

4-1936

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Recommended Citation

Davis, R. H. (1936). Soil Erosion Demonstration Areas In Southern Minnesota. *Journal of the Minnesota Academy of Science*, Vol. 5 No.6, 15-17.

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and etiological phases of the problem (cf. Ellis & Rosendahl).¹ It is becoming more and more clear that in order to insure proper diagnosis and treatment there must be adequate and reliable pollen data available, and it is only by means of field and air studies, carried on throughout the season from early spring until late fall that such information can be obtained. An important part of such data is the demonstration of a high degree of precision in the rhythmic recurrence of vital phenomena in the activities of the plant species involved.

SOIL EROSION DEMONSTRATION AREAS IN SOUTHERN MINNESOTA

R. H. DAVIS

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The evil of soil erosion, by both wind and water, is not only a live issue of the day, but is one of our most important agricultural problems. It is a problem that should have been vigorously attacked fifty or one hundred years ago, but it is the American custom to wait until a problem reaches the verge of being a calamity before any action is taken to improve the situation. This has been true with regard to all our natural resources. We have stripped off our vast areas of virgin timber, with only very meager attempts at reforestation. We have drained swamps that should never have been drained. We have killed off much of our wildlife, and to make matters even worse, we have destroyed much of the natural habitat of this wild life. We have more or less mined our soils and allowed them to wash away, without doing anything to restore their fertility.

In addition to the actual loss of these resources, the cost of our wasteful methods is today being expressed in terms of human misery for thousands who are choking in dust storms of the drought-stricken plains region, and other thousands who have been made homeless by floods in the lower Mississippi Valley. Also, scattered throughout our land there are more thousands of families who, even in normal times, could barely eke out a living from their once fertile fields now impoverished by unrestrained erosion.

All of these problems are a direct result of the misuse of our land, and of our failure to have a long-time plan of use for the greatest good of the majority. The adjustments necessitated by our past mistakes are going to be expensive and will require many years to accomplish, but these adjustments must be made if we are to have a stabilized agriculture.

¹ Ellis, R. V. and Rosendahl, C. O., *Minn. Med.* XVI: 379-389, 1933; *Ibid.* XVII: 378-392, 1934.

We cannot go heedlessly on exploiting our land resources as we have in the past. Recent surveys show that 51,000,000 acres of formerly good agricultural land have been destroyed by erosion to such an extent that it will be impossible to use them for agricultural purposes for several centuries to come. In addition to this, 105,000,000 acres of land have lost most of their top soil, and somewhat more than 100,000,000 acres are being rapidly depleted by this process of erosion.

Last fall the Soil Erosion Service completed an erosion survey of the state of Minnesota, in which it was found that approximately 7,690,000 acres of land were affected to the extent of having lost from one-fourth to three-fourths of the top soil. Approximately 787,000 acres of the same area were found to be severely gullied. A further 3,900,000 acres were mapped as affected by moderate to severe sheet erosion, while slightly less than 3,000,000 acres were shown to be seriously affected by wind erosion.

The present administration in Washington is keenly aware of the critical situation which the American people have brought upon themselves by lack of proper plans of utilization of soil and other natural resources.

In order effectively to present to the people of the nation, methods that should be used to maintain our soil resources, a new Government bureau was established in August, 1933, to set up erosion control demonstration projects throughout the country. This bureau, the Soil Erosion Service, was organized in the Department of the Interior, under the Public Works Administration, with Mr. H. H. Bennett, leading soil conservationist of the country, as Director. Only recently the Soil Erosion Service has been transferred from the Department of the Interior to the Department of Agriculture.

In inaugurating this new service the President specifically directed that representative watershed areas be selected throughout the country, and that a thorough job of erosion control be accomplished on these areas, so that they might serve as a demonstration of essential practices that should be applied to the entire region represented by the demonstration. To date forty such demonstration projects have been established by the Soil Erosion Service. One of these projects, established in southeastern Minnesota, consists of three different watershed areas; namely, the middle branch of Root River in Fillmore and Mower Counties, Beaver Creek in Houston County, and Gilmore Creek in Winona County. The three comprise a total area of approximately 130,000 acres.

One of the fundamental ideas of the Soil Erosion Service is that if we are ever to solve the problem of both erosion and floods, it must be attacked at the source. By that is meant on the sloping hillsides where the run-off water originates. If we can get the soil to absorb the maximum amount of rain water where it falls, then both erosion and flood damage will be largely eliminated. Another fundamental principle of our program is that we do not attack these problems by either engineering or forestry methods alone, nor yet

solely by agricultural methods. We coordinate all three of these activities in order to gain maximum and lasting results.

May I state here that the assistance and advice of the officials of the Minnesota College of Agriculture have been invaluable in getting our program underway. It is the desire of the Soil Erosion Service to maintain the closest possible cooperation with all interested state agencies. A very extensive research program dealing with many phases of the erosion problem is now being jointly planned by the Minnesota Agricultural Experiment Station and the Soil Erosion Service. The knowledge gained by these contemplated studies should enlighten all of us as to the practical application of certain ideas which now are more or less theoretical.

In the Minnesota demonstration watersheds we make a thorough study of each farm, including soil, slope, and cover conditions, and outline the things which must be done on that farm to conserve the maximum amount of water and to effectively control erosion. We induce the farmer to sign an agreement to carry out for a five-year period all practices recommended. In order to get the program started, the Soil Erosion Service furnishes the farmer with certain materials that may be required at the outset, such as seed, lime, fertilizer, wire, and trees.

One of our most difficult and important problems is to get the steeper slopes under a good system of forest management. Many of them have been denuded of timber, and most of them have been heavily grazed and burned. The misuse of these steep timbered areas, which really have a very low grazing value, has resulted in their being rendered practically worthless for watershed protection. Such areas that are adaptable only for timber are being fenced to eliminate grazing. They will be protected from fire, and the denuded portions replanted to trees. The steeper cultivated lands which are subject to severe erosion when used for corn or small grains, are being seeded to permanent pasture or hay crops. The cooperating farmers are induced to lay out their fields on the contour, and to farm them on the contour rather than up and down the slope. Strip-cropping and improved crop rotations play an important part in the erosion control program. Terraces are being constructed on most fields where the gradient is not more than ten per cent and where adequate terrace outlets are available. Gullies are to be controlled by check dams, and by vegetative plantings which will stabilize the banks.

Wild life management plays an important part in our program. If our efforts at revegetation are properly carried out they will greatly enhance the cover and food available for game. When vines, shrubs, and trees are planted to stabilize a gully we might just as well plant species of these plants which will also provide much-needed food and cover for desirable creatures of the wild. The resulting increase in wildlife is very valuable from the esthetic standpoint, as well from the economic. It may open up a possible revenue from lands taken out of cultivation and grazing in the operation of the erosion-control program.