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Paul E. Rosenberry
Iowa State University

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PAUL E. ROSENBERRY[1]

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SYNOPSIS: In an effort to bring soil erosion under control, the Iowa Legislature in 1971 enacted a new law establishing six soil conserving districts with power given to them to require soil conservation practices to be employed when damages occur because of excessive erosion. The main points of this law and their implications are discussed in this report. The report then discusses research needs in the area of sediment pollution. A brief discussion also is included on a research project to be undertaken in this area of research.
INDEX DESCRIPTORS: Conservation, Conservation Economics, Erosion, Sediment, Pollution, Conservancy Law, Environment, Water Quality, Pollution Enforcement.

The public is becoming increasingly concerned with agriculture's part in the pollution of natural resources. Sediment deposition off the farm is the major pollutant of water, in terms of volume. Suspended solid loadings reaching the nation's streams from land runoff are about 700 times the loadings caused by sewage discharge (Wadleigh & Dyal, 1970). Annual sediment damages are estimated at $500 million. The filling of irreplaceable reservoir sites is also of great concern. At the present rate, half of the nation's reservoirs of 100 acre-feet or less capacity will be completely filled with sediment in 60 years.

An increasing number of states are enacting legislation to control agricultural pollution. Many cattle-feeding operators are prohibited from allowing feed-lot runoff to enter streams. Nebraska and Iowa have passed "conservancy laws," establishing administrative bodies with authority to impose limits on sediment deposition off the farm. The Iowa law establishes, prescribes the boundaries of, and provides for administration of six conservancy districts; together they will cover the entire State. The districts—which will have no authority to levy taxes or issue bonds—will coordinate the efforts of individual drainage and soil conservation districts and help effectuate the comprehensive statewide water resources plan developed by the Natural Resources Council under existing law. In order to more effectively control soil erosion and thereby prevent siltation of Iowa's lakes and streams, the law also requires local soil conservation district commissioners to promulgate regulations requiring that soil erosion by wind or water be controlled; to inspect private land upon receipt of written complaints, to determine whether excessive soil erosion is occurring; to direct that soil conservation practices be installed to control erosion; and, in cases of noncompliance, to obtain court orders requiring compliance. Affected landowners and occupants will have the right to appear in court and show cause why they should not be required to comply with the directives of the soil conservation district commissioners.

In summary, the above legislation—

1) Establishes 6 conservancy districts in Iowa. Boundaries are set largely along the lines of major watersheds.
2) Extends the authority held by the soil conservation district commissioners to:
   a) classify land as to propensity to erode,
   b) establish soil loss limits for each land class, and
   c) require landowners to bring erosion within applicable limits.
3) Provides that soil erosion resulting in, or contributing to, damage to property not owned by the owners or occupant of land on which such erosion occurs is deemed a "nuisance."

The legislation permits the conservancy district board, soil conservation district board, soil conservation district commissioners, or owners of damaged property to bring court action. The party filing the complaint must prove that the soil erosion exceeds permitted limits. The act also stipulates that landowners will not be held liable if—

1) Soil and water conservation practices approved by district commissioners have been established and maintained—or other reasonable and prudent measures to prevent excessive soil erosion are in use.
2) Erosion resulted from an unusual event beyond the control of the landowner.

There are several important implications for researchers in this act. First, farmers and the commissioners of soil conservation districts need to know the alternatives available for controlling soil erosion, within the prescribed limits, for the various soils and climatic conditions that normally occur in a district. The landowner needs to know the cost and the degree of control he can expect from each alternative. Since society will likely share the cost (75% in the case of Iowa) of any practices, it will be to everyone's interest to select the appropriate control for each circumstance.

The act also leaves to the district commissioners the awesome task of determining when the permissible erosion limit is exceeded. For many years, researchers and conservationists have been collecting data on the soil erosion syndrome. The time may now be near when definite answers and proposals will be required for both general and specific situations. The question is, are we prepared to supply and defend the information necessary for legal proceedings? We can perceive an occasion in which a farmer following acceptable conservation measures caused siltation of a water resource off his farm, e.g., a country club lake. If a law suit should occur, it will be necessary to have factual testimony presented at the trial in order to settle the dispute. The knowledge and expertise required to present this testimony should be kept in mind as we delineate our work objectives in the future.

[1] Natural Resource Economics Division, Economics Research Service, U.S. Department of Agriculture, Iowa State University, 581 East Hall, Ames, Iowa 50010.

A research project by the Economic Research Service of the U.S. Department of Agriculture in cooperation with Iowa State Experiment Station, will be directed to the problem of agricultural sedimentation. The initial phase of the project will be concerned basically with two research questions–what can be done and what will be the direct and indirect cost to farmers and society? In other words, what will it cost to reduce soil erosion and how will the conservation practices affect: 1) farm profits and the need for farm subsidies, 2) food supply and the resulting food prices, and 3) society's well-being by reducing sediment deposits in ditches, streams, and lakes? If farm profits fall, subsidies may be necessary to compensate farmers for their lost income.

The primary objectives of the study will be to:

1) identify alternatives available to farmers in meeting specified soil erosion limits,
2) establish a linear programming L.P. model capable of determining the least-cost alternatives for achieving pollution controls,
3) determine the effects of alternative erosion control practices on farm incomes,
4) determine the possible impact of various levels of soil erosion, and
5) determine costs and benefits to society of reducing sedimentation associated with alternative erosion control practices.

The study area for this project will be the Iowa-Cedar River Basin. The basin includes all the land drained by the Iowa and Cedar Rivers and their tributaries. It extends diagonally across east-central Iowa, reaching into south-central Minnesota on the north and bounded by the Mississippi River on the south and covering 12,970 square miles. The basin corresponds with one of the 6 districts set up by the Iowa conservancy law and is expected to be the pilot area for initiating the provisions of the legislation. This study will provide data on erosion control and costs and will also make an important contribution to a Type IV River Basin Study of the Iowa-Cedar River system. The Soil Conservation Service, the Forest Service and the Economic Research Service, with the assistance of the Iowa Department of Soil Conservation and the Minnesota Soil and Water Conservation Commission, will cooperate in the Type IV Study with representatives of other Federal, State, and local agencies in preparing a comprehensive program for the conservation and development of water and related land resources to meet foreseeable short- and long-term needs of the basin.

Nearly all of the basin's land is in farms, with about four-fifths in cropland. The remaining fifth is about equally divided into pasture, woodland, urban, and other uses. Many cities are located in the Basin. They include Austin and Albert Lea in Minnesota and Mason City, Waterloo, Cedar Rapids, Marshalltown, Iowa City, and Burlington in Iowa. The population density is 59 per square mile, which is 20% greater than the average for Iowa. Soils range from poorly drained to highly erosive. Average annual rainfall is about 32 inches. The growing season is about 150 days.

Flooding and sedimentation in upstream areas of the Iowa-Cedar River Basin cause an estimated $4 million damage each year. Erosion is a problem on over 2 million acres of crop and pasture land. Gully erosion alone damages 2,600 acres each year and amounts to $1 million damage. Sediment accumulation in the Coralville Reservoir has attracted widespread concern. This 5,000-acre lake is a valuable recreation resource. Impaired drainage is a further problem on 6 million acres of crop and pasture land in the basin.

The various alternatives available to farmers will be determined and set up as activities in a linear programming model. Each of these activities will include a pollution measure that will compete with all other activities for a part of the permissible-pollution-restraint level.

This pollution measure will be based on the universal soil loss equation (Wischmeier and Smith, 1965). This equation was developed to provide specific guidelines needed in selecting appropriate control practices for particular farms or fields.

The application of the equation gives long-term (25 years or more) average annual soil erosion losses caused by rainfall. In predicting these losses from individual fields, the equation takes into consideration the intensity and duration of the storm, soil type, slope length and gradient, cropping patterns, and erosion-control practices. Application of this equation in recent studies shows close agreement between measured and predicted erosion for an extended period (Johnson and Moldenhauer, 1970). However, predictions of soil erosion losses for individual storms or for a specific year are not as accurate.

The L.P. Model will initially be applied to representative soils and topography in the study area of the Iowa River subbasin. This pilot area is defined as that portion of the basin lying between Marshalltown, Iowa and the Coralville Reservoir on the Iowa River. The area was chosen because of its importance in contributing sediment to the Coralville Reservoir, the presence of gauging stations at Marshalltown and at the reservoir, and the concentration of potential P. L. 566 projects. If the L.P. Model can be successfully applied, it will be extended to the entire basin.

The data generated by the L.P. Model will be further analyzed by a cost and return simulator (Rosenberry, 1971). This model will measure the impact of pollution controls on the distribution of farm types in the basin. For example, the number of cash grain farms may be expected to decrease in proportion to livestock farms as permissible erosion rates are lowered.

Consideration will be given in the study to offsite effects of erosion control. Both the benefits of decreased sediment delivered to reservoirs and waterways and the cost to society of accomplishing the reduction will be delineated and quantified, as warranted by the available data.

A consistent and current body of input-output data by crop and livestock enterprises for representative soils and climate, together with the technology and management level assumed, is needed for this and related studies. The collection of this kind of data usually requires a search through countless publications from a dozen different experiment stations and research centers, covering a period of 10 to 20 years. The data collected often come from experiments whose main objective was far removed from generating meaningful input-output data. This situation strengthens the importance of interdisciplinary research in compiling meaningful data.

Looking at river basin research needs in general, a consistent group of soil resources within a region is needed. Where river basin studies cross state lines, there is a problem of aggregating soil data for the entire river basin, and especially in aggregating regional and national data.

Analysis of competing uses for land and especially water will become increasingly urgent research needs in the days ahead. In addition to agricultural and nonagricultural demands for land and water, we need to determine water quality requirements for second uses. Water uses that cause irreversible damages should be defined and quantified. The cost of purifying water for various uses needs to be determined.

Crop responses to water should be studied to determine economic returns. In some areas of the United States, water is used to the point of diminishing returns while downstream needs are left unsatisfied.

The already complicated problem of sediment erosion is further complicated by the fact that sediment carries chemical pollutants. Modern technology in farm production has increased the use of man-made pesticides and fertilizers which have added to water pollution. A definite need exists for data which quantifies the relationship between the chemical content of sediment and such factors as the form of chemical applied, the method, frequency, and time of application.

Sediment in rivers does not originate entirely from agricultural activities. Sediment from urban areas is also becoming a concern of society. Research will be needed in the best ways of applying to urban situations the technology developed to control agricultural erosion.

As pollution of water resources becomes more and more subject to legislative action, it is probable that researchers involved in conservation and pollution control will be increasingly involved in courtroom litigation. The question is, are we prepared to provide the information that will be required?

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