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Perhaps today's concern for soil erosion began with the writings of Aldo Leopold a generation ago on the need for a land ethic, or the cartoons of "Ding" Darling, or the memories of farming in the lean and mean "Dust Bowl" years, or the efforts of the Soil Conservation Service, or the professors of soil science, or the recent environmentalists. At least something, more than likely a combination of many such influences, has brought about the grass-roots realization that although our thoughts have soared with our explorers in space our roots remain in the soil of the planet Earth. We have begun to look anew at the soil.

The soil is Iowa's greatest resource. It belongs, in a sense, to all people now living as well as to those yet unborn. Thus we are committed to conserve the soil for ourselves and future generations. To this end the Iowa Legislature enacted in 1971 a sweeping new law which changes the emphasis in soil conservation practices from voluntary to mandatory.

THE PROBLEM

The movement of soil particles by water and wind has at least a triple effect, first the impact on the original site because of the loss of soil; second the impact somewhere else because of the accumulation of dust, clay, silt or sand; and third the impact on the properties of the carrier while material is being transported. Perhaps the more immediate concern in reducing soil erosion is to control siltation and eutrophication of Iowa's lakes, streams, and constructed reservoirs; however over a longer period of time the soil loss from the original site can be equally damaging as productivity is reduced and the land becomes harder to manage. Movement of soil particles by water may occur as sheet erosion, rill and gully erosion in uplands, and streambank erosion in all meandering and downcutting streams and rivers. It is a natural process affected by many of our activities besides land cultivation, such as grazing management, road construction, timber cutting, urbanization, and mining. It is influenced by the slope of the land, the amount of vegetative cover, soil texture and structure, and climatic factors.

Ninety-five percent of the 36 million acres total land area of Iowa is agricultural land, and 6.3 million acres of that has slopes of more than 4 percent. Erosion is a serious problem on these slopes whenever they are used for clean tilled crops such as corn or soybeans. About 4 million acres of this sloping land primarily in western Iowa have soils formed on medium textured loess (wind deposited soil material). Most loess derived soils are easily tilled, have a high water holding capacity, and when properly managed produce high yields of corn and soybeans even on badly eroded areas. Because these sloping soils can produce high grain yields even when eroded, most of them are in cropland. As is shown for three groups of soils in Tables 1 and 2, the percentage of cropland in this soil area is about the same for all slopes up to 14%. Even on slopes of 14 to 25%, two-thirds of the area is in cropland.

As a result of recent developments in fertilizer technology, low fertilizer prices, improved varieties, and more powerful tractors, there has been an increase in acreage of corn and soybeans on these sloping soils during the past decade. Some of the area is protected by terraces, but the increase in row crops has, in general, canceled out the savings in soil that may have resulted from past conservation work. On many fields that lack conservation practices, erosion rates in excess of 100 tons per acre occur in some years and probably average in excess of 20 tons per acre per year.

Because it is profitable to farm these sloping loess-derived soils even when severely eroded and when eroding at a rapid rate, the erosion problem is more acute on these soils than in other sections of Iowa. Erosion is not a problem on well vegetated land. Vigorously growing pastures or woodlands do not erode even on very steep slopes. On slopes where the soils are not highly productive when eroded there is little economic pressure for cultivation, and erosion can be and is mostly controlled by vegetation.

In Iowa, as is shown in Table 1 and 2 there are approximately 13 million acres of soil with subsoils that are moderately favorable for plant growth. These soils are mostly formed on loam or clay loam glacial till and most of the area is in the Clarion-Webster or Kenyon-Floyd soil areas. However, significant acreages of loess derived soils such as Sharpsburg, Otley, Grundy, Seymour and associated soils which have silty clay loam and silty clay subsoils are also included.

TABLE 1. SOILS OF IOWA GROUPED BY SUBSOIL PERMEABILITY AND SLOPE CLASSES*

	Acres in respective slope classes							
	0-4%		5-8%		9-13%		14%+	
Soil group	Acres x1000	% cropland	Acres x1000	% cropland	Acres x1000	% cropland	Acres x1000	% cropland
1) Subsoils favorable (Ida-Monona, Marshall, etc.)	8,621	73	2,199	87	2,017	85	668	67
2) Subsoils moderately favorable (Storden, Sharpsburg, etc.)	11,904	74	1,295	87	175	76	84	38
3) Subsoils difficult to till (Shelby-Adair, etc.)	2,688	62	594	76	620	58	487	30

[1] Report of the Subcommittee on Soil Erosion of the Committee on Social Implications of Science of the Iowa Academy of Science.

TABLE 2. IOWA CROPLAND CLASSIFIED AS TO SUBSOIL AND SLOPE*

Soil group	Acres of cropland in respective slope classes x 1000				
	0-4%	5-8%	9-13%	14+%	Acres of cropland with slopes in excess of 4%
1	6,293	1,913	1,714	447	4,074
2	8,808	1,127	133	32	1,292
3	1,666	451	360	146	957
					6,323

*Derived from data in W. D. Shrader, David Slusher, and F. F. Riecken. Soil Management Groups of Iowa Soils. Mimeograph release, Agron. Dept., I.S.U. 1962.

Most of these soils are on slopes of 4% or less but 1.1 million acres are cropland on 5 to 8% slopes. No figures are available as to the percentage of grain crops as compared to forages but observations indicate that at least half of this soil and slope condition is used annually for corn or soybeans. While the group of soils in this slope class erode rapidly under cultivation most areas of 5 to 8% slope still have some surface soil remaining.

Within this group of soils there are 133,000 acres of cropland on slopes of 9 to 13% and 32,000 acres of cropland on slopes in excess of 14%. These steeper slopes are mostly devoid of surface soil. The subsoils are more difficult to till than the group 1 subsoils but can be made to produce high yields of corn and soybeans.

There is a group of soils in Iowa, approximately 4 million acres in extent, that has dense fine textured subsoils. On sloping areas Shelby and Adair soils are the principal soil series. These soils are difficult to till when eroded. Almost a million acres on slopes of more than 4% is classified as cropland. These soils are highly erosive when cultivated and many areas have lost all or nearly all of their original surface soil. Because cultivation of the eroded areas is difficult and returns are uncertain, many areas are cropped less frequently than before and some are reverting to pasture.

The greatest source of sediment by far is from the 4 million acres of cropland on sloping areas of medium textured loess. These soils are permitted to erode at a rapid rate because recent technical advances have made it increasingly profitable to use this land for corn and beans even when the land is eroded. Because the eroded areas can be made to produce high crop yields, erosion on these soils does not cause any appreciable immediate loss of productive power.

Erosion does the most permanent damage on the group 3 soils, those with dense subsoils. Most of the croplands in this group on slopes of over 8% have already lost most of their surface soil. This group of soils is reverting to pasture because it is not profitable to use them for cropland. The 451,000 acres of group 3 cropland on slopes of 5 to 8% present a critical erosion problem. These soils erode rapidly when used for corn and soybeans and suffer a severe permanent disinvestment when eroded. Crop yields are lower on eroded than on uneroded sites regardless of the fertilizer treatments used. In general, erosion has not removed all of the surface soil from these soils but the surface soil will be lost within a few decades if present practices continue.

The intermediate group of soils, the group 2 soils, are also intermediate in the effects of erosion. The offsite siltation is less than on the group 1 soils because the total area of sloping cropland is only 1.3 million acres and of this amount approximately 800,000 acres is in the Clarion-Webster soil area. On these soils much of the drainage is by tile, and much of the silt that erodes from sloping areas does not reach streams immediately but is deposited in nearby low areas. As with the group 3 soils the steeper slopes have already lost most of their surface soil so the onsite damage of future erosion will be on the area of 4 to 8% slopes. The productivity of this group of soils is reduced by erosion. Since there are 1.1 million acres of cropland in this category this is an area of serious concern.

Movement of soil particles by wind is primarily associated with those activities which loosen and expose the soil surface to the drying forces of the sun and wind. Adequate vegetative cover can completely control this process. Loss of soil by wind frequently occurs on cultivated land unprotected by crops or crop residue. Lighter soil particles may be lofted into the air and carried great distances, affecting sunsets and viewers' eyes, and gradually falling as a ubiquitous thin dust layer, especially visible on fine furniture. Other particles serve as condensation nuclei and fall with precipitation. Heavier soil particles may be bounced along the soil surface, dislodging other particles in a process known as saltation, which results in the accumulation of material in ditches and fence rows where the force of the wind no longer affects them.

Tillage practices are available to greatly reduce this nuisance which often results in soil-filled road ditches requiring cleaning at $3,000-6,000 per mile of road.[1] Increased soil movement by wind is associated with certain medium and coarse textured soils, fall plowing, soybeans as the previous year's crop, and the long sweep of wind across smooth, clean fields.

In summary the erosion problem in Iowa can be classified as follows:

1. *Offsite effects of siltation.*

Four million acres of sloping cropland, mostly on medium textured loessial soils in western Iowa, are producing large amounts of sediment but suffer no serious decrease in productive capacity as the result of erosion. Construction projects and urbanization in general are contributing sediments to our streams and rivers without loss of onsite qualities.

2. *Sediment production and decrease in productivity that results from erosion.*

There are in excess of 1.5 million acres of land on moderate slope (4 to 8% slope) that are now used for cropland, most of which still have some surface soil and which will be distinctly less productive when this surface is eroded away.

[1] William C. Moldenhauer, Professor of Agronomy, Iowa State University.

On large areas in this group of soils the surface soil will be lost within the next few decades if present practices are continued.

3. *Soil loss by wind action.*
The accumulation of soil in ditches, fence rows, and other places, often removed at public expense, influences drainage and damages established roadside plant species.

4. *Streambank erosion.*
Erosion by naturally meandering streams and downcutting of straightened streams and rivers places a lower limit on reduction of sediment at downstream points, regardless of many conservation practices in the upper watershed.

SOIL CONSERVANCY LEGISLATION

In an effort to bring soil erosion under control, the Iowa Legislature in 1971 enacted a far reaching new law establishing six soil conservancy districts with power given to the local soil conservation districts to require soil conservation practices to be employed when damages occur because of excessive erosion. Erosion from all areas, urban as well as rural, is considered. The six conservancy districts are based on watersheds of major streams and drainage areas of Iowa. (1) The Northeast Iowa Conservancy District consists of all lands drained by the Upper Iowa, Wapsipinicon, Yellow, Turkey, and Maquoketa Rivers and their tributaries. (2) The Iowa-Cedar District consists of the watershed of the Iowa, Cedar and Blue Earth Rivers. (3) The Skunk River District consists of all lands drained by the Skunk River. (4) The Des Moines River District consists of the Des Moines River watershed. (5) The Western District consists of all lands exclusive of lands lying within the Southern District which drain into the Missouri River. (6) The Southern District includes all lands drained by the Fox, Wyaconda, Fabius, Chariton, Thompson, Grand, Platte, Nodaway, Tarkio, and Nishnabotna Rivers.

These districts will be governed by an expanded State Soil Conservation Committee consisting of seven voting members (one farmer from each district and a seventh member at large) appointed by the governor and subject to Senate confirmation. The committee will also have six ex-officio, nonvoting members consisting of the State Secretary of Agriculture, the Dean of Iowa Cooperative Extension Service, an appointee of the U.S. Secretary of Agriculture in an advisory role, and representatives of the Iowa Association of County Engineers in an advisory role, the Iowa Natural Resources Council and the State Conservation Commission.

Each soil conservancy district will be guided by "permissible" soil-loss or erosion limits determined by the local Soil Conservation Districts.[2] Soil loss equations take into consideration the different soil types and their properties, slopes, topography, subsoil qualities, permeability of the topsoil and subsoil, depth of soils and rainfall characteristics; therefore the determination of "permissible" soil losses depends heavily on local characteristics. Hearings will be conducted on these soil-loss limits and modifications can be made.

By April 15, 1972, soil conservation districts of Page, Warren, Lee, Montgomery and Benton Counties had tentatively set soil-loss limits. Once soil-loss limits have been approved by the local soil conservation district and the State Soil Conservation Committee, complaints can be filed against property owners where a soil erosion nuisance has been or is occurring. If the local soil conservation district determines that a soil erosion nuisance exists, the landowner will be notified of the complaint and required to proceed with corrective procedures to be completed no later than one year after the order is issued. Implementation orders cannot be enforced on permanent conservation work such as terraces, farm ponds, dams, perennial seedings, etc., unless 75 percent of the cost is covered by public funds. On temporary conservation work such as seeding of annual grasses, strip-cropping or contour plowing, the State Soil Conservation Committee determines the portion of the cost to be covered by public funds. If a landowner fails to comply with orders directing him to install corrective measures, he can be found in contempt of court resulting in a fine up to $500.00, a six-month jail term, or both.

Despite the precedent-breaking characteristics of the Soil Conservancy Law for Iowa some essential features may have been left out. First of all it seems the 75 percent figure of public support is too high for realistic implementation. The House version of the bill proposed a 50 percent figure; however 75 percent was required by Senate amendments. What happens if public funds are not available at this level of support? And who benefits from the corrective procedure in the short and long term considerations. Second, mandatory wind erosion controls were deleted from the final bill and yet it is well recognized that excessive dust is a nuisance. Third, damage must occur first before a complaint can be filed. This is like locking the barn door after the horse has been stolen except that there are usually some horses left in the barn. Eventually we ought to be able to recognize and control serious erosion threats before damage occurs. Fourth, the bill does not provide for control of erosion based on its effects on the land actually being eroded. Control can come only if there are adverse effects elsewhere. The landowner can do whatever he wishes with his land as long as it does not create a nuisance beyond the property boundaries. Perhaps this is the main point of the need for a land ethic which recognizes land ownership as a trust which must be managed wisely for the present as well as for future generations. An overall policy on land use may be necessary before this shortcoming can be remedied. In addition to soil-loss limits which are being set by each soil conservation district, eventually land-use limits would also need to be determined.

ACTION BY THE ACADEMY

It is difficult to specify the steps which must be taken to see that an effective program of soil erosion control is established and implemented. This is truly a time of transition in which new goals are being set and new ways of accomplishing them are being tried. The new law will have to be tested to find out its strong points and its shortcomings. Perhaps the Iowa Academy of Science can consider adopting the following items:

1. To support the present Soil Conservancy law with recommendations to lower the requirement for public funds support from 75 to 50% and to reestablish mandatory wind erosion control provisions.

[2] William H. Greiner, Director of the State Department of Soil Conservation, estimates these limits will be determined by late 1972.

2. To urge members to participate in local public hearings for the purpose of determining permissible soil-loss limits.

3. To strive for an overall state policy on land use.

4. To plan a soil erosion and land use symposium at the 1973 academy meeting with invited leaders and soil conservation professionals to assess the first year's progress of the Soil Conservancy legislation.

5. To continue an imaginative program of proper conservation practices at the Academy (Parish) Farm near Reinbeck and to encourage its development as a demonstration farm for conservation education by local schools.

6. To identify model farms in every region of the state so that proper conservation practices can be demonstrated to local groups interested in conservation education.

Respectfully submitted, 15 April 1972.

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