

SOIL AND CIVILIZATION*

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In a complex society many factors may affect the development or decline of civilization. The ambitions of people, the utilization of natural resources, and the character of government which may aid or restrict individual achievement, may have an important influence on social progress and intellectual attainment. Although historians do not recognize the early development of agriculture as an indication of civilization, food, shelter, and clothing come directly or indirectly from the soil and are essentials which must be provided before progress in art, science, or social culture can occur. The present centers of world population are located where natural forces tend to preserve the soil. The fertile valleys of the Old World have been farmed for centuries and are still productive. Neither erosion nor leaching is a serious problem under such conditions, because the land is nearly level and deposits of alluvium from floods or from irrigation water help to maintain an abundant supply of mineral nutrients, which are needed for plant development. Under such conditions, productivity depends upon good tillage, return of nitrogen and organic matter to the soil, and selection of crops adapted to climatic conditions which prevail.

When population increases in any area, migrations usually occur to cheaper and less productive land where opportunities for success are frequently limited because information which individuals may need in order to adjust their activities to a new environment is not available. Many Chinese farmers have moved from fertile valleys to adjacent uplands and have demonstrated that they did not know how to develop a permanent agriculture on sloping land. Fields were cultivated as long as profitable yields could be obtained, and then the land was abandoned. After an interval of ten or fifteen years, the land was put into cultivation by another farmer and crops were raised until the natural fertility which accumulated during the interval of idleness was exhausted. Soil erosion has been severe on land which has been handled in this manner. Fields which have been farmed intermittently for centuries are several feet lower than the level of virgin land which has been protected by forest. In south China a different condition exists because bench terraces have been constructed for rice culture. Soil erosion has been controlled on this land, and a more stable type of farming has developed which can be continued indefinitely by future generations.

Greece is a good example of a nation that has made important contributions to science, literature, and art, but the intellectual attainment of the ancient Athenians is no longer existent in the present populace. Another example of the decline of a well-developed civilization may be found in western Asia. According to historical records powerful nations once inhabited the level valleys of the Tigris and Euphrates rivers. Today these streams flow through a barren land which is sparsely populated.

Although soil deterioration and the misuse of land have had an important influence on the development and decline of civilization in many parts of the world, these factors have not received proper consideration in many instances for the good or bad effect which they have had on social progress. During the Dark Ages the development of civilization in southern Europe was retarded by invasion of nomadic people which had not discovered the methods which must be used to maintain a settled existence. With the development of governments which were sufficiently powerful

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to resist barbaric forays, progress of civilization has depended upon internal forces which affect social, economic, and political development. Opportunity for education can only occur when individuals have time or leisure after the needs of a physical existence are provided. In the majority of countries, a high per cent of the population is engaged in agricultural pursuits. These people form the basis of the social pyramid. The artisan, the merchant, the statesman, the philosopher, and the aristocracy cannot exist by their own efforts, although it is this group which has made the greatest contribution to modern science.

As long as great masses of people are engaged in agricultural enterprises their welfare can not be neglected while others enjoy the advantages which are realized from a higher standard of living. The discovery in 1840 that sulphuric acid would enhance the fertilizing value of phosphate minerals was one important step in the development of modern agriculture. Additional studies in plant nutrition have made it possible to grow crops on poor land which would not support a dense population under virgin conditions. The most important factor which will prevent or restrict the application of scientific methods to the solution of agricultural problems is the relation between cost of materials and income derived from farm operations.

When the first immigrants came to America, the problem of soil conservation was not important. Natural resources were abundant, and new land was cleared as the productivity of cultivated fields declined, because land was more plentiful and cheaper than fertilizer. Pioneers moved westward and carved new farms from the forest or turned the prairie sod into cultivated fields. Wheat and corn were produced in abundance. The development of transportation systems and the continued expansion of agriculture in the Ohio and Mississippi Valleys caused farmers in the eastern part of the United States to change their type of farming. Prices which they received for corn and wheat produced at a high cost per bushel on land which possessed little of the natural fertility which was present under virgin conditions were too low to maintain profitable yields. Industrial expansion and a rapid increase in urban population created a demand for food which aided the eastern farmer, because prices for vegetables, poultry, and dairy products were high enough so that the fertility of the soil could be maintained by proper treatment. Lime, phosphorus, potash, and other fertilizers were applied to replace nutrients which were removed when crops are harvested and no residues are returned to the soil.

On fields where much of the surface soil has been washed away and soil fertility has not been maintained, operators have failed to make a living and the land has been abandoned. At the present time, these areas are covered with sedge grass or forest. Where a high percentage of abandoned land occurs, it is impossible to maintain good highways and schools unless local income is supplemented by state or federal funds. Under such conditions, social progress is restricted and regression in standard of living occurs.

Less than fifty years ago, Oklahoma was opened for settlement. People who had no money but were willing to withstand the privations of a new country in order to develop homes were given equal areas of land which were not equal in value. Civilization was built on borrowed capital. Natural wealth which accumulated in the soil from the causative effects of nature was exchanged for homes, schools, and other necessities of life or luxuries which modern industry has developed. At the present time, two million people in Oklahoma depend upon wealth which is directly or indirectly derived from natural resources. These people are in competition with millions of people in adjacent states who are also engaged in the

exploitation of natural resources in those areas. In one generation, destructive changes have occurred in many communities which have brought human suffering and economic disaster to many people. Highly erosive soils of shallow character were planted to row crops, and much of the soil on many of these farms has been washed away. The value of the land has declined. Skeleton cabins and remnants of farmsteads dot many landscapes and serve as silent sentinels to show where misuse of land has occurred. Two million acres of land in different parts of Oklahoma are badly eroded, and deep gullies have developed which cannot be crossed with farm machinery. A large portion of this land could have been maintained in a productive condition by a proper system of soil management, but the need for conservation was not apparent to pioneer farmers, who did not know that centuries of time are required to develop one inch of surface soil and that erosion would remove seven inches of earth in thirty years from a sloping field planted annually to cotton or corn.

Already constructive efforts are being made to preserve the physical plant which is essential for agricultural prosperity, but internal changes have occurred in soil composition which cannot be seen and consequently are more difficult to understand. These changes must be determined by chemical methods in order to measure the decrease in natural fertility resulting from a pioneer type of farming. It would require 150,000 tons of superphosphate to replace the phosphorus which is removed each year from Oklahoma soils by crops like wheat, corn, and cotton. Oklahoma soils have also lost more than one-third of the total nitrogen which was present in them when they were covered with grass or forest. Less than two per cent of the cultivated land in Oklahoma is planted to legume crops, which on the majority of farms are harvested for hay. Depletion of soil fertility cannot be condemned; however, it is a serious matter when farmers make no provision for the future and eventually find that they are cultivating infertile land and have no capital which can be used to obtain plant nutrients which must be applied to the soil in order to obtain satisfactory yields of the crops which they attempt to grow.

When mineral resources are exhausted, cities which have depended upon oil and other sources of natural wealth for existence will soon discover that a prosperous agriculture is the only enterprise which will maintain the community. What can a business man do to help the situation? What must be done to induce the average farmer to utilize systems of farming which will improve the soil? Can mining methods which have already removed nearly forty per cent of the total nitrogen which was present in the virgin soil be altered so that crop production will be stabilized? What agencies are available or should be developed to assist with the readjustment of population when over-populated areas discover that the only source of income which is available to support them must be obtained from the land? Problem areas have already developed, and will continue to increase in number unless rapid changes occur in systems of farming, which according to present economic conditions are not apt to occur. Diminishing income from small acreages of land of low productive capacity and the lack of capital, which is needed to operate large areas of poor land on a proper basis, are two important factors which interfere with the development of better systems of farming in many areas. The development of a program which will prevent people from settling on small areas of poor land which will not provide sufficient income to maintain a decent standard of living would help to solve the problem, but who should be employed to do the job? Correction of the present system of land ownership, which does not recognize the fact that title to property will not hold the soil and that ownership also carries with it a responsibility to the community, should be one of the important objectives of

future legislation. Eroded land is a liability to a community as far as agriculture is concerned, and a community should have the right to control the activities of any individual when neglect on the part of that individual tends to destroy natural resources which contribute to the support and maintenance of government. In many areas, the problem is greater than the community. It is greater than the state. Our national welfare depends upon the development of a sound land policy. Proper land use will aid in the solution of this problem. However, it is quite improbable that uniform standards of living will ever be realized when such a divergence exists in the ability of different individuals and in the productive capacity of different soil types.

At the present time more than \$150,000,000 is spent every year for commercial fertilizers in the southern states, and a high percentage of this material is used for the production of cotton. If the price of cotton declines because of excessive production and limited requirements of markets, many soils which have been used for the production of cotton will be abandoned or changed to a submarginal condition, because cotton is a crop which can be grown on relatively poor soil. During the period from 1914 to 1930, foreign markets absorbed the agricultural surplus which was produced by farmers in the United States, and agriculture was in a prosperous condition because of a favorable export trade. Today export trade is limited, because many nations which formerly imported large quantities of food and other raw materials have erected tariff barriers to stimulate their own agriculture in an attempt to develop a self-sufficient condition. At the present time, the productive capacity of American agriculture exceeds national requirements, and farmers who have been following a system of commercialized farming have suffered economic reverses because of low prices for farm products. An unhealthy condition has also been created in areas where the productivity of the soil is low, and improved standards of living cannot occur without a change in size of farm units or higher prices for crops which are being produced. In some sections of the country, the phrase "poor white trash" is applied to some of these unfortunate people who live in an environment which they did not create. They have no money which can be used to purchase plant nutrients to replace different mineral elements which have been removed from the soil by crops. Many farmers in Oklahoma also have no working capital and also must pay higher freight rates on fertilizers shipped from Tennessee or Florida and higher freight rates on grain, cotton, and livestock which must be hauled to central markets, as compared with similar costs east of the Mississippi River. Climatic conditions are erratic and response from soil treatment is uncertain during periods of severe drought. Lack of machinery for the proper distribution of lime and phosphate is a serious problem. As a result of these conditions, many pathological farming areas have appeared and ultimate recovery is doubtful without a complete reorganization of the farming systems. As individual operators, farmers in these areas are helpless, because they are confronted with physical, social, and economic factors which are completely beyond their control. Under such conditions, terrible punishment has been inflicted on the soil in an attempt to increase farm income. Social progress has ceased, and social problems of a very difficult nature have appeared. If there ever was a rise of civilization in this region, many indications of recession are in evidence.

A knowledge of the character and location of land resources and their possibilities under a good system of management should be the basis for the development of a better system of land utilization. For many years, the Bureau of Chemistry and Soils in the U. S. Department of Agriculture has been studying the soils of the United States and has been attempting

to classify them on a basis of productivity as determined by physical and chemical examinations. Maps have been prepared which show the location of productive soils and other areas which are not suitable for the production of cultivated crops. Thirteen soil survey reports and maps of different counties in Oklahoma have been published, and field work in thirteen additional counties has been completed. Soil surveys supply information which must be obtained before land utilization studies can be made, because an accurate soils map is essential for the development of a land use program except in those areas where climate is more important than soil in determining the most profitable type of agriculture which should be followed.

Although proper land use appears to offer some assistance in solving the problems which are developing because of soil deterioration, how effective are methods for the dissemination of information to the public? How valuable are bulletins? Can everyone read and understand technical reports? What can be done when individuals continue to follow systems of farming which destroy the physical plant and do not change their farming system regardless of educational efforts which are made to help them? How far can society go to protect community welfare? Land use planning and the development of an educational program should be the first step, followed by land zoning to regulate the activities of individuals who will not voluntarily accept the recommendations of the majority.

In land use planning, three definite objectives should be attempted. The first objective should be the development of a comprehensive program for soil conservation; the second objective should be the readjustment in land use or practice where necessary; and the third objective should be a plan for the permanent retirement of lands from cultivated crops which persistently refuse to yield a profit under a system of good soil management. Land must pay its own way. At the present time, there are many communities where the income from land will not provide sufficient funds in the form of taxes to maintain roads, schools, and provide even a moderate standard of living for the individuals who live in those communities. It is exceedingly important that county and state officials realize that tax money is frequently wasted in many areas and that it would be more profitable and desirable to transfer a few citizens who are on relief from lands which are poor and do not yield sufficient income to provide for roads, schools, and other expenses of local government.

Approximately three million acres of state and Indian land in Oklahoma is not subject to taxation, and the remaining farms in the different communities where these lands are located must carry the tax load. Three million acres of non-taxable land operated by tenants who do not appreciate the necessity for conservation and are not required to conserve the soil, is a serious problem from the standpoint of the future welfare of many individuals.

During the past three years, many Oklahoma farmers have received payments from the federal government for the reduction of crop acreage in order to adjust agricultural production to market demands. In 1936, farmers who cooperated in the program of the Agricultural Adjustment Administration could receive payment for applications of limestone and phosphate fertilizers applied to legume crops. A high percentage of the soils in central and eastern Oklahoma are acid and low in available phosphorus; however, very few farmers accepted the opportunity to obtain these materials at a relatively low cost, and \$500,000 which was available to pay for fertilizers which were used in a soil improvement program was not utilized. It is quite probable that the failure of individuals to take advantage of an opportunity to secure soil amendments at a fraction of their total cost was due to insufficient information or evidence of the need for soil

treatment. The expansion of a demonstration program is needed in order to show that soil treatment is essential for the development of a more permanent type of agriculture.

Liberty is not an absolute thing. Any system of government encroaches upon the rights of individuals who do not conform to laws which must be adopted for the protection of society, and the use of police power is an accepted principle for the regulation of personal conduct. In order to prevent individuals from settling on poor land where a self-sufficient type of agriculture cannot be maintained, the states of Wisconsin and Michigan have passed rural zoning laws, which permit county authorities to obtain necessary assistance which is needed for classifying land and setting up regulations for land use. Twenty-three counties in Wisconsin have made use of the rural zoning law in order to help with the solution of local problems. County commissioners have found that rural zoning has not only decreased the cost of local government, but has created a more favorable environment for those individuals who were transferred to more productive areas of land.

In Oklahoma it may be necessary to rehabilitate many people on the land which they occupy. There are many reasons why relief agencies would do more permanent good if they would purchase materials needed to improve the soil so that people could make their own living instead of purchasing food or planning work programs which have no permanent value. The development of an educational program in Oklahoma, which may be needed to convince civic leaders that rural zoning would be effective in this state, may require further research in some areas, but in many areas it is quite evident that individual effort is helpless when sand blows from neglected fields and destroys crops on adjacent areas of good land. The control of dust which also originates in these areas and is frequently carried across the continent is more than an individual problem. To help people in local communities to help themselves is the important objective. The work of the Rural Resettlement Administration will supply valuable information for the solution of certain agricultural problems, but it will not solve the problems associated with uncontrolled misuse of land, which affect economic and social development. Someone has said that land without soil is like a ship without a sail. The past is dead, but it has left a history, which we may read in order that the same errors may not be made in the future. Although waste has occurred in Oklahoma, potential resources still remain. The intelligent use of these resources is essential to maintain a good standard of living for the people of today and leave a heritage which will provide for the welfare of posterity. The great dictator is nature, and we must discover a system of cooperation which will maintain a productive soil in order to keep our civilization viable, healthy, and permanent.

