difference between a crop and a crop failure.

There is need for more study of the underlying processes involved in the loss of water by evaporation from the soil and to methods of control.

Attention needs to be given to the intake of water into the soil, to the moisture retention characteristics of soils, and to the use of soil moisture by plants.

New field practices are needed for more efficient use of precipitation.

If a major breakthrough could be achieved through basic research on this problem, great benefits would

accrue to the agriculture of the Plains.

DROUGHTS of disaster proportions will continue to strike. Despite everything individuals can do to protect themselves, disaster relief programs will be needed at times to alleviate distress. Programs need to be developed that can be put into operation quickly and are suited to local conditions.

The Plains has relatively few industries. The region depends largely on agriculture. The industries it has, however, add to stability and aid in the adjustment of population. As additional industrial plants are located in the Plains, still greater stability will be provided. The industrial development should be encouraged.

In a region of variable income, sparse population, and great distances, such as the Plains, new institutional arrangements need to be developed so that the people will have the same essential services as those in the more densely populated regions. Progress is being made in this direction. A few communities have planned health services and facilities that are adapted to the Plains. Adjustments are being worked out in local school facilities. To provide higher education without duplication of facilities in each State, agreements have been worked out whereby one State will pay another for the students it sends. Adjustments of this kind need to be accelerated.

One of the innovations in the region is the Great Plains Agricultural Council. Its purpose is to analyze the problems of the region, develop possible solutions, promote the adaptation of research, extension, and action programs to conditions in the Plains, and foster cooperation on an attack on the problems of the Plains. The Council, which is an advisory body, provides for an exchange of ideas. It was formed in the early 1930's as various agricultural leaders felt a need to work together on common problems. It has continued to function since on the adaptation of the agriculture to Plains conditions. Local committees of farm

people and representatives of various agencies in many counties function in the same way. The extension of this activity to more counties would greatly facilitate the adjustment of agriculture.

The Great Plains Agricultural Council carries out much of its work through the use of committees. These are: Controlled climate-plant growth laboratory committee (to outline need for regional laboratory and outline areas of work in which research would be conducted); forestry committee (to facilitate tree growing in the Plains); information committee (to publicize the work of the Council); health committee (to facilitate the adaptation of health services and facilities to the conditions peculiar to the Plains); insect control committee (to facilitate adjustment of insect control programs to the needs of the Plains); irrigation committee (to outline research needed on problems of irrigation farming and irrigation development); Plains research committee (to activate regional research projects on problems of the Plains); program implementation committee (to foster program planning at the local level); range management and livestock production committee (to outline research needed in this field); soil moisture research laboratory committee (to outline need for regional laboratory and outline areas of work in which research would be conducted); and tenure, credit and land values (to outline research needed and to facilitate research in these and related fields). A number of these committees have functioned for many years.

Individual landowners and farm operators must take the initiative in solving the land-use problems of the Plains, but various programs of research, education, technical aid, and cost sharing can show the way and reduce the financial burden. Some directional measures may also be necessary. Progress has been made. The effect of the recent drought would have been even more severe than it was if this had not been the case. We expect further progress.