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Soil Erosion, Agrichemicals and Water Quality: A Need for a New Conservation Ethic?

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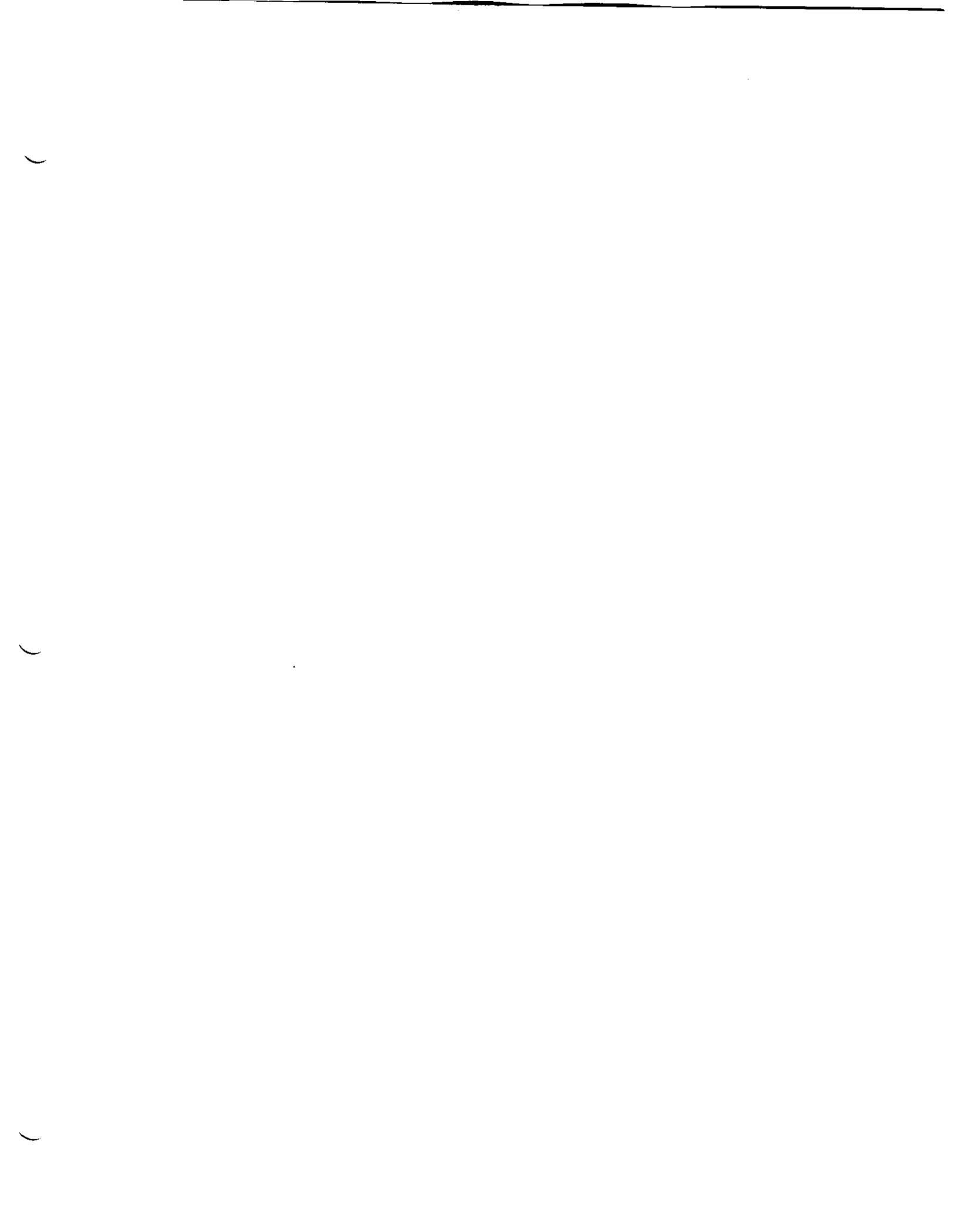
Soil Erosion, Agrichemicals and Water Quality:
A Need for a New Conservation Ethic?

Christine Olsenius
Freshwater Foundation

WATER QUALITY CONTROL: INTEGRATING BENEFICIAL USE
AND ENVIRONMENTAL PROTECTION

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SOIL EROSION, AGRICHEMICALS AND WATER QUALITY:

A NEED FOR A NEW CONSERVATION ETHIC?

Christine Olsenius

I. Introduction

A. Summary

Nearly 41 percent of America's cropland is eroding too fast to maintain long-term soil productivity. This excessive erosion is a by-product of intensive agriculture, increasing in response to worldwide demand for food and fiber. To ensure peak crop production, the use of pesticides has tripled and the use of nitrogen fertilizers has increased four-fold over the last 25 years.

Soil conservation has been a national concern since the Dust Bowl days of the 1930's, but it wasn't until the Soil and Water Resources Conservation Act of 1977 that soil erosion was viewed as a serious water quality problem. Agricultural practices account for millions of tons of runoff or non-point source pollution from sediment, nutrients, animal wastes, pesticides and salts. By volume, non-point source pollution is the single largest source of water pollution.

Each year, an estimated 3.5 million to 21 million pounds of pesticides reach ground or surface water before degradation. Agricultural non-point source pollution has been reported as a moderate or severe problem in 36 states. Some contamination of groundwater by agricultural nutrients has been confirmed in 31 states and contamination by pesticides has been confirmed in 37 states.

In 1982, USDA's National Conservation Program established as one of its two top priorities the protection of ground and surface water quality from non-point sources of pollution. A major emphasis was put on improving consistency between USDA commodity programs and conservation programs. The 1985 Farm Bill followed with its provisions for retiring highly erodible land through the Conservation Reserve Program. The Water Quality Act of 1987 further emphasized the need to protect both surface and groundwater from non-point pollution.

According to the U.S. Department of Agriculture, 80 percent of the people recently surveyed believe that groundwater pollution is a national problem and 70 percent of the respondents felt that farm chemicals are the greatest threat to their drinking water. Ninety-five percent of America's rural residents rely on groundwater for drinking water.

Because groundwater is largely untested and untreated, the potential for public health problems is substantial. Since monitoring and cleanup of contaminated groundwater is costly and since long-range, chronic public health risks are difficult to define, economics and public health are becoming the driving forces behind preventive, proactive land and water management policies on the part of state and local agencies. Economics and public health are the new politics of water quality.

The groundwater "connection" has been a catalyst to forming a more holistic perspective regarding all land use activities, but in particular, agricultural land use. The 1985 Farm Bill with its Conservation Reserve Program, the Water Quality Act of 1987 with its emphasis on controlling non-point source pollution, the 1986 Amendments to the Safe Drinking Water Act with its wellhead protection program, and the 1986 FIFRA amendments which require EPA to establish standards for pesticides in groundwater point toward the need for a new conservation ethic: one which integrates land use with a balanced consideration for protecting surface and groundwater quality.

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II. Background

A. Soil Erosion

1. Each year about 1,600 million tons of soil wear away from the 417 million acres of U.S. farmland into lakes, rivers and reservoirs. While soils in some areas of the country can tolerate a certain amount of erosion, many fragile soils cannot. The Board on Agriculture's analysis of the USDA's National Resources Inventory data found that approximately 41 million acres, or about 10 percent of total cropland, is highly erodible at rates of 50 or more tons per acre per year.

2. Erosion control remains the top priority because, of all the problems addressed by USDA conservation programs, erosion is the most widespread threat to agricultural productivity and environmental quality. About 277 million acres of nonfederal land are eroding at levels above the soil loss tolerance. About 173 million acres of this excessively eroding land are cropland acres. If left unchecked, erosion at rates greater than soil loss tolerance will reduce the ability of the soil to support future plant growth. When eroded soil moves offsite, it

can damage land, air, and water. The costs of offsite damages caused by water erosion have been estimated to be between \$3 billion and \$13 billion each year.

3. Five to ten inches of organic matter-enriched topsoil plus a suitable subsoil and appropriate climate are needed for efficient growth of most plants and field crops. It takes 30 years or more to develop 1 inch of good topsoil (about 150 tons per acre) under the very best conditions. It takes at least 150 years to develop the minimum of 5 inches needed for agricultural production when such topsoil is supplemented by an adequate subsoil and appropriate climate.

The average annual loss of soil by erosion in the United States is about 5 tons per acre, or 150 tons per acre in a 30-year period. On the average, therefore, U.S. cropland is losing soil about as fast as it is being formed under the very best conditions.

B. Water Quality

1. The major off-site impact of soil erosion in the United States is on water quality and on

the condition of the nation's streams, reservoirs, and lakes. Sediment derived from soil erosion decreases water storage capacity in lakes and reservoirs, clogs streams and drainage channels, causes deterioration of aquatic habitats, muddies recreational waters, increases water treatment costs, damages water distribution systems, and carries agricultural chemicals into water systems.

By volume, sediment is the greatest pollutant of surface waters in the United States (Robinson, 1971). Sediment from cropland, pasture/range land, and forest land is estimated to constitute 60% of the sediment discharged to the nation's waters from all sources (U.S. Department of Agriculture, 1978). Sediment from these and other sources is a major concern in the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500).

2. Agricultural nonpoint source pollution has been reported as a moderate or severe problem in 36 states. In addition, some contamination of groundwater by agricultural nutrients has been confirmed in 31 states and is suspected in 6 others. Some contamination of groundwater by

agricultural pesticides has been confirmed in 37 states and is suspected in 8 others.

3. An Environmental Protection Agency (EPA) survey in the early 1980s found that 2.7 percent (603,000 households) of the nation's rural water supplies had nitrate levels above the standard. A 1985 U.S. Geological Survey study found six percent of the nation's rural wells exceeded the standard.
4. Modern farming practices encourage farmers to apply pesticides in ever greater amounts. California farmers, the largest users of pesticides in the U.S., apply 480 million pounds of insecticides, fungicides, and herbicides each year. In Iowa, Nebraska, and Minnesota, corn and soybean farmers treat upwards of 60 percent of their fields with insecticides and more than 90 percent with herbicides. Between 1966 and 1981, herbicide use alone increased 175 percent. In the United States as a whole, the Environmental Protection Agency estimated in 1984, agriculture uses about 1.1 billion pounds of pesticides yearly.
5. In Arizona, California, and Florida, nitrogen fertilizer applications often exceed 200 pounds/acre per year. In many areas, fields receive

so much fertilizer that crops can't use it all. Nitrates then build up in the soil and leach into groundwater.

In Iowa, nitrate concentrations in groundwater in Clayton County's Big Spring basin averaged about 3 mg NO₃-N/l until about 1968. By 1983, nitrate concentrations averaged 10 mg/l . The rise paralleled increasing use of chemical fertilizers on the surrounding farmlands (Hallberg, 1986).

6. The past decade has seen an increase in the federal funding of water quality programs and a decrease in water development funding. The Clean Water Act, the Safe Drinking Water Act, Superfund and new proposed groundwater legislation clearly reflect a growing national concern over water quality and a loss of faith in the quality of America's drinking water.
7. Ten of Iowa's most commonly used pesticides, including aldicarb, 2,4-D, and cyanazine have been found in 97 percent of the 32 municipal water supplies tested in Iowa. In Minnesota, pesticides were detected in 52 percent of the private wells tested and 29 percent of the public water supplies tested.

8. Never has an environmental issue been so closely tied to public health as groundwater contamination. Groundwater supplies drinking water to 50 percent of all Americans, but almost 97 percent of all rural populations. Thousands of private and community wells have been closed nationwide due to contamination. Because groundwater is untreated and largely untested, yet used by such a large number of people, the potential for threats to public health are considerable.
9. In a recent poll to state health departments taken by the Association of State and Territorial Health Officers, water quality was listed as the number one concern of environmental health officers.
10. Protection of underground drinking water supplies is now among the nation's priority environmental issues. Especially in agricultural areas, a multibillion dollar national problem may exist with respect to the health threat. Given the seriousness of these water quality concerns, groundwater protection will soon become a major force in reshaping traditional land management programs.

III. Federal Legislation

- A. Initially, soil conservation practices were presented to farmers as ways to maintain soil productivity and promote viable farm operations. This emphasis was recently reinforced by the Soil and Water Resources Conservation Act. As a result of the Federal Water Pollution Control Act Amendments of 1972, soil and water conservation practices are now presented also as ways to reduce water pollution and environmental degradation (Nowak and Kersching, 1979).

- B. The Food Security Act of 1985 established conservation of highly erodible cropland as a high priority for USDA conservation agencies. Water quality and soil conservation have traditionally been viewed as separate from farm policy issues. Now, the 1985 farm bill links price support and commodity program objectives to the U.S. Department of Agriculture's commitment to reduce soil erosion.

- C. The Soil and Water Resources Conservation Act of 1977 (RCA) was passed in response to public concern about food supplies and environmental degradation. The Act requires the Secretary of Agriculture to identify conservation needs through periodic appraisals. The 1988 program proposal cites the contamination of surface and subsurface water as a serious problem.

1. USDA is elevating protection of water quality from agricultural and other rural nonpoint sources of contamination to second priority within existing USDA programs of research, education, and technical and financial assistance. Under the 1982 National Conservation Program, protection of water quality was not a national priority but was a national long-term objective that could have been designated as a state or local priority. Conservation of water used in agriculture, however, was a priority; because water quantity and water quality are interrelated, water quality did receive considerable attention.

 2. Their updated conservation program will attempt to place 10 percent of the nation's highly erodible cropland in a "Conservation Reserve." It will link soil conservation to all USDA programs so that by 1995, all farmers and ranchers who control highly erodible land will have a conservation program in place.
- D. The Safe Drinking Water Act Amendments of 1986 set drinking water standards for an additional 83 chemicals, including approximately 20 agricultural chemicals. Wellhead protection programs are to be developed by individual states to protect groundwater quality by restricting land use in areas serving a public water supply.

E. States will be the nerve-centers for soil and water management. The Water Quality Act of 1987 stresses that states will replace federal agencies in the management and development of nonpoint source control programs. Water quality is tied to land use and land use is a state and local issue.

IV. State Action

A. The states have lost no time in taking the lead on groundwater policy particularly in light of local jurisdiction over land-use activities.

1. Iowa passed its first groundwater protection statute in 1986. Significantly, farmers (and pesticide manufacturers) do not bear the entire cost of the \$64.5 million program called for in the legislation over the next five years. Of the 75 percent to be raised from fees and higher taxes, \$17.5 million will come from a state oil overcharge fund created by a court settlement. A garbage-dumping fee will increase annually to \$3 a ton by 1991. Grocers and other retailers also will pay an annual fee based on household products that could pollute groundwater. The rest of the money will come from a 75-cent-per-ton tax on nitrogen fertilizer, annual

pesticide manufacturers' registration fees ranging from \$250 to \$3,000, and an annual gross sales fee of one-tenth of one percent to be paid by pesticide dealers.

2. Wisconsin's groundwater program has established a two-tiered approach for standards. There is an enforcement standard and a preventive action standard to be implemented when chemicals are detected in low levels. The preventive action standard is designed to protect groundwater from further degradation.
3. Connecticut is struggling with the issue of liability for groundwater contamination from agricultural chemicals. The State Department of Environmental Protection has found five farmers liable for the contamination of 280 private wells. You can no longer say that what you do on your land is your own business, if it affects groundwater.
4. The Massachusetts Pesticide Board Subcommittee recently voted to revoke the registration of the pesticide alachlor. While the State Pesticide Board did not agree with the decision to revoke the pesticide's registration, they did agree to impose restrictions on the use of alachlor.

According to Jeffrey Carlson, chief of the Pesticides Bureau of the Massachusetts Department of Food and Agriculture, "States are being forced to take a more assertive role in dealing with groundwater contamination problems. In view of the economic, environmental and health related costs associated with contamination, more and more states are leaning towards a prevention-based policy."

- B. There are major social and economic costs related to groundwater remediation. Well monitoring, installation of filter systems, bottled water, new well construction, and connecting to alternative systems are all significant costs that are associated with groundwater contamination. In the case of significant aquifer contamination, in which no cleanup procedures may be feasible, the loss of the water supply to a water-short community could be very detrimental to local economic development. (In a small Massachusetts town of 4,000 people, \$3 million has been spent to develop a new water system as a result of private well contamination from ethylene dibromide and aldicarb.)

V. Management Practices

- A. Best management practices (BMP's) fall into three categories: structural practices, vegetative practices and management practices.

1. Structural practices include terraces, sediment basins and diversions.
 2. Vegetative practices involve crop rotation and strip crops.
 3. Management BMP's involve crop management, as well as pest and nutrient management.
- B. Future BMP's in groundwater-sensitive areas will involve a greater reliance on management practices. They will be site, soil, crop and chemical specific, involving greater nutrient and pest management.
1. Nutrient management involves calculating the plant needs and the level of fertilization needed by the soil.
 2. Split application of nitrogen is essential to reducing leaching in a groundwater-sensitive area.
 3. To increase nutrient consumption by plants, vegetation rotation and double-cropping should be considered.
 4. Integrated Pest Management is a more efficient use of agrichemicals but needs to be more selective in the type of chemicals used in areas vulnerable to groundwater contamination.

- C. Soil erosion in the United States has been cut by 16 percent in two years, according to Wilson Scaling, chief of the U.S.D.A.'s Soil Conservation Service. Under the Department's Conservation Reserve Program, about 23 million acres of erodible farmland have been converted to permanent cover, decreasing annual soil erosion by 467 million tons. This is half way to the program's goal of 45 million acres by 1990.
- D. At a recent conference on "Agricultural Chemicals and Groundwater Protection: Emerging Management and Policy." 80 percent of the conference participants said that available information was insufficient to allow for effective management of agrichemicals and groundwater protection. 91 percent felt that information, when available, was not getting to the right people. This information gap needs to be addressed to encourage better soil and water management.
- E. The conference also highlighted the need for practical, demonstrable best management practices regarding agrichemical use and groundwater protection. (In Iowa, more than 60 sites in 28 counties were used during the 1987 crop season for a series of field demonstrations conducted by Iowa State University as part of the new Integrated Farm Management Demonstration Program.)

F. Food production and commodities programs should be brought into harmony with conservation and environmental programs. Tax and credit policies which promote farm expansion and intense cultivation need to be reevaluated and modified.

1. Innovative new policies within the context of commodity and conservation programs are needed to reward low-input farming systems which also rely on highly effective soil and water conservation practices.

2. Future farm bills need a "stewardship incentive program" which would target program benefits to those farmers willing to reduce rates of fertilization, chemical use and erosion to protect vulnerable water supplies.

G. Institutional barriers built into bank loans and government programs which encourage unnecessary or excessive agrichemical usage need to be eliminated.

VI. Conclusion

A. The Conservation Reserve Program reflects an integrated approach to managing soil erosion, crop surplus and water quality. While having a direct impact on surface water, it also features a Groundwater Pilot Program designed to retire cropland irrigated in an

area subject to overdraft or groundwater contamination. It addresses the important role of wetlands in maintaining water quality and retaining runoff. It offers an economic incentive and a practical voluntary solution to addressing the nonpoint pollution dilemma.

- B. The Safe Drinking Water Act Amendments, which set standards for a broad array of substances, including numerous agricultural chemicals, reflect a growing lack of faith in the quality of drinking water throughout the country. As monitoring of public water supplies increases, so will the detection of various contaminants.
- C. This still leaves millions of private well owners in a questionable level of risk and socially concerned state.
- D. Public concern over water quality, increasing standards, uncertain health risks and the high cost of groundwater remediation are forcing a more preventive, proactive stance to local and state land and water management. This new paradigm will reshape traditional land management programs as they relate to surface and groundwater quality.