

# Soil

## Conservation

Hough Hammond Bennett

# SOIL CONSERVATION

*for Sustainable Agriculture*

**Hough Hammond Bennett**



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## PREFACE

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In fifteen decades, Americans have transformed a wilderness into a mighty nation. In all the history of the world, no people ever built so fast and yet so well. This will be a land of liberty, they said in the beginning, and as they hacked the forest, drove their ploughshares deep into the earth, and spread their herds across the ranges, they sang of the land of the free that they were making. All that they finally built upon this continent is founded in that faith—that here there would be opportunity and independence and security for any man.

Those things are the power and the hope of this democracy. And they have sprung, very largely, from the goodness of our land, its capacity to produce rewardingly. Yet with astonishing improvidence, Americans have plundered the resource that made it possible to realize their dream.

Moving across this country in the greatest march of occupation ever known, they have exploited and abused this soil. As a result, our vital land supply has been steadily sapped by the heavy drain of soil erosion.

Since the first crude plow uprooted the first square foot of sod, and since man's axe first bit into virgin forest, erosion of the soil has been a problem. It is as old as history. Down through the ages it has influenced the lives of men and the destinies of nations and civilizations. In the United States today, no problem is more urgent.

Millions of acres of our land are ruined, other millions of acres already have been harmed. And not mere soil is going down the slopes, down the rivers, down to the wastes of the oceans. Opportunity, security, the chance for a man to make a living from the land—these are going too. It is to preserve them—to sustain a rewarding rural life as a bulwark of this nation, that we must defend the soil.

This nation is still producing bountiful crops. But many thousands of farmers already feel the pinch of erosion. Tens of thousands of them are finding it increasingly difficult to eke out a living on eroded land almost regardless of agricultural prices.

In other words, even in this young nation, pressure on the land already has become acute in many localities. Many areas have been damaged to

such an extent by erosion that not enough productive soil is left for the present population. In Puerto Rico, portions of the Southern Piedmont, and the Rio Grande Valley, for example, erosion already has crowded many people off the land and brought others to the level of precarious subsistence farming. Some of this land can be stabilized, and some severely impoverished areas can be improved, but many land users must seek better soil elsewhere if they are to remain in the business of farming or ranching. Today the nation has an abundance of land, but not enough *good* land. Probaby, if there had not been so much good land in the beginning, there would not have developed the early idea that the productive soil of America was limitless and inexhaustible. This erroneous appraisal of the land resource, passed along as a tradition, accounts for much of our costly steep-land tillage, overgrazing, and failure to defend vulnerable soil from the ravage of erosion.

The present plight of the land brings to mind the extremes to which other countries with small areas of arable soil must go in order to make maximum use of every available acre. In southern France, for example, certain poor soils are utilized under a rotation of fish culture with grain production. In Italy, under the program of the *Bonifica Integrale*, many areas of severely gullied steep slopes are being smoothed down with explosives in order to reclaim them for agricultural use. Always, where populations have increased and agricultural lands have been exploited and wasted, people have looked beyond their borders for additional land. This urge has brought about conquests, wars, and migrations to new lands. Permanent agriculture has been achieved in only a few regions, for the most part of relatively small size, throughout the world. Some parts of the world, blessed with gentle rains, favorable soil, moderate slopes, native skills, and inherent love for the soil, have been held securely. Elsewhere—in Peru, Guatemala, Mexico, the Philippine Islands, parts of Europe, and China—people of primitive culture in ancient civilizations, bench-terraced and, in some instances, irrigated steeply sloping land. The investment of human labor in such enterprises reached fabulous proportions: about \$18,000 or more an acre, on the basis of present costs for human labor, went into the walled terraces and irrigation works of the Incas in the Andes Mountains.

A permanent agriculture, then, is possible, even where the land is highly vulnerable to erosion, when people are willing to pay the price of protecting it. Where the price has not been paid, civilizations have disintegrated and disappeared. If necessary for survival, the American people undoubtedly would bench-terrace all their tilled land, as did the Incas, but it would be done at an undreamed of cost. Fortunately, American agriculture is now in a stage where heavy costs may be avoided by consistently working with, rather than against, natural forces, and by

provident action based on a thorough diagnosis of the present problems of land use.

All our experience has demonstrated that erosion can be controlled in a practical way. The need is for forthright, determined, nation-wide action. Today's necessity for public action is the outgrowth of yesterday's failure to look more carefully to our land. Foresight in the last century, during our march of agricultural occupation, would have produced a different result. Today we are simply retracing our steps across this land in a march of agricultural conservation. "Soil Conservation" is primarily concerned with this second march.

Looking across the background of events which led up to the present national program of soil and water conservation, a number of points stand out in the perspective of the author as prominent mileposts along the way. Among these are the findings of the soil survey of Fairfield County, South Carolina, which, in 1911, disclosed that 90,000 acres of formerly cultivated land had been so cut to pieces by gullies that it had to be classed as *rough gullied land*, and that an additional 46,000 acres of formerly rich bottomland had been converted into swampy *meadow* land because the streams, gorged with the products of erosion, had lost their original channel capacities. This was probably the first survey of a large area in America which pointed specifically and quantitatively to the wholesale ravages of unrestrained soil erosion.

Another outstanding event was the publication of two bulletins giving the results of measurements of the rate of soil and water losses from definite types of land. One of these bulletins was published by the Agricultural Experiment Station of Missouri, in 1923 (*Erosion and Surface Runoff under Different Soil Conditions, Research Bull. 63*); and the other by the Spur branch of the Agricultural Experiment Station of Texas (*Factors Influencing Runoff and Soil Erosion, Bull. 411*).

Another step toward national recognition of the seriousness of erosion was the educational campaign carried on by the U. S. Department of Agriculture in the late 1920's. In this effort, *Soil Erosion, A National Menace, Circ. 33*, published in 1928, played an important part. This program of education aroused nation-wide interest, and on Dec. 18, 1928, the House of Representatives adopted, without a dissenting vote, the Buchanan Amendment to the Agricultural Appropriation Bill for the fiscal year 1930, appropriating \$160,000:

To enable the Secretary of Agriculture to make investigations, not otherwise provided for, of the causes of soil erosion and the possibility of increasing the absorption of rainfall by the soil in the United States, and to devise means to be employed in the preservation of soil, the prevention or control of destructive erosion and the conservation of rainfall by terracing or other means, independ-

ently or in cooperation with other branches of the Government, State agencies, counties, farm organizations, associations of business men, or individuals.

The Agricultural Bill, including this amendment, was subsequently adopted by the Congress.

This amendment followed a detailed inquiry by its author, Representative James P. Buchanan of Texas, into the problem of soil erosion and its prevention before the Subcommittee of the House Committee on Appropriations (Hearings on the Agricultural Appropriation Bill for 1930, 70th Cong., 2d Sess., pp. 310-330, Nov. 21, 1928).

As the result of this and subsequent appropriations, ten soil-erosion experiment stations were established on important types of farm land in various parts of the country. Information quickly acquired through these investigations, together with that derived from the work of the state experiment stations, proved a vigorous stimulant to the educational program. This information spread rapidly around the world and undoubtedly had much to do with the present widespread interest in the problem of soil conservation in various parts of Africa, Australia, and other countries.

On Sept. 19, 1933, the Soil Erosion Service was established in the Department of the Interior with \$5,000,000 provided under the authority of the National Industrial Recovery Act. Almost immediately soil and water conservation demonstration projects were established in a large number of erosion problem areas throughout the country. Behind these original projects, and every one established later, was the basic, underlying principle that permanent results in conservation of the soil could not be attained except through the coordinated treatment of the different kinds of land that make the farms, ranches, and watersheds of the nation, in accordance with their specific needs and adaptabilities. By making use of the various proved methods for meeting these needs, and applying them so that one measure would support another and so that what was done in one field or on one farm would contribute protection to another field or farm, remarkably good results were attained.

The great dust storm of May 12, 1934, stimulated national interest in the problem of erosion. This spectacular dust cloud was the first one in history big enough to retain its identity as it swept across the country from the Great Plains to beyond the Atlantic Coast. It blotted out the sun over a large part of the nation and sifted through the windows of New York skyscrapers. When that happened it began to dawn on the public that something had gone wrong with the land resource of the nation.

Another milestone of historic importance was the passage of the Soil Conservation Act of Apr. 27, 1935, in which Congress definitely com-

mitted the national government to the policy of soil conservation. The preamble of that act reads:

It is hereby recognized that the wastage of soil and moisture resources on farm, grazing, and forest lands of the Nation, resulting from soil erosion, is a menace to the national welfare and that it is hereby declared to be the policy of Congress to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public health, public lands and relieve unemployment.

This was an historic event, as was the inclusion in the Omnibus Flood Control Act of 1936, of a specific provision for erosion-control and water-retardation work over upstream agricultural lands to supplement the control effect obtained with large engineering installations downstream, along the channels of major streams. A number of other acts including erosion-control provisions have also been passed recently. Altogether, Congress has made possible the launching of a great and beneficent program for the conservation of the nation's most indispensable asset—its agricultural lands.

Another epochal step in the history of soil conservation in the United States was the passage by a large number of states of Soil Conservation District Laws, beginning with the enactment of the first act of this kind in Arkansas in 1937. Under these state authorizations, districts have been established in many parts of the country, comprising many millions of acres; work in them is progressing rapidly and effectively.

Thus, within a few short years, the problem of erosion control and soil conservation has been moved out from a position of comparative obscurity to become the objective of a national policy and the basis for an expanding program of work on the land.

Much success and much progress have been achieved under the national program since its inception. Farmers generally, as well as the public, have approved this type of work, although its full value cannot be accurately determined this early. Appraisal of the importance of the land to national welfare demands consideration of the future and recognition of the land as a resource that needs to be defended forever in order that it may remain productive and continue to support the population.

“Soil Conservation” explores the wide ramification of the land problem into many fields—physics, chemistry, and biology, economics and sociology, climate, soils, ecology, geology, engineering, and others. The point is stressed that lasting accomplishment—a permanent agriculture—can be achieved only by coordinating the knowledge of many sciences toward a common objective. Major emphasis is placed on (1) the erosion process; (2) physical effects of erosion on land, vegetation, and

agriculture; (3) economic, social, and human-welfare aspects of the erosion problem; (4) relation of erosion to floods and siltation; (5) conservation action (work on the land); (6) techniques, plans, and programs for soil and water conservation; (7) search for new and improved methods for defense of the soil resource and for conservation of rainfall, wildlife, and other resources dependent on the land; and (8) results obtained through (a) direct and coordinate application of conservation techniques and (b) education. More concisely, the primary objective of this volume is to present a comprehensive statement of the *science and practice of soil and water conservation*. Simplification of presentation is sought through division of the material under two major groupings: Part 1: The Problem; Part 2: Soil Conservation.

If this volume seems to center about the program of the Soil Conservation Service, it is because the author is most familiar with that program, having had intimate association with its conception, inception, and development. It is fully understood that other organizations, Federal, state, and private, as well as individuals, have contributed a vast amount of fundamental information, education, and work on the land to the development and furtherance of various phases of the conservation movement, including defense of the soil through better land use. The term *national program* used frequently throughout the text may be open to possible misinterpretation. It should be explained that the word *national* as used here is not synonymous with *Federal*, nor does the term *national program* imply activities of the national government alone. On the contrary, it is used to designate the whole soil-conservation movement, in which not only the national government, but also the states and many private organizations and individuals, are taking a vital part.

The author's experience of thirty-six years' work studying land problems and conducting land surveys in the United States and other countries, as well as the experience of other specialists and travelers, has been drawn upon in the preparation of the text.

The toll of soil wastage by erosion would have been much greater but for the beneficent effects of soil-building crops, crop rotations, cover crops, improved varieties of crops, etc., developed through the activities of many patient, persistent, and able specialists and land users in this and other countries. To this large group of workers the nation owes a debt of gratitude that can scarcely be paid. The author makes full acknowledgment to these men and women for the wealth of material that has been drawn upon in the preparation of this volume. Limitation of space has imposed severe restrictions on specific citations and credits; it also has necessitated laying aside much material pertinent to a complete treatise on the subject, as well as the details of the programs of other agencies engaged in related fields of conservation. Only indirect acknowl-

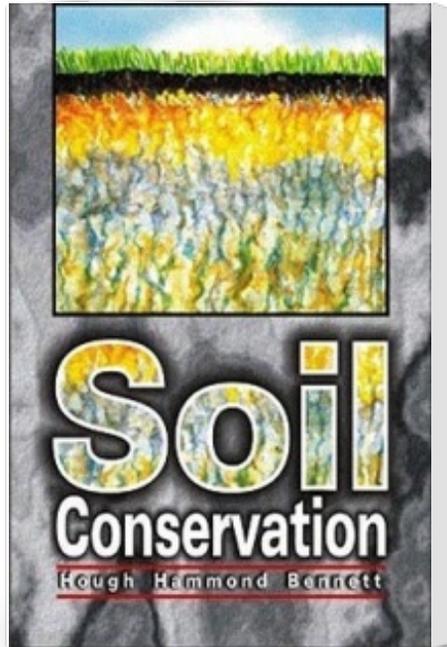
edgment can be made of the work of a long list of those who have made valuable contributions in the field of soil and water conservation and better land use by referring to two recently published bibliographies: *Bibliography on Soil Erosion and Soil and Water Conservation*, U. S. Dept. Agr. *Misc. Pub.* 312, 1938; and *A Selected Bibliography on Management of Western Ranges, Livestock, and Wildlife*, U. S. Dept. Agr. *Misc. Pub.* 281, 1938.

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