THE ROLE OF FORESTRY IN SOIL CONSERVATION

by

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History of the Soil Conservation Service

The Soil Conservation Service today is the outgrowth of the Soil Erosion Service, an agency established in October, 1933, to carry out the provisions of the National Industrial Recovery Act relating to the prevention of soil erosion.

On March 25, 1935, the Soil Erosion Service was transferred from the Department of Interior to the Department of Agriculture, and on April 27, 1935, the President formally approved an act of Congress changing the name to the Soil Conservation Service. (1)

Looking back, we see that the Soil Conservation Act of 1935 was the result of 250 years of American experience with soil erosion and its consequences. After the frontiers of new land had disappeared and there was not escape to new lands, the menance of soil erosion to sustained productivity of the land and to our economic structure became apparent to the American people, and they were brought face to face with the problem of conserving its soils, and, therewith, its waters. The response to this problem on the part of the informed public and its representatives was primarily responsible for the enactment of the Soil Conservation Act. It initiated a new era in the relationship of the people of the United States to their land; it was and is the official statement of a national policy which has been long in finding a full and articulate expression. (4)

Provisions of the Soil Conservation Act

The act states that "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 declares it to be the policy of Congress to provide permanently for its control and prevention. The act further empowers the Secretary of Agriculture to coordinate and direct all activities with relation to soil erosion, and he is given specific authority to conduct surveys, investigations, and research relating to the character of soil erosion; to the preventative measures needed to publish the results of any such surveys, investigations, or research; to disseminate information concerning such methods; and to conduct demonstrational projects in areas subject to erosion by wind or water. He is further empowered to carry out prevention methods including, but not limited to, engineering operations, methods of cultivation, the growing of vegetation, and changes in the use of land; to cooperate or enter into agreement with, or to furnish financial or other aid to any agency, governmental or otherwise, or any person, subject to such conditions as he deems necessary, for the purpose of the act; and to acquire lands, or rights or interests therein, by purchase, gift, condemnation or otherwise."

Divisions and Regions of the Service

The administrative organization of the Soil Conservation Service is divided into the following departments:

Division of Conservation Operations

Section of Engineering

Section of Wildlife Management

Section of Woodland Management

Section of Conservation Nurseries

Section of Erosion-Control Practices

Section of Conservation Surveys

Section of Agronomy

Division of Research - Six subdivisions

Soil erosion and moisture-conservation studies; watershed studies; sedimentation and hydrologic studies; climatic and physiographic studies; hill culture studies; and economics of soil conservation.

Division of Cooperative Relations and Planning

Division of Business Management

Division of Personnel and Training

H. H. Bennett, who for many years was connected with the Soil Survey and Soil Erosion Service of the Department of Agriculture, is chief of the Soil Conservation Service. (5)

The organization is further divided into eleven regions, each of which is under the jurisdiction of a regional conservator with headquarters at a point most convenient from the standpoint of transportation, communication, and accessibility within the region. (2)

SOIL CONSERVATION REGIONS

Region No.	Name	Headquarters
1	Northeast	Williamsport, Pa.
2	Southeast	Spartanburg, S. C.
3	Ohio Valley	Dayton, Ohio
4	Midsouth	Fort Worth, Texas
5	Upper Mississippi	Des Moines, Iowa
6	Southern Great Plains	Amarillo, Texas
7	Central Great Plains	Salina, Kansas
8	Southwest	Albuquerque, N. Mex.
9	Northwest	Rapid City, S. Dakota
10	Pacific Southwest	Santa Paula, Calif.
11	Pacific Northwest	Spokane, Washington

Objectives of the Service

The objectives of the Service are to propagate the use of soil conservation practices in agriculture through the medium of demonstration; to effect at the same time a maximum control of erosion on as large an area of agricultural land as possible; and to ascertain the fundamental scientific facts essential to the development and improvement of soil-conservation methods and techniques. These objectives are approached by three distinct but interrelated fields of activity involving, (1) the demonstration of practical and effective measures of soil conservation; (2) actual work upon the land; and (3) the consistent development and improvement of such measures through research and investigation. (1)

Research Division

Fifteen soil- and water-conservation experiment stations are operated by the Division of Research. These are located respectively at Guthrie, Oklahoma; Temple, Texas; Hays, Kansas; Tyler, Texas; Bethany, Missouri; Statesville, North Carolina; Pullman, Washington; Clarinda, Iowa; La Crosse, Wisconsin; Zanesville, Ohio; State College, Pennsylvania; Ithica, New York; Beemerville, New Jersey; Athens, Georgia; and Mexican Springs, New Mexico.

The purpose of these experiment stations is for soil research, plant experimentation, and engineering aspects of the cause and methods of controlling erosion. (3)

Seriousness of Soil Erosion

The first important field project started by the Soil Conservation Service was the completion of a nation-wide reconnaissance erosion survey and the presentation of the results in report form and as an erosion map of the United States.

The results of this survey showed that there are 800,000,000 acres out of a total of 1,377,000,000 included in the survey that gave marked evidence of accelerated or man-induced erosion in some form or other of common occurance or as a prevailing characteristic.

The survey further revealed that serious erosion on about 48,200,000 acres of this land and it had been destroyed by water and wind erosion in so far as general use for the

production of crops was concerned. Almost all of this land had at one time been cultivated and was at one time good soil.

Topsoil loss from practically all of the greater part of an area comprising about 86,700,000 acres was determined by the survey. Much of this, however, was not entirely unsuited for further tillage, but most of it has been materially reduced in productivity.

The survey showed in addition to this severely eroded area, an aggregate of approximately 467,800,000 acres on which from one-fourth to three-fourths of the topsoil had been lost over an area covering more than 25 percent of its extent. Much of this land is still productive and is well worth saving, even though a considerable cultivated portion of this moderately eroded area is rapidly losing its topsoil. The major problem in conservation of agricultural lands is concerned with lands of this category.

It was found that a large area was seriously affected by wind erosion, especially in the Middle Western States east of the Rocky Mountains and extending from North Dakota to Texas. The survey showed an area of approximately 5,200,000 acres over which more than 25 percent had been essentially destroyed for cultivation while more than 25 percent of the farmland, included in an area of about 36,500,000 acres, was damaged by wind erosion to such an extent as to seriously affect agricultural values.

Forestry Operations in the Field

During the fiscal year of 1937 the work accomplished on woodland and wildlife areas consisted of treatment of 55,000

acres as demonstration plots, the planting of 206,000 acres in the establishment of new woodland areas, fencing to exclude grazing, fire control, and other woodland and wildlife-management practices. Cooperative agreements call for placing a total of 1,216,000 acres of woodland under proper management for erosion control and for development as productive forest areas.

Conservation Nurseries

Tree and shrub nurseries for the fiscal year of 1935 were producing 274,000,000 trees, either directly or by cooperative agreement. These came from nurseries directly under the Soil Conservation Service and from nurseries of the States and United States Forest Service. The total number producing this amount of trees was 79. Last year the Soil Conservation Service maintained 43 of their own nurseries which produced 120,000,000 trees in addition to large amounts of grass-seed and shrubs. Of this amount approximately 45,000,000 were conifers and 75,000,000 were hardwoods. Of interest is the fact that the Forest Service contributed 1,897,000 trees while the state nurseries provided 12,630,000 plants.

Seed collection from trees totalled 36,000 pounds of coniferous seed and 1,285,000 pounds of hardwood seed for a grand total of 1,321,000 pounds. In quantity of collection, the coniferous species of which seeds were collected in the greatest amounts consisted of loblolly and slash pines, red cedar, and Rocky Mountain juniper. Hardwood tree seed included especially walnut, oak, tulip poplar, hickory, ash, maple, and hackberry in the order named.

The nature of nursery work requires that production schedules be planned for two to three years ahead of the time that the planting stock will be used. Therefore, seed collection and nursery-stock-production programs must be planned and executed in close cooperation with the Sections of Woodland Management, Wildlife Management, and Agronomy and Range Management. (3)

Division of Woodland Management

(It would be impossible here to discuss all of the Divisions of the service, so only those that directly pertain to forestry will be taken up.)

Woodland Management as a measure of soil conservation involves the introduction of a new attitude toward wooded areas. The former attitude that woods and waste-land are synonymous is reflected in the condition of most farm woodlands.

The Service is making demonstrations that are designed to show methods of converting waste land to productive farm woods. They include planting trees on worn-out fields and eroded slopes, fencing woods to prevent erosion and other damage from grazing animals, taking steps for fire prevention, cutting timber selectively to bring about the best silvicultural conditions, and in general inducing the farmer to appreciate his woodland so that it will have an opportunity to become a producing unit of the farm. A national plan of erosion control, when consummated should increase the area of all farm woodlands by at least 17,000,000 acres, thus bringing the total from the latest census figure of 185,000,000 acres

to well over 200,000,000. This is believed to be a minimum figure; it seems probable that the farm woodland area will eventually reach a total of between 225,000,000 and 250,000,000 acres.

During the year 104,452,000 trees and shrubs were planted on farms under cooperative agreement. This amount added to those previously planted makes a total of 280,544,000 planted under the erosion-control program on 88,268 acres of farm land. (3)

Wildlife Management

The restoration of vegative cover is important both for control of erosion and conservation of wildlife. The removal of the original plant cover over large sections of the United States has permitted tremendous acceleration of erosion; loss of habitat has caused equally great reductions in animal populations. Logically, since the same course has resulted in the depletion of the two resources, the conservation of both should be accomplished by the same means. With proper direction soil conservation means wildlife conservation.

Wildlife-management activities of the Science are divided into three phases: (1) Direct-erosion planting made for the benefit of wildlife; (2) development of other soil conservation practices so as to enhance their value to wildlife; and (3) development of an appreciation on the part of the farmer, other conservation agencies, and the general public of the direct relationship between wildlife welfare and soil conservation.

During the last year, 3,882 acres of land in demonstration areas were planted in trees and shrubs and an additional 5,318 acres seeded to herbaceous vegetation feneficial to wildlife. Under the Service program 83,957 acres of land were planted to trees and protected by fencing, providing a haven for wildlife. In addition, shrub borders or interplanting and underplanting has made the woodlands of still greater value for animal populations. (3)

The Forest as a Conservor of Soil and Water

The Coordinated approach to the prevention and control of erosion, and therewith the conservation of soil and water as authorized by the Soil Conservation Act, gives primary consideration to the basic resource, the soil. Soil crops and methods of crop production are considered in the light of their effects upon the maintenance of the integrity of the soil resource. Once this requirement is met, a liberty of action is assured in which crop production in kind and amount may respond to prevailing demands.

Forest cover thus is given a consideration apart from its yield of wood products. The forest becomes a cover crop, a soil saving crop. The forest has always contributed to soil formation and has preserved the resulting soils over large areas ready for agricultural use. In turn, the forest within approrpriate climatic regions becomes also the great healer of worn-out or erosion damaged lands. The forest restores soils; it renews the natural balances of erosion, soil formation, and stream flow.

The protection forest comes to have an additional function; it may serve also to keep soils in storage for later agricultural crop production. Conversion of forested lands to such use, however, should properly await such demands as would justify methods of soil management that will safeguard the soil resource. (6)

Dr. Hans Burger, a pioneer in the study of the partnership of wood and water in Switzerland, states:

"After many examinations it is found that the trees of the forest, according to the species of tree and the density of the forest, will hold back 20 to 40 percent of the rainfall so that it never reaches the ground but evaporates and increases the humidity of the air."

The main defenses of the woodland against erosion, however, are on the floor of the forest. This is composed of a blanket of litter and humus which is composed of not a smooth layer but rather of a series of little depressions. These act as a sieve, and the water filters downward to the soil beneath. This organic cover influences the soil in several ways, making it more permeable to the waters that filter through the blanket. The surface of the soil is kept moist and absorbent even in winter when the exposed soil is deeply frozen. Organic acids in the humus react to make the soil more prous, giving it what is known as tilth. Furthermore, the soil and the humus form the principal habitat for a vast population of organisms important to soil building, soil holding, and water storing.

The forest carpet and the soil that blends into it are the home of rodents, earthworms, ants, larvae of locusts and

other insects, all of which aid in water movement and storage. But as Dr. Arthur Paul Jacot of the Appalachian Forest Experiment Station has said, "These members of the animal kingdom are local in their effects as compated to that of the arthopods that are so numerous and generally distributed in organic soils as to be of outstanding importance in making and keeping the soil full of minute channels, which make it possible for rain water to enter it instead of running off the surface." The intricate patterns which these micro-organisms establish are of far greater importance in water percolation that mechanical soil porosity as evidenced in soil which has been so eroded as to have lost this animate layer.

Woodland cover has still another line of defense against soil erosion. The intricate woven mass of living roots forms a sulcarpet beneath the forest litter with extensions deep into the mineral soil, binding the humus and earth into a mat or ball that resists erosion. While the line of defense is important only on the steeper slopes in a virgin forest, it is elsewhere of primary importance when the erosion control efficiency of the forest floor has been seriously reduced by man.

The relative efficiency of woodland cover for soil and moisture conservation as compared with various other uses of moderately sloping land has been demonstrated at several of the erosion-control experiment stations of the Soil Conservation Service. As against negligible run-off and soil losses amounts for woodlands, the annual run-off records range from 14 percent for good crop rotations to 30 or 35 percent for

continuous row crops, and as much as 44 percent for fallow land. Soil losses range from 3 to 65 tons per acre for these land uses. It is indeed fortunate that there remains in our agricultural regions over 185,000,000 acres of farm woodlands.

These woodlands are a far cry, for the most part, from the virgin forests that once occupied thier sites. Many acres of these woods are struggling on areas but recently abandoned and removed from cultivation as a result of erosion or soil depletion. The few years of tillage have destroyed the favorable soil structure that has been painstakingly built up over the centuries. The influences of tillage are well illustrated by the experience of Dr. C. A. Schenck, an internationally recognized forester, on an estate in North Carolina. Given the job of reforesting the many farm fields that made up the tract, Dr. Schenck observed the fine form and growth of the important "climax" hardwoods in adjoining sites of the same soil type which had never been deforested, and he tried to reforest the fields with hardwoods. Many of the trees died and those that survived made so little growth that they could hardly compete with the weeds and grass. The tilled soil which but a few years before had had the structure and composition of that in the woods at the edge of the field, would no longer support the climax forest vegetation represented by the woods. Dr. Schenck turned to pines and spruces, more primitive species in nature's succession, and these have been successfully established. If these areas are undisturbed over the course of several rotations, the soil conditions essential to the climax hardwoods will be restored and the site will

again be occupied by them. It is obviously better woodland economics to dedicate sites permanently to woodland use rather than to rotate woodland and tillage as we have usually done in the past. (9)

The Evil of Burning

Our farm woodlands are frequently burned, either accidentally or intentionally under various barbaric theories arising from our ancestors' struggle to establish tillage in a wilderness. Fire works in several ways to reduce the effectiveness of woodland in conserving soil and moisture. The so-called "harmless" ground fires intended to "clean up the woods", to "kill boll weevils", or to accomplish other legendary objectives, are especially damaging to the essential mantle of litter and humus. A single severe fire or repeated light burnings consume this organic material, decimate beneficial soil fauna, and materially increase run-off and erosion. Soil-erosion experiment station results indicate that annual burning off of woodland increases run-off from 10 to 30 times and soil loss from 12 to 300 times. Fire destroys the seed and seedlings on which woodland renewal depends. When severe, it destroys mature trees, but in farm woodlands this is usually less of a factor than damage due to resulting fungal attack. (9)

Overgrazing of the Woodlot

In still another way are natural conditions in farm woodlands materially changed through unwise acts of man. Nearly three-fifths of these 185,000,000 acres are grazed by domestic

animals. Except in certain limited areas of open woodland where grasses and trees form a congenial association, grazing is a double-barreled uneconomic practice. On the one hand, woodland pastures provide little more than bare subsistence grazing as contrasted to profitable grazing. The grass is sparce, scattered, and unpalatable, and actual measurement of changes in weight of stock forced to graze in woodlands indicate that the practice is economically unsound purely from the livestock standpoint. On the other hand, grazing causes cumulative damage to the woodland cover, ultimately resulting in its destruction. Increased run-off and erosion accompany this damage. (9)

Extent of Forestry in Soil Conservation

The extent to which forestry is employed in the conservation of farm lands is indicated by the work of the Soil Conservation Service in farm woodlands. Up to June 30, 1936, statistics indicate that this organization had worked on 33,450 farms covering an area of 5,375,000 acres. On these farms the land retired from cultivation and planted to trees and shrubs increased the percentage of woodland from 10 to 15 percent of the gross area, an increase of 250,000 acres.

Quoting Mr. Mattoon of the Forest Service; "Farm woodland is the best forest land on the average, because the farms are located in the regions of the best soils. Their productive capacity, therefore, probably averages highest of any class of timber land in the country." The management of this large area

of farm woodlands is a task for which the forester has exceptional qualifications.

The interest in soil conservation has brought forestry to the front, as properly managed forests are an exact antithesis of soil erosion. The work of the Soil Conservation Service in its present stage of demonstrating to farmers the proper way to farm without losing the soil through erosion and still making a living out of the land, is giving foresters a new vantage point of attack as well as a more direct responsibility for making farm forestry contribute its part to the revenue producing ability of each farm unit. (7)

Coordinated Approach of the Service to the Soil Erosion Problem

The Soil Conservation Service has a cordinated approach to the soil erosion problem. It draws together all of the specialists in agriculture: engineers, biologists, agronomists, agricultural economists, soil technicians and foresters; and together they prepare a new plan of land use adapted to the peculiar conditions of the farmer and of his land. The income of the farmer is very sensitive to changes in land use. The new program, therefore, focuses attention on woodland management in order to justify the substitution of forests for more unstaple land use practices.

The philosophy which the Soil Conservation Service is attempting to bring to the farmer is that there is no waste land, that any part of the farm which cannot or should not produce annual vegetative crops can produce revenue in some other form, either as trees, as wildlife, as recreation, or

as an aesthetic area which will have its reaction in the increased value to the farm. In the scheme of the Soil Conservation Service the forester is a member of a consulting board which recommends the proper type of land use for any area. His advice is fire protection for the fields and woods, fences to keep grazing animals off the woodlots, and the reforestation of steep and eroded lands. In making up this advice he has the help of other agricultural specialists. For example, if the agronomist provides better pasture on half the acreage formerly used, the steep part of the old pasture is released for reforestation; if the engineer concentrates water by means of diversion ditches, it is possible to grow trees in parts of the United States where it was not possible before. The forester knows from his contact with the farmer, and because he has helped to make the new farm plan, what forest products are needed. He plans his silviculture and his rotation accordingly. (7)

Variation of Forestry Problems

The forestry problems as encountered by the Soil Conservation Service are almost as varied as are the different forest types and sites of the United States. The primary problem is to get some sort of cover on the "sore spots". The badly eroded fields and gullies where all the topsoil is gone present a particular problem. Here any sort of vegetation which will grow is planted as a preliminary crop. For such place the black locust can be counted on as a tree of prime value; next in importance are the hard pines and some of the

shrubs which are often the only soil-protecting plants which can be artificially established.

In many other situations, however, erosion has not so completely removed the topsoil but that it is still possible to get trees that are more representative of the climax type to survive. For example, in the Northeast there is some opportunity to grow spruce, and whenever this opportunity exists, plans are being made to grow the spruce in the nursery and plant them on the farms with the cooperation of the farm owners. Spruce on suitable sites in the Northeast can be profitably grown because of its high value for pulpwood and the fact that here is located a great paper industry largely dependent on this species. Here also the sugar maple reaches its best development, and maple-sugar orchards are common. They have, however, been sadly neglected by overgrazing; and all foresters in this territory have a real opportunity in developing these orchards.

In the Great Plains, where the dust storms originated, forestry is making progress chiefly in the planting of shelterbelts and windbreaks. In this region shelterbelts alone are not enough to control erosion and conserve moisture. They must be aided by cultural methods which give the wind little chance to pick up the dirt. They must be supplemented by cover crops, strip crops, by furrowing or by permanent grass cover.

The Forester's Place in Soil Conservation

For a long time we have been wasting our soil through misuse, and not realizing that his methods were wrong, that

the life-giving soil itself was being slowly but surely carried away by the same rain upon which he depended to water his crops, the farmer has been following his relentless course until disaster has threatened both him and the nation that is dependent upon the soil. All over the country are abandoned farms, and thousands of others which are rapidly reaching the stage of abandonment.

The sustaining power of the forest to hold the soil, the ability of nature to reclaim worn out land by the re-establishment of trees, is proved by the forests which have grown to maturity on what was once cleared crop-land. All through the eastern states we can find the old stone fences in the midst of newly grown forests, which marked the site of old fields. The corn rows can still be distinguished in the dense second growth forest. Wild apple trees, descendants of farmers' orchards, attest the power of the forest to recliam and hold the soil.

It is not strange then that the forester has been called in as an expert to manage these areas. He is the master of the best means for soil conservation; he must be a big factor for only a forest can reclaim the steep eroded lands cast off by agriculturists. The training and experience of a forester make him particularly adapted to soil conservation work. He has always been accustomed to land-use planning; the very nature of his work requires long-time thinking. He is accustomed to making maps; one of the chief things that he learns is how to put a square mile of land on a square inch of paper; he is a rough and ready surveyor; soils, slopes, contours, and

ridges are all familiar subjects. The forester is likely to prove more and more useful in the work of soil conservation.

Most of the farms in the eastern part of the country contain from 10 to 60 percent of their area in forest growth. Some of it is land that has once been cleared. Down South, the farmer has been chasing his woodland from one end of his farm to the other for the last hundred years. He clears the forest in one place and it springs up again on the fields abandoned in another. Everywhere he has cut it and culled it, and often almost ruined it for productive use by maltreatment. Grazing animals have trampled the young trees and packed the soil, and fires have been allowed to burn unchecked. The methods of cultivation have failed to hold the soil on many of the which in increasing numbers are cast aside for crops or pasture use and become "idle lands" capable of reclamation only by the forest.

The farmer's income now comes mostly from two-thirds to one-half or even less of his farm area, and that proportion through soil erosion is fast decreasing, and can be saved only by strip-cropping, by terracing, and other soil husbandry practices. The part of the farm which is now in woods or which must be planted to forest trees in order to save it, must be made to produce its share of the farm income. That is the forester's task; it is his job to aid other farm specialists by making the forest pay its share. The farmer must use his forest not only for its soil-building and soil-healing properties on land worn out for crops, but he should get a cash income from it. The farmer has been accustomed to

think of his woods as merely so much of his farm which can not be tilled. He has drawn on it for years for his house logs, his lumber, his posts, and his fuel, but he has become so accustomed to this that he has scarcely appreciated it. He has more or less taken for granted what he gets from his woods. He has always had it, but has given it little attention and no credit. The burden of the soil conservation teaching is to get the farmer to see that he gets out of his farm very much in proportion to what he puts into it. The woods on his farm are no exception to this rule.

First of all, then, the forester must make the farmer appreciate his woods so that he will keep them and take care of them. Chasing the woods about the farm is a poor way of getting an income from them. He must appeal on the basis of economics, aesthetics or sentiment. The forester must make the farmer appreciate his woods by making them appear as they actually are, an integral and valuable part of the farm; capable of producing saleable products and as much in need of a definite plan of management as the cultivated portions of the farm. If he can succeed in doing this, the woods, which are the best agency to hold the soils,will not be destroyed by fire and grazing, or ruined by unintelligent cutting.

The forester's job in soil conservation is definite and clear cut. He not only has a place in soil conservation; he is indispensible.

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