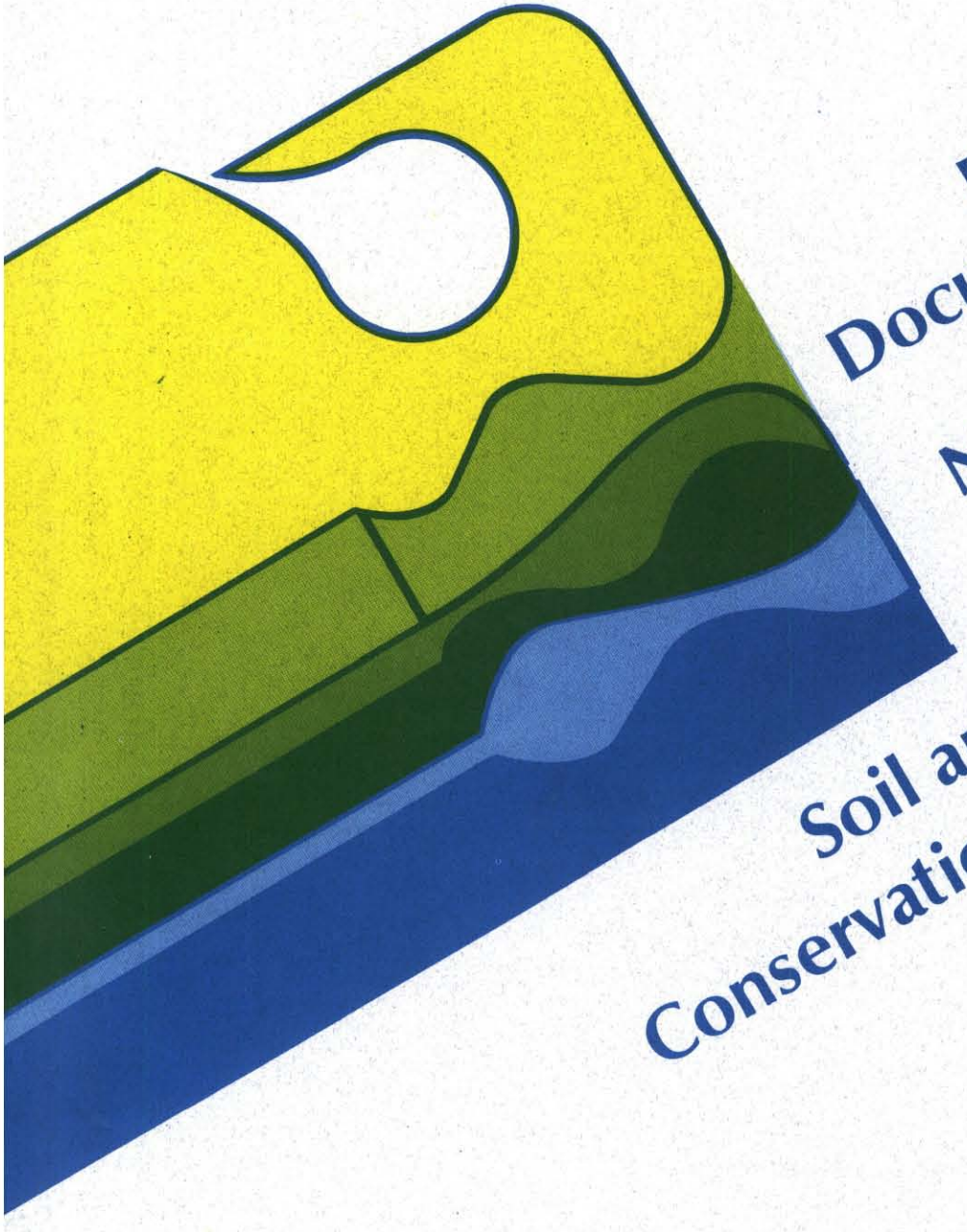

Base Document of the Nebraska Soil and Water Conservation Strategy

Nebraska Natural Resources Commission

STATE OF NEBRASKA
Planning and Review Process

NEBRASKA SOIL AND WATER CONSERVATION STRATEGY

BASE DOCUMENT

Information Current as of 1986

Nebraska
Natural Resources Commission

State of Nebraska
E. Benjamin Nelson, Governor
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Nebraska Natural Resources Commission

Frank Bartak	Bob Gifford	Glen Kroese	Michael Shaughnessy
Ed L. Ediger	David Jones	Donald H. Larson	Clinton VonSeggern
Charles A. Folsom	Harold Kopf	Wilbur L. Nelson	Clifford Welsh
Milton H. Fricke	Vince Kramper	Donald Roberts	Robert J. Yost

Dayle E. Williamson, Director of Natural Resources

Terrence L. Kubicek, Deputy Director

Gene T. Phillips, SCS Liaison
Paul Smith, SCS Liaison

Gerald P. Wallin, Head, Planning Section
Donald Adelman
Herman Harms
Daniel Kloch
James A. Larson
Julie Powers
Vicki Samson
Wanda Schroeder
Ronald Smaus
Steve Soberski
Richard Webster
Laurie Booth
Jill Richters

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PREFACE

The Soil and Water Conservation Strategy is a cooperative inter-agency effort by and between state and federal agencies as well as natural resources districts and select departments of the University of Nebraska. It is intended to guide conservation efforts in Nebraska with reasonable standards and expectations. It also has realistic benchmarks to measure progress.

This Base Document is part of the original Soil and Water Conservation Strategy, which was conceived in 1986 and published in summary form. As such, this Base Document contains detailed information on erosion, land use, conservation agencies and programs as of 1986. In addition, the Action Items appearing in Appendix A were originally published in the Erosion and Sediment Control Program (October 1986).

In effect, the conservation program for the State of Nebraska is founded on the background information of the Base Document. This broad base of information is then sharpened to a policy point in the form of Strategy Updates and further refined as Action Items for implementation.

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Chapter 1. INTRODUCTION

Erosion is a natural process, one that is as old as the earth itself. It is one of the geologic processes that formed the boundless prairie that became Nebraska. When settlers came here a little over a hundred years ago and began turning over the prairie sod, they found a rich, fertile layer of topsoil several feet thick. Today, erosion of this precious soil in many places in Nebraska and much of the world far exceeds the natural formation of new soils. In many instances, the topsoil is completely gone and the subsoil can readily be seen in the shoulders of eroding hillsides.

HISTORY OF CONSERVATION IN AMERICA

Soil erosion first received federal government attention in 1908, when a Division of Soil Erosion was established in the U.S. Department of Agriculture (USDA)-Bureau of Chemistry and Soils. This division was directed to study the effects of erosion on the nation's agricultural lands. Congress didn't recognize soil erosion as a national problem until twenty years later. In 1929, $160,000 was appropriated to establish ten erosion research stations. These stations, located at existing state agricultural experiment stations, were part of the Bureau of Chemistry and Soils, directed by Hugh Hammond Bennett.

Bennett published the circular "Soil Erosion, A National Menace" in 1930, which explained his proposal to put unemployed young men to work on public works programs to control erosion. President Franklin D. Roosevelt acted on this proposal on September 13, 1933, when he created the Soil Erosion Service (SES) as a temporary agency in the U.S. Department of the Interior (USDI). He named Bennett as Director of SES and gave it $500,000 in public works funds to employ people on erosion control projects. By 1934, the SES had completed a national Reconnaissance Erosion Survey which grimly described the spreading damage of erosion across America.

This damage became visible even in Washington, D.C. on an afternoon in late March of 1935. Bennett was testifying in a Congressional hearing on a proposed soil conservation bill when a dust cloud arrived and dramatically blotted out the midday sun. The bill was passed in the House on March 29 and in the Senate on April 19. It became the Soil Conservation Act of 1935, Public Law 75-46, and was signed by President Roosevelt on April 27, 1935.

Public Law 75-46 has been called the major landmark in the nation's conservation movement. Citing the "wastage" resulting from erosion as a "menace to the national welfare," the law established the Soil Conservation Service (SCS) within the USDA. The SES, which had been transferred from the USDI to the USDA on March 25, 1935, was renamed the SCS. The erosion research stations of the Bureau of Chemistry and Soils and the Civilian Conservation Corps (CCC) camps of the Forest Service were also transferred to the SCS. By the summer of 1936, the SCS was operating 23 research stations, 454 CCC camps, and 17 demonstration projects. The SCS had also developed conservation plans for nearly five million acres of land.

Just as the consolidation of all the federal erosion-control activities under a single agency was beginning to show results, Congress passed the Soil Conservation and Domestic Allocation Act of February 29, 1936. This act gave the Agricultural Adjustment Administration (AAA) a major role in soil conservation through the establishment of a new "cost-sharing" program, the Agricultural Conservation Program (ACP). Under the program, farmers received payments for shifting their land from the production of soil-depleting surplus crops into erosion-preventing and soil-building crops, such as grasses and legumes. Farmers also received payments for installing certain soil conservation practices. The ACP established local and state committees to administer the program.

The federal government's effort to involve local authorities in conservation activities intensified on May 13, 1936 when the USDA Land Policy Committee published a proposed "Standard State Soil Conservation Districts Act." If this model law was passed by the states, it would provide for the creation of local conservation districts to administer federal and state programs. Districts would also be able to make agreements with landowners, provide assistance, propose land-use regulations, and

conduct erosion research and demonstration projects. President Roosevelt sent a letter to all the governors, urging each state to adopt legislation similar to the model law. In his letter, he discussed the seriousness of erosion, the need for federal, state, and local cooperation, and his conviction that "...the nation that destroys its soil destroys itself." Twenty-two states, including Nebraska, passed soil conservation district laws in 1937 and, by 1947, the remaining states had adopted district legislation.

In June of 1936, Congress passed the Omnibus Flood Control Act. It authorized USDA to carry out runoff retention and erosion prevention improvements in upstream watersheds. A later act, the Flood Control Act of 1944, limited upstream watershed programs to land treatment measures and minor land stabilization structures. These measures provided limited flood protection benefits and it became apparent that better flood protection was needed on the small tributaries. This need was addressed on August 4, 1954 when Congress passed the National Watershed Protection and Flood Protection Act, Public Law 83-566. This act gave local organizations the responsibility for starting watershed projects, sharing in the cost, acquiring all land rights, and operating and maintaining the completed project. It was the first permanent small watershed legislation in the nation and is still in effect today.

NEBRASKA'S CONSERVATION HISTORY

Nebraska's interest in soil conservation dates back to the 1880s, when the Agricultural Research Experiment Stations (ARES) first conducted soils studies. The first soil survey in Nebraska was published in 1903. It covered the northwest portion of Stanton County and the corners of Madison, Pierce, and Wayne counties. Reporting on the results of the early research efforts, the April 22, 1908 issue of Nebraska Farmer warned that farmers "...must not jeopardize the strength of the nation by impairing the producing capacity of the soil."

By 1920, the Nebraska Agricultural Extension Service (NAES) had begun a statewide campaign to control soil erosion. The campaign included the publication of soil erosion studies and an education program to encourage farmers to adopt simple conservation measures. In June of 1924, an Extension Service circular estimated that 16 million acres of land in the east and southcentral part of the state were subject to "appreciable" damage from erosion. The circular recommended farming on the contour, planting legumes, and building terraces to prevent erosion.

The first federal erosion control demonstration project in Nebraska was established by the SES in March 1934. It was located in the Plum Creek watershed near Albion. Nine CCC camps were operating in the state by the summer of 1935.

In July 1935, the Nebraska Soil Conservation Advisory Committee was established. Its primary functions were to coordinate the various agencies involved with soil conservation and to encourage the formation of soil conservation associations. Legislative Bill 553, passed in May of 1937, created the State Soil Conservation Committee (SSCC), which gradually took over the functions of the Nebraska Soil Conservation Advisory Committee. Members of the first SSCC were George F. Condra, Director of the Conservation and Survey Division (CSD), W.H. Brokaw, Director of the NAES, and W.W. Burr, Director of the ARES.

The passage of LB 553 was not easily accomplished. At a March 25, 1937 public hearing, over 100 farmers and farm groups went on record against the provisions allowing enforcement of land use regulations. Most felt that soil erosion could be solved by farmers working individually, without organized community action. One leading farm magazine called LB 553 an "...example of...government planning, a la Russia...", while another called it "...not democracy, but dictatorship...as we might expect in...Italy!" After several amendments, the final version was passed on May 13, 1937 by a vote of 36 to 6. While the final bill retained the provision allowing conservation districts to adopt land use regulations, the authority to enforce the regulations was deleted. Governor Cochran signed LB 553 on May 18, 1937.

For nearly a year after the passage of LB 553, the formation of soil conservation districts remained controversial. The first referendum to create a district, in Johnson, Otoe, and Pawnee counties, was held at Burr on November 13, 1937. Only 20 percent of the eligible landowners turned out and the referendum was defeated on a vote of 98 to 113. Through the fall of 1937, the SSCC conducted six more hearings on proposed districts, but all six failed.

Nebraska's first successful referendum to create a district was held in Washington County on February 19, 1938. Over half of the 363 eligible landowners turned out, and the final vote was 159 for the creation of the Washington County district and 25 against. The new district was named the Papio Soil Conservation District.

Seven district referenda were approved in 1939, ten were approved in 1940, and 12 were added in 1941. By the end of 1941, soil conservation districts covered six million acres of the state, which was about one-fifth of the state's farms. On January 8-9, 1942, the Nebraska Association of Soil Conservation Districts was formed. After the approval of the Perkins County district on December 16, 1949, Nebraska became the first state west of the Mississippi River to have all of its land in organized soil conservation districts.

Other significant conservation legislation followed in the 1950s and 1960s. Legislation was passed in 1957 to provide for the formation of Watershed Conservancy Districts and the Nebraska Soil and Water Conservation Committee to serve as sponsors of PL 566 watershed projects. That organization became the Nebraska Soil and Water Conservation Commission in 1961. In 1964 the Legislature broadened the Commission's responsibilities to include comprehensive water and related land resources planning. The Natural Resources Data Bank was authorized in 1969.

Legislative Bill 1357 was passed in 1969 also. It provided for the merger of existing soil and water conservation and other water resources districts into Natural Resources Districts (NRDs). In addition, the groundwork was laid for the reorganization of the Nebraska Soil and Water Conservation Commission, which led to creation of the current Natural Resources Commission in 1972. Amendments to LB 1357 were passed in 1971 and 1972 before the merger into NRDs actually took place on July 1, 1972.

NEED FOR A STRATEGY

Over fifty years of federal, state, and local conservation programs have produced significant results. It was estimated in 1985 that 62 percent of Nebraska's agricultural land had adequate land treatment. However, much remains to be done, and as is often the case, the last to be done is the most difficult. The remaining untreated lands are generally those on which the land owner or operator fails to see sufficient short-term benefits to venture the cost of applying needed measures. The cost of such practices may also exceed the owner's financial resources. In addition, the 62 percent considered adequately treated will need to be continually maintained by assisting landowners and operators with future conservation decisions.

While the short-term losses caused by erosion affect individual farmers, long-term damages such as reduced national productive capacity, reduced water quality, and sedimentation damages to road ditches, streams, and reservoirs affect the entire country. Recent estimates have placed the net annual damage caused by soil erosion at over $6 billion dollars. Further action must be taken to reduce the damages caused by this physical problem.

At the State level, the soil and water conservation effort has been primarily the distribution of the Soil and Water Conservation Program funds to NRDs for cost-sharing with farmers. It appears to be in the best long-term interest of the State to take a lead role in the protection of the resource base to help sustain production, because a large share of Nebraska's economy is based on agricultural production.

INITIATION OF STRATEGY STUDY

Nebraska statutes created the predecessors to the Natural Resources Commission (NRC) as the "...official agency of the state in connection with soil and water conservation,...." A 1983 revision to the Nebraska Soil and Water Conservation Act says, "The Legislature recognizes and hereby declares that it is the public policy of this state to properly conserve and utilize the water and related land resources of the state....The Legislature further declares that it is in the public interest of this state to financially assist in encouraging water and related land resource conservation measures on privately owned land and that this will produce long-term benefits for the general public." Despite having this state statutory responsibility for soil and water conservation, the NRC's major thrust as a planning agency over the past several years has been in water planning.

Shortly after his inauguration, Governor Kerrey held a press conference devoted to soil and water conservation issues. He presented data prepared by SCS and the state association

of NRDs which indicated that over $335 million of production increases and/or cost reductions could be realized annually in Nebraska by the application of needed soil and water conservation practices. The data indicated the need for an additional $862 million worth of practices on 27 million acres. A September 1983 meeting between Governor Kerrey and Sherman Lewis, SCS State Conservationist, and Dayle Williamson, Executive Secretary of the NRC, resulted in an agreement to develop and implement a State Soil and Water Conservation Strategy.

DEFINITION OF THE STRATEGY

The Soil and Water Conservation Strategy and accompanying Action Plan is a strategy for conserving the soil and water resources of the state for the benefit of current and future generations. It calls for a renewed commitment to soil and water conservation in Nebraska. The Strategy contains an analysis of the state's resources–their condition, alternatives and goals for improvment. Recommendations and alternatives, as well as an action plan for implementation are included.

The Strategy is designed to include several basic activities. The programs pertaining to soil and water conservation of all state and federal agencies will be examined to improve coordination and eliminate duplication. An effort will be made to coordinate the distribution of eligibility and funding information on these programs. Administrative and regulatory policies dealing with resource conservation in Nebraska and other states will be reviewed to develop recommendations for modification of existing policies or implementation of new policies. The review will include an analysis of the impact of changes in funding levels on soil and water conservation in Nebraska. State and federal tax policies will also be examined to determine their impact on conservation. Management policies for land owned by the state will be reviewed to ensure that applicable conservation practices are adopted. An analysis of water quality issues associated with conservation practices will be conducted, which may indicate the need for additional changes in state policies and programs. Other areas to be addressed include data assembly, research needs, and public education/information programs. Periodic reports on these soil and water conservation needs, with strategies to address these needs, will be submitted to the Governor and the Legislature as part of the NRC planning process.

The purpose of the Strategy is to initiate new policies or strengthen existing policies, programs, or funding for accelerating land treatment with conservation measures or practices. This effort would effectively commit the state to the maximum utilization, protection, and conservation of its soil resources. Although the initial thrust of the strategy involves planning for three to five years, it is expected to guide a long-term state commitment. Objectives of the programs implemented or accelerated by the Strategy are:

(1) Promote the use of soil within its capability. This will help sustain a continuing supply of food and fiber by maintaining production and by supporting the agricultural base necessary for the economic vitality of Nebraska. It would also help prevent damage to highly erodible lands due to improper land use.

(2) Protect and improve the soil and forage resources of the state's grasslands, sustaining their productivity and improving economic returns.

(3) Enhance the quality of the state's waters by protecting them from sediment and other agricultural pollutants.

(4) Conserve and protect the state's surface water and ground water to ensure adequate supplies for sustaining life, maintaining agricultural production, and preserving recreation opportunities and aesthetic appeal.

SCOPE OF THE STRATEGY

The geographic range of the study is statewide. Originally conceived as a soil conservation study and considered to include only rainwater conservation, it was expanded early to a soil and water conservation strategy that also includes on-the-farm irrigation water management. Soil and water are so closely related as natural, physical systems that it is impossible to fully understand, wisely use, or effectively manage one without considering the other.

Within this framework, the Strategy considers existing programs for soil and water conservation being carried out by the federal government, state agencies, local units of government, and private organizations. It is anticipated that the Strategy will be useful in determining how the state may become an equal partner with local and federal efforts, and establish a framework by which all efforts are coordinated, focused, and evaluated. An integral part of the strategy will be an action plan for implementation and a follow-up process to assess progress.

The Strategy is primarily a policy-making, program planning document and is not concerned with individual conservation management or mechanical practices. However, action items relating to individual farmers, land users, and land utilization decision-makers are included. Indeed, they are the final authorities in determining the extent the strategy is implemented and are the final arbiters of its success.

PARTICIPATION IN THE STRATEGY

The Strategy development effort was organized during the fall of 1983. An executive committee was formed consisting of the Governor's Assistant for Natural Resources; Directors of the State departments of Agriculture and Environmental Control; The Executive Secretary of the NRC; USDA representatives including the SCS State Conservationist, the Director of the Cooperative Extension Service, and the Program Manager for ASCS; and the President and Executive Director of the Nebraska Association of Resources Districts. The Chief of the NRC Planning Division was appointed Project Manager. An Advisory Committee consisting of the general managers of the NRDs and technical staff from the organizations on the executive committee participated throughout the process.

In February 1984, an Intergovernmental Personnel Act contract was signed between NRC and SCS. As a result, a Resource Conservationist from SCS was detailed to the NRC for over two years to work full-time on the Strategy. This action officially committed both agencies to the study effort. Meetings were then held with NRD directors and staff, local SCS employees, and others with an interest in the Strategy. A symposium was held in February 1985 which included extensive public involvement, nationally known speakers, and small discussion groups.

The NRC and the SCS cooperated with many state and federal agencies to develop the Strategy. The action items, the key to this Strategy, were developed through negotiations with the following agencies: The Board of Educational Lands and Funds, Nebraska Department of Education, Nebraska Department of Agriculture, and Natural Resources Districts.

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Chapter 2: RESOURCES, USES, AND CONSERVATION NEEDS

Nebraska has abundant supplies of two basic resources: land and water. In the past they have not always been put to the best use or used carefully, so problems have arisen in some areas. The resources, their uses, the problems, and the potential for the future are reviewed in this chapter.

LAND RESOURCES

The land resources of the state vary widely. Mineral resources are limited in number, and small areas are barren of soil and vegetation, but the vast majority of the land is well suited to agricultural production of some type. About 54 percent of the land is suitable for cultivation, 43 percent is suitable for pasture, range, and other agricultural uses, and only three percent is classified unusable for agriculture.

In 1970, about 95 percent of the state was in agricultural uses, about three percent was being used for transportation, urban, and related uses, and about one percent was covered with water. The remaining one percent was used for recreation, fish and wildlife, mineral areas, and military use. A 1982 inventory showed that 28 percent of the agricultural land was nonirrigated cropland, 15 percent was irrigated cropland, 54 percent was pasture and range, and 3 percent was forest lands or farmsteads.

NEBRASKA SOILS

Soils are a product of the interaction of biologic activity and climatic conditions with the parent material from which the soils are developed. Soil production and erosion are continuing processes that have been going on since the beginning of time. Geologic studies show that the climatic and geologic conditions that controlled soil formation and erosion in the past varied from one extreme to the other. Nebraska has experienced times when the amount of precipitation was sufficient to support hardwood forests and other times when precipitation was so low that the Sandhills region was a vast desert. Temperatures have also varied widely and exerted a marked effect on soil development.

There are three main physiographic divisions in Nebraska: the High Plains, the Sandhills, and the Loess region. The soils in the High Plains vary widely, but the soils of the Sandhills are mostly sandy. Loess soils are generally found in the eastern and southern parts of the state.

The topography of the High Plains is characterized by broad table lands and wide valleys. These soils are generally high in alkalinity because the low annual rainfall permits little leaching. The Sandhills areas of the central and northern part of the state are a continuous succession of dunes and swales. The soils are thin and sandy, permitting rapid infiltration of water.

The loess soils of the eastern and southern parts of the state lie atop steep irregular slopes along the Missouri River, the moderately steep rolling hills of most of eastern Nebraska, and gently sloping plains elsewhere. These soils are usually loamy to moderately clayey in texture. The water infiltration rate is moderate to moderately slow, but water holding capacity is very good.

LAND USE

Nebraska was covered with prairie grasses when the first settlers began breaking the sod and planting crops a little over 100 years ago. This conversion of the land to agricultural use continued until the 1920's. Some minor fluctuations in the amount of tilled land occurred since then, but most of the land in the state has been used for agriculture for nearly a century. Urban and other uses of land have always occupied a minor part of the total area of the state.

Historical Land Use

Very little data is available on the use of the land early in the state's history. However, the data on population and economic growth give some indication of the nature of the use of the land. Figure 2-1 shows the population growth and distribution between rural and urban areas since the first census was taken in 1854.

Even though settlement began before Nebraska became a territory in 1854, it was not significant until after the Civil War and statehood in 1867. Settlers were encouraged to move into Nebraska by the Homestead Act of 1862. The act allowed acquisition of 160 acres of land by living on it for five years and making certain improvements. Homesteaders were permitted to file for an additional 160 acres by the Timber Culture Act of 1873. To comply, they had to plant trees on one forty-acre plot of the 320 acres.

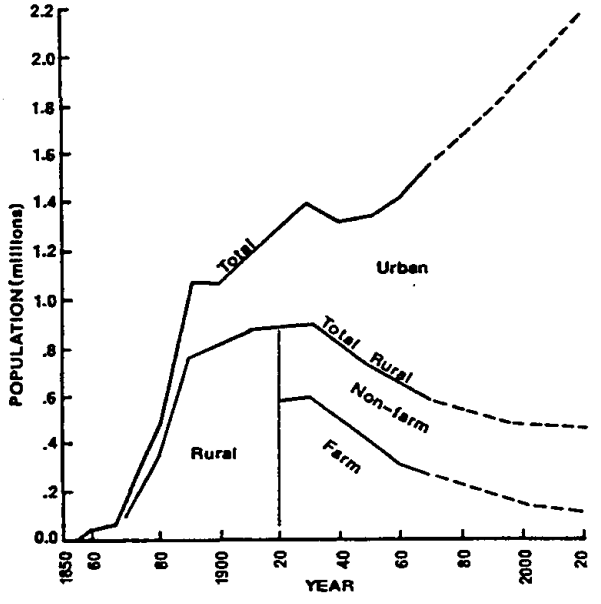


Figure 2-1
NEBRASKA POPULATION

Agricultural development was stimulated by the Homestead Act of 1862, but distant markets and inadequate transportation retarded its growth. Completion of the transcontinental railroad through Nebraska not only improved transportation, but the railroads themselves stimulated the development of agriculture by their efforts to sell and settle the lands they had been given.

State population and the number of farms grew fastest between 1867 and the drought of the 1890's. This severe drought caused the failure and consequent emigration of many farmers who had not learned the techniques of farming the relatively arid prairie. Those who remained learned how to survive and some even prospered under such adverse conditions. By 1890, the initial settlement of agricultural land in the state was nearly complete and the periods of rapid population growth were over.

The Kincaid Act of 1904 further encouraged settlement by permitting people who had not homesteaded to file on 640 acres. Under this act, existing homesteaders could increase their holdings to 640 acres. Homesteaders initially selected sites near perennial streams to avail themselves a continuous supply of water. Wells were dug by hand during this time so it was difficult to reach the main aquifer, especially in the rolling hills. Many of the towns also were built near perennial streams for the same reason, which meant that most of them were in the floodplains.

Growth was fairly steady until drought and depression in the 1930's brought severe hardships and forced many farmers from the land. The population continued to decline until the economy turned upward during World War II. Since the 1930s, the total population of the state has been growing slowly, even though the farm population has continued to decline.

History shows that land use has not been static. As the state's population increased, farmland was annexed by cities and towns. Economic conditions also caused shifts in land use. Improvements in farm technology, such as conservation tillage, terraces, irrigation, and drainage, have made it possible to farm land that was previously unsuited to row crops. Changes in ownership, from individuals to corporations, have also caused changes in land use. Table 2-1 gives a comparison of land uses from 1929 to 1982.

Table 2-1

COMPARISON OF LAND USES FROM EARLY RESOURCES INVENTORIES

Year	Cropland	Range and Pasture	Forestland Grazed and Ungrazed
	(1,000 Acres)		
1929	26,503.9	20,708.0	941.2
1934	25,361.6	22,285.1	934.2
1982	20,276.7	25,221.0	732.1

Recent Land Use

Several inventories of land use and conservation needs have been made by the USDA. Conservation Needs Inventories were conducted in 1958 and 1967, and National Resources Inventories (NRIs) were conducted in 1977 and 1982. Table 2-2 gives a summary of the 1982 NRI data by NRD. The data have a high degree of accuracy on major land resource areas greater than one million acres, with the accuracy decreasing in smaller areas. It is considered adequate for planning purposes using the NRD land mass as the planning unit.

Cropland. Cropland categories in the 1982 NRI inventory include row crops, close-grown crops, horticulture, and hayland except native hay, which is classified as rangeland. Figure 2-2 shows that 43 percent of Nebraska is devoted to cropland. Of those 20.3 million acres, 62 percent is planted to row crops, 17.5 percent is close-grown crops, 12.4 percent is other cultivated crops, 7.7 percent is hayland, and the rest is horticulture.

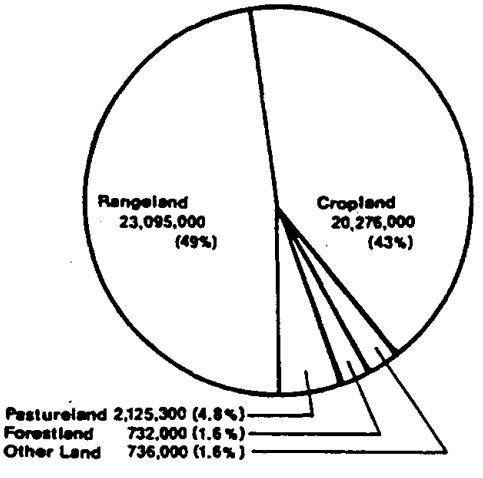


Figure 2-2
LAND USE IN NEBRASKA

Pasture. Pasture is considered to be land vegetated with introduced grasses. These grasses are usually easy and relatively inexpensive to establish. They include, but are not limited to, brome grasses, tall fescue, orchardgrass, and some of the wheatgrasses. Most introduced grasses have shallow root systems, but produce very well when moisture and nutrients are adequate. This limits their dryland use to areas of the state with higher rainfall and loamy to clayey soils with higher water holding capacities. The recent use of single native grass species for pastures is extending pastures to drier regions with sandy soils. Figure 2-2 shows that 2.1 million acres (4.8 percent) of all agricultural land in Nebraska is pasture.

When economic returns are favorable, pastures are often plowed and planted to row crops. It is fairly easy and inexpensive to shift back to pasture when farm prices and farm programs dictate. However, changing land from pasture to cropland and back complicates erosion control. Some practices, such as terraces for cropland, should not be needed and, in fact, may be a hindrance when the land is seeded back to grass.

Rangeland. Rangeland is land on which the vegetation is dominated by native grasses, forbs, or shrubs. Tall grass species, usually found in the eastern part of the state, include big bluestem, sand bluestem, indiangrass, and switchgrass. Medium height grasses, such as sideoats grama, little bluestem, needleandthread, and green needlegrass, are found throughout central Nebraska. Short grasses such as buffalo grass, blue grama, hairy grama, and alkali sacaton are most common in western Nebraska.

Rangeland acres have remained fairly constant in recent years. Minor fluctuations have resulted from efforts to return critically eroding cropland to rangeland. At the same time, the center pivot boom of the late sixties and seventies caused some rangeland to be broken up and converted to cropland. Because of economic reasons irrigation development has slowed, nearly stabilizing this land use again. Figure 2-2 shows that 23.1 million acres (49 percent) of Nebraska's agricultural land is rangeland. Over 11 million acres of rangeland are in the Sandhills, and most of the remainder is in the western half of the state.

Forest. Land in forests has also decreased as a result of periodic increases in cropland. Since 1958, over 300,000 acres have changed to either cropland or grassland. Forest is defined as land that is at least 10 percent stocked by trees at the stump or ground level, in plots at

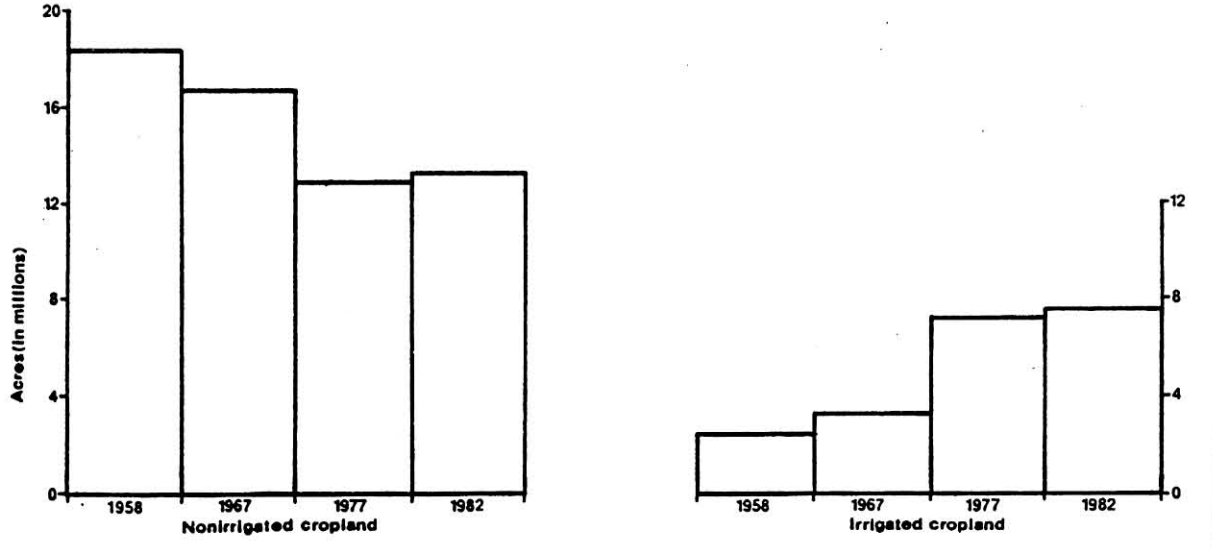
Table 2-2

LAND COVER/USE OF NONFEDERAL LAND AND SMALL WATER IN 1982

NRD	Rural Land						Urban and Built-up Land	Rural Transportation	Small Water Area	Total
	Cropland	Pasture	Rangeland	Forest Land	Cover/Uses	Total				
	(1,000 Acres)									
Upper Big Blue	1,590.1	96.2	70.3	14.3	38.1	1,809.0	17.4	46.4	1.4	1,874.2
Lower Big Blue	758.7	123.7	58.9	31.3	19.7	992.3	10.4	29.2	0.0	1,031.9
Upper Elkhorn	544.1	58.9	1,181.5	6.2	34.3	1,825.0	12.7	38.9	1.4	1,878.0
Lower Elkhorn	1,989.8	265.2	113.0	20.3	92.4	2,480.7	22.9	64.1	6.1	2,573.8
Little Blue	1,076.8	39.8	272.0	21.0	28.1	1,437.7	17.8	37.4	3.5	1,496.4
Upper Loup	113.8	8.0	4,004.8	0.0	25.8	4,152.4	1.0	20.7	4.2	4,178.3
Lower Loup	1,765.5	295.2	2,736.9	33.2	97.0	4,927.8	18.3	79.7	11.8	5,037.6
Lewis & Clark	548.3	183.5	201.7	6.3	19.3	959.1	15.5	23.5	0.0	998.1
Middle Mo. Trib.	368.0	79.2	15.3	34.0	13.4	509.9	6.0	9.4	0.0	525.3
Papio	375.5	40.0	0.5	32.5	19.6	468.1	109.4	18.0	6.2	601.7
Nemaha	1,072.3	327.7	16.1	49.8	33.8	1,499.7	13.5	42.1	8.8	1,564.1
Upper Niobrara	882.1	151.2	2,958.2	230.8	36.3	4,258.6	12.7	41.5	11.2	4,324.0
Mid Niobrara	225.3	5.5	2,431.2	18.4	19.3	2,699.7	4.0	18.5	0.0	2,722.2
Lower Niobrara	455.9	67.8	1,043.3	64.0	27.2	1,658.2	6.8	33.3	1.4	1,699.7
North Platte	816.6	31.3	1,913.7	9.4	48.7	2,819.7	15.0	36.4	13.2	2,884.3
South Platte	1,061.9	29.6	508.3	0.0	14.2	1,614.0	7.8	31.7	0.8	1,654.3
Twin Platte	531.8	4.7	1,965.6	35.9	30.5	2,568.5	19.4	31.3	1.1	2,620.3
Central Platte	1,115.0	48.2	671.9	36.9	39.3	1,911.3	33.0	51.2	3.4	1,998.9
Lower Platte N.	778.4	86.6	16.0	6.5	25.8	913.3	11.1	23.3	0.0	947.7
Lower Platte S.	702.7	153.2	13.7	34.2	25.0	928.8	48.6	32.3	0.0	1,009.7
Up. Republican	975.4	3.3	698.0	0.0	15.3	1,692.0	4.6	23.4	3.0	1,723.0
Mid. Republican	1,111.1	0.0	1,291.7	9.6	19.9	2,432.3	7.5	31.6	4.6	2,476.0
Low. Republican	762.5	8.6	679.0	27.6	20.6	1,498.3	8.6	35.6	8.4	1,550.9
Tri-Basin	655.1	17.9	234.1	9.9	15.7	932.7	5.7	22.7	4.1	965.2
Nebraska	20,276.7	2,125.3	23,095.7	732.1	759.3	46,989.1	429.7	822.2	94.6	48,335.6

Source: 1982 Nebraska Resources Inventory: NRI/NRD Individual and Summary Tables for 24 Nebraska Natural Resources Districts, USDA, Soil Conservation Service, November 1986.

Figure 2-3
TRENDS IN IRRIGATED AND NONIRRIGATED CROPLAND



least 120 feet wide and one acre in size. Most of Nebraska's forest lands are along rivers and streams.

The NRI survey includes only non-federal land, so Nebraska's National Forests are not included. Figure 2-2 shows 732,000 acres in forests. Nearly 60 percent of this acreage is grazed by livestock.

Land Use Trends

The inventories of 1958, 1967, 1977, and 1982 provide a general overview of the trends in land use. While total cropland acres changed very little, the changes from non-irrigated to irrigated crops were significant. The 3.3 million acres of irrigated cropland in 1967 increased to over 7 million in 1982. The trends are shown in Figure 2-3. Most of the added irrigated acres were converted from dryland cropland, although some were converted from pasture, range, and forest lands.

Pastureland nearly doubled from 1967 to 1977, but decreased by one-fourth from 1977 to 1982. Over one million acres of rangeland were removed from 1967 to 1977, although one-third of that had been restored by 1982. Forestland showed a continuous decline from 1967 to 1982, decreasing by 25 percent.

The trends of changing land use have stabilized in the past few years and should remain stable until economic factors such as crop prices, beef prices, or interest rates change to improve the margin of profit.

LAND CAPABILITY

Most of Nebraska's land is suitable for some beneficial purpose. The majority is capable of sustaining some agricultural production. However, there are areas in the state with severe land use limitations.

Non-agricultural Capability

Some of the non-agricultural land in the state is capable of being used for urban, transportation, and related uses. Only a limited amount of land is suitable for mineral recovery including gravel pits, limestone quarries, and oil wells. Larger areas are underlain by oil and gas,

Figure 2-4
LAND CAPABILITY CLASSIFICATION MAP

but only a small amount of land is actually needed for its production.

Agricultural Capability

The SCS identifies all rural land using eight land capability classifications, according to its suitability for intensive agricultural use. Class I lands have few, if any, limitations restricting their use. Classes II through IV have increasingly greater limitations but are still considered suitable for agricultural production. Classes V, VI and VII have such severe limitations that they are suited only for permanent vegetation. Class VIII has no potential for agricultural use. Classes II through VII are divided into subclasses to identify specific limitations or problems that restrict use. The subclass letter "e" represents an erosion risk, "w" indicates wetness, "s" indicates soil limitations, and "c" indicates climatic limitations.

The immense Sandhills area makes Class VI Nebraska's largest classification. Compared to western neighbors, Nebraska has a very small percentage of Class VII and VIII land. Table 2-3 gives land use by capability class and subclass. Figure 2-4 is an example of a land capability map.

EROSION

Erosion is a continuous natural process which moves soil by wind, water or other natural action. It is frequently accelerated by human activities, however. Before cultivation began, the soils were covered with grasses which provided protection from the wind and rain, so the rate of erosion was very low.

Water Erosion

Cultivation removed the protective grasses and exposes the soil to the forces of nature. Raindrops falling on bare soil dislodge soil particles and carry them with runoff water. Soil particles tumbling in the runoff water strike other particles, dislodging them, and accelerating the process.

The removal of a thin, fairly uniform layer of soil is called "sheet" erosion. This type of erosion usually isn't detected unless muddy runoff and sediment buildup occur. Land

Table 2-3

RURAL LAND USE BY CAPABILITY CLASS

Class and Subclass	Rural Land					
	Cropland	Pasture	Rangeland	Forest Land	Minor Land Cover/Uses	Total
	(1,000 Acres)					
I	2,498.2	60.6	36.1	10.9	61.0	2,666.8
IIe	4,351.9	177.0	372.4	26.5	140.9	5,068.7
IIw	1,491.4	198.3	154.3	47.1	47.5	1,938.6
IIs	728.6	9.5	23.1	1.5	17.9	780.6
IIc	1,391.0	16.2	139.3	0.0	41.2	1,587.7
All II	7,962.9	401.0	689.1	75.1	247.5	9,375.6
IIIe	4,679.1	525.3	1,075.8	24.9	146.8	6,451.9
IIIw	464.1	48.4	126.9	11.7	4.3	655.4
IIIs	102.5	1.2	7.6	0.0	0.0	111.3
IIIc	154.9	2.6	22.9	0.0	3.7	184.1
All III	5,400.6	577.5	1,233.2	36.6	154.8	7,402.7
I-III	15,861.7	1,039.1	1,958.4	122.6	463.3	19,445.1
IVe	2,835.2	511.3	2,299.0	29.5	92.8	5,767.8
IVw	173.9	18.7	292.2	5.5	2.7	493.0
IVs	124.3	28.7	103.7	2.4	1.6	260.7
IVc	0.0	0.0	0.0	0.0	0.0	0.0
All IV	3,133.4	558.7	2,694.9	37.4	97.1	6,521.5
I-IV	18,995.1	1,597.8	4,653.3	160.0	560.4	25,966.6
V	41.5	19.7	564.5	22.1	3.1	650.9
VIe	978.3	352.8	12,475.7	116.9	45.0	13,968.7
VIw	115.9	68.2	397.4	113.2	31.4	726.1
VIs	114.7	36.7	884.4	14.0	5.7	1,055.5
VIc	5.4	0.0	3.8	0.0	0.0	9.2
All VI	1,214.3	457.7	13,761.3	244.1	82.1	15,759.5
VIIe	8.9	35.5	3,512.4	47.0	10.4	3,614.2
VIIw	3.9	1.1	8.2	0.0	0.0	13.2
VIIs	10.3	9.6	540.1	236.1	21.1	817.1
VIIc	0.0	0.0	0.0	0.0	0.0	0.0
All VII	23.1	46.2	4,060.7	283.0	31.5	4,444.5
VIII	2.7	3.9	55.9	22.9	59.4	144.8
V-VIII	1,281.6	527.5	18,442.4	572.1	176.1	20,999.7
NA	0.0	0.0	0.0	0.0	23.6	23.6
Total	20,276.7	2,125.3	23,095.7	732.1	760.1	46,989.9

Source: Nebraska Final 1982 NRD Tables, USDA, Soil Conservation Service, November 1984.

owners may overlook the real damage because this serious problem is difficult to recognize.

As runoff water moves in sheets down a slope, it begins to concentrate, forming channels two to four inches deep. This "rill" erosion is nearly always present below areas of sheet erosion. "Ephemeral" erosion occurs when subsequent runoff follows the same rills, deepening them into ditches four to eighteen inches deep. Rills cause little effect on farm machinery, but ephemeral erosion becomes a nuisance to cross. If left unchecked, ephemeral erosion will turn into gullies.

"Gully" erosion is the most visible type of erosion and is typified by ditches greater than 18 inches deep. Once started, gullies can grow deeper and wider very rapidly because the gully cuts below the level where organic matter and soil structure tend to hold the particles together. Without these physical properties, the soil erodes much faster. Although gully erosion is the most visible, more soil is removed by sheet, rill, and ephemeral erosion.

Wind Erosion

The force of wind on bare, dry soil dislodges soil particles, causing them to collide with one another. Continued wind action on soil reduces the particle size, permitting it to be carried aloft. Tillage that bares and loosens the soil, permitting it to dry out, is an invitation to wind erosion. This type of erosion removes the nutrient-rich, organic matter-laden topsoil, in turn reducing the ability of the soil to produce. The airborne particles can even cut off emerging plants, further reducing the plant cover and magnifying the problem. The damage occurs not only where the soil is removed, but also where the soil drifts and covers existing vegetation.

Damage Caused by Erosion

Both wind and water erosion cause damage, which ranges from economic losses to water pollution. Farmers, ranchers, the public, and even fish and wildlife are affected by erosion damage.

Sediment and Water Quality. Erosion will increase the amount of sediment and suspended solids in streams, rivers, and lakes, degrading their water quality. These materials can originate within streams via streambank erosion and resuspension of bottom sediments, or from erosion of soils in the surrounding watershed. Certain amounts of these materials are natural, but human activities have intensified the processes and associated problems. Consumptive uses, recreational uses, and fish and other aquatic life are all affected by sedimentation.

The impacts on the above uses are related to the following four general effects of excessive suspended solids on water quality. 1) Nutrient, pesticides, and heavy metals attached to sediment alter the water chemistry, can accelerate eutrophication in lakes, and can make water unfit for domestic and aquatic uses. 2) Increased turbidity limits the amount of light passing through the water, in turn decreasing photosynthetic growth and primary food production in aquatic systems. 3) Increased amounts of organic materials are carried into the water. As the organic matter settles and decomposes, dissolved oxygen levels can decrease. 4) The physical presence, movement, and accumulation of excess sediment, bed load, and suspended solids may clog or abrade fish gills and other respiratory surfaces, provide conditions conducive to disease-related organisms, and change the streambed composition critical for various life forms.

Erosion and sedimentation can have acute effects on wildlife and fishery resources. Toxic chemicals attached to sediment can poison fish and wildlife when introduced into their water supply and food chain. Another example is the direct suffocation of fish eggs by a layer of sediment.

Other effects on aquatic life may occur more subtly over time. Species more tolerant of high levels of sediment and suspended solids may replace formerly diverse and stable aquatic communities. Highly desirable sport fish such as trout, bass, walleye, and pike may be replaced by highly tolerant but less desirable species such as carp and bullhead. Overall, the aquatic community may experience a shift from healthy, diverse, and abundant organisms to fewer types of organisms in less abundance, which reflects the degraded health of the aquatic community.

Another indirect effect of sedimentation on wildlife and fisheries is the acceleration of the natural aging process of lake and pond habitats. In this process, an area changes from aquatic habitat to terrestrial habitat. Under natural conditions the aging process is successional, taking long periods of time for any perceptible change. Whether this process involves decades

or centuries depends on many factors, including geology, soils, plant cover, and the natural physical, chemical, and biological characteristics of the lake or wetland. Sediment loading from excessive erosion can cause virtual overnight changes in physical and chemical characteristics that otherwise might take decades to occur.

Impacts on Terrestrial Wildlife. The reactions of wildlife and fish to these changes are complex and variable according to conditions at specific sites and the requirements and sensitivity of the species involved. The situation is further complicated because habitat for some species may be created or improved by the factors that destroy or degrade the habitat of another species. Generally, however, gains are only temporary. For example, accumulation of sediment can convert a highly valued deep-water fisheries habitat into a cattail marsh of only limited fishery value. The marsh may, however, serve as breeding and migration habitat for waterfowl and may also support furbearers. Continued deposits of sediment may ultimately eliminate the attractive mix of open water and emergent cattail-bulrush stands, which may be replaced by dense stands of less desirable vegetation.

Sedimentation results in stream bed aggradation, which is the capacity of the stream course to convey seasonal and storm-related high flows. When this occurs, flooding is the result. A frequent response to flooding is to mechanically straighten the stream, further reducing the use of the stream to fish and wildlife.

Wildlife research conducted in Missouri established that the weights of wild raccoons and rabbits were markedly influenced by soil fertility. Although this relationship has not been demonstrated in Nebraska, it would not be unreasonable to assume that if soil loss continues for a long time without correction, terrestrial wildlife species will be harmed by cropland erosion and deposition of sediment.

Benefits to wildlife are usually secondary concerns to most farm operators. Yet, as wildlife becomes scarcer as a result of greater pressures on the land base, the surviving stock of wildlife automatically takes on an increased value. Therefore, many farmers and ranchers could be adding this dimension to their planning effort. Opportunities to integrate wildlife production with economic goals vary from region to region and from farm. Many opportunities exist to convert uneconomic remnants of cropland and pasture to uses that are tailored to wildlife benefits.

Economic Losses. Erosion results in economic losses in a variety of areas. As topsoil is eroded, the productivity of the land decreases. An SCS study in southeast Nebraska determined that applying land treatment on soils eroding at 31 to 40 tons per acre per year could increase income by $84.50 per acre per year. The SCS estimated that $335 million in potential production increases and/or cost reductions could be attained if proper conservation practices were adopted statewide.

As sediment clogs streams and lakes, the capacity to carry or hold flood flows is reduced. It can result in increased flood damages and maintenance costs. The sediment must be removed from reservoirs and farm ponds or their life spans will be reduced. Ditches and culverts must also be cleaned out. The extra sediment load, and the chemicals attached to it, will result in higher water treatment costs for municipal and industrial supplies. If the sediment is carried through irrigation equipment, the pumps and nozzles may require more maintenance.

Erosion Control

Through the years, many practices to control erosion have been tried. Some of the earlier attempts to reduce erosion were successful, but others were not. Several of the early practices have been improved and are still in use today.

Past Activities. The settlers who broke the sod of the Nebraska prairies had learned how to farm in more humid climates where the land was usually forested. They were unprepared for Nebraska's drier climate. Their new farming and ranching techniques were learned by trial and error. Much of the homesteaded prairie was plowed to grow crops only to find that wind and water erosion destroyed its ability to produce or that rainfall was inadequate. These parcels were usually sold to cattlemen or were abandoned, and the farmers moved on to try again in another place. In most cases, the abandoned farmland that was allowed to revert back to grass by natural succession which was labeled as "go-back" land.

The cattlemen also were just learning about grass management. Before settlement, the grasses of Nebraska were utilized by wildlife that grazed an area and moved on, permitting regrowth. The regrowth could replenish the

stored food reserves in the roots and maintain plant condition and vigor. But early ranchers thought they had to use all of the forage to get the most value out of it. They concentrated their cattle with fences and grazed the same area all year. Overgrazing resulted and the grass condition deteriorated to the point where the better forage grasses began to disappear, replaced by lower value plants. Wind and water erosion began taking its toll on rangeland as well as on the cropland.

By the 1930's, conditions were in a deplorable state. But matters became worse as the agricultural depression that began in 1924 was compounded by the drought which lasted from 1931 to 1940 and threatened agriculture over the entire state. To some degree, wind erosion was controlled in the early 1940's when more frequent rains came back to the midwest. The added moisture permitted better crops, and the crops provided protective cover. Cover crops were effective, but were dependent on rain to get them started and even then were used only for part of the year. The cover usually had to be destroyed to plant the cash crops.

Structural measures were developed to control erosion where cover crops could not. Many of these practices were tested as demonstration projects in the Civilian Conservation Corps (CCC) camps in the 1930's and were refined by trial and error. Dams, diversions, terraces, and grassed waterways were installed statewide through the CCC program.

The post-World War II period brought more innovations in erosion control. The chemical industry was expanding and early herbicides like DDT and 2,4-D were becoming more widely available. By 1950, International Harvester was manufacturing its first till-planter. It did not sell well, so the company gave nearly half of the fifty units to agricultural colleges for research. Four of these units were donated to the University of Nebraska. The University developed its own till-planter in 1958. These early models had design problems which prevented their use in heavy clay soils, until a Columbus, Nebraska man developed a model in 1963 which worked well in clay soils. This successful model, the Buffalo planter, allowed conservation tillage to be used nationwide.

Current Practices. Cover is still the most effective way to control both wind and water erosion. Herbicides provide one way to destroy weeds, but the previous year's crop residue is left on the surface as cover for erosion control. There may be additional costs involved for herbicides, but they are usually offset by the amount saved by fewer tillage operations.

Conservation tillage can be used to leave an adequate amount of residue on the soil surface for erosion control. It can be used alone or in combination with other practices. When row crops are grown without performing a tillage operation, it is called no-till. There are many soils and slopes on which conservation tillage and no-till will reduce erosion below the tolerable limit, but other practices may be necessary on steep and long slopes with erosive soils.

Strip cropping is used to interrupt the erodible area with a close sown crop. Windbreaks and other barriers also interrupt the erodible area to reduce wind erosion. Terraces are simple barriers constructed of soil that intercept the flow of runoff water, moving it on a nearly flat grade on a contour around the hill to a stable outlet, usually a grassed waterway or a tile outlet. Terraces shorten the length of slopes and provide a guideline for contour farming. Today's terraces have been adapted to fit wider equipment, although the terrace width is limited by the steepness of the slope. Many terraces on steeper slopes are pushed up from the downhill side rather than from the top side. Basin terraces are often used to temporarily impound runoff water with the excess removed through plastic tile outlets eliminating the need for a grassed waterway. Dams, diversions, and grassed waterways have also been refined from their earlier counterparts.

These practices conserve moisture as well as control erosion. When added to crop rotations that utilize close sown crops to conserve moisture and control erosion, there are possibilities of controlling erosion on all Nebraska land that is classified as arable (Classes I through IV).

Tolerable Soil Losses. All of the processes that originally formed soil are still active, so topsoil development is an ongoing process. The rate of development is very slow; on most Nebraska soils it is approximately five tons per acre per year. The maximum annual rate of soil erosion that could occur on a given soil without causing a decline in long-term productivity is called the soil loss tolerance, or "T" value. Thus, a typical soil in Nebraska has a soil loss tolerance of five tons per acre per year. Soils that are eroding at less than the T value are

stable and production can be maintained under those conditions. Those that are eroding at greater than the T value are unstable and their ability to produce is being reduced.

Current Erosion and Treatment Needs

Only 62.6 percent of Nebraska's rural nonfederal land is considered adequately treated to prevent it from eroding beyond its soil loss tolerance. Treatment needs on the remaining 37.4 percent vary according to the land capability class and the type of land use. Treatment is needed on cropland, rangeland, pasture, and forest land. Even urban areas and federal land may need land treatment; however, these areas are not addressed in this report.

Cropland Conditions. Table 2-4 shows that over 13 million cropland acres are stable, yet there are nearly 3.2 million acres eroding at a level between T and 2T and 3.6 million acres eroding at greater than 2T. Approximately 34 percent of Nebraska's cropland is eroding at a rate that is damaging its ability to produce. This same 34 percent accounts for 80 percent of the total amount of soil lost on cropland.

The Natural Resources Inventory data from the Soil Conservation Service (NRI) show that the heaviest rate of erosion (31.7 tons per acre per year) is occurring on 508,400 acres of the Class VI land that is being cropped. This is to be expected since Class VI land has very severe erosion hazards due to slope steepness and soil texture. The SCS Technical Guide recommends that Class VI land be in some type of permanent vegetation because of the severe limitations. The second worst erosion rate, an average of 24.4 tons per acre per year, is occurring on the 1,273,100 acres of Class IV land. Though Class IV land is considered cropable, much of it is marginal because of slope and soil texture limitations. Expensive conservation practices are often needed to keep it stable.

Approximately 1.2 million acres of Class III land are eroding at an average rate over 6.8 tons per acre per year, and another 1.4 million at an average 20.7 tons per acre per year. The Class III land may offer the greatest potential for an immediate thrust to save soil because it has fewer limitations. Treatment costs would be lower than for Classes IV and VI land and the production potential saved would be greater. This theory is somewhat complicated because there is usually a certain amount of intermingling of the land classes which would complicate treating and cropping just Class III land. Cropland further breaks down into non-irrigated and irrigated. Table 2-5 shows that the 13.2 million acres of dryland cropland includes 7.8 million acres (58.8 percent) that are adequately treated, while 5.3 million acres (40.3 percent) need erosion control.

The irrigated cropland is described in Table 2-6, which shows that nearly 7.1 million acres are irrigated. Of these acres, 3.7 million acres (nearly 52.6 percent) are adequately treated, while 1.5 million acres (nearly 21.8 percent) need erosion control. Irrigation water management practices are needed on 1.8 million acres (25.2 percent). Erosion on irrigated land occurs where pivots are placed on steep rolling hills and where gravity irrigation is used on runs that are too steep. It also occurs where tillage or harvest, in the case of potatoes and sugar beets, leaves the soil bare and subject to wind erosion. Irrigation water management to save water and prevent pollution of ground water and surface water is needed on an additional 1.8 million acres (25 percent) of the irrigated cropland.

Pasture Conditions. Pastureland occupies 2.1 million acres of Nebraska land. This represents only 4.8 percent of the total agricultural land, yet erosion problems exist on this land that need attention to sustain the ability of these soils to produce.

Historically, pastures were relatively small, easily accessible from the farmstead, and were a secondary enterprise on the farm. As a result, many received poor management and yielded below the optimum. The 1982 NRI data (Table 2-7) shows only 749,100 acres, or 35 percent, are in good condition. Approximately 51 percent are in fair condition and 14 percent are in poor condition (Figure 2-5). Over 200,000 acres are eroding at rates greater than T (Table 2-4).

Treatment needs include reseeding the acres in poor condition and establishing planned grazing systems on the remainder. In many areas, there are grade control problems that structures could correct. Nearly all Nebraska pastures could be better managed for optimum production.

Rangeland Conditions. Rangeland is rated according to the condition of the climax species. Rangeland in excellent condition will have 76 to 100 percent of the potential natural vegetation present and the economic return will be the greatest. Good condition has 51 to 75 percent of the potential natural vegetation, fair has 26 to

Table 2-4

ESTIMATED ANNUAL EROSION ON 1982 LAND USE
ACRES IN RELATION TO T VALUE

Land Use	Capability Class	I	II	III	IV	V	VI	VII	VIII	Total
					(1,000 Acres)					
Cropland	<T	2,322.6	6,563.4	2,789.0	1,236.8	37.2	511.9	7.5	2.7	13,471.1
	T-2T	141.8	1,031.7	1,197.2	623.5	3.0	194.0	2.5	.0	3,193.7
	>2T	33.8	367.8	1,414.4	1,273.1	1.3	508.4	13.1	.0	3,611.9
	Total	2,498.2	7,962.9	5,400.6	3,133.4	41.5	1,214.3	23.1	2.7	20,276.7
Pasture	<T	60.6	396.1	540.6	483.2	19.7	392.9	25.6	2.6	1,921.3
	T-2T	.0	4.9	22.7	48.6	.0	32.0	6.6	1.3	116.1
	>2T	.0	.0	14.2	26.9	.0	32.8	14.0	.0	87.9
	Total	60.6	401.0	577.5	558.7	19.7	457.7	46.2	3.9	2,125.3
Rangeland	<T	36.1	686.7	1,224.8	2,605.5	564.5	13,044.0	3,527.3	44.7	21,733.6
	T-2T	.0	.0	.1	41.1	.0	326.8	262.8	11.2	642.0
	>2T	.0	2.4	8.3	48.3	.0	390.5	270.6	.0	720.1
	Total	36.1	689.1	1,233.2	2,694.9	564.5	13,761.3	4,060.7	55.9	23,095.7
Forest land	<T	10.9	75.1	36.6	37.4	22.1	214.6	195.0	17.0	608.7
	T-2T	.0	.0	.0	.0	.0	16.3	39.9	2.7	58.9
	>2T	.0	.0	.0	.0	.0	13.2	48.1	3.2	64.5
	Total	10.9	75.1	36.6	37.4	22.1	244.1	283.0	22.9	732.1
Total	<T	2,430.2	7,721.3	4,591.0	4,362.9	643.5	14,163.4	3,755.4	67.0	37,734.7
	T-2T	141.8	1,036.6	1,220.0	713.2	3.0	569.1	311.8	15.2	4,010.7
	>2T	33.8	370.2	1,436.9	1,348.3	1.3	944.9	345.8	3.2	4,484.4
	Total	2,605.8	9,128.1	7.247.9	6,424.4	647.8	15,677.4	4,413.0	85.4	46,229.8

Source: Nebraska Final 1982 NRI Tables, USDA, Soil Conservation Service, November 1984.

Table 2-5

CONSERVATION TREATMENT NEEDS ON NON IRRIGATED CROPLAND IN 1982

NRD	Adequately Protected	Treatment Needed			Total
		Erosion Control	Drainage	Total	
		(1,000 Acres)			
Upper Big Blue	400.3	169.2	21.3	190.5	590.8
Lower Big Blue	354.5	252.7	2.4	255.1	609.6
Upper Elkhorn	107.5	85.5	0.0	85.5	193.0
Lower Elkhorn	596.6	1,000.6	17.2	1,017.8	1,614.4
Little Blue	386.6	249.9	2.5	252.4	639.0
Upper Loup	54.2	12.2	0.0	12.2	66.4
Lower Loup	462.8	387.5	0.0	387.5	850.3
Lewis and Clark	199.0	285.5	3.7	289.2	488.2
Middle Missouri Tribs	86.7	196.8	11.7	208.5	295.2
Papio	122.8	205.5	18.2	223.7	346.5
Nemaha	592.4	432.4	21.2	453.6	1,046.0
Upper Niobrara	473.8	202.2	0.0	202.2	676.0
Middle Niobrara	97.3	31.6	0.0	31.6	128.9
Lower Niobrara	232.1	51.1	0.0	51.1	283.2
North Platte	380.4	101.0	0.0	101.0	481.4
South Platte	716.6	267.6	0.0	267.6	984.2
Twin Platte	251.0	38.9	7.4	46.3	297.3
Central Platte	169.0	108.8	0.0	108.8	277.8
Lower Platte North	252.7	297.5	4.9	302.4	555.1
Lower Platte South	317.6	369.1	2.4	371.5	689.1
Upper Republican	342.4	196.3	0.0	196.3	538.7
Middle Republican	576.9	248.6	0.0	248.6	825.5
Lower Republican	398.3	88.2	0.0	88.2	486.5
Tri-Basin	184.6	31.0	1.2	32.2	216.8
Nebraska	7,756.1	5,309.7	114.1	5,423.8	13,179.9

Source: 1982 Nebraska Resources Inventory: NRI/NRD Individual and Summary Tables for 24 Nebraska Natural Resources Districts, USDA, Soil Conservation Service, November 1986.

Table 2-6

CONSERVATION TREATMENT NEEDS ON IRRIGATED CROPLAND IN 1982

NRD	Adequately Treated	Treatment Needed				Total
		Erosion Control	Drainage	Management	Total	
				(1,000 Acres)		
Upper Big Blue	599.7	125.1	4.7	269.8	399.6	999.3
Lower Big Blue	80.5	19.3	0.0	49.3	68.6	149.1
Upper Elkhorn	183.5	122.9	5.0	39.7	167.6	351.1
Lower Elkhorn	162.2	89.7	0.0	123.5	213.2	375.4
Little Blue	253.2	63.1	0.0	121.5	184.6	437.8
Upper Loup	16.4	19.9	0.0	11.1	31.0	47.4
Lower Loup	503.6	262.5	0.0	149.1	411.6	915.2
Lewis and Clark	6.1	1.2	0.0	52.8	54.0	60.1
Middle Missouri Tribs	31.8	16.1	0.0	24.9	41.0	72.8
Papio	15.1	3.6	9.1	1.2	13.9	29.0
Nemaha	16.2	7.7	0.0	2.4	10.1	26.3
Upper Niobrara	119.4	78.1	0.0	8.6	86.7	206.1
Middle Niobrara	38.7	56.5	0.0	1.2	57.7	96.4
Lower Niobrara	141.4	31.3	0.0	0.0	31.3	172.7
North Platte	79.1	186.6	0.0	69.5	256.1	335.2
South Platte	48.4	26.5	0.0	2.8	29.3	77.7
Twin Platte	152.7	52.4	0.0	29.4	81.8	234.5
Central Platte	372.3	73.3	3.4	388.2	464.9	837.2
Lower Platte North	138.4	22.7	4.9	57.3	84.9	223.3
Lower Platte South	6.3	2.2	0.0	5.1	7.3	13.6
Upper Republican	219.9	165.5	0.0	51.3	216.8	436.7
Middle Republican	151.9	47.4	1.3	85.0	133.7	285.6
Lower Republican	190.3	40.6	0.0	45.1	85.7	276.0
Tri-Basin	208.5	30.4	0.0	199.4	229.8	438.3
Nebraska	3,735.6	1,544.6	28.4	1,788.2	3,361.2	7,096.8

Source: 1982 Nebraska Resources Inventory: NRI/NRD Individual and Summary Tables for 24 Nebraska Natural Resources Districts, USDA, Soil Conservation Service, November 1986.

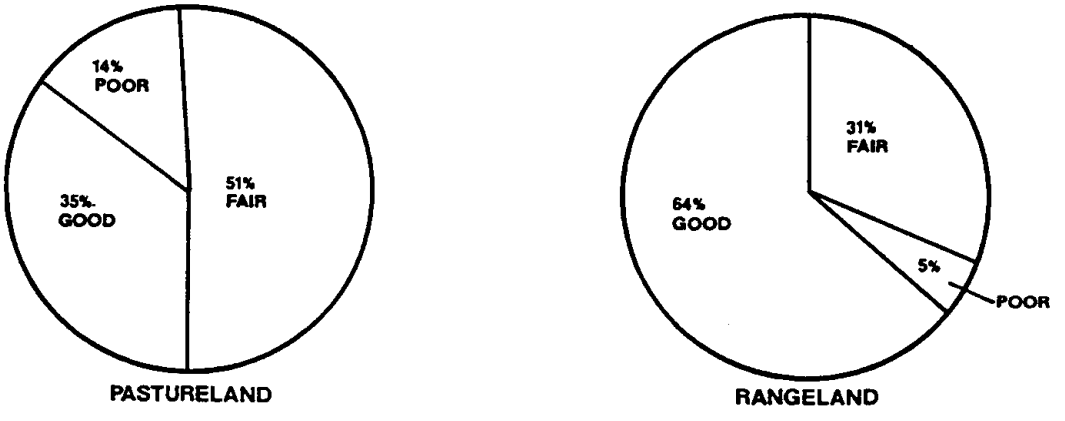
Table 2-7

PASTURELAND CONDITION IN 1982

NRD	Good	Fair	Poor	Other	Total
			(1,000 Acres)		
Upper Big Blue	52.4	35.1	7.5	1.2	96.2
Lower Big Blue	34.4	69.6	19.7	0.0	123.7
Upper Elkhorn	28.1	30.8	0.0	0.0	58.9
Lower Elkhorn	46.6	161.2	57.4	0.0	265.2
Little Blue	8.8	27.2	3.8	0.0	39.8
Upper Loup	0.0	0.0	5.5	0.0	5.5
Lower Loup	130.4	132.8	34.5	0.0	297.7
Lewis and Clark	40.8	118.1	24.6	0.0	183.5
Middle Missouri Tribs	22.4	43.3	13.5	0.0	79.2
Papio	11.3	20.3	7.8	0.6	40.0
Nemaha	125.7	144.0	55.5	2.5	327.7
Upper Niobrara	63.3	81.6	6.3	0.0	151.2
Middle Niobrara	1.6	3.9	0.0	0.0	5.5
Lower Niobrara	27.6	36.0	3.6	0.6	67.8
North Platte	15.7	14.4	1.2	0.0	31.3
South Platte	9.5	17.7	2.4	0.0	29.6
Twin Platte	1.2	0.0	3.5	0.0	4.7
Central Platte	16.8	20.1	11.3	0.0	48.2
Lower Platte North	24.8	56.5	5.3	0.0	86.6
Lower Platte South	75.2	54.6	21.9	1.5	153.2
Upper Republican	3.3	0.0	0.0	0.0	3.3
Middle Republican	0.0	0.0	0.0	0.0	0.0
Lower Republican	3.7	3.7	1.2	0.0	8.6
Tri-Basin	5.5	12.4	0.0	0.0	17.9
Nebraska	749.1	1,083.3	286.5	6.4	2,125.3

Source: 1982 Nebraska Resources Inventory: NRI/NRD Individual and Summary Tables for 24 Nebraska Natural Resources Districts, USDA, Soil Conservation Service, November 1986.

Figure 2-5
1982 LAND USE CONDITIONS



50 percent, and poor has 0 to 25 percent. The condition class can be improved through planned grazing systems, grass reseeding, and other improvement practices.

For example, a planned grazing system on fair rangeland could improve it to good condition in three to five years. Continued proper management could raise it to excellent condition where the maximum amount of forage could be harvested. An exception to this is poor rangeland. When the condition is this low, reseeding will usually be necessary to improve the condition class.

Continuous overgrazing will cause rangeland to decrease in condition and eventually permit erosion to take place. On sandy soils, the erosion will appear as blowouts where the wind moves the sand, cutting off and covering plants until the area is completely void of vegetation. On heavier soils, increased runoff will start as sheet erosion, then concentrate in cattle trails and swales to cause gullies.

The 1982 NRI data (Table 2-8) shows that Nebraska has 2.2 million acres of rangeland in excellent condition, 12.6 million acres in good condition, 7.1 million acres in fair condition, and 1.1 million acres in poor condition. Nearly 1.4 million acres of rangeland are eroding at greater than the T value for the soil (Table 2-4).

There is a great opportunity for protecting both soil and grass through proper range management. Reseeding the 1.1 million acres of rangeland in poor condition and managing the 7.1 million acres now in fair condition to achieve a good condition could result in an additional 1.4 million animal unit months of grazing each year, valued at approximately $15 million. This could result in the production of an additional 60 million pounds of beef.

Forest Conditions. Although forests are usually found on the poorer classes of land, the land is in reasonably good shape. Over 83 percent of the total 732,100 acres has a tolerable rate of soil loss (Table 2-4). Only 55,900 acres (7.6 percent) need erosion control measures (Table 2-9). This could involve reshaping and seeding critical areas or installing erosion control structures. Another 72,400 acres of the grazed forestland need forage improvement or protection for optimum production from the site. In some cases, this could involve reseeding grass in the open areas.

The weakest element in the forest category is the adequacy of timber stands. While this does not affect the soil resource, 216,300 acres (29.5 percent) need timber stand improvements before optimum yields can be realized from this resource.

Other Lands. There are 736,500 acres of land classified as "other lands" that have some resource problems. This includes farmsteads, odd areas on farms, mines, quarries, pits, and

Table 2-8

RANGELAND CONDITION IN 1982

NRD	Excellent	Good	Fair	Poor	Other	Total
		(1,000 Acres)				
Upper Big Blue	0.0	4.8	55.3	7.5	2.7	70.3
Lower Big Blue	0.0	14.9	39.1	4.9	0.0	58.9
Upper Elkhorn	248.4	604.3	286.4	42.4	0.0	1,181.5
Lower Elkhorn	2.6	17.8	41.3	51.3	0.0	113.0
Little Blue	13.3	69.1	158.2	31.4	0.0	272.0
Upper Loup	588.4	2,456.5	819.1	158.3	0.0	4,022.3
Lower Loup	150.7	1,207.2	1,215.5	141.0	5.0	2,719.4
Lewis and Clark	13.7	67.2	120.8	0.0	0.0	201.7
Middle Missouri Tribs	0.7	7.6	5.1	1.9	0.0	15.3
Papio	0.0	0.5	0.0	0.0	0.0	0.5
Nemaha	3.7	7.3	3.9	1.2	0.0	16.1
Upper Niobrara	178.2	1,708.5	963.5	108.0	0.0	2,958.2
Middle Niobrara	123.7	1,759.9	444.3	103.3	0.0	2,431.2
Lower Niobrara	61.4	490.6	450.7	40.6	0.0	1,043.3
North Platte	296.9	1,147.9	416.1	52.8	0.0	1,913.7
South Platte	14.9	250.3	220.0	23.1	0.0	508.3
Twin Platte	306.8	1,132.4	387.6	138.8	0.0	1,965.6
Central Platte	30.1	319.7	260.7	46.6	14.8	671.9
Lower Platte North	4.9	7.7	1.8	1.6	0.0	16.0
Lower Platte South	0.0	2.6	9.5	1.6	0.0	13.7
Upper Republican	17.7	266.8	386.1	22.2	5.2	698.0
Middle Republican	92.4	758.6	355.1	54.9	30.7	1,291.7
Lower Republican	29.4	246.8	346.4	31.8	24.6	679.0
Tri-Basin	10.6	87.1	123.7	3.8	8.9	234.1
Nebraska	2,188.5	12,636.1	7,110.2	1,069.0	91.9	23,095.7

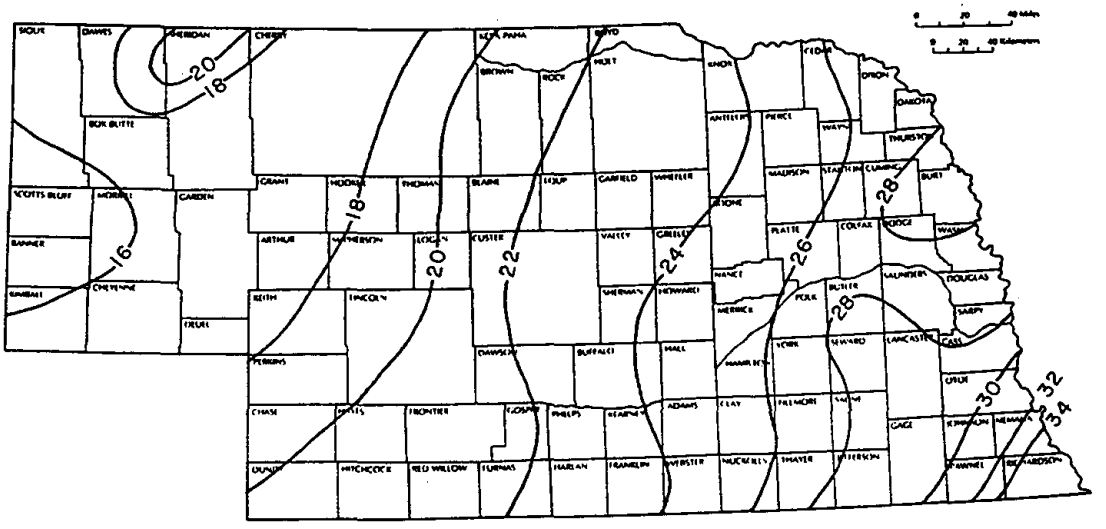
Source: 1982 Nebraska Resources Inventory: NRI/NRD Individual and Summary Tables for 24 Nebraska Natural Resources Districts, USDA, Soil Conservation Service, November 1986.

Table 2-9

CONSERVATION TREATMENT NEEDS ON FOREST LAND IN 1982

NRD	Adequately Protected	Treatment Not Feasible	Treatment Needed				Total
			Erosion Control	Timber Improvement	Forage Treatment	Total	
			(1,000 Acres)				
Upper Big Blue	8.2	1.2	.0	4.9	.0	4.9	14.3
Lower Big Blue	7.3	.0	.0	9.7	14.3	24.0	31.3
Upper Elkhorn	.0	6.2	.0	.0	.0	.0	6.2
Lower Elkhorn	2.5	2.5	.0	9.8	5.5	15.3	20.3
Little Blue	5.0	.0	.0	13.5	2.5	16.0	21.0
Upper Loup	.0	.0	.0	.0	.0	.0	.0
Lower Loup	21.6	.0	.0	4.2	7.4	11.6	33.2
Lewis and Clark	5.0	1.3	.0	.0	.0	.0	6.3
Middle Missouri Tribs	7.7	1.7	.0	24.6	.0	24.6	34.0
Papio	20.8	.0	.0	11.7	.0	11.7	32.5
Nemaha	26.5	1.3	3.3	18.7	.0	22.0	49.8
Upper Niobrara	85.2	21.7	48.8	43.8	31.3	123.9	230.8
Middle Niobrara	10.3	6.6	.0	.0	1.5	1.5	18.4
Lower Niobrara	44.4	9.1	.0	3.3	7.2	10.5	64.0
North Platte	7.8	.0	1.6	.0	.0	1.6	9.4
South Platte	.0	.0	.0	.0	.0	.0	.0
Twin Platte	12.3	2.4	.0	21.2	.0	21.2	35.9
Central Platte	26.0	4.7	.0	6.2	.0	6.2	36.9
Lower Platte North	.0	.0	.0	4.9	1.6	6.5	6.5
Lower Platte South	11.2	.0	2.2	19.7	1.1	23.0	34.2
Upper Republican	.0	.0	.0	.0	.0	.0	.0
Middle Republican	.0	.0	.0	9.6	.0	9.6	9.6
Lower Republican	13.4	3.7	.0	10.5	.0	10.5	27.6
Tri-Basin	.0	9.9	.0	.0	.0	.0	9.9
Total	315.2	72.3	55.9	216.3	72.4	344.6	732.1

Source: 1982 Nebraska Resources Inventory: NRI/NRD Individual and Summary Tables for 24 Nebraska Natural Resources Districts, USDA, Soil Conservation Service, November 1986.



Source: This map is reproduced from "An Analysis of Nebraska's Precipitation Climatology with Emphasis on Occurrence of Dry Conditions, " Agricultural Experiment Station, UN-L, Wilhite, D., 1981.

Figure 2-6
AVERAGE ANNUAL PRECIPITATION IN INCHES FOR THE PERIOD 1900-1979

other rural land not falling in categories already discussed. Nearly 15 percent (108,600 acres) of these areas need erosion control measures. Treatment practices could include stabilizing critical areas, seeding permanent vegetation, diversion terraces and possibly some erosion control structures.

WATER RESOURCES

Water is essential to life and the amount of water present will influence the area's development or affect its productivity. Water sources available in Nebraska include precipitation, streams, lakes, and ground water.

PRECIPITATION

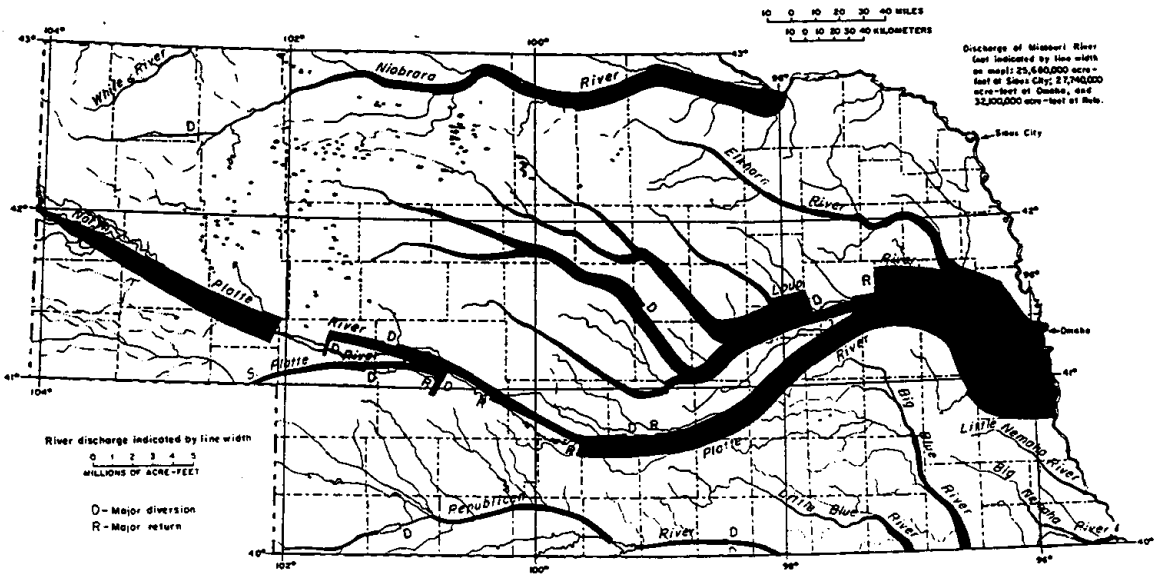
Average annual precipitation in Nebraska ranges from greater than 34 inches in the southeastern corner of the state to less than 16 inches in the Panhandle, as shown in Figure 2-6. The amount of precipitation received at any location can vary considerably from year to year. Periods of very low rainfall resulted in the severe droughts of the mid-1930's and mid-1950's. Excessive rainfall can also be a problem, causing localized and, on occasion, widespread flooding. Eastern Nebraska experienced widespread flooding in June of 1967 and again in June of 1984. Unusually heavy spring snowmelt can also cause flooding, as it did over much of the state in March of 1960.

In Nebraska, about 80 percent of the average annual precipitation normally occurs from April to September. During this period, intense thunderstorms are common and generally localized in extent. In some instances, these storms have caused flash floods in one watershed, while neighboring areas recorded only a trace of precipitation.

SURFACE AND GROUND WATER AVAILABILITY

The major source of surface water in the state is its network of streams. A second source is the hundreds of natural lakes, mainly located in the Sandhills. There are also approximately 2,700 reservoirs and countless farm ponds storing surface water across the state.

Most of Nebraska's streams flow from west to east and all eventually drain into the Missouri River. There are more streams draining the eastern half of the state than in the western half. The discharge of the principal rivers also increases from west to east, as shown in Figure 2-7.



Source: Bentall, R. and Shaffer, F.B., Availability and Use of Water in Nebraska, 1975, Conservation and Survey Division, University of Nebraska-Lincoln.

Figure 2-7
DISCHARGE OF THE PRINCIPLE RIVERS, WATER YEAR 1975

Streamflow generally fluctuates from one season to the next. It is usually highest in the spring due to runoff from snowmelt and spring rains. Irrigation diversions from July to September can decrease streamflow to its yearly low. October to February is considered the baseflow period when diversions and precipitation contributions are the lowest, leaving fairly constant streamflow supplied mainly from ground water.

Nebraska's reservoirs with a surface area of 100 acres or more have the combined capacity of nearly 3 billion acre-feet of water, although their actual storage is generally significantly less. Figure 2-8 shows the locations of these reservoirs. Farm ponds, permanent pools in floodwater retention structures, and grade-stabilization structures also contribute to the total surface-water storage in the state.

There are many natural lakes in Nebraska, but most have surface areas of less than one square mile and are less than ten feet deep. Most of these lakes are in the Sandhills. Oxbow lakes are a second type of natural lakes occurring in the state. Many abandoned sand and gravel mining pits are now filled with water and provide further storage, wildlife, and recreational uses.

It has been estimated that Nebraska has over 2.1 billion acre-feet of good quality recoverable ground water in storage. However, ground water is not uniformly distributed across the state, as shown in Figure 2-9. The saturated thickness of the principal aquifer ranges from 0 to 1,000 feet. Yields in some areas exceed 1,000 gallons per minute (gpm), but in other areas yields are too small or too low in quality to supply even a domestic well.

WATER QUALITY

Surface water quality in most areas of the state is acceptable for most uses. Water quality is good or excellent in over 70 percent of the miles of designated stream segments in the state. The quality is poor in about two percent of the stream segment miles. In the past ten years the water quality has been improved in six percent of the stream segment miles, degraded in three percent, and has been maintained in 54 percent. Data is inadequate to assess some stream segments.

Ground water of high quality underlies most of the state, but is limited or absent in some areas, such as parts of southeastern Nebraska. Ground water quality problems result primarily from human activities. Intensive crop production with irrigation and fertilizers have contributed to high concentrations of nitrate in the central Platte Valley and in Holt County. Nitrate concentrations have increased significantly in the

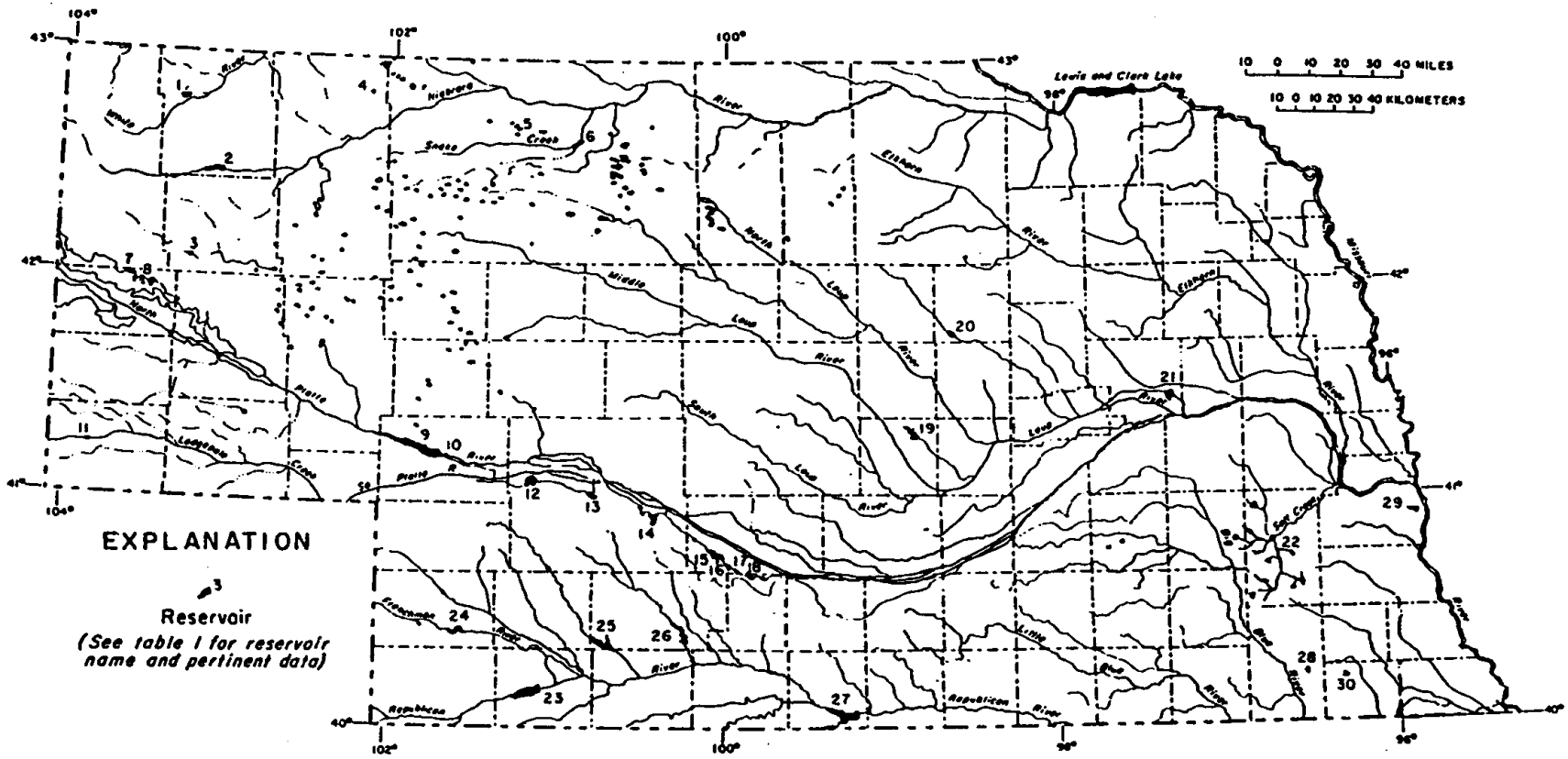
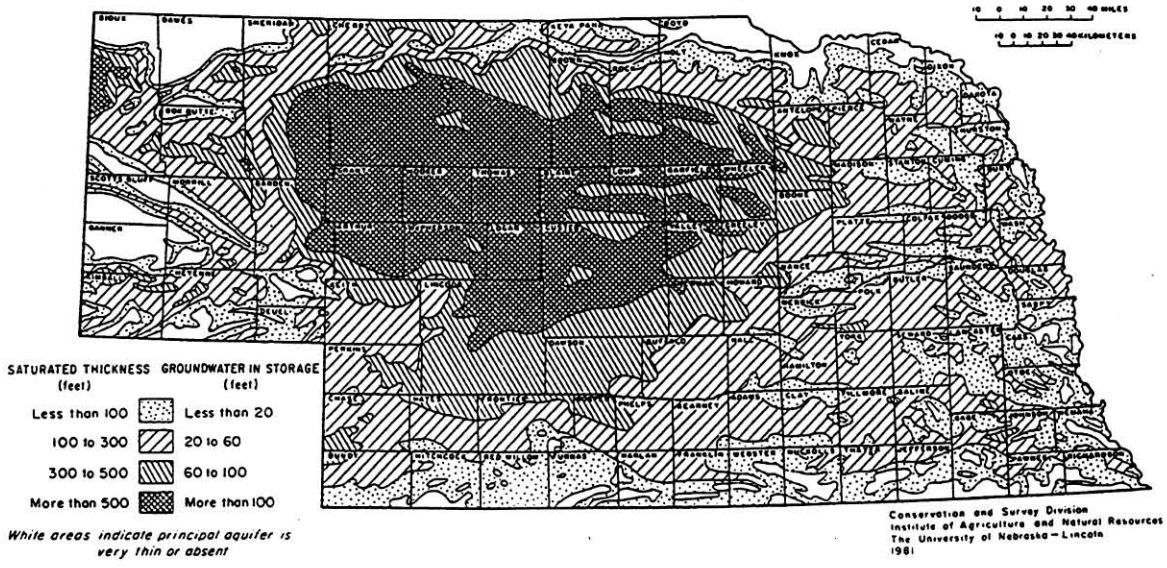


Figure 2-8
LOCATIONS OF RESERVOIRS HAVING A SURFACE AREA GREATER THAN 100 ACRES

Figure 2-8 (Continued)
Locations of Reservoirs Having A Surface Area Greater Than 100 Acres

PRINCIPAL RESERVOIRS IN NEBRASKA (surface area greater than 100 acres)					
Map No.	Reservoir Name	County	Surface Area (Acres)	Storage Capacity (Acre-Feet)	Operator
SUBREGION 1. HAT CREEK, WHITE RIVER, AND WHITE CLAY CREEK DRAINAGE AREAS					
1	Whitney Lake	Dawes	984	10,960	Whitney Irrigation District
SUBREGION 2. NIOBRARA RIVER AND PONCA CREEK DRAINAGE AREAS					
2	Box Butte	Dawes	1060	31,060	U.S. Bureau of Reclamation
3	Kilpatrick Lake	Box Butte	115	2300	Cook Livestock Co., Inc., Scotts Bluff
4	Antelope Creek Watershed	Sheridan	193	770	City of Gordon
5	School House Lake	Cherry	177	935	Elvin Adamson
6	Merritt	" "	2906	74,500	U.S. Bureau of Reclamation
SUBREGION 4. NORTH PLATTE RIVER DRAINAGE AREA					
7	Lake Alice	Scotts Bluff	776	11,015	U.S. Bureau of Reclamation
8	Lake Minatare	" "	2158	62,190	" "
9	Lake McConaughy	Keith	35,000	1,948,000	Central Nebraska Public Power and Irrigation District
10	Lake Ogallala	" "	530	13,000	Nebraska Public Power District
SUBREGION 5. LODGEPOLE CREEK AND SOUTH PLATTE RIVER DRAINAGE AREAS					
11	Oliver	Kimball	3000	7480	Kimball Irrigation District
12	Sutherland	Lincoln	3190	80,000	Nebraska Public Power District
13	Lake Maloney	" "	1670	6000	" "
SUBREGION 6. MIDDLE PLATTE RIVER DRAINAGE AREA					
14	Jefferey	Lincoln	600	11,500	Central Nebraska Public Power and Irrigation District
15	Midway Canyons Lake System	Dawson	560	9400	" "
16	Gallagher Canyon Lake	" "	180	3000	" "
17	Plum Creek Lake	" "	220	4600	" "
18	Johnson	Dawson and Gosper	2800	54,000	" "
SUBREGION 7. LOUP RIVER DRAINAGE AREA					
19	Sherman	Sherman	2850	69,100	U.S. Bureau of Reclamation
20	Ericson	Wheeler	160	1650	Nebraska Public Power District
21	Lake Babcock and Lake North	Platte	1070	4500	Loup River Public Power District
SUBREGION 9. LOWER PLATTE DRAINAGE AREA					
22	Wagon Train	Lancaster	300	2500	U.S. Corps of Engineers
	Stage Coach	" "	200	1900	" "
	Olive Creek	" "	170	1410	" "
	Blue Stem	" "	320	3200	" "
	Yankee Hill	" "	210	2020	" "
	Conestoga	" "	230	2700	" "
	Twin Lakes	Seward	260	3500	" "
	Pawnee	Lancaster	730	8600	" "
	Branched Oak	" "	1780	26,000	" "
	Capitol Beach Lake	" "	290	1430	Capitol Beach, Inc., Lincoln
	Holmes Lake	" "	100	1200	U.S. Corps of Engineers
SUBREGION 10. REPUBLICAN RIVER DRAINAGE AREA					
23	Swanson	Hitchcock	4794	120,160	U.S. Bureau of Reclamation
24	Enders	Chase	1707	44,480	" "
25	Hugh Butler	Frontier	1629	37,776	" "
26	Harry Strunk	" "	1850	37,141	" "
27	Harlan County	Harlan	13,240	342,560	U.S. Corps of Engineers
SUBREGION 12. BIG BLUE RIVER DRAINAGE AREA					
28	Rockford Lake	Gage	149	1825	Mud Creek Watershed Conservation District and Nebraska Game and Parks Commission
SUBREGION 13. WEEPING WATER CREEK, LITTLE NEMAHA RIVER, AND BIG NEMAHA RIVER DRAINAGE AREAS					
29	Beaver Lake	Cass	300	8520	Beaver Lake Corp., Plattsmouth
30	Burchard Lake	Pawnee	147	1798	Nebraska Game and Parks Commission



Source:
Conservation and Survey Division, Institute of Agriculture and Natural Resources, The University of Nebraska - Lincoln, 1981.

Figure 2-9
AREAL DISTRIBUTION OF GROUNDWATER SUPPLIES

last decade and many municipal and domestic water supplies are now affected.

WATER USE

Water use in Nebraska is divided into five main categories: public supply, self-supplied industrial, thermoelectric power generation, rural domestic and livestock, and irrigation. Ground water is the major source for all of these categories except thermoelectric power generation, which relies almost entirely on surface water. Irrigation is the largest use category, using nearly 9.3 million gallons of water per day in 1980. Table 2-10 shows the breakdown by category of the water used in Nebraska in 1980.

Non-Rural Water Use

Non-rural water use includes the categories of public supply, self-supplied industrial, and thermoelectric power generation. In 1980, these uses accounted for 23.5 percent of the total water use in the state. Thermoelectric power generation is by far the largest of the three non-rural categories, using 20.6 percent of the total water used in 1980. It uses 10 times more surface water than ground water. Public supply amounted to 2.5 percent of the total water used in 1980 and used three times more ground water than surface water. Self-supplied industrial is the smallest category, using only 0.4 percent of the state's total water use in 1980. Its reliance on ground water was over five times larger than its surface water use during that year.

Rural Domestic and Livestock Use

Rural domestic and livestock uses are supplied mainly by private wells pumping ground water, although some of the livestock demand is supplied from surface water. The total water used in this category is small, accounting for only 1.3% of all water used in 1980. Water quality has become a major concern in recent years due to increasing nitrate levels in local ground water supplies. In several areas, these increases are the result of intensive irrigation and

Table 2-10

1980 WATER USE

Category	Surface Water	Ground Water	Total	
	(Millions of gallons per day)			(%)
Public supply	67.3	237.4	304.7	2.5
Self-supplied industrial	7.2	41.2	48.4	0.4
Thermoelectric power generation	2,527.7	25.2	2,552.9	20.6
Rural domestic and livestock	23.2	142.5	165.7	1.3
Irrigation	2,578.5	6,714.2	9,292.7	75.2
Total	5,203.9	7,160.5	12,364.4	100.0

Source: An Inventory of Public, Industrial, and Power-generating Water Use in Nebraska, 1979 and 1980, Conservation and Survey Division, IANR, UNL, February, 1983.

fertilization. Some domestic and livestock wells have been abandoned because their nitrate levels have exceeded tolerable levels for human and livestock consumption. Intensive irrigation has also caused ground water levels to drop in many areas and, as a result, many domestic and livestock wells have had to be lowered.

Most of the livestock wells located in pasture or range sites are powered by windmills and pumped into stock tanks. However, continued animal traffic around these tanks has led to severe erosion on some sites. In areas where ground water is absent or of poor quality, small farm ponds and dugouts have been constructed to store surface water to meet livestock demands. Soil erosion from surrounding land has caused siltation problems in many of these ponds.

Irrigation

Irrigation has historically been the largest user of water in Nebraska. In 1980 it accounted for 75.2% of the state's total water use. Irrigation is projected as the single largest demand for supplemental water in the future.

Historical Overview. Surface water irrigation was practiced in Nebraska as early as 1860, when four miles of ditch canals were in operation. By 1890, there were 298 miles of irrigation canals in the state. That number jumped to 1,654 miles by 1920. Most of this early surface water development took place in the central Platte River basin and in Scotts Bluff and Morrill counties. The first permanent diversion dam in the state was constructed at the headgate of the North Platte Canal in 1912. The Public Works Administration (PWA) Program began constructing canals in Nebraska in 1934 and by 1946 there were 115,000 acres irrigated under PWA projects. Figure 2-10 shows the location of surface water irrigation in 1940, when county assessors' records reported 620,911 acres irrigated using surface water.

Ground water irrigation in Nebraska started prior to 1900, when records show that windmills were being used to raise water from wells for irrigation. Many of the early wells were simply large-diameter pits dug to a point near the ground water table, where a small-diameter pipe attached to a pump was inserted. The depth of the early wells was usually limited to 25 to 30 feet but, as well drilling equipment was developed and refined, smaller diameters and greater depths became more common. County assessors' records show 73,059 acres under

County	Acres	County	Acres	County	Acres
Adams	450	Fillmore	365	Morrill	84,500
Antelope	389	Franklin	1250	Nance	473
Arthur	10	Frontier	353	Nuckolls	400
Banner	1365	Furnas	1018	Otoe	5
Blaine	220	Gage	200	Perkins	480
Boone	1273	Garden	24,080	Phelps	8200
Box Butte	3960	Garfield	2790	Pierce	656
Boyd	65	Gosper	1283	Platte	1335
Brown	572	Greeley	1650	Polk	428
Buffalo	34,081	Hall	15,278	Red Willow	5150
Burt	60	Hamilton	1974	Richardson	35
Butler	759	Harlan	1577	Rock	280
Cass	190	Hayes	1349	Saline	309
Cedar	20	Hitchcock	10,980	Sarpy	200
Chase	2257	Holt	160	Saunders	410
Cherry	2662	Howard	550	Scotts Bluff	201,000
Cheyenne	4248	Jefferson	220	Seward	536
Clay	327	Johnson	41	Sheridan	1000
Colfax	2462	Kearney	9892	Sherman	3830
Cuming	783	Keith	25,060	Sioux	28,383
Custer	4711	Keya Paha	65	Stanton	1417
Dakota	130	Kimball	7674	Thayer	340
Dawes	11,118	Knox	220	Thomas	44
Dawson	88,400	Lancaster	110	Thurston	34
Deul	6860	Lincoln	47,260	Valley	12,281
Dixon	64	Logan	22	Washington	120
Dodge	1352	Loup	5115	Wayne	50
Douglas	1235	Madison	1366	Webster	710
Dundy	4020	Merrick	4717	Wheeler	46
Source: Water Resources of Nebraska, Nebraska State Planning Board, 1941				York	656

Figure 2-10
NEBRASKA LAND IRRIGATED IN 1940

pump irrigation in 1937. During the 1946 growing season, 3,820 pumps were operating from wells, irrigating approximately 250,000 acres.

Early ground water irrigation simply pumped well water into a ditch and gravity carried it down the crop rows. This required fairly level fields with a slight grade. Gated pipe was introduced in the 1930s, making it possible for an irrigator to regulate the flow of water by adjusting the gates. This also reduced the amount of land leveling required to maintain gravity flow of water along the crop rows. The first sprinkler systems came into use in the early 1940s. They attached to stationary aluminum pipes and allowed uneven fields and sandy soils to be irrigated. Self-propelled sprinklers were developed in the next few years, which saved farmers the labor of moving the pipes around the field. The development of the center pivot in 1949 revolutionized the irrigation industry. Further refinements to the center pivot in the late 1960s led to widespread adoption of the system. By 1972, 2,665 pivots were irrigating 354,000 acres of land in Nebraska.

Current Practices. Nebraska Agricultural Statistics for 1982 reported 7,600,000 acres irrigated with ground water by 69,471 registered irrigation wells. Conservation and Survey Division estimates that 22,820 center pivots were in operation that same year. Surface water irrigation was estimated at 1,057,990 acres in 1975. As these numbers illustrate, irrigation plays a major role in Nebraska's agricultural

Table 2-11

WATER CONVEYANCE EFFICIENCY AND LOSS FOR
THREE NEBRASKA IRRIGATION DISTRICTS

District	Losses 2/			Canal
	Conveyance Efficiency 1/	Canals	Type of Laterals	
	(percent)			
Farwell	46.3	34.8	18.9	Earth
Sargent	46.8	45.4	7.8	Earth
Ainsworth	64.8	6.1	29.1	Concrete canal & Earth laterals.

1/ Conveyance efficiency is the ratio of water released or diverted to the amount of water delivered to the farm.
2/ Losses include return flow, seepage, and evaporation.

Source: Nebraska Policy Issue Study on Water Use Efficiency, NRC, June, 1984.

production. Nebraska's extensive use of irrigation has led to a vast array of system types and equipment available to today's irrigator.

Gravity irrigation systems can be any of the following types: contour ditch, basin, border, contour level, furrow and corrugation, and water spreading. Furrow is the most common type used in Nebraska and is mainly used on row crops. This method is best suited for medium to moderately fine textured soils with relatively high available water holding capacities and infiltration rates. It can be used on fine textured slowly permeable soils if the field is level enough to allow water impoundment and thus a longer period for infiltration. Efficient furrow irrigation on sandy soils requires very short furrow lengths, short application times, relatively close row spacings, and small depths of water allocation. Moderately high application efficiencies can be obtained with furrow irrigation if proper water management practices are followed and the land is properly prepared. Rainfall can be better utilized when only alternate rows are irrigated. The initial capital investment is relatively low on lands not requiring extensive land leveling because common farm equipment can be used to form the furrows. Some of the drawbacks associated with furrow irrigation include: (1) erosion hazards on steep slopes which are subject to high intensity precipitation, (2) salts accumulating in furrow ridges which lower crop yields, (3) high labor requirements, (4) lateral spread of water in coarse textured soils which may be inadequate to entirely wet the soil between furrows, and (5) land leveling which is usually required.

The efficiency of gravity irrigation systems is greatly affected by the type of delivery system used to convey the water from the source to the field. The source of water will also affect the efficiency. Ground water pumped directly into the field ditch or levee will naturally have a higher delivery efficiency than surface water conveyed greater distances from a reservoir via an unlined canal. Seepage as a percent of the total diversion is ten times higher for unlined canals than for concrete canals. Using a closed pipeline rather than an open canal would eliminate evaporation losses as well as seepage losses. Table 2-11 gives conveyance system efficiencies and losses for three Nebraska irrigation districts.

Sprinkler irrigation is adaptable to many crops, soils, and topographic regions. Sprinkler systems are classified by how the sprinkler heads are operated (individually or laterally) and

how they are moved or cycled to water the entire field. Lateral sprinklers can be (a) periodically moved from one position to another until the entire field is irrigated; (b) set so closely together that they do not require relocation to irrigate the entire field (solid set), (c) continuously moved around a pivot point (center pivot), or (d) continuously moved along an open or closed water supply channel to irrigate a rectangular area (traveling lateral). Gun or boom sprinklers are individual sprinkler heads that can be periodically moved from site to site, permanently mounted in closely set spacings, or mounted on trailers and continuously moved (traveling gun). Periodic move systems are best suited to areas where irrigation is required every five to seven days. For higher frequency irrigation, solid set or continuously moving systems are more adaptable. Center pivots and traveling guns may cause runoff problems on soils with lower permeabilities.

There are many variations in sprinkler nozzle type, arrangement, and operating pressure, which will determine the droplet size. Droplet size and distribution are important for two reasons. First, the small droplets are subject to wind drift which will distort the application pattern. Second, large droplets possess greater kinetic energy which is transferred to the soil surface, causing particle displacement and puddling which may result in erosion or surface crusting and runoff. Unfortunately, many of the energy-saving low or reduced pressure sprinkler systems have large droplets and therefore should not be used on soils prone to erosion or crusting.

Current Trends. As irrigation systems have been refined, irrigation water management has evolved from a guessing game to a scientific approach. Irrigation scheduling has led to more timely water applications in the amounts calculated to increase infiltration and reduce runoff. Reuse pits on gravity systems have helped to increase application efficiencies, reduce the amount of water leaving a field, and reduce sedimentation. Chemigation has also been more widely adopted in recent years. While the amount of water used in chemigation is small, the possibility of surface and ground water pollution from this practice is high, and it should be closely monitored.

Rainfall Management

In Nebraska, crops may suffer from a shortage of moisture at some time during the growing season. The average year includes periods of intense rains that result in runoff followed by dry periods that may stress crops. Some land is irrigated to prevent yield reduction from dry spells, but the margin of profit is reduced by pumping costs every time water is applied. Management of the land to conserve rainfall as well as soil could reduce runoff, reduce erosion, store more water in the root zone, save irrigation water, and improve profits.

Management of rainfall involves capturing it as it falls and storing it in the soil profile until plants need it. On grassland, the grazing system should leave enough grass at all times to intercept raindrops and slow the movement of excess water, providing more time for infiltration. Rainfall management on dryland fields also involves leaving enough cover to intercept raindrops. The cover may be current growth or the previous year's crop residue. This will maintain the initial infiltration rate of the soil.

On both grassland and dryland acres management should also utilize the water-holding capacity of the soil to store the rainwater. This capacity ranges from 0.05 inches of moisture per inch of soil on coarse textured soils, such as a Valentine sand, to 0.24 inches per inch of soil on a Crete silty clay loam or similar soil. Temporary storage in excess of the soil's water-holding capacity will percolate to the ground water supply as an added benefit.

Rainfall management on irrigated cropland is more complex. Usually a portion of the soil's water-holding capacity is "reserved" to allow for rainfall, rather than irrigating to fill the entire storage capacity of the soil profile. This portion may vary according to the soil type and precipitation pattern of the area. Reserving a "space" in the soil profile allows rainfall to infiltrate, rather than having all the rainfall run off because the soil profile is already fully saturated.

Using crop residues as a soil cover on irrigated land can help absorb raindrop impact and hold or slow down the rainwater to allow greater infiltration time. On sprinkler irrigated land, the residue may be used in the same manner as on dryland fields. Furrow irrigated land needs special residue treatment to insure that residue doesn't block the furrow, preventing irrigation water from reaching the lower end of the furrows. Methods of special residue treatment involve placing residue only on ridgetops or irrigating only in alternate rows while placing residue throughout the remaining rows. Rainwater movement through furrows can be slowed down without using residue by

furrow-diking. Furrow-diking is the construction of small basins at intervals within the furrows themselves.

Forty-three percent, or nearly 8.8 million acres, of Nebraska's cropland needs erosion control, which indicates that water management could be improved. If one inch of the rainwater that normally runs off could be captured and stored in the soil on Nebraska's 17 million acres of land needing erosion control, runoff would be reduced by 1.4 million acre feet. That is nearly 20 percent of the total water that leaves Nebraska via rivers and streams each year. Much of the extra water stored could be used by crops. The reduced runoff could significantly reduce erosion.

WATER PROBLEMS AND OPPORTUNITIES

Water problems can include inadequate supplies, excesses of water, and water of a quality unfit for a desired use. These problems occur naturally, but can become more severe with extensive water use. Irrigation uses the most water in Nebraska, so it has the greatest impact on the water resources of the state.

Excessive Irrigation Water Use

Water is applied by some irrigators in excess of crop irrigation requirements for a variety of reasons. Proper irrigation management requires more time and effort and may require special equipment. Some irrigators apply excess water to ensure that their crops have adequate moisture. Some irrigation districts do not have the flexibility to deliver water when it is most needed by the crops, so their irrigators must apply water when it is available. Also, many ground water irrigation systems are not designed for optimum water management.

Extensive irrigation in some parts of the state has resulted in significant water table declines (Figure 2-11). Declines greater than 30 feet have occurred in the upper Big Blue and upper Republican River Basins and in Box Butte County. Less extensive declines have also been recorded north of the Platte River in central Nebraska, in the Little Blue River Basin, and in Holt and Cheyenne counties. These declines are affected by the duration and rate of pumping, the number of irrigation wells, the rate of recharge to the aquifer, and the hydrologic properties of the soil. Water table declines can increase pumping costs, cause well failure, and may eventually result in a return to dryland production.

On the other hand, irrigation can also raise ground water levels. In some cases, importing surface water for irrigation can raise the water table to, or near, the land surface, which can severely limit land use. Development of surface water irrigation systems has resulted in dramatic rises in the water table in some areas, as shown in Figure 2-11. These rises are caused by reservoir and canal losses, excessive applications of water, and poor drainage. Mounding of as much as 90 feet has occurred in the Central Nebraska Public Power and Irrigation District service area in Gosper, Phelps, and Kearney Counties. Drainage problems are not limited to surface water project areas, however. Problems have been reported in the Sandhills where center pivot systems have been installed in areas where geologic conditions prevent good drainage.

The rate of soil erosion is also affected by irrigation practices. While added moisture at the surface can reduce wind erosion, water applications by gravity and sprinkler systems can detach and transport soil particles. This process is significant when slope gradients and slope lengths are excessive and application rates are high. Erosion caused by rainfall can be more severe following irrigation applications because the precipitation does not infiltrate into the wet soil as rapidly as it would in drier soil.

Sediment and Adsorbed Chemicals in Surface Water

Sediment is the major water pollutant in Nebraska by weight and volume, making streams, lakes, and reservoirs less desirable for municipal supplies, recreation, industrial consumption, cooling of hydroelectric facilities, and promoting aquatic wildlife. Water samples collected from the Elkhorn River at Waterloo ranged from 4,050 tons of suspended sediment per day on November 2, 1982 to 141,000 tons per day on May 20, 1983.

Sediment also acts as a carrier of other pollutants. Organic compounds, nitrogen, phosphorus, pesticide residue, and pathogens can attach to soil particles. Once the particles are carried into a body of water, these pollutants can impact potential uses of the water.

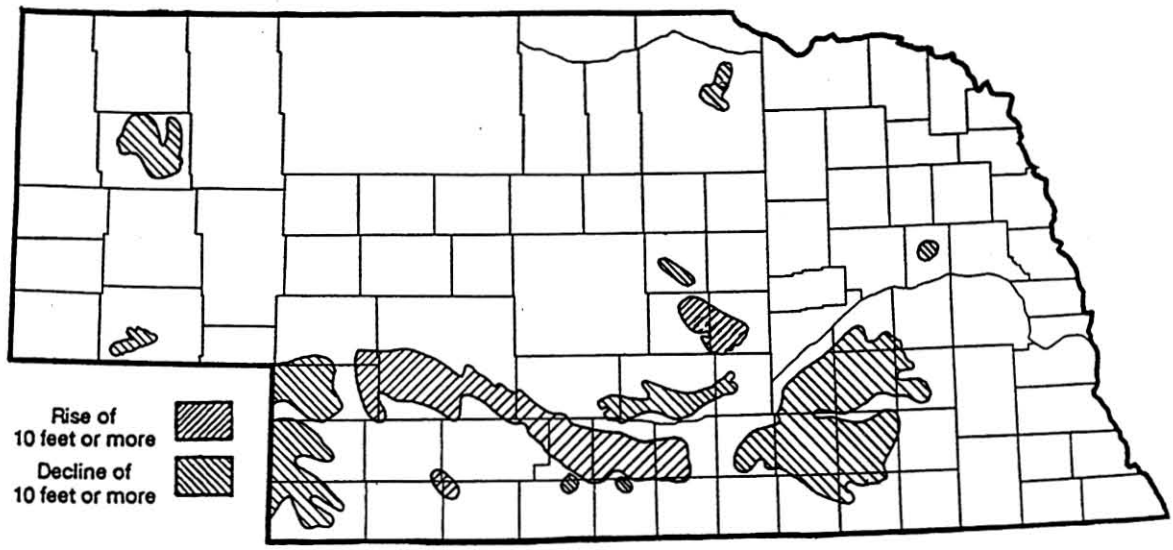


Figure 2-11
AREAS WITH WATER TABLES RISES AND DECLINES SINCE PREDEVELOPMENT

Pollution of Ground Water

Some agricultural chemicals, such as nitrogen fertilizers and some pesticides, are easily leached from the root zone to the ground water table. This problem is most serious on irrigated, sandy soils. There are two extensive areas in Nebraska with nitrate concentrations in the ground water exceeding the safe drinking water standard of 10 mg/l NO_3-N. One area is north of the Platte River from the city of Kearney through Hall and Merrick Counties; the second is in north-central Holt County. Shallow water tables, sandy soils, and intensive irrigation characterize these areas. Fertilizer nitrogen is the principal source of nitrate in these areas, but point sources such as barnyards, feedlots, and septic tanks may also contribute to the problem.

The rate of nitrate leaching is influenced greatly by precipitation, soil properties, fertilizer application and irrigation water management. Ground water nitrate concentrations in some wells in Holt County have risen by an average of 1.1 mg/1 per year. Research in the Sandhills near Tryon, Nebraska has shown that over 90 pounds of nitrogen per acre per year can be leached from a cornfield with "normal" irrigation and fertilizer management. The movement of the nitrate through the soil profile was estimated to be about seven feet per year, indicating that a problem may not show up in the ground water for years after the beginning of intensive crop production.

The Sandhills region is susceptible to ground water contamination because of its highly permeable soils. Seventy-two monitoring wells were installed in 1981 to measure ground water contaminants in the eastern Sandhills. In 1982 and 1985, samples were taken and analyzed for nitrates and pesticides. Two wells had nitrate levels exceeding the 10 mg/l standard, and two shallow wells showed atrazine contamination.

While nitrate contamination is widely recognized, less is known about leaching of pesticides into the ground water. Traces of atrazine were found in the upper levels of nearly all of the monitoring sites in the eastern Sandhills.

ENVIRONMENTAL RESOURCES

Our environment is everything surrounding us, including the air, plants, and animals as well as the land and water discussed previously. The

quality of our air, water, and land is an issue directly affecting all Nebraskans. Clean air to breathe and water fit for many uses have long been adequate or plentiful throughout the state. Habitats and the beauty of the land are also important environmental resources.

AIR QUALITY

Air quality evaluations are based on National Ambient Air Quality Standards for total suspended particulate matter, lead, sulfur oxide, carbon monoxide, ozone, and nitrous oxide gases. Nebraska's air is relatively clean and problem areas have been limited to Omaha, Lincoln, Weeping Water, and Louisville. The air quality in these areas has been improved significantly.

Suspended particulates include windblown dust as well as the products of industrial processes and combustion. Particulate levels across the state increased slightly in 1984. The only violation of the standards that year occurred at Nebraska City and was attributed to a major construction site.

WATER QUALITY

The quality of a water supply is defined by its physical, chemical, and biological characteristics. It is assessed with respect to its suitability for a particular use. A water supply may be acceptable for some uses and unacceptable for others. Water quality is affected by natural conditions and also by human activities.

Surface Water Quality

Water quality in streams, as well as lakes and impoundments which are publicly owned or open to public access, is addressed in Nebraska Water Quality Standards for Surface Waters of the State. Beneficial uses are assigned to each stream segment and lake. These beneficial uses generally reflect the existing uses of the particular body of water. They include primary and secondary contact recreation, cold water and warm water aquatic life, public drinking water supplies, agricultural uses, industrial uses, aesthetics, and public health. General criteria and numerical limits for selected parameters have been established to define acceptable water quality for each of these beneficial uses.

A water quality index has been established by the Department of Environmental Control to assess general water quality in the designated segments. The assessment is based on dissolved oxygen, pH, suspended solids, nitrate-nitrite nitrogen, un-ionized ammonia, fecal coliform, and conductivity.

An assessment of surface water quality was made by the Department of Environmental Control in 1982. The water quality standards applicable at that time included 165 designated stream segments totaling 7,152 stream miles.

From 1972 to 1982, water quality was judged as "maintained" in 87 segments, representing 54 percent of the stream miles. Improvements were made in 15 segments (about 429 miles), while 4 segments (215 miles) were degraded. Eighteen segments totaling 1,144 stream miles in western and northcentral Nebraska were rated excellent at that time. Ninety-three segments (3,934 stream miles), and 25 segments (787 stream miles) were rated as having good and fair water quality, respectively. The data were insufficient to evaluate 27 segments. Poor water quality was found in two segments totaling 143 stream miles. These were the upper reaches of the West Fork Big Blue River and a portion of Lodgepole Creek.

Poor water quality indicates that most beneficial uses are impaired and some may not be supported; the stream is moderately polluted most of the time. Municipal sewage and industrial discharges are the suspected causes of problems in the West Fork Big Blue River. Degradation in Lodgepole Creek is thought to result from municipal sewage and low flows.

Lakes are also addressed in Nebraska surface water quality standards. Data are available for the assessment of 32 lakes and reservoirs, which have a combined surface area of 107,726 acres. This comprises 79 percent of the total lake surface in the state. All but four lakes fully support their assigned beneficial uses. Holmes Lake, Memphis Lake, Olive Creek Lake, and Standing Bear Lake can only partially support fish and wildlife protection.

Water quality has been maintained in most of the lakes and has been improved in Oliver Reservoir and Stagecoach Lake in the last ten years. Holmes Lake has been degraded by excess sediment loads. Eutrophication has accelerated in Memphis Lake.

Ground Water Quality

The quality of the ground water throughout most of the state has traditionally been very good. It varies considerably from location to location within some aquifers and from aquifer to aquifer. Ground water quality problems in Nebraska are primarily caused by human activities and can be traced to both point source and nonpoint source contamination.

There are four principal aquifer groupings which are used for water supply in the state. The first aquifer group, Holocene and Pleistocene deposits, include alluvium, dune sand, terrace deposits, sand and gravel, loess, and glacial drift. These aquifers are found throughout most of the state, although water is less readily available from these deposits in the Panhandle, the southwest, and glaciated areas in the east than in other areas of the state. The quality of water from these aquifers is variable as it is affected by recharge from surface irrigation projects and streams. In some places, the quality is reduced by such pollution sources as feedlots and fertilized cropland.

Tertiary aquifers are found in the western two-thirds of the state. The Ogallala Formation, an important source of water in the state, is included in this grouping. Its water quality is good.

Mesozoic aquifers are also used for water supplies along the extreme eastern part of the state, except in the Nemaha River Basin, where they do not occur. They are also used in Scotts Bluff and Banner counties in the west. The Dakota Sandstone, with variable water quality, is used as a water supply in the east if no other sources are available.

The last aquifer grouping, Paleozoic, underlies almost all of the state, but these aquifers are used for a water supply only in upland areas in the southeast. Water quality is quite variable in this grouping. Some aquifers are highly mineralized.

There have been 135 documented occurrences of ground water contamination in the state. This total includes 84 cases of nitrate contamination; 25 cases of spills or leaks of gasoline or other hydrocarbon compounds; 20 cases of ground water contamination by synthetic organic compounds, such as solvents and pesticides; two cases of contamination by sulfuric acid and zinc; and one case each of contamination by chloride, detergents, pesticides, and salt. Ground water contamination has occurred in all parts of the state as shown in Figure 2-12. Most of these incidents of contamination have involved public water supplies and were identified by the Department of Health.

Documented or suspected sources of the contaminants have been identified for only a portion of these occurrences. These sources included municipal wastewater lagoons, storage tanks, industrial facilities, and an abandoned barnyard. Widespread nitrate contamination along the Platte River in Hall, Buffalo, and Merrick counties and in northern Holt County is primarily attributed to nitrogen fertilizers. Nitrate contamination in the southeastern part of the state has been caused by poorly constructed wells.

HABITATS

There are seven habitat types in the state including grasslands, cropland, woodlands, water, developed areas, badlands, and other lands. Grasslands and croplands make up over 90 percent of the state.

Critical Habitat

Some areas provide especially valuable habitat for certain species of animals because of the mingling of different kinds of habitat. The Platte River in central Nebraska provides water, large expanses of unvegetated area, riparian vegetation, wet meadows, and cropland in close proximity to one another. Many species, including the endangered whooping crane, take advantage of this rare combination. For this reason, a reach of the Platte River and adjacent areas have been declared a critical habitat area by the U.S. Fish and Wildlife Service.

Grasslands

Grasslands in the state range from short grasses in the west and mixed grasses in the Sandhills to remnants of tall grass prairies in the east. Grasslands form the primary habitat of prairie grouse, which are found in the greatest numbers in the northcentral part of the state. Grasslands in association with woodlands are an important habitat for bobwhite quail in eastern and southern Nebraska. Antelope occur throughout the western short grass area and deer, especially mule deer, occur throughout the

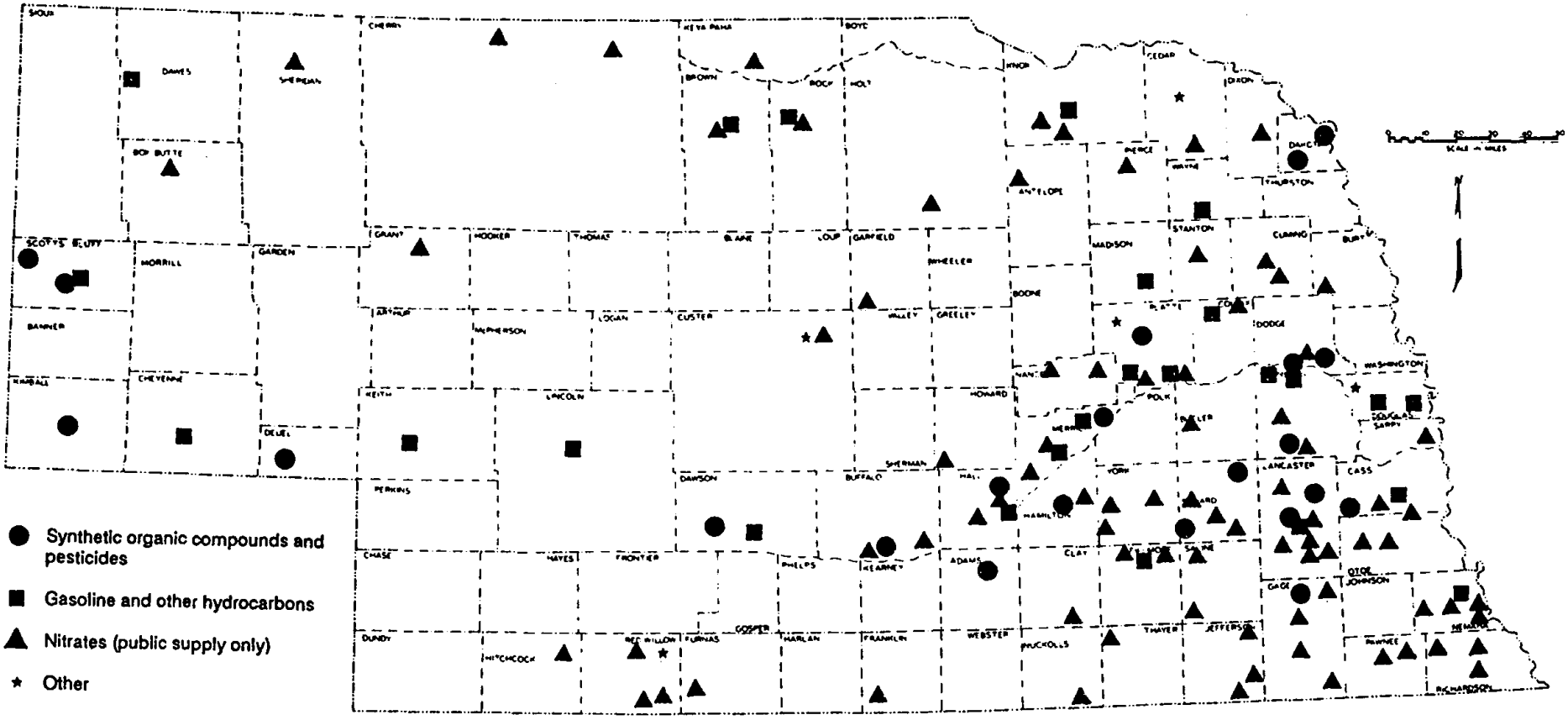


Figure 2-12
LOCATION OF GROUNDWATER CONTAMINATION OCCURRENCES

grasslands in central and western parts of the state. Heavy grazing and mowing limit the value of some grasslands as habitat.

Cropland

Corn, wheat, sorghum, soybeans, and alfalfa are the major crops grown in the state. Some farming is done in every county, but cropland is limited in portions of the Panhandle and the Sandhills. Center pivot technology has allowed some grassland and woodland areas to be converted to cropland. Many species of upland game, waterfowl, and big game use agricultural crops and residues as an important part of their diet. Some areas provide cover for nesting and brooding of pheasants, but farming operations such as mowing destroy many nests.

Woodlands

Woodlands are found along streams and rivers throughout the state. Wooded uplands are also scattered throughout the state, but the largest areas are found near the northwest, northeast, and eastern boundaries. This habitat is very important because many wildlife species require woody cover at one time or another. Shelterbelts and windbreaks are important because of their proximity to other habitat types. Woodlands are limited in Nebraska and removal of these areas is a threat to the state's wildlife resources.

Water

Water areas are important to all wildlife and are particularly important for waterfowl production and migrants, such as ducks, geese, and Sandhills cranes. Warm water fish are supported in most reservoirs and in some natural lakes, farm ponds, and sand pits. A 1979 inventory has determined that 9,536 miles of warm water streams are productive from a fisheries standpoint. Approximately 851 miles of productive coldwater streams exist in the state. Mixed cold and warm water fish populations are supported in 382 miles of streams.

OPEN SPACE, AESTHETICS, AND INTANGIBLES

An important aspect of the natural resources of the state is their contribution to the quality of the environment. The land provides scenes of natural beauty such as mesas, buttes, river bluffs, rolling wooded hills, and scenic rivers and reservoirs. Open spaces for "elbow room" on broad expanses of prairie, stretching as far as the eye can see, are also important resources. Lakes, reservoirs, and streams also provide recreational opportunities for boating, water skiing, swimming, fishing, and hunting.

CULTURAL CONDITIONS

Cultural conditions in Nebraska include population, employment, land ownership, education, age distribution, attitudes, and stewardship. All of these cultural conditions affect the state of our natural resources. The condition of the resources in turn affects these cultural conditions.

POPULATION

In 1980, the population of Nebraska was 1,569,825 (Table 2-12). Population increases were not dramatic during the period from 1930 to 1980. The state's population grew at an annual rate of about one-half percent from 1940 to 1980 after a decline between 1930 and 1940.

A more dynamic aspect of the changing population of Nebraska has been where people live. In 1930, about 35 percent of the people lived in urban places (towns of 2,500 or more). By 1980, almost 63 percent of the population was urban. The rural population has changed dramatically since 1930 when the total rural population was almost 900,000. The rural population in 1980 was about 582,000, a decline of about 35 percent since 1930. The farm portion of the rural population has also declined over this 50-year period. In 1980, there were about 405,000 fewer people on farms than there were in 1930. The proportion of the rural population on farms went from 65 percent in 1930 to about 31 percent in 1980.

Changes in the characteristics of the population of Nebraska indicate that fewer and fewer people are directly involved in agriculture at the farm level. There are also fewer people that reside in rural places, indicating that fewer people are involved in businesses that are closely related to the farming sector of the state's economy.

Table 2-12

NEBRASKA POPULATION, URBAN, RURAL, AND RURAL-FARM RESIDENTS, 1930-1980

Year	State Total	Urban	Rural	Rural Farm
1930	1,377,963	486,107	891,856	582,981
1940	1,315,834	514,148	801,686	495,477
1950	1,325,510	621,905	703,605	391,435
1960	1,411,330	766,053	645,277	308,759
1970	1,483,493	912,598	570,895	237,978
1980	1,569,825	987,874	581,951	178,115

Source: Detailed Population Characteristics, Nebraska, Census of Population, 1980, U.S. Department of Commerce.

EMPLOYMENT

Just as the population of Nebraska has grown and changed over the years, so has the structure of the economy and, therefore, the kind of work that the population does. The employment figures in Table 2-13 reflect economic conditions. In 1940, total employment in Nebraska was 433,477. About 62 percent (269,909 people) worked at non-agricultural jobs while the remaining 168,568 (38 percent) were employed in agriculture. In 1980, about 732,000 people were employed. Of those, about 90 percent (659,000 people) were employed by the non-agricultural sector. The structure of Nebraska's economy has changed such that fewer people are directly employed in agriculture even though agriculture is the primary basis of the economy.

LAND TENURE

The ownership of farmland in Nebraska also changed substantially in the period from 1940 to 1982, as shown in Table 2-14. In 1940, there were 35,064 operators that were owners of farm enterprises. The operators that were tenants in 1940 numbered 63,947 and there were 21,497 part owners. Only 29 percent of all farm operators were full owners.

Table 2-13

NEBRASKA EMPLOYMENT, BY NON-AGRICULTURE AND AGRICULTURE EMPLOYMENT, 1940-1980

Year	Total Employed	Non-Ag	Ag
1940	433,477	269,909	163,568
1950	590,600	393,200	197,400
1960	613,000	453,000	160,000
1970	612,300	522,600	106,000
1980	732,000	659,900	102,000

Source: Nebraska Statistical Handbook, 1984-1985, Nebraska Department of Economic Development.

Table 2-14

TENANCY OF NEBRASKA FARMERS FOR SELECTED YEARS

Year	Full Owners	Part Owners	Tenants
1940	35,064	21,497	63,947
1950	37,939	27,164	41,747
1959	31,141	26,520	32,490
1969	28,416	26,087	17,754
1978	26,744	24,971	14,201
1982	24,840	23,083	12,320

Source: Census of Agriculture, 1982, Nebraska, Vol. 1, Part 27, U.S. Department of Commerce, Bureau of Census.

There were 60,243 farm operators in 1982 compared to 121,062 in 1940. The number of full owners in 1982 was 24,840 (about 41 percent of the total) and there were 12,320 tenants (about 20 percent). The total number of farm operators in 1982 was substantially less than in 1940, but the pattern of ownership has changed. The figures show more farms were owned by the operators in 1982 (41 percent) than in 1940 (29 percent). In 1940, over 50 percent of farm operators were tenants. By 1982, only 20 percent of all operators were tenants.

AGE DISTRIBUTION

In the past 40 years, farming operations have emphasized the substitution of capital (machinery, equipment, and chemicals) for labor and other resources. The focus has been on producing more agricultural commodities from a fixed amount of land. Typically, the younger generation is more likely to adopt new technology and methods, including changes in farm operations and conservation practices. Consequently, the age distribution of the population provides some insight to the potential for improved conservation.

The average age of the total state population has changed little during the last 40 years (Table 2-15). The female population has grown more rapidly than the male population, and females have exceeded the number of males since 1960. The average age for females for the period of 1940 to 1980 is 30.5, while the average age of males for that same period is 29.8.

Characteristics of the rural population may be more revealing concerning resource conservation issues. Average age and sex for rural non-farm and rural farm categories is displayed in Table 2-16. The most notable aspect of these statistics is the growth in the rural non-farm population from 1960 to 1980. The other notable trend is that the rural non-farm population has become younger on average while the farm population has grown older from 1960 through 1980. Another aspect of the rural population that may have some bearing on natural resource conservation issues is the age of the persons who actually own or control those resources. The average ages of farm operators in Nebraska are listed for Agricultural Census years from 1940 through 1978 in Table 2-17. This information suggests that the age of operators has been very stable for many years although it appears to have increased slightly since the 1940's.

EDUCATION

In 1980, 90 percent of all Nebraskans 20 to 24 years of age were high school graduates. At the same time, 90.5 percent of all rural Nebraskans in the same age group graduated from high school. This indicates a slightly higher graduation rate for rural Nebraskans 20 to 24 than for all Nebraskans in the same age group.

Table 2-15

AVERAGE AGE OF NEBRASKA'S POPULATION AND AVERAGE AGE BY SEX, 1940-1980

Year	Total	Age	Male	Age	Female	Age
1940	1,315,834	29.7	665,788	29.9	650,046	29.5
1950	1,325,510	31.0	667,332	30.8	658,178	31.3
1960	1,411,330	30.2	700,026	29.6	711,304	30.9
1970	1,483,493	28.6	724,455	27.4	759,038	29.7
1980	1,569,825	29.7	765,894	28.6	803,931	30.9

Source: Detailed Population Characteristics, Nebraska, Census of Population, 1980, Department of Commerce, Bureau of Census.

Of all Nebraskans 25 and over, 15.5 percent have attended four or more years of college. Among rural Nebraskans in the same age group, this figure drops to 10.4 percent. These figures indicate that in 1980, both rural and non-rural Nebraskans were likely to graduate from high school (nine out of ten), but rural Nebraskans were less likely to attend a college for at least four years.

The amount of conservation education any individual in Nebraska has received by the time of high school graduation is difficult to determine. Rural residents are more likely to have received this type of education than non-rural Nebraskans. Opportunities for formal education in conservation are limited to the Vo-Ag/FFA program in Nebraska high schools. Many students (generally rural) have received conservation education through this program. An extra-curricular program, 4-H, also exposes rural and non-rural Nebraskans to conservation ideas. Other students benefit from conservation education from individual teachers who seek out further information on soil and water resources. The Ag in the Classroom program has assisted several teachers in expanding their teachings on soil conservation topics. Many students have also benefitted from various NRD education programs. Some form of conservation education reaches approximately 5,000 to 7,000 Nebraska elementary and secondary students each year.

ATTITUDES

A good starting point in determining an approach to solving a public issue is to determine what the public knows and how they feel about the issue. Lack of awareness might be the first part of the problem. If they are aware of it, then alternative solutions can be sought that will be acceptable to the public.

The U.S. Department of Agriculture conducted public meetings during 1978 as a part of the implementation of the Soil and Water Conservation Act of 1977 (RCA). The meetings were held to solicit public views regarding natural resource concerns and problems. Nationally, soil erosion was identified as a major resource concern at about one-third of the 9,000 meetings. Food and fiber production, land use, water supply, and water quality were ranked behind soil erosion as other major concerns.

The ranking of resource concerns from meetings held in Nebraska is quite different from the national view. Soil erosion as a concern was ranked ninth behind food and fiber production, land use, water supply, socio-political concerns, water quality, flooding, recreation, and organic waste management. This seems to indicate that Nebraskans are not aware of the severity of erosion problems.

The Department of Agriculture also commissioned a survey to determine public attitudes regarding conservation of soil, water, and related resources.

Some of the findings were:

- Half of all Americans consider misuse of soil and water resources to be a serious problem.
- Fifty-three percent feel the loss of good farmland is a serious problem.

Table 2-16

RURAL NON-FARM AND RURAL FARM POPULATION
IN NEBRASKA BY AVERAGE AGE AND SEX, 1960-1980

	Year		
	1960	1970	1980
		Non-Farm	
Total	336,518	331,879	403,838
Age	33.3	33.2	31.9
Male	168,166	162,428	198,132
Age	31.9	31.5	30.1
Female	168,357	169,451	205,698
Age	34.9	34.9	33.6
Farm			
Total	308,759	238,194	178,113
Age	29.4	31.4	32.8
Male	162,344	123,548	94,281
Age	30.1	31.9	32.1
Female	146,415	114,646	83,832
Age	28.7	31.0	33.6

Source: Detailed Population Characteristics, Nebraska, Census of Population, 1980, U.S. Department of Commerce, Bureau of Census.

- People view conservation as a joint public and private responsibility.
- Over 80 percent of those surveyed view federal action to protect farmland from erosion as a proper role for government.

In general, it appears that a majority of the public are somewhat aware of conservation issues and are willing to support actions to mitigate problems.

A survey of opinions and attitudes of Nebraska Sandhills residents was conducted in 1980. Of those surveyed, about 89 percent expressed concern about the natural resources of the Sandhill region. More specific questioning revealed the major concerns of the residents, and these are shown in Table 2-18.

Table 2-17

AVERAGE AGE OF FARM OPERATORS IN
NEBRASKA, 1940-1978

Year	Operator Age
1940	46.2
1950	45.9
1954	47.1
1959	48.1
1964	49.2
1969	50.3
1978	48.7

Source: Census of Agriculture, 1982, Nebraska, Vol. 1, Part 27, U.S. Department of Commerce, Bureau of Census.

Table 2-18

SANDHILLS RESIDENTS CONCERNS

Concerns	Percent Mentioning Concern
Low water table	48
Keep land the way it is	12
Soil erosion	10
Too much irrigation	7
Conservation	4
Wildlife habitat	4
Ground water pollution	3
Foreign investment	3
Government intrusion	1
Other	6

Source: NRC/NARD Sandhills Residents Community Study, SRI Research Center, Inc., December 1980.

When respondents were asked about regulation of natural resources, 68 percent agreed that it may be necessary. When asked who should regulate natural resource use, 45 percent felt that local government should be responsible, 18 percent indicated state government, 13 percent preferred local land owners, and 3 percent indicated the federal government should do it. When questioned about alternative approaches to regulation, the respondents did not clearly favor any particular approach.

Another survey was conducted in the Maple Creek Watershed in northeast Nebraska by the Natural Resource Economics Division of the USDA Economic Research Service (formerly the Economics, Statistics, and Cooperatives Service). The findings of that survey indicate that a typical operator in the Maple Creek area uses four conservation practices. The most frequent practices reported were crop residue management (86 percent) and waterways (80 percent). Contouring, strip cropping, and terraces were among the least used conservation practices.

The results, presented in Table 2-19, show a disparity between SCS estimates of the soil erosion hazard on farms and the operator and landlord view of the hazard. The SCS classified 82 percent of the farms as having major soil erosion problems, while only two percent of the operators and none of the landlords concurred. The results indicate that younger operators who have resided on their farms less than 10 years agreed more closely with SCS about the severity of soil erosion on their farms. These younger operators also used more practices than those who disagreed with SCS estimates of soil erosion severity.

Table 2-19

DEGREE OF SOIL EROSION ON FARMS CLASSIFIED BY OPERATOR, SCS AND LANDLORD, MAPLE CREEK MIP, 1977

Degree of Soil Erosion on Farms	Operator		SCS		Landlord	
	No.	Pct.	No.	Pct.	No.	Pct.
Major problem	2	2	87	82		
Moderate problem	47	44	15	14	20	43
Low problem	15	14	4	4	2	3
No problem	42	40			34	49
No response					3	4
Total	106	100	106	100	69	100

Source: Operator and Landlord Participation in Soil Erosion Control in the Maple Creek Watershed in Northeast Nebraska, Economics, Statistics, and Cooperatives Service, USDA, March 1980.

CULTURAL PROBLEMS AND OPPORTUNITIES

A segment of the farm population is convinced that using conservation practices to control erosion and manage rangeland and water resources is the right thing to do. Some believe it is good economics, some believe it is the ethical thing to do, and others apply practices because they believe practices will be regulated someday. Collectively, these farmers are adequately treating their land with conservation practices. A smaller group of farmers have refrained from applying proper conservation practices, whether due to financial constraints or personal attitudes.

The desire to clean till cropland fields is still present, but not to the same extent as in the past. Conservation tillage is now used on 45 percent of Nebraska's cultivated land and serves as evidence that clean till is not a necessity. A very high percentage of those who use clean till also use herbicides, but there is some fear of poor weed control and of increased cost of weed control with conservation tillage.

Straight row cultivation is still practiced by some land users. This is especially true in cases where a low margin of profit per acre has forced many operators to farm more land. The additional land has encouraged the use of larger equipment which may not negotiate contours as well as straight rows. Operators may be hesitant to adopt contouring and other conservation practices which may take more time.

A segment of the agricultural sector still does not recognize erosion and water quantity or quality problems, or they do not perceive them to be problems. This was demonstrated in the Maple Creek watershed survey. This lack of recognition restrains some operators from using practices that could increase their immediate net profits. These practices include planned grazing systems that could increase carrying capacity of rangeland, irrigation water management that could reduce pumping costs and increase profits, and conservation tillage which could reduce tillage costs and increase yields.

Even though cost sharing of up to 75 percent is available for the more expensive practices, financial constraints still prevent some operators from using them. They may have good intentions, but due to the present ag economy cannot raise even 25 percent of the costs.

It appears that constraints of ignorance could be reduced by intensive education programs. The effectiveness of these programs would depend on several factors. First, the programs should be designed to attract land users to attend, and the technical manpower should be available to deliver the program. The extent that resource users can realize short run profits from practices, and the use of incentives and regulations can affect the use of education programs. Present information programs are designed to reduce these constraints, but the scale of these programs is much too small to have a significant impact.

An intensive educational program on soil and water resources for school children would accelerate the training of the adult sector. In time, it would produce a public with an appreciation for the need to sustain soil and water resources. The response to subsequent adult education would also be greater. The present system, left entirely up to the ability and preferences of the teacher, needs to improve the quantity or quality of environment/conservation education.

There are still people who respond to reasoning based on ethics and the need for soil stewardship. They could be reached by a combination of the education possibilities mentioned above and ethical promotion of their church philosophy by the ministry. Most church denominations have a policy to encourage soil and water resources stewardship. That philosophy, however, needs greater emphasis by the ministry in the local church.

There is no one attitude that would cause a significant increase in the application of conservation practices. However, a comprehensive approach to strengthen all of the above attitudes could make a significant improvement.

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Chapter 3. CONSERVATION AGENCIES AND ORGANIZATIONS AND PROGRAMS

There are many agencies and organizations within the State of Nebraska concerned with conservation of natural resources. They have a number of programs which are educational, incentive, or regulatory in nature. These agencies and programs are discussed in this chapter.

CONSERVATION AGENCIES AND ORGANIZATIONS

Many organizations and government agencies are working to conserve soil and water resources in Nebraska. These organizations and agencies may be local, state or national. Some are privately funded, and others are publicly funded government and university agencies and organizations. Many have promoted and worked on conservation for years. In addition, other organizations and corporations influence conservation policies and programs.

LOCAL AGENCIES AND ORGANIZATIONS

Local agencies have been in the forefront of conservation for many years. These agencies include local governments, such as counties and cities, and political subdivisions, such as NRDs and school districts. They promote conservation through individual and cooperative education, assistance, and regulation programs.

Natural Resources Districts

Nebraska is divided into 24 Natural Resources Districts (NRDs) whose boundaries approximate the major river basins in the state. The statutory responsibilities of the districts include soil conservation, flood control, development and conservation of water resources, pollution control, development and management of fish, wildlife, and recreational facilities, and forestry and range management. In addition, many of the districts have established public information, education, and tree planting programs.

History. NRDs were formed in 1972 under legislation adopted by the Nebraska Unicameral in 1969. These districts replaced and assumed the duties of 154 existing districts, including soil and water conservation districts, and several types of watershed districts and boards.

Current Size and Capability. Total NRD funding in fiscal year 1984-85 was almost $27 million. Over $9 million was from local taxes. The average district budget was just over $1.11 million. The median budget, however, was only $480,000. This discrepancy between the mean budget and the median budget occurs because a few districts with large tax bases are able to generate a much larger amount of funding than the majority of districts. For instance, the Lower Platte South NRD has a total budget of over $3,475,000 with $1,199,999 in local tax contributions, whereas the Upper Loup NRD has a total budget of only $159,672 with only $74,356 in local tax contributions.

These discrepancies in tax base and funding result in significant differences in the size of NRD operations. The Papio NRD funds 20 district staff and 5 SCS field office secretaries, and the Lower Niobrara funds only one district employee and one field clerk. In total, the 24 districts fund 128 district staff and 81 SCS field office secretaries.

The NRDs are governed by a board of directors, and every district has a manager to supervise its operations. Each NRD elects from 5 to 21 directors. Directors are elected from subdistricts within each district and one director is elected at large.

Authorities and Programs. To further their purposes, NRDs are empowered to: (1) make studies and conduct research, (2) acquire property and rights by eminent domain, if necessary, and (3) construct and operate required facilities.

NRDs have the authority to formulate rules and regulations governing use of lands in the district in the interest of conserving soil and water resources and controlling soil erosion. However, such land use regulations cannot be enacted unless 75 percent of the affected landowners vote for the regulations in a referendum. Municipal, county, and regional land use regulations take precedence over district regulations in cases of conflict. NRD land use authorities have not yet been used.

Educational. The NRDs recognize the need to educate and inform the people of Nebraska if they are to accomplish their collective goal of properly managing the state's resources. They offer varied public information programs and activities, some in cooperation with the Nebraska Association of Resource Districts (NARD). Many focus on Nebraska's youth, in an effort to develop a conservation ethic that will result in responsible adult leadership in the future.

NRD education and demonstration programs are intended to inform and educate citizens about the importance of proper resources management. The 24 NRDs collectively offer over 60 information and education activities. Three NRDs employ full-time public information managers. Other districts provide public information activities through full-time or part-time staff who may also perform other duties. Most NRDs submit press releases to newspapers and nine publish columns in local newspapers. Information is also disseminated through newsletters, radio programs, public service announcements, and soil stewardship week materials (Table 3-1).

NRDs also inform the public through youth education programs (Table 3-2). Twenty-three NRDs sponsor land or range judging contests. Many provide conservation education through booklets, films, videos, contests, and conservation camps. Districts show teachers how to implement conservation education in their school curriculums. Conservation school days are also a popular activity.

NRDs have offered scholarships or financial aid to persons attending various camps, workshops, and schools (Table 3-3). Two NRDs sponsor a conservation education workshop, and three districts in the Blue River basin cosponsor the Environmental Education Institute at Camp Jefferson. Some districts finance conservation education materials, including television programs, films, and public information projects. Table 3-4 lists those NRDs which provide materials, usually trees, for outdoor education. One district also grants funds to schools for conservation education materials. Twenty-two NRDs offer various awards (Table 3-5). The most popular of these awards is the conservation farm photo award, given by 20 NRDs. Urban conservation awards are offered by two natural resource districts. Along with the distribution of information to other award programs, the local NRD participates in and nominates persons for stewardship recognition awards at the local, state and national levels.

NRDs use many other methods of supplying information and services to their constituents (Table 3-6). Seven offer irrigation scheduling demonstration projects, and others provide irrigation scheduling hotlines. Nearly half the NRDs sponsor conservation tillage programs or demonstrations.

While it is not possible to judge the effectiveness of these 24 public information programs with respect to each other, the amount of information each offers can be compared. From the information compiled on Tables 3-1 through 3-6, it is obvious that some NRDs conduct information and education programs which are more varied and extensive than others. One NRD participates in 7 activities; another in 35. The average number of activities per NRD is 18. Figures indicate a great disparity between the NRDs and what each offers to the public in the way of information and education. This difference is due, at least in part, to the amount of funding available in each district.

Incentive. Many of Nebraska's NRDs return a portion of local tax receipts to district landowners in the form of cost-sharing funds for installing conservation measures. The NRD "shares" the cost of these measures with eligible landowners. In recent years, these local cost-sharing programs have provided about nine percent of total government money available for land treatment in Nebraska. With cutbacks likely in federal funding, this percentage may expand significantly. Sixteen NRDs included funds for land treatment in their fiscal year 1986-1987 budgets. These funds totaled just over $3.1 million.

The eligibility requirements and allowable practices for NRD cost-sharing programs vary between districts. The way these funds are coordinated with state and federal cost-sharing funds also varies. Districts generally use all available federal and state funds before local funds are spent.

Regulatory. NRDs have a number of special powers and duties related to ground water. They are empowered to apply to the Director of the Department of Water Resources for ground water control areas in parts of their district. These areas may be designated to address problems of potentially inadequate water supplies, or ground water quality problems. A variety of regulations may be adopted, including allocation of ground water

Table 3-1

Public Information Activities

Central Platte	Lewis & Clark	Little Blue	Lower Big Blue	Lower Elkhorn	Lower Loup	Lower Niobrara	Lower Platte North	Lower Platte South	Lower Republican	Middle Missouri Tribs	Middle Niobrara	Middle Republican	Nemaha	North Platte	Papio	South Platte	Tri-Basin	Twin Platte	Upper Big Blue	Upper Elkhorn	Upper Loup	Upper Niobrara-White	Upper Republican	
						•																		Publish Annual Newsletter
		•	•																•					Publish Quarterly Newsletter
													•		•									Publish Bimonthly Newsletter
	•			•	•		•			•					•	•	•							Publish Column in Local Newspapers
													•	•	•	•		•	•	•			•	Display Booth at County Fairs
								•							•				•					Employ Public Information Manager
•	•		•	•	•	•	•	•			•	•	•	•	•		•	•	•	•			•	Submit Press Releases to Newspapers
											•													Monthly Radio Program
					•											•								Weekly Radio Program
•	•		•																•				•	Publish Annual Report
•					•			•		•					•				•					Conduct Public Opinion Survey
															•				•					Traveling Display of NRD Activities
•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•			•	•	Soil Stewardship Week (provide literature)
								•		•				•	•			•					•	Produce Public Service Announcements for Radio
								•						•	•			•					•	Produce Public Service Announcements for TV
															•			•						Monthly Television Informational News Program

Table 3-2

Youth Education Activities

	Central Platte	Lewis & Clark	Little Blue	Lower Big Blue	Lower Elkhorn	Lower Loup	Lower Niobrara	Lower Platte North	Lower Platte South	Lower Republican	Middle Missouri Tribs	Middle Niobrara	Middle Republican	Nemaha	North Platte	Papio	South Platte	Tri-Basin	Twin Platte	Upper Big Blue	Upper Elkhorn	Upper Loup	Upper Niobrara-White	Upper Republican
Outdoor Classroom	•		•			•	•	•	•	•			•						•	•			•	•
Sixth Grade Conservation Camp																	•						•	•
Student Field Tours			•																	•				•
Participate in County Government Day				•		•	•	•		•		•		•				•			•	•		•
Conservation School Days and Grades			•	• 5th			• 8th	• 6th		• 7th,8th	• 6th	• 8th	•				•	• 8th		•	• 8th			•
Conservation Speech Contest										•				•			•							
Conservation Poster Contest				•									•	•		•								
Provide Films or Video to Schools				•	•		•								•	•				•		•		•
Provide SCSA Conservation Booklets		•	•	•	•		•		•	•			•	•	•			•	•	•		•		•
Sponsor Land, Range and Soil Judging Contests	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
High School Classroom Workshops						•														•				

Table 3-3

Scholarships and Financial Aid

Central Platte	Lewis & Clark	Little Blue	Lower Big Blue	Lower Elkhorn	Lower Loup	Lower Niobrara	Lower Platte North	Lower Platte South	Lower Republican	Middle Missouri Tribs	Middle Niobrara	Middle Republican	Nemaha	North Platte	Papio	South Platte	Tri-Basin	Twin Platte	Upper Big Blue	Upper Elkhorn	Upper Loup	Upper Niobrara-White	Upper Republican	
											•	•						•						UN-L Curtis Scholarships
	•			•																				Scholarships for FFA Graduates
												•												McCook Community College Scholarships
•																		•						Scholarship for Evironmental Class at UN-K
		•	•																•					Sponsor Environmental Teachers Institute
				•																				Sponsor School for Elementary Teachers
																•					•			Sponsor Conservation Education Workshop
•											•	•		•				•			•		•	Financial Aid for Students to Environmental Classes
•					•			•	•		•		•	•	•			•	•		•		•	Financial Aid For Teachers to Environmental Classes
	•	•		•		•		•		•	•	•		•						•	•		•	Scholarships to 4-H Camp at Halsey
	•	•				•		•	•		•	•	•	•		•	•	•		•	•		•	Nebraska Range Camp Scholarships

Table 3-4

Outdoor Education Materials

	Mini-Grants for Materials	Give Complimentary Trees for Educational or Conservation Purposes	Future 4-Her's Birthday Trees	Trees for Schools (Arbor Day)	Tree Planting and Seedlings for Schools	Road Beautification Plantings
Central Platte				•		
Lewis & Clark		•				
Little Blue		•		•		•
Lower Big Blue		•		•	•	
Lower Elkhorn						
Lower Loup		•		•	•	
Lower Niobrara		•		•		
Lower Platte North						
Lower Platte South		•				
Lower Republican						
Middle Missouri Tribs						
Middle Niobrara				•		
Middle Republican		•		•	•	
Nemaha						
North Platte		•				
Papio	•					
South Platte		•		•	•	
Tri-Basin			•	•		
Twin Platte		•		•		
Upper Big Blue		•		•		
Upper Elkhorn		•		•	•	
Upper Loup		•		•	•	
Upper Niobrara-White					•	
Upper Republican		•		•	•	

Table 3-5

Awards

	Conservation Farm Photo Award	Outstanding Cooperator Award	Farmer Recognition Award	Grassland Management Award	County Fair Award ($ for 4-H projects)	Marc Cox Per. Ag. Program (Sioux City)	Urban Conservation Award	Tree Care Award	Tree Award
Central Platte	•						•		•
Lewis & Clark	•			•		•			
Little Blue	•								
Lower Big Blue	•	•							
Lower Elkhorn	•					•			
Lower Loup									
Lower Niobrara	•			•		•			
Lower Platte North									
Lower Platte South			•						
Lower Republican	•			•				•	
Middle Missouri Tribs	•					•			
Middle Niobrara	•	•		•	•				
Middle Republican	•			•	•				
Nemaha	•								
North Platte	•	•		•					•
Papio	•						•		
South Platte	•								
Tri-Basin	•								•
Twin Platte	•								•
Upper Big Blue	•								
Upper Elkhorn	•			•		•			
Upper Loup	•	•		•					•
Upper Niobrara-White									
Upper Republican	•	•			•				

Table 3-6

Information and Education Services and Activities

	Central Platte	Lewis & Clark	Little Blue	Lower Big Blue	Lower Elkhorn	Lower Loup	Lower Niobrara	Lower Platte North	Lower Platte South	Lower Republican	Middle Missouri Tribs	Middle Niobrara	Middle Republican	Nemaha	North Platte	Papio	South Platte	Tri-Basin	Twin Platte	Upper Big Blue	Upper Elkhorn	Upper Loup	Upper Niobrara-White	Upper Republican
Free Nitrate Tests			•			•	•			•			•						•		•	•		•
Run Streamflow Studies	•		•	•			•						•						•			•		•
Run Groundwater Studies	•		•	•	•	•	•	•	•				•	•	•				•		•	•		•
Develop Computer Based Resources Data Information System																			•	•			•	•
Cosponsor Annual Crop Clinic												•												
Maintain Nature Trail					•					•														
Run Water Quality Studies	•		•	•		•	•						•	•					•		•	•		•
Cosponsor Forestry Field Days									•															
Conduct Grassland Interseeding Tour										•		•							•			•		•
Cosponsor Conservation Tillage Program or Demonstration				•	•	•			•		•			•	•	•	•						•	•
Provide Irrigation Scheduling Hotline					•	•				•					•		•	•		•	•			•
Irrigation Scheduling Demonstration Project	•			•		•												•				•	•	•
Operate Weather Stations and Distribute Data					•	•						•						•		•	•			•

use, well spacing, rotation of use, well metering, irrigation scheduling, and moratoriums on new wells. Control areas were established in most of the Upper Republican Natural Resources District and the Upper Big Blue Natural Resources District in 1977. A portion of the Little Blue Natural Resources District was declared a control area in 1979. NRDs are also responsible for adopting ground water management plans, which may require designating management areas where allocations, rotations, or well spacing, and metering are required.

Natural Resources Districts (NRDs) may also request that the Director of the Department of Water Resources declare a Ground Water Control Area if their board believes that ground water use has or is likely to cause water shortages or ground water quality problems. A variety of regulations may be adopted, including allocation of ground water use, well spacing, rotation of use, well metering, irrigation scheduling, and moratoriums on new wells. Regulations for a control area must be approved by the Department of Water Resources before they can be implemented. Ground Water Control Areas have been approved for the Upper Republican, Upper Big Blue, and Little Blue NRDs. The Upper Republican NRD requires well metering on large capacity wells, ground water allocations, well spacing, and permits to apply chemicals through irrigation systems. The Upper Big Blue Control Area requires well spacing, notification of well abandonment or anticipated replacement, and notification of amounts pumped by municipal, industrial, and recreational wells. If the rate of ground water table decline is in excess of the goal the NRD has set, allocations and well metering may be required. The Little Blue NRD requires well metering; notification of amounts pumped by municipal, industrial, fish and wildlife, and recreational wells; acreage certification; and allocations of ground water whenever water table levels drop below a predetermined baseline.

Statutes requiring ground water management plans for each NRD were enacted in the 1985 legislative session. In their management plans, NRDs may include management areas in which they are allowed to institute allocations, rotations, well spacing, and metering. When the Director of Water Resources approves the management plan, the district must hold a public hearing if it proposes to form a management area. Within a designated ground water management area, the district must determine the volume of water which may be withdrawn from the ground water reservoir, while maintaining the ground water reservoir life goal in its management plan. It then adopts controls which would allow beneficial use of that volume of water. Districts may annually adjust any allocation or rotation controls to accommodate new findings or new uses and must do so at least once every three years. No ground water management areas have yet been approved.

Nebraska's Ground Water Management and Protection Act requires NRDs to adopt rules and regulations to control or prohibit surface runoff from ground water irrigation. Each NRD must adopt rules and regulations which prescribe: (1) standards and criteria describing what constitutes inefficient or improper runoff of ground water used in irrigation, (2) procedures to prevent, control, and abate such runoff, (3) procedures for the construction, modification, extension, or operation of remedial measures which prevent, control, or abate runoff of ground water used in irrigation, and (4) procedures for enforcement of runoff control.

Ground Water Conservation Districts

The five ground water conservation districts currently in operation are in York, Clay, Fillmore, Hamilton, and Seward Counties. An inactive district exists in the Upper Republican. Ground water conservation district activities have included adopting runoff controls, monitoring ground water, educational activities and working with NRDs. Directors of the districts are elected by a majority vote of the landowners. At least a majority of directors must own registered irrigation wells. Statutes have forbidden the organization of new districts since June 30, 1972, and all ground water conservation districts are to be dissolved within 90 days after January 1, 1987.

History. Ground water conservation districts were authorized in 1959. They were the primary districts with water regulatory powers until the creation of NRDs and ground water control areas.

Authorities and Programs. The purpose and authorities of ground water conservation districts include: (1) gathering and supplying information concerning ground water conservation, (2) promulgating and administering policies relating to ground water, except that responsibility for land treatment programs will be limited to recommendations, and (3) adopting,

administering, and enforcing rules and regulations to ensure the proper conservation of ground water within the district. Any rules and regulations adopted must receive concurrent approval of the NRD or NRDs in which they are located.

Cities and Counties

City and county comprehensive plans often contain provisions for soil and water conservation.

Authorities and Programs. County zoning statutes authorize the regulation and restriction of land uses, including agriculture. In formulating regulations and restrictions, factors related to soil conservation, water supply conservation, and surface water drainage and removal must be considered. County comprehensive plans may also make recommendations concerning physical development patterns. Garfield County has adopted a comprehensive plan which has soil conservation as one of its major purposes.

City comprehensive development plans must also contain a land use element and land use zoning. Municipal wells may be protected through such zoning regulations. Well fields beyond the regular zoning jurisdiction of the city are generally not subject to protection in cities of over 5,000 population. However, cities and villages of less than 5,000 have jurisdiction to 15 miles from the corporate limits for purposes of protecting their water source from pollution or injury. Current statutes relating to such topics as city control of construction site erosion and city controls on water use are general in nature and relate to reasonable controls under police powers. There are no specific statutes addressing construction site runoff or water use controls. Roadside erosion is not controlled specifically by statute. However, the Department of Roads has design standards and regulations covering items such as backslopes for new rural roads and seeding along new or reconstructed roads.

School Districts

Size and Capability. As of the 1985-86 school year, there were 962 public school districts and 264 non-public school districts in Nebraska. Information on the public school districts is given in Table 3-7. Public school enrollment in September 1985 totaled 266,298 students.

Authorities and Programs. Within the broad curriculum requirements set by the State Board of Education, local school boards have authority over specific course selection, content, and teaching materials. School boards may appoint committees of teachers to assist in the selection of teaching material, which could potentially include soil and water conservation topics.

At present, there are no courses at the elementary school level specifically emphasizing soil and water resources or conservation. The textbooks used to meet the earth sciences requirement touch on this subject, but detail is limited. Individual teachers sometimes seek out further information and materials, however, and teach expanded soil and water conservation sections. The Game and Parks Commission, SCS, Cooperative Extension Service, NACD, and many of the NRDs make educational materials, films, or staff available for classroom presentations.

At the secondary school level, there is more opportunity to study soils and water, yet offerings are still limited. As in the elementary schools, there is no curriculum requirement mandating soil and water conservation courses. The only related course which is mandated is a general earth science course which may touch on the subjects of soil and water. At the secondary school level, however, this general earth science course may be optional to the student. Individual schools may offer more in-depth classes on environmental awareness, soils, or conservation, but little data is available on these programs. Individual teachers may choose to emphasize one or more of these subjects either by their own initiative or as a result of extracurricular teacher training, such as the Environmental Education Institute at Camp Jefferson.

Churches

Authorities and Programs. Many religious denominations are concerned with stewardship activities related to soil and water conservation. The Lutheran church and the United Methodist church sponsor advocacy programs which encourage members to stay informed of natural resources issues and indicate their views to legislators and others who set public policy. The Holy Earth Movement, sponsored by the United

Table 3-7

PUBLIC SCHOOL DISTRICTS

Class	District Population	Types of Schools	No. of Districts	Enrollment*		
				Maximum	Minimum	Total
I	No limits	Elem. only	604	600	0	16,396
II	Under 1,000	Elem. and High School	65	232	0	8,821
III	1,000 to 100,000	Elem. and High School	220	14,307	74	169,227
IV	100,000 to 200,000	Elem. and High School	1			25,209
V	Over 200,000	Elem. and High School	1	41,632		
VI	No limits	High School	23	673	34	4,534

*September 1985 enrollment.

Methodist church also emphasized simple lifestyles that do not exploit natural resources. Organized church groups can have a strong influence on public policy regarding soil and water conservation.

Bible Study programs, pamphlets, filmstrips, and books on conservation of natural resources are published by many churches. The Presbyterian church held their annual conference in 1978 on the family farm theme. Soil and water conservation were topics included in that conference.

STATE AGENCIES AND ORGANIZATIONS

Organizations active in soil and water resources management and conservation at the state level include agencies, associations, and University of Nebraska-Lincoln divisions.

Nebraska Natural Resources Commission

The major responsibility of the Nebraska Natural Resources Commission (NRC) is the long range management of the state's land and water resources.

History. The Natural Resources Commission was originally established by statute as the State Soil Conservation Committee in 1937. It subsequently became the Nebraska Soil and Water Conservation Committee in 1957 and the Nebraska Soil and Water Conservation Commission in 1961. In 1969, legislation was passed which resulted in the Soil and Water Conservation Commission being reorganized as the Natural Resources Commission in 1972. In 1974, partially as a result of the Special Recommendation made for the State Water Plan, the Commission was made responsible for the newly created Nebraska Resources Development Fund. The Commission received responsibility for the newly established Nebraska Soil and Water Conservation Fund in 1977.

Size and Capability. The Commission has 16 members; 13 elected by NRD directors residing in Nebraska's 12 river basins, and three members appointed by the Governor. Forty-eight employees serve as the staff of the Natural Resources Commission, under the supervision of the Director of Natural Resources. The Director is chosen by the Governor from a list of names supplied by the Natural Resources Commission. In fiscal year 1986-87, the general fund budget of the NRC totaled $4.07 million. Of

that amount, $1.91 million was obligated to the Soil and Water Conservation Fund and $101,597 to the Resources Development Fund. The Small Watersheds Flood Control Fund was funded at $200,000 in fiscal year 1986-1987.

Authorities and Programs. Duties and powers of the Natural Resources Commission include: providing assistance to the Water Management Board and governmental subdivisions with water resources responsibilities, facilitating coordination and cooperation between local, state, and federal agencies, and planning, developing, and promoting the implementation of a comprehensive program of resource development, conservation, and utilization for Nebraska soil and water resources. The Commission's major planning program is the State Water Planning and Review Process. The Commission is also directed by statute to develop and maintain a Natural Resources Data Bank, which stores thousands of individual pieces of natural resources information.

Educational. The Commission offers on loan several audio-visual materials including a slide presentation for children five to ten years old entitled "You and Your Natural Resources". A variety of brochures are available which explain Commission functions and programs, and summarize the issues examined through the Water Planning and Review Process. The Commission also offers on loan the slide presentation "Our Soil, Water, and Time--Are They Running Out?". Produced in collaboration with the SCS, this presentation offers a look at the current state of soil conservation efforts in Nebraska and those problems which still lie ahead.

Incentive. The Commission is responsible for administering the Nebraska Soil and Water Conservation Program. Established in 1977, this program provides state financial assistance to help landowners defray the costs of installing conservation practices needed to control runoff and conserve water. The fiscal year 1986-1987 appropriation to this fund was about $1.91 million. Funds are divided evenly among NRDs and are only reallocated when unused funds are returned to NRC. They are not targeted to the areas of the state with the greatest need.

Another Commission duty is administering the Small Watersheds Flood Control Fund. This fund was established by the passage of L.B. 71 in 1963 and is allocated to local organizations to enable them to acquire property or easements needed to install upstream flood control or watershed protection and flood prevention structures. These structures are usually authorized by SCS, through the federal Watershed Protection and Flood Prevention Program, or sponsored by the Corps of Engineers or an NRD. The Commission is responsible for a non-structural program of flood plain management programs and flood insurance. The NRC is additionally responsible for the administration of the Nebraska Resources Development Fund, which provides financial assistance for projects and programs that will properly develop water and related land resources. Assistance may be requested by state agencies, or local political subdivisions such as NRDs, counties, and cities.

Department of Water Resources

The Department of Water Resources administers the laws relating to water use in Nebraska. The Department is a code agency headed by a director appointed by the Governor, and confirmed by the Legislature.

History. The Department of Water Resources was established in 1957 to replace the Bureau of Irrigation, Water Power, and Drainage in the Department of Roads and Irrigation. The authority over water rights for irrigation, power, and all other useful purposes was first assigned to the State Board of Irrigation in 1895.

Size and Capability. The Department is staffed by about 40 full time employees. Its main office is in Lincoln; division offices are located in Bridgeport, Cambridge, Ord, and Norfolk. During the irrigation season, water commissioners are employed at division offices to regulate the use of water.

Authorities and Programs. A major responsibility of the Department of Water Resources is the issuance of rights for the use of water in natural streams, and regulation of use in accordance with the water rights system. The Department also examines and approves plans for proposed diversions from streams, dams, and reservoirs; measures streamflows, canal diversions, and pumping from streams; and carries out agreements on interstate streams. The Department of Water Resources has the responsibility and authority to oversee the regulation of ground water, to register high-capacity wells, and to regulate wells. It has the authority to adopt controls for ground water

control areas where NRDs do not exercise this authority, and issue permits to drill wells in designated control areas.

Department of Environmental Control

The Department of Environmental Control (DEC) administers the rules, regulations, and standards adopted by the Environmental Control Council to protect and improve the quality of Nebraska's air, water, and land. The Department is a code agency with a director appointed by the Governor from a list of nominees submitted by the Council and approved by the Legislature. The Environmental Control Council is composed of 16 members appointed by the Governor with the advice and consent of the Legislature. Each council member represents a major industry or institution with a specific interest in environmental quality in the state.

History. The Department of Environmental Control and the Environmental Control Council were established in 1971.

Size and Capability. The staff of the Department of Environmental Control includes lawyers, inspectors, lab technicians, chemists, biologists, engineers, public information specialists, and others. There are over 80 full time employees. The resources of the Department include laboratory facilities for the analysis of samples.

Authorities and Programs. The Department of Environmental Control is responsible for administration of state programs established under the Federal Clean Water Act, Federal Resources Conservation and Recovery Act, portions of the Federal Safe Drinking Water Act, Federal Clean Air Act, and also the Nebraska Environmental Protection Act. The Department is responsible for all federal and state grants and incentives for environmental protection, and is authorized to issue permits; conduct studies, inspections, surveillance, and monitoring; develop plans and schedules for implementation of required pollution control measures; and develop long term strategies, such as the ground water quality protection strategy and nonpoint pollution control strategy. The Department has specific authorities relating to air and water pollution, solid waste, hazardous waste, agricultural pollution, and limited authorities relating to noise pollution.

Game and Parks Commission

The Nebraska Game and Parks Commission is charged with managing and controlling the state's wildlife, parks, and outdoor recreational resources in the best longterm interest of the people. It is headed by a seven member commission. Commissioners are appointed by the Governor and confirmed by the Legislature to serve five-year terms. The Commission in turn appoints a Director - Chief Conservation Officer with supervision and control of all activities and functions of the agency. The main office of the Commission is located in Lincoln. Other offices are maintained at Alliance, Bassett, Norfolk, North Platte, and Omaha. The first four are each assigned a supervisory conservation officer, fisheries manager, game manager, resource services manager, labor, and crew.

History. The forerunner of the Game and Parks Commission was designated in 1860, when the Territory of Nebraska House of Representatives created a hunting season. Additionally, fish were protected by a law passed in 1875, which limited fishing methods. A Board of Fish Commissioners was created in 1879, and in 1901, the name was changed to the Game and Fish Commission, when the scope of the duties was broadened. The Commission made numerous name, department and responsibility changes before it finally became the Game and Parks Commission in 1967.

Size and Capability. The number of employees of the Game and Parks Commission averages about 250 per year, but fluctuates seasonally, with temporary employees in the summer months. The operating costs of the Commission exceed $20 million per year.

Authorities and Programs. To carry out their charge of maintaining the state's parks, fish, and wildlife, the Commission is provided statutory powers and duties to regulate hunting, fishing, and use of water and state lands for recreation, and to take action to improve recreation, fisheries, and wildlife conditions.

Educational. The Nebraska Game and Parks Commission offers extensive public information materials which promote the state's wildlife, outdoor recreation resources, and parks. A staff of 20 prepares these materials, which include brochures, booklets, bulletins, pamphlets, curriculum materials, films, slide-tape presentations, and maps. Nebraskaland magazine features wildlife and outdoor recreation, and is the most popular publication of

the Commission. Game and Parks personnel are also available as speakers. The Commission assists youth school groups in developing wildlife habitat projects and holds outdoor education workshops throughout the year.

Incentive. Nebraska's Wildlife Habitat Program was established in 1976. Funds from the sale of Habitat Stamps are administered by the Game and Parks Commission to improve the state's wildlife habitat. The Habitat Program involves a three-part attempt to rebuild the state's declining wildlife habitat base. Funds are used to acquire land for wildlife, encourage the establishment and preservation of habitat on private land, and improve the quality of habitat on public lands. Each of these areas receives about one-third of the program's funds.

The Land Acquisition program purchases modest acreages with the intent to supply critically short habitat, or enhance existing habitat on nearby private lands. Typically, the most valuable wildlife lands are wetlands, woodlands, and riparian lands, which are all considered marginal for agricultural production. The main function of these lands is to provide critical habitat components such as nesting, feeding areas, and winter cover sites. This is a cooperative program between Game and Parks and the U.S. Fish and Wildlife Service. Most purchases are cost-shared, with each Habitat Program dollar matched by three dollars of federal aid. As of 1985, 34 areas have been purchased through this program, ranging in size from two acres to 880 acres. Over 9,000 acres have been acquired at a cost of $4.3 million. The average cost per acre has been $486.

Land acquisition has been most successful in the eastern half of the state, where the population is centered and most habitat stamps are sold. The state's lands needing the greatest wildlife habitat protection are also in eastern and southern Nebraska, where intensive agriculture and land development are immediate threats. The Rainwater Basin in southcentral Nebraska and riparian areas along eastern Nebraska streams are considered priorities for acquisition through this program.

The Habitat Improvement on Private Lands program is the part of the Habitat Program which encourages landowners to improve and maintain existing habitat and establish new habitat. It is administered through NRDs with the Game and Parks Commission usually providing 75 percent of funding and the NRDs providing 25 percent. Over 2,300 cooperators and 50,000 acres are currently enrolled in this program.

The Game and Parks Commission will pay landowners under contract an additional $2.50 per acre to make their land available for public hunting, fishing, trapping, and other non-consumptive uses. The Commission provides free bundles of green ash seedlings to rural landowners to encourage the establishment of "home woodlots". They also provide free five-pound-bag mixtures of wildlife food and cover seeds for establishing smaller habitat plots.

The Habitat Management on Public Lands program which enhances the wildlife habitat on Game and Parks Commission wildlife lands and other public lands is the goal of the third section of the Habitat Program. Roadsides, national forests, land surrounding reservoirs, and federal Waterfowl Production Areas are more carefully managed to enhance wildlife habitat. From 325,000 to 400,000 acres of public land could be available statewide for developing and maintaining wildlife habitat.

The Land and Water Conservation Fund provides grants to the states and their political subdivisions for up to 50 percent of the project cost for acquiring and developing outdoor recreation areas and facilities. These funds may be used for buying land if specified federal procedures are followed. Funds may also be used for fencing, landscaping, roads, and parking lots in outdoor recreation areas. Swimming pools, ball fields, tennis courts, parks, playgrounds, picnic facilities, and many other municipal facilities have also been developed through this fund.

The National Park Service in the Department of the Interior administers this fund through the Nebraska Game and Parks Commission. State law specifies that 60 percent of Nebraska's annual apportionment from the fund must be made available to political subdivisions and the Game and Parks Commission may use the remaining 40 percent. Local sponsors must make a commitment to complete the project; provide appraisals, engineering, and other design requirements; and assume responsibility for operation and maintenance. They must also provide 50 percent of the development cost. Grant applications always exceed available funds, so there is a backlog of projects. Non-traditional projects have to compete with traditional projects in the annual allocation of funds by the Game and Parks Commission.

Board of Educational Lands and Funds

The Board of Educational Lands and Funds (BELF) is a state agency with the responsibility for administering "school lands" for the support of the state's public schools.

History. Nebraska received 2.8 million acres from the Federal government for the support of public schools upon attaining statehood in 1867. The State Constitution of 1875 provided for a Board of Commissioners to manage the lands. Several legislative changes in state policy followed, and much of the land was subsequently sold at auction. BELF assumed its present Governor-appointed structure in 1955.

Size and Capability. The agency is headed by a five-member board appointed by the Governor. One member is appointed from each of the four congressional districts, and the fifth from the state at large. Twelve land managers directly supervise the use of the land, negotiate leases, and implement soil and water conservation practices with the SCS.

The board and its land managers oversee about 1.5 million acres, of which 1.2 million are rangeland and the remainder cropland.

Authorities and Programs. The authorities of BELF have varied since its inception; at present, its five members are authorized to lease, trade, or sell school lands at their discretion. Its primary function is the management of these lands as an educational trust. The Board attempts to maximize income from the lands.

Department of Agriculture

The Nebraska Department of Agriculture is a code agency with a director appointed by the Governor. It is comprised of 8 bureaus and divisions, each with a specialization in the food production process. The Department of Agriculture monitors the activities between agricultural producers, processors, and consumers in Nebraska, offering services through its eight divisions. These include: Agricultural Development, Agricultural Statistics, the Bureaus of Plant Industry, Animal Industry, and Dairies and Foods, the Weights and Measures Division, and Agricultural Promotions and Development.

History. The Department of Agriculture was created by the Civil Administrative Code Law of 1919. Several name changes followed, but it returned to its original name in 1967. Divisions and duties of the department have also changed in the years since its inception. Many were dropped or transferred to other state agencies; others were added to give this department regulatory authority over the diverse agricultural economy of the state.

Size and Capability. The Nebraska Department of Agriculture employs over 160 people, with nearly half of those people in offices scattered across the state. The Department of Agriculture has an annual budget of over $11 million.

Authorities and Programs. The primary duty of the Department of Agriculture is regulation of the agriculture industry in Nebraska. It operates for the protection of the public by providing many consumer services. In a joint responsibility with the federal government, this department is specifically responsible for assuring supplies of sanitary and wholesome food. Among its numerous authorities are regulation of the livestock, poultry, dairy, and food products industries.

Educational. Agriculture is Nebraska's economic backbone, and the Department of Agriculture recognizes the need to inform and educate the public to the importance of understanding this industry. The Agricultural Development Division offers this information through various activities designed to educate Nebraskans so they will be prepared to make informed decisions concerning agriculture and its effects on their lives. This division offers no conservation programs, but conservation activities are included in their cooperative "Ag in the Classroom" program.

Department of Education

The Department of Education promotes learning and development and the improvement of educational opportunities for all residents of the state. The Department accomplishes this task through its three major divisions: Rehabilitation Services, School Support and Operations, and Vocational Education. The Board of Education sets broad curriculum requirements which are then implemented by the Department of Education. These requirements include instruction in science for elementary school students. The curriculum guidelines do not mandate specific courses, but give general areas of emphasis and specific areas to be studied (e.g. physical, life, earth, and space

sciences). Curriculum requirements for secondary school students are similar. These students must complete 40 units of science (four classes) from whatever science courses are offered.

History. The office of State Superintendent of Public Instruction was created by state legislation in 1869. This position remained essentially unchanged until 1952 when the State Department of Education and the State Board of Education were established by constitutional amendment. Duties of the State Superintendent were transferred, and in 1954, the newly elected Board of Education appointed a Commissioner to head the department. This structure has since remained unchanged.

Size and Capability. The State Board of Education is a constitutional body composed of eight persons elected on a nonpartisan ballot. The Board is the policy-making arm of the Nebraska educational system. It is responsible for overseeing the Department of Education, which includes appointing the Commissioner of Education, who heads this department and also serves as the Executive Officer of the Board.

Authorities and Programs. The Nebraska Department of Education administers the state's educational system. To accomplish this task, a mix of local and state control and regulations is used. At the local level, teachers and local school boards administer their school districts according to rules and regulations established at the state level. The State Department of Education and the State Board of Education are charged by state statutes with providing leadership, improving the state's school system, and performing regulatory and service activities.

Educational. The Department of Education recognizes the need for generating environmental awareness by working with local school districts in planning environmental education programs. These programs may include soil and/or water conservation activities. The Department is a cosponsor of "Ag in the Classroom" and of the annual Environmental Education Institute at Camp Jefferson, a teacher training workshop which includes soil and water topics.

The only conservation related courses available in most of Nebraska's secondary schools are those courses taught through the Vocational Agriculture (Vo-Ag) program sponsored by the Nebraska Department of Education. The curriculum and information used to teach Vo Ag are selected by the schools and teachers from a number of sources. The curriculum is often chosen based on local needs and conditions.

Vo-Ag programs are designed to provide agricultural skills and knowledge to students preparing for careers in agriculture. The goals of Vo-Ag in Nebraska include teaching the necessary skills and developing competency within students to allow them to work in agriculture after high school or continue their studies beyond high school. Leadership training and development are also emphasized. Due to the nature of the Vo-Ag program, these courses are generally offered in rural schools and instruction is limited to those students preparing for careers in agriculture. The Department of Education requires that Vo-Ag programs offer to students a certain number of classroom hours and an FFA (Future Farmers of America) program, but beyond these minimum requirements schools are allowed to develop individual programs.

The Vo-Ag program offers instruction in seven basic areas of agriculture, including agricultural resources. Within this general area, Vo-Ag offers a crop and soil science alternative involving 20 units from which the student may choose. One of these units, land evaluation (formerly soil judging), involves learning to evaluate agricultural land. This enables the student to determine what practices may be applicable to the land. Land evaluation and a similar range evaluation class offer students a basic understanding of the properties and capabilities of soil. A separate soil science unit is also taught; topics in this course include agronomy and the Universal Soil Loss Equation. Surveying is another offering of the Vo-Ag program. Students learn surveying fundamentals and apply these skills in the field surveying conservation resources such as contours, terraces, and dams.

Most students enrolled in Vo-Ag also participate in FFA (approximately 90 percent in 1985), but they are not required to do so. Through FFA, Vo-Ag students gain practical experience by applying classroom skills and knowledge to the everyday world of agriculture. FFA emphasizes leadership skills and the practical "hands-on" portion of Vo-Ag. It sponsors contests and competitions at the local, state, and national levels in which members relate their instruction in crop and soil science to actual agricultural situations. Students studying land evaluation learn to determine the many

properties of soil, including the depth of topsoil, permeability, texture, and organic content. They are then able to place the land in a capability class and determine what farming practices would or would not be applicable to the land. Approximately 1,200 FFA members (mostly high school students) participate in land evaluation yearly.

The Division of Vocational Education (Agriculture section) within the Department of Education oversees the state's 129 Vo-Ag programs. The State provides no funding to these programs, but applications for federal grants must be approved by the Department of Education. State-developed curriculum is provided to every Vo-Ag program, but they are not required to use it. State employees also visit schools, critique programs, and offer advice to improve programs. The State also coordinates many activities outside the classroom, including the Nebraska FFA program and all of its numerous activities, land evaluation contests, and in-service training and workshops necessary to keep the state's Vo-Ag teachers informed on agricultural issues and research.

The Department of Education also offers several other projects and programs that provide environmental education, which may include sections on soil or water conservation. The Department can provide schools with information about the National Diffusion Network. Projects available through this program generally involve environmental or ecological education. Another program offered by the Department is a potential resource for educating Nebraska school children to the importance of conservation. Instructional Television (ITV) expands teaching opportunities through the use of television. Programs are broadcast statewide each school day over the Nebraska Education Television Network (ETV). There are currently no programs in use which deal specifically with soil or water conservation, although two series of programs (basic earth science) may touch on this subject.

ITV programming is generally limited by the need to match it with mainstream curriculum requirements, which do not include conservation education. Conservation-related programming may be available, however, because ITV can acquire products from outside sources (commercial distributors, other ITV agencies, government-funded sources) or through production consortiums involving several states when there is a mutual need for certain programs. Materials may also be locally produced by ITV. Whatever the source of the materials, there must be sufficient demand before ITV is able to offer them.

The Department also offers assistance in setting up environmental education workshops, and makes available the State of Nebraska Information Center for Education Resources (SNICER). This information source involves a computerized search which provides a listing of environmental education resources.

Cooperative Extension Service, University of Nebraska-Lincoln

The Cooperative Extension Service is an informal educational arm of the Land Grant University system. In Nebraska, it is a division of the University of Nebraska Institute of Agriculture and Natural Resources (IANR).

History. Established in 1914 by the Smith-Lever Act, the Cooperative Extension Service was to extend the University storehouse of information and research to farmers.

Size and Capability. Federal, state, and county governments share in financing, planning, and carrying out the extension education programs. All of the state's 93 counties have the services of county or area extension agents. District and state specialists, located on the UNL East Campus and in five district offices, provide program leadership to support the county extension programs and services.

Authorities and Programs. The Cooperative Extension Service is charged with the responsibility of developing and diffusing useful and practical information on subjects related to agriculture, rural and solar energy, and home economics,in conjunction with land grant universities. Issues that the Cooperative Extension Service will emphasize in the future include: enhancing water quality by encouraging soil testing and irrigation scheduling, and conservation of natural resources by encouraging soil conservation and range management.

The Cooperative Extension Service (CES) operates in four major program areas; agriculture and natural resources, 4-H and youth development, home economics and family living,and community resource development.

Bulletins and circular are available from the Cooperative Extension Service, as well as the NebGuide series. There are NebGuides available on the subject of irrigation engineering,

water resource management, waste management, soil resource management, pesticides, general agriculture, and wildlife management. These publications, plus others, cover information in all of the CES program areas and are available at local County Extension offices or through the IANR Department of Information in Lincoln.

Educational. The CES has developed many educational materials in the 4-H and youth development program area. In 1984, 63,365 Nebraska youth participated in 4-H through one or more of its programs. This represented nearly 24 percent of all youth in Nebraska between the ages of 9 and 19. Sixty-one percent of the participants lived on a farm, in a rural area, or in a small town. The remainder lived in cities with populations over 10,000. Youth may become involved in one of four ways: (1) 4-H clubs, which are organized in schools as an extra-curricular activity, (2) special interest groups, (3) individual study, or (4) school enrichment programs, which involve viewing 4-H audiovisual aids or videocassettes. These aids are available to non-4-H groups, such as schoolteachers, through the 4-H Audiovisual Loan Library and the Videocassette Library. Both of these libraries are located on UNL's East Campus. The Audiovisual Library offers a six-part slide presentation entitled "Environmental Awareness". These presentations deal with various aspects of the preservation and improvement of diverse environments, including farms. The Videocassette Library offers a five-part videocassette series entitled "Adventures in Conservation". One of the videocassettes discusses soil, offering activities, experiments, and a discussion of the interrelationships of soil, water, animals, plants, and man. Another videocassette discusses water, current water management practices in Nebraska, and water's important interrelationships.

Several other 4-H programs dealing with conservation and the environment are offered. The Plant and Soil Science program includes Soils 608, a project in which members participate in hands-on experiences with plants and soil. Soil formation, parent materials, subsoil, and topsoil are among the topics included in this course. The Conservation and Natural Resources program offers Adventures in Conservation and Natural Resources 666. This is an ecology project involving the interrelationships of soil, water, air, plants, and man. Though not a soil and water conservation course, it does include two half-hour videocassette programs entitled "Soil" and "Water".

Another area where 4-H is involved in natural resources is the Leadership and Environmental Camp offered yearly to 4-H members. The camp offers a three day in-depth workshop session on natural resources, stressing the conservation and value of natural resources. The 1984 camp was attended by 197 4-H teens, representing 66 percent of the extension units in Nebraska.

Other 4-H activities involving conservation and/or natural resources are School Conservation Days, Outdoor Education for Youth, and the State 4-H Camp. School Conservation Days were conducted by a majority of Nebraska counties in the 1950's, and are again becoming more popular. Through films, tours, and other presentations, students are provided with basic information concerning the importance of conservation. A recent program in Red Willow County introduced 175 fifth-grade students to conservation education.

The Outdoor Education for Youth program offers 4-H and non-4-H youth an opportunity to gain knowledge and skills in outdoor education. This program includes discussion and hiking activities in natural resources conservation, including the principles of conservation and ecological balance. The State 4-H Camp annually attracts nearly 4,500 youth and adults. Among various offerings of the camp is programming in natural resources education.

Water Resources Center, University of Nebraska-Lincoln

The Nebraska Water Resources Center (NWRC): assists water resources-related researchers in obtaining financial support for their investigations, administers and coordinates research projects, and provides funds for research and teaching positions in other units. In addition, NWRC integrates University water research and training programs with the needs and efforts of federal, state, and local agencies. The Center also disseminates information. With the Conservation and Survey Division, the Water Resources Center forms one division of UNL's Institute of Agriculture and Natural Resources.

History. The forerunner of the Center, the Nebraska Water Resources Research Institute, was established in 1964 in response to the

Federal Water Resources Research Act of 1964. In the ensuing 20 years, the Center has funded 132 projects. The Institute's name was changed to the Water Resources Center in 1975.

Size and Capability. The Center has distributed or used over $6 million in various grant funding, not including University match or state funding. Examples of the types of research funded include irrigation scheduling, agricultural meteorology, eutrophication, water use efficiency and conservation, and water quality. The Center staff currently consists of 12 administrative and professional employees; much of the Center's research, however, is conducted by other University staff.

Conservation and Survey Division, University of Nebraska-Lincoln

The Conservation and Survey Division was created to survey the State's soils, water and water power, geology, forests, road materials, and industry. In combination with the Water Resources Center, it forms a division of the Institute of Agriculture and Natural Resources.

History. The Conservation and Survey Division was created in 1921 as part of the University of Nebraska. The Director of the Conservation and Survey Division is appointed by the Board of Regents.

Size and Capability. The Conservation and Survey Division consists of approximately 45 employees and has an operating budget of over $1 million annually. In addition to state funds, Conservation and Survey obtains grants for projects it undertakes.

Authorities and Programs. Among the Division's duties related to soil and water conservation are: (1) survey and describe the natural resources in the state; (2) to investigate and report on the state's conservation problems; and (3) to provide an information bureau on the state's resources, industries, and development.

With the approval of the Board of Regents, the Division may also enter into agreements with federal agencies necessary to carry on cooperative surveys and investigations. Presently, water surveys are being conducted in cooperation with the U.S Geological Survey, and soil surveys are being conducted in cooperation with the U.S. Department of Agriculture Soil Conservation Service with funding from the Natural Resources Commission.

Agricultural Research Division, IANR

The Agricultural Research Division (ARD) of the Institute of Agriculture and Natural Resources (IANR) is part of the University of Nebraska system.

History. Formerly known as the Agricultural Experiment Station, the ARD was established in 1887 under the authority of a Congressional act. That act allowed land grant colleges to create experiment facilities to investigate the principles and applications of agricultural science. This program was expanded in 1903 when the Nebraska Legislature established several regional experiment substations under the control of the Lincoln station. The Agricultural Experiment Station became a division of the IANR in 1973 and was renamed the Agricultural Research Division by the Board of Regents in September 1984.

Funding for the Agricultural Research Division is provided by several sources. Federal funds are provided through the Hatch Act of 1887 and the Water Resources Research Act of 1964. State funds may be available through appropriations and research contracts with a variety of state agencies. Other sources of funding include the University of Nebraska Foundation, natural resources districts, the National Science Foundation, and private corporations.

Size and Capability. The Division operates five regional Research Extension Centers and several satellite agricultural research laboratories. The Southeast Research and Extension Center is located in Lincoln and coordinates the operation of the Agricultural Research and Development Center at Mead. Clay Center is the headquarters for the South Central Research and Extension Center. The West Central Research and Extension Center, located in North Platte, oversees the operation of the Northwest Agricultural Laboratory near Alliance, the Gudmundsen Sandhills Research Center near Whitman, and the Sandhills Agronomy Laboratory at Tryon. Sidney is the site for the High Plains Agricultural Laboratory, which operates under the Panhandle Research and Extension Center at Scottsbluff. The Northeast Research and Extension Center is located near Concord. These centers conduct research and experiments directly related to agriculture and rural life. Bulletins and reports are published regularly and are available upon request.

Nebraska Association of Resources Districts

The Nebraska Association of Resources Districts (NARD) is an association formed by the districts to assist NRDs and their constituents in conserving land, water, and other related resources. The NARD represents the districts in a variety of activities, including some of the education and public information programs offered by the districts.

The Association represents the interests and presents the view of Natural Resources Districts in the Unicameral, the U.S Government, and government agencies of all levels. The NARD provides services and materials to districts to help them carry out their responsibilities, and provides seminars and training programs for the directors and staff.

History. The Nebraska Association of Resources Districts is a nonprofit corporation organized in 1972 to assist NRDs and their constituents to properly conserve land, water, and related resources. It is an association of Nebraska's 24 NRDs, and it is governed by a board of directors elected from each district.

Size and Capability. The Association has a staff of four: a director, a program coordinator, and two clerical employees. Its annual budget for 1986-1987 is $232,000. Sixteen percent of the budget was for the distribution of public information material.

Authorities and Programs. Cooperative agreements and projects by local NRDs are authorized through the Interlocal Cooperation Act. The NARD is a cooperative effort of the districts, and its authorities are derived from the collective authorities of the districts. The Conservation Cooperation Act, which gives NARD some authority to raise and disburse funds, was enacted to provide assistance to landowners to encourage conservation of water and related land resources.

The NARD sponsors a variety of state-wide educational activities which are carried on within the districts, including conservation and environmental education workshops and field trips for public school teachers, students, and the general public. The NARD also informs Nebraskans about the NRDs and the services the districts offer. They produce curriculum materials and educational films for use by the NRDs.

The Center For Rural Affairs

The Center for Rural Affairs is a non-profit research and advocacy organization. Their project areas include: rural public policy, rural community economics, world agriculture, conservation and environment, sustainable agriculture, emerging technology, and family farm opportunity.

History. The Center was started in 1973. The founders were working on a community action program in the Walthill area, when the Center for Rural Affairs was formed.

Size and Capability. The Center currently has 18 employees. It is funded through private donations and foundation grants.

Authorities and Programs. The Center for Rural Affairs prints a monthly newsletter and a quarterly publication called "The Advocate". The newsletter scrutinizes "events affecting rural Nebraska", offering a viewpoint more politically oriented than other rural-oriented publications. Soil and water conservation articles occasionally appear in this newsletter. The Center periodically publish reports on special topics as well.

Nebraska Groundwater Foundation

The Groundwater Foundation is a non-profit educational foundation whose activities are designated to illuminate social, legal, economic and health issues concerning ground water to enable citizens to understand and respond to issues facing them and their communities.

History. The Nebraska Groundwater Foundation was founded in 1985 in Lincoln, Nebraska. In 1986, the Foundation sponsored the first annual Groundwater Week in April of that year.

Size and Capability. The Groundwater Foundation has over 400 members and relies on private citizens and foundations to fund activities.

Authorities and Programs. The Ground Water Foundation's main purpose is to educate the public about ground water conservation and management. It accomplishes this by sponsoring symposia, awards, and a Ground Water Week in April of each year. It also publishes a quarterly journal called "The Aquifer".

State Publications

The Nebraska Farmer, published semi-monthly by the Nebraska Farmer Company,

is the oldest and most widely read periodical about Nebraska agriculture. Advertised as "The Magazine of Nebraska Agriculture", its emphasis is on providing news and information to the state's farmers and ranchers. It offers an all around view of agriculture in Nebraska with an eye on new developments in any ag-related field. The Nebraska Farmer regularly prints articles on soil and water conservation practices and developments as part of the magazine's Natural Resources Report or as feature articles. These features often report the experiences of Nebraska farmers and ranchers. The magazine also contains articles on new and proposed laws, regulations, and programs with a slant on how the law or program will directly affect the readership. Conservation tillage equipment is occasionally featured in the magazine's Machinery Report. The Nebraska Farmer also prints advertisements which feature conservation tillage equipment. Feature articles have included a look at conservation gains of the last 50 years and a front page conservation visual quiz. They accept unsolicited articles for publication, but prefer to prepare most articles using staff writers. Articles have been accepted from both UNL and the Soil Conservation Service and are occasionally solicited from experts in various other disciplines.

The Omaha World-Herald is Nebraska's largest circulation daily newspaper. Its various editions are delivered throughout the state. It is estimated that the World-Herald reaches 41 percent of possible readership in 107 Nebraska and western Iowa counties each Sunday, and 35 percent daily. The World-Herald employs a farm editor and a natural resources staff writer, but does not feature soil and water conservation regularly except during the growing season. The newspaper then publishes "The Conservation Notebook", a weekly information series, in its Sunday editions. Information for the column is gathered from specialists at the University of Nebraska and includes topics such as nitrogen management and reuse pits. Technical information is supplied in an easily readable and usable form, allowing farmers and ranchers to apply the information directly to their agricultural operation.

The Omaha World-Herald Master Conservation Award is given annually for outstanding soil and water conservation practices. Five individual producers from different areas of the state are recognized each year. Recipients are awarded a plaque and are honored by the Nebraska Association of Resources Districts. They are also featured in a special issue of the World-Herald's Magazine of the Midlands.

The Lincoln Star, a morning newspaper, and the Lincoln Journal, an evening newspaper, claim Nebraska's second and third largest circulation among daily newspapers. Both of these newspapers employ farm editors and print conservation and natural resources articles, generally as news items. Other Nebraska newspapers with wide circulations include the Norfolk News and the Grand Island Independent. At least nine newspapers, including the Norfolk News, print columns prepared by NRDs.

State Media

The Nebraska Educational Television Network, or ETV, is a statewide network of broadcasting stations offering instructional and public television programming to Nebraska's homes and classrooms. Programming originates out of KUON-TV in Lincoln, and is broadcast to nearly the entire state through 8 transmitters and 16 translators located throughout the state. ETV programming is primarily supported by viewer contributions; state tax funds are used to maintain the network's technical system. ETV offers several programs which occasionally include soil or water conservation topics. NOVA is a weekly PBS special featuring science and related topics, and the brief Farm Day report offers farm news, market prices, features, and analysis each morning. ETV also offers occasional features about soil and water conservation, such as a 1985 show examining the controversial development of agriculture in the Sandhills.

Commercial television stations are scattered across Nebraska; the largest of these stations are located in Lincoln and Omaha, and the majority of urban Nebraskans have access to their programming. KOLN/KGIN TV broadcasts from Lincoln to a southeast Nebraska audience. It is also carried on 110 cable TV systems claiming 273,000 subscribers. Three large commercial stations are located in Omaha: KETV, KMTV, and WOWT. These three stations broadcast to a majority of the state's urban population and much of eastern Nebraska's rural population. They are also carried on 99 cable TV systems claiming over 300,000 subscribers.

Nebraska commercial television stations occasionally air programs concerned with soil or

water conservation issues. An Omaha station broadcast three half-hour public service television programs which focused on current agricultural conditions, including water resources management. These programs were broadcast to an area which includes more than 75 percent of the state's urban population.

Several Nebraska radio stations broadcast natural resources news and information provided by NRDs. Three stations carry either weekly or monthly NRD radio programs. Five NRDs also produce public service announcements for local radio stations.

Other States

Twenty-four states and the District of Columbia have approved erosion and sediment control legislation. In 19 of the states, the programs created or supplemented by this legislation are regulatory. Seventeen are regulated by state-level rules and regulations only; in Iowa and Montana, rules and regulations are adopted by both conservation districts and the state. Enforcement is shared by the state and conservation districts in seven cases. In the other 12 states, enforcement is accomplished by the state only; conservation districts only; or by a county, city, town, or township.

Fourteen states offer cost-sharing programs, and most of these programs are administered by conservation districts. Four states allow exemptions from laws or penalties if cost-sharing assistance is not available. Soil loss limits are established in six states, but only in Iowa are these limits established by conservation districts.

The legislation and programs of all 24 states have been considered as possible models for a Nebraska erosion and sediment control program. Many were rejected because they emphasize the control of urban erosion problems, rather than agricultural problems. The Iowa and Illinois programs, however, emphasize agricultural erosion control, and could serve as models for a Nebraska program.

Illinois. The Illinois program, established in 1977, is directed at both rural and urban sedimentation and erosion. The state and conservation districts share enforcement responsibilities. Sediment and erosion control goals that gradually decrease the amount of acceptable erosion were established by the state. Districts are required to adopt specific sediment and erosion control standards which must be consistent with state standards, and may be more stringent.

Illinois conservation districts are required to encourage all persons involved in land disturbing activities on agricultural land to comply with district standards. Cost-sharing of up to 75 percent is available for eligible practices and structures. Eligible practices and cost-sharing rates may fluctuate; they are determined annually by the Illinois Department of Agriculture. The Illinois program also specifies conditions to be met on nonagricultural land and inspection sites.

Iowa. Iowa's erosion and sediment control program was established in 1971. Cost-sharing funds have been available through the program since 1973. This comprehensive state program directs each soil conservation district to establish maximum soil loss limits for all lands in the district. If a district receives a complaint and sediment is found to be damaging adjacent lands and exceeding limits, landowners are required to implement practices to control the erosion. This may be done voluntarily, in which case 50 percent cost-sharing must be provided to the landowners. Landowners who do no comply voluntarily receive an administrative order to implement practices. These landowners must be provided 75 percent cost-sharing funds.

The Iowa program also provides 75 percent cost-sharing for erosion control practices installed above lakes that are on a state priority list. In addition, Iowa's conservation districts implement programs which promote urban erosion control, reduced tillage farming, planting and maintaining windbreaks, and comprehensive conservation education.

To date, Iowa has appropriated over $60 million for cost-sharing with landowners through its erosion and sediment control program. Five percent of these funds are earmarked annually for use when landowners are ordered to install erosion control practices.

NATIONAL ORGANIZATIONS AND AGENCIES

Many agencies of the federal government and a number of private organizations are active in conservation and management of soil and water resources.

Soil Conservation Service

The Soil Conservation Service (SCS) is a part of the U.S. Department of Agriculture. It is

the primary federal agency with responsibility for soil and water conservation.

History. The federal government first took responsibility for protecting the nation's soil and water resources by establishing the Soil Erosion Service (SES) under the Department of Interior in 1933. On March 25, 1935, President Roosevelt transferred the SES to the Department of Agriculture. One month later, on April 27, 1935, a bill (Public Law 46) was passed to change the Soil Erosion Service to the Soil Conservation Service (SCS). This law declared that the wasting of soil and water resources was a menace to national welfare, and it established policies for preserving natural resources, controlling floods, preventing the impairment of reservoirs, and maintaining navigability of rivers and harbors.

Size and Capability. The SCS is organized to perform a variety of functions, and it has different types of offices throughout the country. Basin field activities are managed by a chain of command that starts with the Chief in Washington, D.C. and moves down to the State Conservationist for each state, the Area Conservationist, and the District Conservationist at the field office level. In Nebraska, the State Conservationist administers the program through four area offices and 81 county field offices. There are approximately 420 employees in this state, including technicians, soil conservationists, engineers, soil scientists, foresters, and other specialists.

Authorities and Programs. Public Law 46, passed in 1935, outlined the general policies of the SCS for working on public or private land. Generally, it says that the SCS will provide technical assistance to landowners and operators on planning and applying practices to sustain the soil and water resources. Special conservation programs, in which the SCS has responsibilities, have been authorized since 1935. These are the Great Plains Conservation Program, the Watershed Protection and Flood Prevention Program (Public Law 566), and the Resources Conservation and Flood Prevention Program, and the Resources Conservation and Development Act. In addition, the SCS provides technical assistance for cost-share programs offered by the Agricultural Stabilization and Conservation Service, the Natural Resources Commission, and the Natural Resources Districts.

Educational. The SCS offers a diverse public information and education program designed to increase interest in conservation practices and provide information on these practices to the people of Nebraska. Many publications on various natural resources topics are available from the state office and field offices. Slide shows and video tapes on a variety of natural resources topics are available for public use through the field offices. They also have a game which demonstrates conservation-influenced changes in farming over the last fifty years.

Teaching kits are offered through the state office which contain publications and experiments for use in teaching about the environment. Field office personnel are available as speakers for conservation day programs and to assist in developing conservation plans for outdoor classrooms. They also advise teachers in developing environmental studies classes for school curriculums.

Available to schools through county extension agents is the SCS publication "Conserving Soil". It is designed for use as school enrichment material for grades six through nine, but has been used by other grades as well. "Conserving Soil" includes information on soil formation, erosion, and conservation. It also discusses critical soil issues and includes activity masters, color transparencies, suggested activities, and lesson plans for teacher use. This booklet is designed as a self-contained teaching/learning unit, yet a more effective approach involving the use of this material must involve developing curriculum to accompany and supplement it. It should be viewed as base material only and not a complete course in itself.

The SCS sends out press releases concerning trends in natural resources and serves as a source of information for feature stories appearing in publications such as the Omaha World-Herald and the Nebraska Farmer. The Lincoln SCS office has developed media packets for field office personnel entitled "Irrigation Water Management Campaign - Let's Make Every Drop Count". These packets contain materials and ideas for presenting this topic to the local media.

Since 1950, the SCS has been mapping the soils of Nebraska by county. When a county's mapping is completed, a comprehensive soil survey for that county is published and available at the local SCS office. These surveys provide information on soils for land use planning. Among their many users are farmers, ranchers,

agronomists, engineers, home builders, waste disposal planners, and teachers. Conservation technicians use soil surveys to determine the capability of soils in planning resource management systems with land users.

The SCS plans to have a soil survey published for each Nebraska county by 1989. Surveys are produced with funding and other assistance from the Conservation and Survey Division of the University of Nebraska, the NRDs, county governments, and the NRC.

The SCS currently is charged with monitoring the condition of soil and water resources. This includes updating a resource inventory every five years. The last update was in 1982.

Incentive. Incentives used to promote the rational use of resources are usually monetary incentives, yet free access to technical assistance also can be considered an incentive. Approximately 420 SCS personnel throughout the state assist landowners in managing their soil and water resources. This assistance includes specialists at the state office for field support.

The SCS also provides technical specifications and other design criteria to ensure that practices function properly. This criteria was developed from research and field trials. Technical specifications are used by SCS technicians, but are also available to private or public agencies and individuals.

The Great Plains Conservation Program was authorized in 1956 to provide cost-sharing funds for conservation practices in the semi-arid and arid parts of the great plains. In Nebraska, this includes the western two-thirds of the state. A major objective of the program is to convert marginal cropland back to grassland, yet all agricultural land uses are eligible for funding. Nearly 7,500 cooperators have applied complete resource management systems under five to ten year contracts. Funding for this program is inadequate to meet the demand. The SCS is responsible for administration and technical assistance.

The Watershed Protection and Flood Prevention Program, P.L. 566, was established in 1954 to provide for flood control in small watersheds. In approved watersheds of less than 250,000 acres, local residents, through NRDs, provide easements and rights-of-way. The federal government provides funding, planning assistance, and technical assistance for floodwater detention structures through the SCS.

Watershed plans must be approved by the SCS Washington office. Approvals for both planning and operation are limited by funding. Since 1982, some watershed plans have been approved for watershed protection (land treatment) only. In these cases, landowners contract for cost-sharing to apply land treatment. To date in Nebraska, there are 24 completed watersheds, 28 operational watersheds, nine watersheds in planning, and 29 waiting for planning authorization.

The Resource Conservation and Development Program is an SCS program which promotes natural resources management and economic improvement in areas larger than 250,000 acres. SCS coordinators work with local governments, action groups, and landowners to write comprehensive plans for these areas, which may include several communities. Those portions of planned developments which involve soil or water resources management, such as floodwater retarding structures, are eligible for federal funding. There are two Resource Conservation and Development areas in Nebraska: the North Central area, including six counties, and the Panhandle area, including eleven counties.

Agricultural Stabilization and Conservation Service

The Agricultural Stabilization and Conservation Service (ASCS) is a part of the U.S. Department of Agriculture. The national office of ASCS is in Washington, D.C. The country is divided into five geographic areas; Nebraska is in the Northwest Area. At the state level, the ASCS is managed by a committee of three who are appointed by the Secretary of Agriculture. This committee appoints an Executive Secretary.

History. The ASCS was established by Congress in 1936 to provide economic aid to the nation's farmers.

Size and Capability. Nebraska is divided into seven districts, each of which has a director to manage county offices. Each of the 84 county ASCS offices is headed by an Executive Director and a locally elected committee of three who are resident farmers. There are 423 full time employees in the county offices and 23 in the state office.

Authorities and Programs. The ASCS provides a number of incentives to encourage conservation.

Incentive. The Agricultural Conservation Program (ACP) is a program of the ASCS which provides financial assistance to landowners applying conservation practices. Its purpose is to accelerate the application of practices to sustain the soil and water resources. Protecting these resources is often expensive and many landowners are unable to afford the costs. Recognizing that the nation benefits from conservation, the federal government set up this program to help pay the costs.

When it began in 1936, eligible practices included terraces, waterways, dams, grass seeding, cover crops, green manure crops, lime application, and land leveling. Present rules allow funds to be used only for enduring practices which control erosion and conserve water. Funds are limited and priority is given to the requests which would save the most soil.

The Emergency Conservation Program was authorized in 1954 by the Agricultural Conservation Program (ACP) Appropriations Act. This extension of ACP provides funds to repair damage to conservation practices or to apply certain special practices after disasters. To qualify for funding, the county ASCS committee makes a request that must be approved by the state ASCS committee and by the program administrator in Washington. Available funds are dependent on the extent of the needs. In 1984, $2,030,003 was available for this emergency program.

The Water Bank Program provides a yearly incentive payment based on contracts with landowners to maintain certain classes of wetlands for waterfowl. Nearly one million dollars was available for contracts in 1984.

Another program administered by ASCS is the Forestry Incentives Program. It was first authorized in 1973 to encourage the planting of hardwood timber for future use as lumber. Cost-sharing funds are offered to pay for the cost of trees and planting. This program is offered in twelve Nebraska counties. It was reauthorized in 1977 as the Cooperative Forestry Act.

Agricultural Research Service

The Agricultural Research Service of the U.S. Department of Agriculture conducts nationwide research programs, usually in cooperation with land grant universities. In Nebraska, much of the research is done in cooperation with the University of Nebraska's Agricultural Research Division. Some of the areas which are being researched include: hydrologic properties of watersheds, erosion and sedimentation, water conservation, irrigation, drainage, soil-plant-water relationships, and hydraulics of water control structures and channels. The purpose of the research is to provide a scientific basis and support for the land and water resource programs administered by various agencies of the U.S Department of Agriculture.

History. The federal government became involved in agricultural research with the passage of the Hatch Act in 1887. This act transferred federal funds to the states for research at the land grant colleges. In addition, a number of federal bureaus were established to conduct research. These included the Bureaus of Animal Industries in 1884, Plant Industries in 1901, Chemistry in 1901, Soils in 1901, Entomology in 1904, Home Economics in 1923, Dairy Industry in 1924, and Agricultural Engineering in 1931. In 1953, all research components were consolidated in the Agricultural Research Service.

Size and Capability. The University of Nebraska currently maintains offices and staff support for 30 ARS faculty in agriculturally related fields, excluding the animal research faculty. A total of 45 ARS staff are located in Lincoln.

Farmers Home Administration

The Farmers Home Administration (FmHA) of the U.S. Department of Agriculture provides financial assistance to farmers, rural residents, and rural communities. FmHA credit programs were established to help build the family farm system, improve the economic base of rural communities by expanding business and industry, and upgrade the quality of rural life.

FmHA provides loans in most cases, but grants are awarded for some community projects. Credit can be provided to help purchase or operate farms, develop irrigation and drainage systems, and develop many other kinds of private and community projects.

The assistance provided by FmHA is directed to individuals and groups unable to obtain credit from other sources. It is supplemental to credit provided by private lenders and is not meant to compete with them; most of the programs require borrowers to

obtain commercial credit when they are able to do so.

Size and Capability. There are 36 county offices and seven district offices located throughout the state; the state office is located in Lincoln. Agency personnel help borrowers gain maximum benefit from loans through counseling and technical assistance. The staff is also active on state and county committees involved with the development and improvement of rural areas.

Soil Conservation Society of America

The Soil Conservation Society of America (SCSA) is a private, nonprofit, scientific and educational organization which promotes practices that will sustain soil, water, and related resources. The organization provides its members an opportunity to become informed on natural resource management and to take part in educating others. It advocates the wise use of land and water resources as a consideration in the actions of policy makers, resource managers, and landowners. It also publishes the bimonthly Journal of Soil & Water Conservation, is a bimonthly publication seeking "to advance the science and art of good land use". Its articles feature land and water issues and results of applied research.

History. The Soil and Conservation Society of America was founded in 1945.

Size and Capability. SCSA has over 13,000 members in 105 chapters in the United States, Canada, and Puerto Rico; there are also 60 student chapters on college campuses. The national office of SCSA is in Ankeny, Iowa. There are six chapters in Nebraska, including the Lincoln, Blue Nemaha, Northeast Nebraska, Nebraska Sandhills, Nebraska Panhandle, and the South Central Nebraska chapters. Coordination of activities is accomplished by the Nebraska State Council of Chapters.

National Association of Conservation Districts

The National Association of Conservation Districts (NACD) is a private nonprofit organization of soil and water conservation districts (NRDs in Nebraska) from all 50 states and several territories.

History. It was organized in 1946 and has undergone two changes of name since that time. The association is led by its officers and board of directors, who are supported by regional and state organizations.

Authorities and Programs. The NACD offers an extensive public information program and serves as a conservation champion on the national level. The NACD publishes the "Tuesday Letter", a newsletter offering national news and information on a broad range of resource and conservation topics. The NACD has also produced a series of public service announcements for television which can be purchased by conservation districts for local use. Brochures and other publications on conservation topics are also available through the Davis Conservation Library. Films and slide shows are offered through the NACD's Environmental Film Service.

Educational. A program to promote conservation education was established in 1974 and several special projects in conservation education have also been organized and carried out. The most extensive special project of NACD is the Conservation Tillage Information Center (CTIC), established in 1983.

The NACD provides the information needed in church stewardship programs which provides much of the information that is used in bible study programs and sermons.

In cooperation with Allis Chalmers, the NACD sponsors an Environmental Conservation Education Awards Program to recognize teachers dedicated to merging conservation principles in their curriculum. The objectives of this program are to foster awareness and appreciation of the value of conservation education, and to stimulate efforts by teachers and conservation districts to advance the wise use, protection and enhancement of the nations natural resources. Cash prizes and plaques are awarded to the first and second place winners in the national contest.

The American Society of Agricultural Engineers

The American Society of Agricultural Engineers (ASAE) is a nonprofit, technical, scientific, and educational organization which serves the public by promoting improved application of engineering principles to agriculture.

Size and Capability. The membership includes over 9,000 professionals in agriculture engineering and 2,300 student members in the United States and 90 foreign countries.

ASAE has five technical divisions: electric power, animal housing, farm power and machinery, food engineering, and soil and water. The latter includes land reclamation, irrigation, and drainage. Standards, engineering practices, and data are developed in these technical areas through the Cooperative Standards Program. These voluntary standards, engineering practices, and data establish performance criteria and provide a common basis for testing and describing performance and characteristics for products, materials, and systems. These standards also develop a sound basis for codes, education, and legislation relating to the agricultural industry.

Numerous engineering practice standards for the design, construction, and operation of irrigation systems, have been developed by ASAE. In 1980, the society published the monograph Design and Operation of Farm Irrigation Systems, edited by M. E. Jensen. They also publish the monthly Journal of Agricultural Engineering.

National Audubon Society

The National Audubon Society is a nonprofit conservation organization which conducts research, education, and action programs to preserve wildlife and protect the natural system. These goals are met through publications, films, lectures, nature centers and ecology camps, research centers, and sanctuaries.

History. The Audubon Society was founded in 1905.

Size and Capability. The Society has a membership of 500,000.

Sierra Club

The Sierra Club is a nonprofit organization dedicated to the exploration, enjoyment, and protection of the wild places of the earth, the practice and promotion of the responsible use of the earth's ecosystems and resources, and restoration of the quality of the natural and human environment. These objectives are accomplished by wilderness outings, work on legislation and litigation, and education programs which use publications, films, exhibits, conferences, and a library.

History. The Sierra Club was founded in 1892. The Sierra Club Foundation is a nonprofit public foundation established in 1960 to finance the educational, literary, and scientific projects of groups working on national and international environmental problems. Parcels of land are owned and preserved by this foundation. The Sierra Club Defense Fund, Inc. is a nonprofit corporation created to support lawsuits brought on behalf of citizens' organizations to protect the environment.

National Wildlife Federation

The National Wildlife Federation is a nonprofit conservation education organization promoting the wise and proper management of the soil, air, water, forests, minerals, plant life, and wildlife. It conducts a comprehensive conservation education program, distributes numerous periodicals and educational materials, sponsors outdoor educational programs in conservation and litigates environmental disputes in an effort to conserve natural resources and wildlife.

History. The federation was organized in 1936 and has a membership of 4,200,000. The National Wildlife Federation Endowment, Inc., was established to finance conservation education and resource management programs through the National Wildlife Federation.

Size and Capability. Membership in the Federation is 4,200,000.

Ducks Unlimited

Ducks Unlimited (DU) is a conservation organization active in the preservation of wetlands for the purpose of preserving waterfowl habitat. DU encourages the use of uplands as feeding and habitat areas.

History. Incorporated in Washington,D.C. on January 26,1937, Ducks Unlimited's purpose was to restore populations of North American waterfowl that dropped sharply during the dustbowl, when drought and dry winds destroyed their nesting habitat. Originally started in 1930 under the name of "More Game Birds in America Foundation", John Palmer Knapp founded the organization.

Size and Capability. Ducks Unlimited has over 550,000 members and in the 50 years of existence has raised $436 million for conservation projects.

National Publications

Several national farm publications offer at least occasional articles on conservation. The

Farm Journal, published by Farm Journal, Inc., advertises itself as the "Magazine of American Agriculture". It is a nationally oriented "business magazine...published for families who own or operate farms/ranches". Subscription orders must show an agriculture connection. This family-oriented magazine features action and "how to" articles.

Successful Farming, the "Magazine of Farm Management", is published monthly by the Meridith Corporation. This magazine also requires subscription orders to show an agriculture connection. It is advertised as a magazine "for families that make farming their business". Articles are slanted towards farm management. Successful Farming accepts solicited and unsolicited articles for publication.

Irrigation Age, published by the Webb Company, is a national publication distributed free to farmers who irrigate. It contains a variety of articles of interest to irrigators and a regular feature section entitled "Conservation". The Furrow, published by Deere and Company, is distributed by dealers of John Deere equipment. It contains diverse agriculture and conservation-related articles and features. The No-Till Farmer is a specialized magazine published 17 times yearly by No-Till Farmer, Inc. "for farmers interested in any aspect of reduced tillage". This magazine discusses current trends and products in conservation tillage and feature articles on the experience of farmers nationwide, with comments by the editor.

COOPERATIVE CONSERVATION PROGRAMS

Cooperation between many resource oriented agencies and organizations allows these groups to provide additional services and programs by combining the strengths of each. Federal, state, and local agencies and associations and many school districts participate in cooperative programs.

Ag in the Classroom

"Ag in the Classroom" is a state program created by the Departments of Agriculture and Education to increase knowledge and awareness of Nebraska's agricultural system. Elementary and secondary teachers participate in tours and workshops, then develop instructional units to teach in their classrooms. All elementary and secondary teachers are eligible to participate. As funding and interest in the program increase, "Ag in the Classroom" could have important, far-reaching effects on conservation education in Nebraska's schools.

Following the initial teachers tour and workshop in 1984, seven teachers returned to their classrooms and developed the first units of agricultural related concepts. Several of these teachers emphasized soil conservation in their programs. They taught their students about the importance of soil and water and followed this with planting experiments in different soil types. Another teacher brought resource people, including personnel from the SCS, into the classroom to meet and talk with students. "Ag in the Classroom" projects in development include annual teacher tours, curriculum writing workshops, speaking engagements, teacher training seminars, and a pilot teaching packet for kindergarten through sixth grade.

Environmental Education Institute

Environmental education for teachers is the theme of the Environmental Education Institute's annual summer camp at Camp Jefferson near Fairbury. This two week course is sponsored by the Little Blue, Lower Big Blue, and Upper Big Blue NRDs and the Nebraska Department of Education. All elementary and secondary school teachers in the state are eligible to participate. The course provides teachers with background material and basic information in environmental education through practical training and outdoor experiences. They may then incorporate concepts and ideas of environmental education into existing courses, or develop new programs within existing curriculum. Following completion of the course, teachers are also encouraged to develop instruction units. These units are published and distributed to other teachers by the Department of Education. Courses which have been offered at the Institute include agricultural ecology, soils, and teaching methods in natural resources and conservation.

State Conservation Cost-Sharing and Assistance

Landowners installing conservation practices which control runoff and conserve water can obtain financial and technical assistance from local, state, and federal agencies. Practices such as farm dams, terraces, terrace outlets (grassed or mechanical),

irrigation reuse pits, grade stabilization structures, and diversions may be eligible for state cost sharing funds through the Nebraska Soil and Water Conservation Program. The program is administered by the Natural Resources Commission and coordinated by the NRDs at the local level. NRDs also dispense federal cost-sharing funds and many offer local cost-sharing programs funded through local taxes. These federal, state, and local cost-sharing programs remain separate, although their goals are similar.

Eligibility for state cost-sharing assistance is established when an application is submitted by the landowner and approved by the appropriate NRD board. A technician must also determine that the proposed practice is needed and practical before funds may be obligated. Technical assistance is normally furnished by the NRD or the SCS.

Cost-sharing payments are usually 75 percent of either the average cost or actual cost of installation, whichever is less. Under certain conditions, NRDs may use a percentage less than 75 percent. NRD directors also may give preference to the treatment of lands or the installation of practices which will yield the greatest public benefit.

Federal Conservation Cost-Sharing and Assistance

Landowners applying conservation practices can obtain financial and technical assistance from federal agencies and NRDs. The ASCS administers the Agricultural Conservation Program (ACP), which provides cost-sharing assistance for practices that conserve soil and water. The SCS provides conservation planning and technical assistance for this program at the field office level. NRDs sometimes provide additional funds to help offset the $3,500 per year limitations of the ACP.

The ACP program has been responsible for conserving much soil and water. Its main limitation is inadequate funding to satisfy demand. Inflation has driven the cost of construction practices up, yet funds for Nebraska have been reduced from a high of $7,192,000 in 1950 to $4,480,000 in 1984.

Assistance in repairing damage to conservation practices or applying certain special practices after disasters is also available from federal agencies through an extension of ACP, the Emergency Conservation Program. It is administered by the ASCS and the SCS provides technical assistance.

The Water Bank Program is another administered by the ASCS with technical assistance from the SCS. It provides a yearly incentive payment based on contracts with landowners to maintain certain classes of wetlands for waterfowl. It is operational in ten Nebraska counties.

Habitat Improvement on Private Lands

The Habitat Improvement on Private Lands program is the part of the Nebraska Game and Parks Commission Habitat Program which encourages landowners to improve and maintain existing habitat and establish new habitat. It is administered through NRDs with the Game and Parks Commission usually providing 75 percent of funding and the NRDs providing 25 percent. Over 2,300 cooperators and 50,000 acres are currently enrolled in this program.

Landowners choose between four wildlife habitat practices in this program. Practice I establishes permanent wildlife cover, such as native grasses or shrubs, on marginal cropland. This cover must be maintained for the duration of the contract, which ranges from three to ten years. The maximum size of these areas cannot exceed 80 acres and the maximum payment is $35 per acre per year. An additional payment may be provided the first year to pay for land preparation, plants, and seeds.

Practice II protects and enhances wetlands, stream borders, shrub-lined draws, and center pivot corners. Contracts run from three to ten years, with a maximum size of 40 acres. Annual payments range from $7.50 to $15.00 per acre, with wetlands receiving the highest payment.

Rotation practices such as planting a mixture of sweet clover and oats to enhance wildlife habitat are encouraged under Practice III. Annual payments are $35 per acre and contracts are for two years. Maximum tract size is 80 acres. NRDs may develop special practices to meet their specific needs under Practice IV. These practices may include border planting grasses along rowcrop fields, or cost-sharing for fencing of farm ponds or small watershed impoundments.

Habitat Management on Public Lands

The Habitat Management on Public Lands program, which enhances wildlife habitat on

public lands is part of the Game and Parks Commission Habitat Program. Roadsides, national forests, land surrounding reservoirs, and federal Waterfowl Production Areas are more carefully managed to enhance wildlife habitat. From 325,000 to 400,000 acres of public land could be available statewide for developing and maintaining wildlife habitat.

The County Roadside Seeding for Wildlife program is a successful cooperative venture of the Habitat Program. Counties are reimbursed for the cost of seed to plant new and reconstructed roadsides with a grass and legume mixture to provide wildlife cover. The 84 participating counties have agreed to follow a policy of limited mowing and spot weed treatment. Benefits to the counties include reduced roadside erosion, reduced maintenance, mowing, and spraying expenses, and improved roadside aesthetics. In a companion program, several counties and the Department of Roads use Habitat Program funds to establish permanent living snow fences or windbreaks along roadsides.

Irrigation Scheduling Services

Information, assistance, and incentives which promote irrigation scheduling are provided by a variety of sources. Some NRDs conduct irrigation scheduling demonstration projects. The Cooperative Extension Service often provides this service in special projects, such as the Long Pine Creek Rural Clean Water Program. The Blue River Association of Ground Water Conservation Districts provides irrigation scheduling services for cooperators in their area. Cooperators are charged a fee, but it does not cover the full cost of this service. Association employees install moisture blocks, take readings, and calculate irrigation scheduling recommendations. The managers of 140 wells and 15,500 acres in Fillmore, Hamilton, Seward, and York counties participated in the program in 1984.

Climatic data is collected by a system of automated weather stations maintained by the Center for Agricultural Meteorology and Climatology, National Weather Service stations, and cooperative observer stations. Data are compiled and are available. Some NRDs also collect climatological data for irrigation scheduling programs. Crop water use data are available through recorded telephone messages maintained by some county extension offices and NRDs. Crop water use data is also broadcast by some radio stations and reported in newspapers.

Hall County Water Quality Special Project

The Hall County Water Quality Special Project was a cooperative program designed to study water quality problems in a targeted area. The project area covered 41,600 acres of the central Platte River valley in Hall County. Ground water nitrate concentrations had increased greatly in the years preceding the study, with nitrate levels in many municipal and domestic wells in the area exceeding drinking water standards. This area has sandy soil, a shallow water table, and is intensively farmed. Irrigated corn is the predominant crop. Fertilizers are a major source of the nitrate in the area's ground water.

The objectives of this project were to reduce the amount of nitrate leaching to the ground water, to improve ground water quality, and to demonstrate that nitrogen and irrigation can be managed efficiently without yield reductions. The lead agency in the project was the ASCS, which provided cost-share funds to producers for specific management practices. The SCS provided technical assistance for improving irrigation systems and land use practices. The Cooperative Extension Service produced educational and promotional material for the project and assisted producers with implementing irrigation and nitrogen management techniques. The Central Platte NRD and Agricultural Research Service were responsible for water quality monitoring. Funding for education and demonstration of the irrigation and nitrogen management practices was provided by the Environmental Protection Agency through the Nebraska Department of Environmental Control. The Central Platte NRD and Nebraska Water Resources Center also provided funding for the program.

A major part of the project was the promotion of nitrogen management. This practice requires a determination of the nitrogen available in the soil and irrigation water, establishment of a realistic yield goal, and calculation of fertilizer requirements. The timing of fertilizer applications is also important. Nutrients should be applied at times and in amounts which maximize uptake of the nutrients by the crops. Cost-sharing was available for the analysis of soil and water samples and a

payment for using recommended nitrogen application methods was made.

Irrigation management was also promoted in the project area. Techniques employed to improve water management included irrigation scheduling and changing set sizes, set times, and length of rows. Irrigation scheduling involves a determination of crop water use, soil moisture, predicted rainfall, and other water applied. The proper time for the next irrigation can then be computed. The soil profile is only partially refilled by irrigation water to allow room for rainfall that might occur. Soil moisture monitoring equipment, water meters, and irrigation system improvements were cost-shared in the project area.

Nitrogen management practices were used on 19 to 26 percent of the 33,000 irrigated acres in the project area during the years 1980-83. Estimated nitrogen savings using recommended rates were 82, 90, 78, and 65 pounds per acre for the four years, respectively. The lowered nitrogen applications had no adverse effects on corn yields. Irrigation management was practiced on 1,560 to 3,360 acres. Estimated reductions in irrigation water use ranged from 0.7 inches to 2.6 inches. None of the cooperators indicated any loss in yield due to irrigation scheduling. The analysis of samples taken from irrigation wells in the project area indicated that no statistical change in nitrate levels occurred from 1979 to 1983. This suggests possible stabilization of the nitrate concentration in the ground water.

Long Pine Creek Rural Clean Water Program

The Long Pine Creek Rural Clean Water Program is a concentrated effort of cooperating agencies to correct water quality problems in a unique Nebraska stream. The Long Pine Creek watershed supports abundant wildlife, including trout in some stream reaches. This habitat has been adversely affected in recent years by sediment, pesticides, nutrients, animal waste, and sewage.

The Rural Clean Water Program is a federal program for targeting resources in critical areas. The Long Pine Creek project within this program began in 1980 and will continue until 1995. The project area includes 80,000 acres in Brown and Rock counties. The goals of this program are to reduce the following: sediment from agricultural lands, deep percolation of irrigation water carrying nutrients and pesticides, streambank erosion, and pollution from feedlots.

The ASCS administers the Rural Clean Water Program and provides cost-share funds to landowners to apply recommended management practices. The SCS provides technical assistance. The Cooperative Extension Service provides promotional and education material for the program and assistance to cooperators who use the suggested practices. The Department of Environmental Control monitors the quality of surface water and ground water in the area. The Middle Niobrara NRD sponsors the project and contributes funds and educational assistance.

The management practices being promoted in the area reduce erosion on agricultural lands and along streams and improve irrigation, fertilizer, and pest management. Management of feedlot waste and solid waste disposal facilities and control of roadside erosion are also needed, but these practices are ineligible for Rural Clean Water Program funds.

Significant progress was made in the early years of this project. Erosion control practices reduced soil losses by an estimated 59,000 tons between October 1983 and November 1984. Farmers who used University of Nebraska fertilizer recommendations spent approximately $135,000 less for fertilizer on 7,000 acres. Yields improved about 10 percent on the 5,700 acres of irrigated cropland which were included in the integrated pest management program. Sewage treatment systems at Ainsworth and Long Pine were upgraded and problems at the Long Pine solid waste facility were corrected.

Agricultural Energy Conservation Project

In December 1983, the State of Nebraska and the Cooperative Extension Service (IANR, UNL) began a five-year cooperative educational program to conserve energy, soil, and water. The State provided $500,000 from energy overcharge funds, which was matched by $500,000 from the University of Nebraska Foundation to fund the project. The University of Nebraska-Lincoln and several Nebraska agricultural commodity check-off boards also have provided funds for this project.

The objective of this program is to increase the adoption of soil conservation and water management practices. Specific goals in targeted areas include: expand ecofallow acreage by 20 percent; expand conservation tillage for row crop acreage by 20 percent;

expand no-till acreage by 10 percent; reduce irrigation energy consumption by 20 percent; and reduce irrigation water consumption by 10 percent. Achieving these goals within the target areas would reduce soil erosion, on-farm fuel consumption, labor, water, and energy used for crop production.

The three components of the Agricultural Energy Conservation Project are conservation tillage, irrigation water management, and ecofallow. Three target areas have been set up for the conservation tillage component: Saline, Gage, and Johnson counties; Wayne County; and Thurston, Burt and Washington counties. In each of the three areas, advisory committees have been formed to develop project plans. Conservation tillage meetings were held in the target areas and 75 percent of farmers attending said they would change their tillage practices as a result of the information presented. Thirty-eight cooperators have planted demonstration plots using various types of tillage equipment. A rainfall simulator has been constructed to demonstrate soil erosion under different amounts of residue. In each of the three areas, 100 farmers were surveyed to inventory tillage practices currently used. This survey will generate baseline data from which to measure any increased adoption of conservation tillage.

The second component of the project, irrigation water management, is promoted in two target areas: Buffalo County, and Antelope and Holt counties. SCS personnel, NRD managers, and extension agents helped develop the plan for this component. Buffalo County has five cooperators who will receive an intensive review of their irrigation water management practices. One furrow-irrigated farm will be computer monitored to optimize the system. A pump plant test will be conducted to determine its efficiency. A second furrow-irrigated farm will be analyzed to reduce or eliminate the problem of restricted water flow due to crop residues from conservation tillage on row crops. Another field will be analyzed to increase the uniformity of a medium pressure center pivot with regulators. A second center pivot will be analyzed on a field which has steep slopes and varying soil types. The last field test, also under a pivot, will evaluate the effectiveness of inter-row tillage practices in controlling runoff due to slope and soil type.

Thirty fields in each of Antelope and Holt counties will be targeted for irrigation water management. Ten fields will make up a core group; these farmers will receive extensive training which will enable them to calculate their own irrigation schedule. The remaining 20 fields in each county will comprise a buffer group where water use will be closely monitored. All 30 wells in each county will receive an irrigation pump plant efficiency test. A phone survey will collect baseline irrigation data for both counties.

A task force of Extension agents, SCS personnel, NRD managers, and agribusiness people has been formed to provide input and review project plans for the third component, ecofallow. Its target area includes Chase, Lincoln, Perkins, Keith, Garden, Deuel, and Cheyenne counties. This project will review equipment, needed modifications, and necessary management to successfully use ecofallow under heavy residue conditions. The accuracy and uniformity of chemical spray patterns will be checked using a spray deposition analyzer. An ecofallow newsletter is being mailed to farmers and agribusinessmen in the area and a NebGuide on "Markers for Chemical Sprayers" will be distributed in the targeted counties. Some mass media news coverage of ecofallow practices has occurred here. Farming practices in the target area were surveyed in the fall of 1984 to determine energy use and the amount of crop residue remaining on the soil under different cropping systems.

Conservation Plans for Board of Educational Lands and Funds

The board and its land managers oversee about 1.5 million acres, of which 1.2 million are rangeland and the remainder cropland. Approximately $400,000 is budgeted yearly to apply conservation practices to the land. Funding requests may be initiated by either the leaseholder or a land manager. The SCS develops conservation plans and does the necessary technical work. Practices are applied to sustain the soil and water resources within the limits of the lease requirements, while attempting to achieve the goal of maximizing income.

Nitrate Task Force

The UNL Institute of Agriculture and Natural Resources established a task force to address ground water nitrate contamination. This interdisciplinary group was formed to exchange data and ideas, and to recommend policies on

nitrate management and information. It meets irregularly, in response to specific problems or issues. Improved coordination among different disciplines has resulted and at least one publication has been released.

Range Management Cooperative Committee

The Nebraska Range Management Cooperative Committee is working to bring together all agencies and organizations who have an interest in range management. Federal, state, and local agencies and organizations provide technical assistance, conduct research, and provide information and education on rangeland resources. These agencies have signed a cooperative agreement to share information and develop public awareness programs, to bring institutions together to develop a stronger cooperative effort, to promote professional range education by sharing research and jointly publishing documents, and to provide a forum where agencies can interact to implement these goals.

The cooperative agreement is signed by the Governor and representatives of the SCS, Cooperative Extension Service, Agricultural Research Division of the University of Nebraska, Nebraska National Forest Service, NRC, ASCS, BELF, Nebraska Game and Parks Commission, Nebraska Stock Growers Association, U.S. Fish and Wildlife the Service, and Society for Range Management.

Conservation Tillage Information Center

The Conservation Tillage Information Center is a joint effort of NACD, agricultural industry leaders, private organizations, and government agencies. Since 1983, the Center has assisted farmers and others with agricultural interests in gathering and disseminating accurate information on new methods of conservation tillage. This is done through various means, including conservation tillage demonstration projects. The Center publishes a guide to conservation tillage audio-visual materials and also publishes the Conservation Tillage News, an authoritative information source. The Center has also coordinated three national conservation tillage data surveys. It offers a referral service of scientists and scientific information, and a library reference system of local and state publications.

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Chapter 4. CONSERVATION GOALS

It is vital that all Nebraskans recognize that "we do not inherit the land from our ancestors, we borrow it from our children." Much of the land in Nebraska is now protected from excessive runoff and erosion, and it can be passed on to future generations with pride. Nevertheless, some land still remains unprotected and will become a burden to future generations. The individuals who have custody of the untreated land have apparently not heard about conservation land treatment, don't believe it works, or can't afford to apply it. These landowners, and much of the public, need to understand that the costs to Nebraska in lost resources, production, and economic activity will be greater in the long run than the cost of accelerating treatment on the unprotected lands.

Accelerating the application of soil and water conservation practices would also help reduce the pollution of surface and ground water. The concentrations of nitrates and pesticides in ground water increase year by year for several reasons. First, ground water moves much more slowly than water in streams. Subsequent annual applications to fields allow repeated doses of nitrates to enter a given volume of water. Compounding the situation, there is less opportunity underground for chemical reactions that reduce pollution. The most effective way of reducing this type of pollution is to prevent it from leaching out of the root zone. The sooner conservation practices are applied, the better ground water quality will be.

Soil and water conservation practices applied to lands in tributary watersheds would also reduce the amount of sediment and attached agricultural chemicals that reach streams and lakes. Sediment, a non-point source of pollution, is one of the major pollutants of surface water in Nebraska. A national program for cleaning up this country's surface waters was established in the Clean Water Act. Under this program, great strides have been made in cleaning up point sources of pollution, but success has been limited in reducing pollution from non-point sources. To achieve the national goal, the amount of sediment from erosion must be reduced. Accelerating the application of conservation practices will help meet the nation's clean water goals.

At the current rate of progress, it will take nearly 50 years to protect the remaining untreated land. Many people are now aware that in 50 years, the losses in soil productivity, the economy, and the environment will be too great. Those who assisted in the development of this Strategy realized that changes were needed, so new goals for conservation activities were established.

GOALS OF THE SOIL AND WATER CONSERVATION STRATEGY

The Strategy is aimed at sustaining the ability of the soil and water resources to support a high quality of life for present and succeeding generations. To do this, it must motivate land managers to accelerate the use of conservation practices that (1) reduce erosion to an acceptable level within each land use; (2) make maximum use of precipitation, reducing runoff and minimizing ground water pumpage; (3) use the most efficient systems of irrigation, fertilizer, and pesticide management that also conserve water and protect water quality; and (4) maintain rangeland, pasture, and forest resources in a condition in which the key species can be maintained.

LAND TREATMENT

Ideally, Nebraskans should strive to use each acre of land within its capability and treat it according to its needs. From a practical standpoint achieving 100 percent land treatment is not possible because of the continual changes in land use, ownership, and farm programs. This fact was considered by an Executive Committee, composed of the heads of many state agencies, which oversaw and coordinated the development of the Strategy. The committee's members agreed that the Strategy should establish a state goal of completing 80 percent of the remaining treatment needs while maintaining the existing treated land. Achieving this goal would raise the total amount of adequately protected land to 92 percent. Less extensive programs could then be continued to deal with the remaining eight percent and with maintenance.

The numbers for acres of cropland, rangeland, and pasture requiring treatment and acres that need to be treated to achieve the 80 percent treatment goal are shown in Table 4-1. Also shown is the number of acres with excessive erosion that will be adequately treated if the total needs, such as improving the condition of rangeland, are achieved.

The 8.5 million acres of cropland that need treatment are eroding at a rate that is damaging their ability to produce. Much of the state's soil loss is concentrated on this cropland, especially the acres in land capability classes IV and VI. Most of the grassland acres primarily need treatment to raise their condition to good or excellent. Accomplishing this will also adequately protect 80 percent of the rangeland and pasture acres that are eroding at a rate greater than the tolerable limit.

Relatively little land in Nebraska is in forest. The National Resources Inventory shows a total of only 732,000 acres of forest land use. It also shows that 123,000 acres are eroding at a rate greater than the tolerable limit. The state's goal is to adequately treat a minimum of 98,000 of these acres. It also calls for improving grazing management on the portion of forest land that is being grazed. This means raising the condition of 58,000 acres to at least good condition.

WATER CONSERVATION

Nebraska possesses extensive and important water resources. The state's vast supply of ground water has proved to be especially important, as it has been used to expand an agricultural system which now produces impressive amounts of food and fiber. The rapid growth of Nebraska's agricultural output was possible because ground water was available for use in agricultural irrigation systems. Although ground water does underlie the state's most fertile soils, extensive withdrawals for irrigation are lowering the water table in some areas, and recharge is very slow.

The Strategy places a high priority on the conservation of these precious water resources. This initial Strategy report focuses mainly on soil conservation, but goals have been established and are included here for conserving water on the state's irrigated lands. The water conservation goals are largely aimed at conservation on irrigated lands because this is where the vast majority of water use in Nebraska occurs.

Generally, water can be conserved in two ways: by managing water from precipitation and storing it in the soil, and by reducing the amount withdrawn from storage or streamflow for consumptive uses. Of the more than 7 million acres of irrigated cropland, 25 percent needs improved irrigation water management and 22 percent needs erosion control. The state's goal is to accomplish maximum precipitation management for erosion control and proper irrigation water management on 3.3 million acres of 7 million acres of irrigated cropland.

TIME PERIOD FOR ACCELERATION

It has been estimated that nearly 50 years would be required to protect the remaining

Table 4-1

TREATMENT GOALS FOR THE MAJOR LAND USES

Land Use	Strategy Goal	Area Needing Treatment	Total Treatment Goal	Eroding Area in Treatment Goal
	(Percent)		(Millions of Acres)	
Cropland	80	8.5	6.8	6.8
Rangeland	80	8.3	6.6	1.1
Pasture	80	1.4	1.1	0.2

inadequately treated lands. The benefits of reducing the time period for preserving our resources to 25 years will be greater than the estimated costs because it is less expensive to prevent erosion and water contamination than to fix the problem after it occurs. Considering what level of treatment could be reasonably attained, those responsible for the development of the Strategy established a state goal of 25 years for adequately treating 80 percent of the unprotected lands.

STATE FUNDING GOAL

For the past 50 years, federal, state, and local governments have cooperated in soil and water conservation in Nebraska. However, but it has only been in the last 15 years that the state and local NRDs have contributed significant amounts of funds to cost-sharing. In 1973, one year after their establishment, some NRDs were providing local funds for cost-sharing. The state contribution was limited to personnel services until 1977, when the first state funding for cost-sharing with landowners on conservation practices was authorized.

Funding for cost-sharing and for technical assistance has been a major reason for the successes of the partnership to date, and will be even more important in the future. To achieve the state's goal of 80 percent land treatment in 25 years, Nebraska must increase the Soil and Water Conservation Fund to at least $6.9 million per year. The federal government must continue its support at least at the present level, and NRDs must also maximize their financial and promotional efforts to reach the state's goals.

Chapter 5. CONSERVATION PRACTICES, ACTIONS, ALTERNATIVES, AND IMPACTS

Soil and water are conserved only by the application of conservation practices. This strategy is a means of accelerating the use of those practices.

INTRODUCTION

This chapter addresses practices that conserve soil and water; actions that can be taken by agencies and organizations to accelerate application of conservation practices; policies and actions that the Governor and Legislature can select to improve conservation; and the effectiveness and impact of all actions.

INTRODUCTION TO EFFECTIVENESS OF PRACTICES

Some conservation practices are more effective than others in reducing erosion or conserving water. Some accomplish more than others for the amount of money and other resources required to build, purchase, or prepare them and to use them. Many practices serve more than one purpose, which complicates the process of evaluating their effectiveness.

Water can be conserved by practices which reduce runoff and increase infiltration or reduce evaporation. Many erosion control practices, such as terraces, dams, conservation tillage, and contour farming, reduce runoff and increase infiltration. Field windbreaks and conservation tillage are examples of practices that reduce evaporation. When more precipitation is saved, less irrigation water is required. Irrigation scheduling and rainfall management will also make more efficient use of irrigation water and reduce the risk of ground water contamination.

Many practices can also reduce sediment delivery from irrigated fields. Land leveling and short irrigation runs are particularly important for gravity irrigation. Terraces, contour farming, and conservation tillage are just as important for center pivot irrigation on steeper slopes as they are for dryland farming.

Selection of the proper practices requires careful analysis and design to ensure their effectiveness. Soils, slopes, weather, and many other physical factors affect the performance of many conservation practices. Practices that are very effective in heavy soils on moderate slopes may not work well in sandy soils or on steep slopes, for instance. In addition, the cost of building or converting to some practices changes in different situations and the same amount of erosion control might be achieved at lower cost in one place than another.

Judging the cost effectiveness of erosion control practices is very difficult. Potential on-farm productivity losses due to excessive runoff and soil erosion can be identified, but these losses are not easily measured. Many site specific factors such as soils, crops, management, and weather influence productivity. While there is ample data on the costs of conservation measures, the cost of erosion can only be estimated.

INTRODUCTION TO IMPACTS

Conservation practices are intended to have an impact on erosion, waste, and pollution. These practices, and the activities employed to accelerate their application, produce additional impacts on people, resources, and the environment. Some impacts are temporary, or short-term, and others are long-term impacts. Impacts can be beneficial or adverse, and they can be both beneficial and adverse at the same time. Any activity could have beneficial impacts on one group and adverse impacts on another. In some cases the impacts have been studied extensively and are well documented. In other cases very little information is available.

Impacts can be categorized in many ways. In this chapter, they are categorized by the cause of the impact, the duration of the impact, or by the type of impact.

Impact Causes

Most impacts are caused by physical activities, like the installation of conservation practices, but some can be caused by policy decisions and administrative actions. Installation of terraces requires physical activity like moving

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soil, which can produce dust and other reactions. Policy decisions, such as the decision to add or discontinue a conservation program may cause some social and economic impacts before implementation of any conservation practice takes place. Changing a program could impact the jobs of many people, even cause them to move to a different location.

Physical activities may include construction, installation, development, and purchases. Construction of features like dams and terraces has many potentially serious impacts. Construction and installation of some measures, such as moisture blocks, would have lesser impacts. Development activities, such as the production of classroom notes and teaching aids would have different types of impacts. Finally, the act of purchasing new conservation tillage equipment would have economic impacts, and the use of that equipment would have impacts on resources.

The long term use of conservation tillage equipment instead of conventional equipment can have substantial impacts. Maintenance of conservation measures, cleaning irrigation ditches, removing trash and sediment from dams and sediment basins, and fixing fences or livestock wells could have economic and environmental impacts, as well.

Impact Duration

Impacts can also be categorized by their duration. Some are temporary, or short-term impacts, and others are more permanent.

Short-term Impacts. There are short-term impacts associated with the construction of structural practices and adoption of nonstructural practices. Construction of dams or purchase of new conservation tillage equipment are examples of actions that produce short-term impacts. Construction of a dam can produce substantial impacts for a few months or a few years, but many of these will end when earth-moving stops, vegetation is restored, and payment is made. Some will be replaced by impacts of a different kind over the life of the dam.

Long-term Impacts. Long-term impacts can also result from the construction of structural practices and adoption of non-structural measures. In some cases, these impacts are permanent, in other cases they are reversible.

Structural practices like terraces and waterways intercept, collect, or channel excess runoff water (from rainfall or irrigation), which may reduce erosion from fields, pastures, and forests. If the water they intercept might otherwise have reached a wetland, the wetland could be reduced or eliminated. Reducing the amount of cropland runoff through the use of terraces may increase infiltration and reduce the chance of sediment and agricultural chemicals being carried to lakes, ponds, streams, and wetlands. However, decreasing runoff would result in increasing infiltration which may allow greater movement of nitrates and other agricultural chemicals into ground water.

Nonstructural practices which could have long-term effects include ground cover or wind barriers which reduce wind erosion and the amount of air-borne soil particles (improving air quality). Ground cover plantings absorb raindrop impact and may further reduce water erosion. Together with wind barriers, ground cover may trap snow and rain, increasing infiltration and stored soil moisture. They should also increase soil tilth by increasing organic matter content. These plantings may increase plant diversity in the area, and may provide additional, or more diverse, wildlife habitat and food base.

The long-term economic impacts from the operation of conservation practices may vary. Some practices, like reshaping terraces and spraying and mowing grassed waterways, may incur maintenance costs. Some cropland may be removed from production to install terraces or to convert to grassland, but the seeding of cover crops for these practices may provide a source of livestock forage. Conservation practices could reduce the cost of sediment removal from ditches, roads, and other places. The increased soil moisture resulting from these practices may also increase crop yields.

Impact Types

In addition to their duration, impacts can be categorized by type. Physical, economic, environmental, and cultural/social are some types of impacts.

Physical Effects. The physical impacts of any conservation practice are varied and can be numerous and extensive. There can be primary and secondary physical impacts. For example, moving earth is the major construction activity in building a dam. Among the primary impacts of this activity is the displacement of topsoil, destruction of plants, and compaction of the soil. The construction of a dam may also change the

regimen of the stream, create a pond or lake, flood land in the reservoir, and allow more water to seep underground around the reservoir.

Primary physical impacts can produce secondary physical impacts also. Secondary impacts of displacing topsoil and destroying plant cover include wind and water erosion, which may accelerate after the vegetative cover is removed and before the land is revegetated. The result may be sediment deposition in undesirable places and added particulates in the air. These physical effects could then produce environmental and economic impacts.

Environmental Impacts. Conservation practices and irrigation management affect water quality, wildlife habitat, and wetlands. Soil particles and chemicals are carried by runoff water into streams and lakes, and chemicals can leach from the soil into the ground water.

Environmental features that could be impacted include: (1) land and soil, (2) water quality and quantity, (3) air quality, (4) plants, (5) wildlife, (6) wetlands, (7) uncommon scenic features, and (8) archeological or historic features. The quality of land and soil resources can be impacted through chemical or structural changes. The structure can be changed by compaction or saturation with water. The chemistry of the soil can be changed by the addition of salts or the addition of water that leaches out alkali or nitrates. The quality of the land can also be impacted by changes in its appearance. Leaving crop residue on the land will change its visual impact on the viewer. Stabilizing a gully or establishing grass on eroding areas will make them aesthetically more appealing.

Many conservation measures will have an impact on the quality of both surface water and ground water. They will change the chemical composition of the water, or impact its temperature, or produce biological changes in it. It will also impact its aesthetic value by changing the color, odor, or taste of the water.

Sediment, on a mass basis, is the major nonpoint source pollutant. Sediment directly damages fish and other wildlife habitats and their food supplies. Soil washing into streams, lakes, reservoirs, and wetlands destroys the habitat for the most desirable fish and wildlife species. Suspended sediment in the water impairs the dissolved oxygen balance and obscures the light needed for photosynthetic aquatic plants. Heavy sediment particles can blanket fish nesting and spawning areas and cover food supplies.

Installation of conservation measures can impact the quality of the air by either adding or reducing the amount of dust. Construction of some measures can also add pollution to the air from the exhaust from construction machinery.

The number, size, and diversity of plants, wildlife, and wetlands can all be impacted by conservation measures. Some measures might reduce numbers and diversity, other could increase types and numbers and their visual appeal.

It is not likely that construction or operation of conservation measures would have substantial impacts on rare or unusual scenic features, archeological discoveries, or historical features, but it could possibly happen in some instances. The construction of dams or terraces, for instance, could destroy or cover up artifacts or archeological or historical significance.

Economic Impacts. Economic impacts can be direct and indirect, beneficial and adverse. The cost of constructing terraces may be an adverse impact on the landowner, but beneficial to the construction contractor. Having terraces in a field could increase the yield from it, and produce a beneficial impact for the landowner.

There are initial costs associated with most soil conservation practices. Some practices, particularly those requiring construction, have a high initial cost. These costs will impact the landowners and operators and can also affect government agencies and the taxpayers if cost-sharing is provided. Initial costs for some practices may be limited to the acquisition of different management skills.

Structural practices like dams, diversions, terraces, grassed waterways, and planned irrigation systems require earth moving and materials such as concrete, pipe, and seed which are major cost items for conservation practices.

A number of nonstructural practices have short-term economic impacts. Trees, shrubs, and grass seed are required for tree plantings, critical area plantings, and the conversion of cropland to grassland. Planting and seeding costs must not be overlooked. New equipment may be needed for the adoption of conservation tillage systems. A planned grazing system may require additional fencing and livestock watering facilities.

Some industries benefit from the implementation of soil conservation practices. Land improvement contractors can benefit financially from the construction of structural

practice. Soil conservation practices may also benefit seed and equipment dealers and nurseries.

Social/Cultural Impacts. Conservation practices could affect the following social/cultural features: socio-economic, demographic, social attitudes and relations, and administrative/legal. Economic impacts produce socio-economic effects such as changes in employment and income. Changes in employment may produce demographic impacts including changes in population. Similarly, the impacts on social attitudes and relations may be many and varied. Achieving more conservation would impact some attitudes toward stewardship of the land and the land ethic as a whole. Changes in statutes, in turn, could affect attitudes toward regulation and even create conflicts. Other policies could impact the level of education and appreciation for conservation. Changes in statutes and other policies would potentially impact the administrative structure and the regulatory system in the state.

CONSERVATION PRACTICES, EFFECTIVENESS, AND IMPACTS

Over the past 50 years many measures have been developed for conserving soil and water resources. Some have proven more effective than others, and some have evolved due to changes in agricultural practices.

Methods of conserving soil include structural and non-structural practices. Dams, terraces, and waterways require earth moving and other construction activities. Conservation tillage, contour farming, and strip cropping require primarily changes in farming operations.

The following is a description of the most common practices, or systems of practices, used for sustaining the productivity of the soil, water, and rangeland resources. Their effectiveness and impacts are provided where available.

CONSERVATION TILLAGE SYSTEMS

Conservation tillage is any tillage sequence that reduces the loss of soil or water relative to conventional tillage. The broad term, conservation tillage, includes several methods. Minimal tillage is simply a reduced number of tillage operations over the field. With no-till, only a narrow strip of soil is disturbed during planting, and no other tillage operations occur. Primary tillage, done with a chisel plow or sweeps is called mulch tillage. A variation of mulch tillage, subsoiling, involves pulling the chisel at a deeper than normal plowing depth.

The goal of conservation tillage is to leave residue on the surface. Research has shown that tillage and planting systems that maintain residue cover on at least 30 percent of the soil surface reduce soil erosion by water [15]. Where wind erosion is a primary concern, it calls for maintaining the equivalent of 1,000 pounds of flat small grain residue on the surface during the critical erosion periods.

Effectiveness

The effectiveness of any conservation tillage method depends on the amount of residue left on the soil surface. Research has shown that for each 10 percent increase in ground cover, erosion is reduced about 40 percent [13]. The greatest effect on erosion comes with 0 to 20 percent cover. For example, studies reported 36 to 65 percent reduction in soil loss with 20 percent residue cover. This same study showed that conservation tillage also reduces wind erosion. With at least 3 tons/acre wheat straw mulch on the ground, annual soil losses averaged 0.9 tons/acre. Compared to bare soil which had an average annual soil loss of 14.3 ton/acre. By using no-till, residue increased 892 pounds per acre which reduced erosion by 45 percent. Even minimum tillage, which left 670 pounds per acre of residue, reduced erosion by 36 percent.

Researchers conducted an 18 year study of corn yields as affected by erosion. On slightly eroded soils, yields averaged 92 bushels per acre, while yields were 48 bu/ac on soils with severe erosion. Another study compared the fertilizer needs for eroded and noneroded soils [8]. They found that in some cases increased fertilizer rates could compensate for the effects of erosion. The cost of fertilizer needed to bring soil productivity up to the noneroded standard varied from $27.00/acre to $228.50/acre.

Environmental Impacts

Field experiments in Iowa compared no-till and moldboard tillage and broadcast and incorporated fertilizer application methods [9]. The research showed that under no-till conditions more nitrate was retained in the root

zone (0 to 5 feet) in comparison to the moldboard plow. They also noted higher leaching of nitrate in the moldboard plowed fields. For example, after a 6 inch rain, 26 percent of the total nitrate had moved below the root zone in the moldboard plowed areas, while only 6 percent of the nitrate in the no-till fields had moved below the root zone.

Kanwar et al. investigated the effect of tillage and nitrogen management on nitrate concentrations in drainage tile water [10]. In 1984, results showed that water from no-till plots had nitrate concentrations of 11.8 ppm, while water from conventional tillage plots had a concentration of 10.7 ppm. However, in 1986, average nitrate concentrations from conventional tillage plots was significantly higher (23.2 ppm) than no-till plots (11.4 ppm) with split nitrogen applications and no-till plots with a single nitrogen application (14.7). Because no-till improves infiltration, tile flow increases and higher nitrate losses occurred with the single 175 kg/ha nitrogen application in comparison to conventional and no-till/split application.

Baker and Leflen found that although conservation tillage greatly reduced runoff, soluble nitrogen and potassium losses were significantly higher than with moldboard plowing [2]. The higher losses in conservation tillage systems are due to the placement of the fertilizer, which is broadcast and not incorporated. The researchers also found that herbicides which were broadcast applied were vulnerable to runoff.

Researchers using the Chemical, Runoff, Erosion from Agricultural Management Systems (CREAMS) model simulated long term effects of best management practices on nitrogen loading to surface water and ground water. The model showed that while no-till reduced surface loading of nitrates, no-till resulted in greater nitrate loadings to the ground water.

Economic Impacts

It has generally been assumed that because conservation tillage reduces the number of tillage operations, fuel costs will be lower and in turn, production costs. Experience has proved that fuel savings depends on the soil type, tillage, crop, and herbicide treatment.

The energy required for tillage, planting, and weed control for a corn crop using moldboard conventional tillage was 5.4 to 8.3 gal/acre depending on the soil [19]. While till-plant and no-till required 4.0 to 4.7 gal/acre of diesel fuel. Operations in a soybean field lowered fuel requirements in the no-till system. No-till required 3.3 to 3.9 gal/acre, while conventional moldboard tillage required 5.7 to 8.9 gal/acre of diesel fuel. Energy savings with low energy tillage are often offset by the energy need to apply extra herbicide or to account for heavy soils. Ritchey et al. found that the maximum possible savings was 5 gal/acre of fuel.

In 1984 the SCS reported on crop budget comparisons of conservation and conventional tillage in Burt and other counties [21]. The example shown in the SCS Technical Guide is from a dryland field planted to corn after soybean. Total costs for conventional tillage were reported as $211.62 per acre and $2.55 per bushel based on a yield of 83 bu/ac. Total costs for no-till were $216.29 per acre and $2.12 per bushel with a yield of 102 bu/ac. The yield increase for no-till resulted in a net income of $85.01 per acre. Additionally, the soil loss for no-till was only 4 tons/acre/year, while soil loss was 11 tons/acre/year for conventional tillage.

For irrigated crops, the SCS found that no-till required 1.6 hours/acre of labor, total costs of $385.00/acre, and 3 tons/acre/year soil loss. Conventionally tilled fields required 2.2 hours/acre of labor, total costs were $405.00/acre, and soil loess was 34 tons/acre/year. Based on the SCS work in Burt and Cedar counties, no-till is cost effective in reducing soil erosion.

Putman and Alt used the Erosion Productivity Impact Calculator (EPIC) to estimate costs of conservation systems in Iowa [18]. Using EPIC it was estimated that after 100 years of erosion, erosion-caused yield loss would reduce farm income 4% below 1982 levels. The model showed that corn grown with conservation tillage was the most profitable system on most Iowa soils.

Putman and Alt also studied the effect of restricting erosion. Not all land would be able to meet the 2 T or 1 T limits, and this land would be converted to pasture or hay land. Based on data showing pasture cash rents for 35% to 58% of that for cropland in Iowa, they assumed conversion would reduce income by 50%. The model results showed that limiting erosion to 1 T would cause a net annual loss of $13.00/acre (a 12% reduction) in farm income. While limiting erosion to 2 T can cause a $2.83/ acre annual net loss or 9.5% reduction in farm income.

Lee et al. studied the effect of minimum till on the sediment yield for an Indiana watershed [11]. They found that with 100 percent compliance of minimum till, erosion could be reduced by 46 percent. The cost of implementing minimum till on 100 percent of the cropland was estimated at $80,873 or $25.40 per acre. They also investigated the conversion of all cropland acres in the watershed to pasture or small grains. This plan would reduce erosion 42 percent and would cost $851.00 per acre. Lee et al. concluded that a targeted minimum till program would provide a cost effective method of reducing erosion in the watershed.

An Illinois watershed was studied as part of the Rural Clean Water Program. Researchers looked at the production cost changes for implementing the best management practices [20]. The estimated cost for implementing conservation tillage for the 10,570 acres contracted in watershed was $488,000 or an average of $46.00 per acre.

CONTOUR FARMING

Contour farming simply follows a nearly level contour around and across slopes, as opposed to farming straight across the field, which might be straight up and down slopes. By conducting field operations on the contour, small furrows are formed that catch and hold rainfall runoff or snow melt.

Physical Effects

These practices retain or reduce runoff, increase infiltration, and in turn potentially increase ground water recharge. The increased soil moisture may increase plant productivity. Streamflow attributed to runoff (v. baseflow) may be reduced.

Economic Impacts

Contour farming may require more operator time to complete field operations and may consume more fuel, thus increasing costs. The added time and fuel requirements may be partially offset by more nearly level operations, which may slightly reduce fuel consumption.

STRIP CROPPING

Strip cropping is normally used to control wind erosion on coarse textured soils or soils on broad flat landscapes. Wind resistant crops, shrubs, or trees are planted in alternating strips with row crops or fallow and are arranged at right angles to the prevailing winds during the critical erosion period. More recently, strip cropping has been used to control water erosion. Cultivated close-growing crops are planted in alternate strips across the slope. The close-growing crop improves absorption of runoff and sediment from the row crop.

CRITICAL AREA TREATMENT

Practices in this category include planting vegetation such as trees, shrubs, vines, grasses, or legumes on critically eroding areas to stabilize the soil or on highly erodible soil to prevent erosion.

Physical Effects

The conversion of marginal cropland to grassland can result in reduced runoff and less water and wind erosion. Reseeding with a variety of native grasses and forbs will increase plant diversity. The structure of the soil can also be improved by the conversion to grassland.

Environmental Impacts

The conversion of eroding land to grassland will reduce runoff and improve water quality as fertilizer and pesticide use decreases and less runoff and sediment reaches surface waters. It may result in more precipitation infiltrating to the root zone. Evapotranspiration may increase or decrease, depending on the amount and type of vegetation before the change, and ground water recharge may also change to some degree. Leaching of nitrates and pesticides to the ground water may decrease as the application of agricultural chemicals is decreased or stopped. The conversion to grassland will improve wildlife habitat for some species in some areas. This practice can have a positive impact on aesthetic values as poor and eroding cropland is returned to grassland.

Economic Impacts

The initial cost of the conversion of cropland to grassland includes the cost of seeding the grasses and the loss of productivity during the time it takes for the grass to become established. The income of the landowner may also be affected in the long term depending on the relative economics of crop and livestock production. Expenditures for sediment removal from road ditches may be reduced by the reseeding of marginal cropland.

DAMS

Dams are constructed across streams and other natural water courses for the purpose of intercepting runoff water and impounding it for varying periods of time. Often dams are constructed for multiple uses, including flood water retardation, irrigation, recreation, wildlife habitat improvement, or municipal or industrial water supply.

Effectiveness

Dams can impound water making it available for different uses such as irrigation recreation, ground water recharge, and maintenance of minimum streamflows. Impoundments can be utilized by a variety of fish and wildlife as a water source, and habitat. Flood flows can also be affected by dams and the larger structures having the most significant effect.

Physical Effects

Short-term Impacts. Construction can have short-term physical impacts, including displacement of topsoil and soil compaction. It almost always requires destruction of vegetation and removal of topsoil at the location of the dam and often at a borrow area. Removal of additional earth may also be required. This exposes the soil below to weathering, and it may produce accelerated wind and water erosion. Often, if a perennial stream is dammed, it must be re-routed at least once during construction, subjecting new material to the force of flowing water, causing erosion and sedimentation. When the construction is complete, or nearly complete, the flowing water is directed to the new outlet, and a new area must adjust to the change.

Long-term Impacts. The existence of a dam has a variety of long-term physical impacts. It affects the stream, the land under the dam under the reservoir, the trees and plants in the reservoir, and the water stored in the reservoir.

Physical impacts on the stream below the dam include the quantity and quality of the water. Downstream peak flows and total stream flows could be reduced by reservoirs. The change in quantity is a function of the amount of storage available and the length of time water stays in storage. The decrease in flow and flood peaks eventually has an effect on the bed and banks of the stream. The decrease can also impact the quality, especially the temperature and sediment carrying capacity of the water. Other factors that influence the temperature and chemistry of the water in the stream below the dam include the size and depth of the reservoir and the length of time in storage.

Storing water in a reservoir provides the opportunity for some of the water to seep into the ground. This seepage can raise the water table around the reservoir and waterlog some of the surrounding land if it is low enough.

Environmental Impacts

Short-term Impacts. Environmental impacts of dam construction include a temporary increase in erosion and sediment in runoff water. Construction activities also destroy plant life that provides wildlife habitat. Construction and maintenance consumes fuel and results in dust and exhaust which can affect air quality.

Long-term Impacts. Dams can restrict fish movement in flowing streams and can reduce the flow of water to wetlands. Dams act as a trap for nutrients as well as sediment and can also warm the water. Archeological and historical features may be unearthed, damaged, or destroyed by construction or could be inundated once the dam is completed. A dam may affect the aesthetics of an area; a dam may be more pleasing than eroded land.

Reservoirs could significantly affect the water quality of streams. Water released from the reservoir will carry less sediment, nutrients, pesticides, and other pollutants, because they settle out in the reservoir. This may allow greater movement of nitrates and other chemicals into the ground water. Dissolved nutrient levels may be reduced in the impoundment through biological activity. If nutrient loading in the reservoir is sufficient,

biological activity can degrade the impounded water, and algae and aquatic plants may flourish, reducing dissolved oxygen levels and increasing water temperature.

Wildlife habitat and plant diversity may be increased around reservoirs. A permanent pool will provide a water source for wildlife and may be stocked to provide a greater variety of fish populations where there previously were none. Dams may interfere with fish populations downstream. However, a structure designed for storage could be operated to release water to supplement an otherwise intermittent stream, improving the habitat for aquatic life.

Economic Impacts

The earth moving required for construction makes dams costly. Another cost of dams is the land taken out of production, which can be considerable for larger dams with extensive impoundments. Some maintenance of the structure and sediment removal may be required. However, costs of offsite sediment removal such as in road ditches may be reduced. Contractors and associated groups receive benefits from construction activities.

Water can carry tremendous amounts of sediment into a reservoir. Crowder reported that 15% to 25% of the reservoir capacity constructed is meant for sedimentation [6]. Crowder estimated that the cost of cropland sedimentation impacts on reservoirs was about $33 million for the Northern Plains states. And as the reservoir storage capacity is reduced so it the potential for power production if the reservoir is used for hydro-electric power production. Sediment-laden water also increases wear on the turbines when passing through power plants.

DIVERSIONS

Diversions are channels with a supporting ridge constructed across the slope or on the contour of a hill. Diversions are usually constructed to divert excess runoff water from an unstable waterway outlet to a stable waterway outlet or to prevent water from channeling across valuable Class I or Class II land.

PLANNED GRAZING

This system includes a number of practices. One practice outlines a pasture management system to provide optimum production for livestock while maintaining adequate soil cover to protect it from erosion. Another management system establishes or restores long-term stands of adapted species of perennial and biennial forage plants. A third management practice alternates two or more grazing units in a planned sequence of grazing and recovery periods. Rest periods may be distributed throughout the year or planned to optimize the growing season of key plants. It can be a low intensity system of two or three pastures or a very intense grazing system of a dozen or more pastures. In the fourth practice, native grazing land is interseeded with introduced species to optimize livestock or wildlife production.

Effectiveness

Short duration or planned grazing has been advocated as a method of improving and maintaining range condition [16]. The basic principles of range management are: balance the number of animals with forage supply, and graze during the proper season. In a planned grazing system each pasture is grazed for a certain period, then allowed to rest.

The SCS evaluated range conditions on three ranches before and after planned grazing was implemented [21]. At ranch A, range was in fair condition and had a capacity of 0.48 animal unit-months (AUMs) before planned grazing. After using planned grazing, range condition improved to good and had a capacity of 0.65 AUMs. The remaining ranches raised the capacity of the rangeland from 0.59 to 0.70 AUMs by implementing planned grazing.

Planned grazing has the added benefit of reducing wind erosion. Prior to implementing planned grazing, the SCS found that 22,500 tons of soil was eroded from 150 acres. Planned grazing reduced the soil loss to 2,250 tons of soil. The other ranches had similar results.

Researchers have compared the effect of grazing on sediment yield and infiltration rates [17, 22]. They found that moderately stocked pasture continuously grazed all year had lower sediment production and a higher infiltration rate than an over-stocked short-duration system. Ungrazed rangeland had the lowest sediment

yield. Thus, the stocking rate is an important factor in any grazing system.

Physical Effects

A planned grazing system prevents the stress of overgrazing and can improve plant vigor and quality, and increase forage production. This practice can result in a more reliable food base. Damage caused by animal traffic can also be reduced. Soil loss from wind and water erosion will be controlled as adequate soil cover is maintained.

Environmental Impacts

Improved vegetative cover will reduce surface runoff and increase infiltration. Surface water quality may be enhanced as sediment loads are reduced. Wildlife habitat is enhanced by proper range management. The elimination of blowouts and barren areas make rangeland and pastures more aesthetically pleasing.

Economic Impacts

The SCS Technical Guide provides estimates of costs for planned grazing systems [21]. An example is from a 647 acre ranch in Brown county with fair to good range conditions. The planned system consisted of 104 cow/calf pairs and intensive grazing of 9 pastures on a rotation.

TERRACES

A terrace is an earth embankment and a channel, or a combination ridge and channel constructed on the contour of sloping land. Terraces intercept and transport excess runoff to stable outlets such as grass waterways or underground tile systems. Underground tile systems have a conduit installed under the ground that conveys excess surface water from terraces and diversions to a suitable outlet.

Effectiveness

Terraces are designed to decrease the slope length and control runoff. The length of the slope is a critical factor in controlling erosion. As slope length increases runoff accumulates, this increases the erosive power of the runoff water to detach and transport soil particles. If slope length is greater than 300 feet, terraces are generally needed to significantly reduce erosion. Research has shown that terraces can reduce sediment transport by 95 percent. Terraces allow runoff water to pond behind the embankment which increases the time for infiltration. The amount of erosion that occurred on two slopes, one terraced and one nonterraced farm in Missouri was compared [3]. The erosion was measured after a rainfall of 2.15 inches, with a maximum intensity of 4.5 inches per hour for a 15-minute period during an 80-minute storm. The slope that was not terraced had a soil loss of 88 tons per acre. The slope that was terraced had a soil loss of 5 tons per acre.

The universal soil loss equation (USLE) illustrates how terraces can shorten slope length and reduce erosion [3]. An example was used from a field in eastern Nebraska with an 8% slope, 350 feet in length, with continuous corn in straight rows, plowed clean in the fall. Calculating erosion with the USLE for this situation shows a loss of 38 tons/acre/year. By constructing terraces, the slope length can be shortened to 100 feet, which lowered erosion to 22 tons/acre/year. In addition, if contour farming was used on THE terraced land in this example, annual erosion could be lowered to 13 tons/acre. Although erosion was still above the tolerable limit, the soil loss was reduced by 66 percent.

Terraces, contouring, filter strips, and grassed waterways reduce the transport of soil and the chemicals carried with it. Baker and Johnson reviewed a study which showed that flow through a grassed water way resulted in a 70% reduction in herbicide (2,4-D) levels in the runoff [1]. Terraces reduced sediment transport by 95% and in turn reduced total soil nutrient loss by one half.

Physical Effects

The soil profile may be disturbed and soil compaction may occur in portions of the field due to the construction of terraces. Surface runoff and soil erosion are reduced, so smaller amounts of sediment and pollutants are delivered to surface waters. Water held behind a terrace can infiltrate adding soil moisture or percolating to the water table.

Environmental Impacts

Terraces slow runoff, reduce erosion and increase deposition of sediment in the field. This reduces the amount of sediment transported to waterways and reduces pollution due to sediment and attached chemicals. If runoff containing dissolved chemicals is reduced by increased infiltration, surface water pollution is also reduced. Ground water quality can be affected to the extent ground water recharge is increased--nitrate and pesticides may be leached from the root zone in greater quantities. Grass-back slope terraces increase plant diversity and wildlife habitat. Terraces with curves are aesthetically pleasing and unsightly sediment deposits can be reduced. Archeological and historical features could be impacted by construction activities and by the effects of the terraces on runoff and erosion.

Economic Impacts

Several factors influence the cost of terraces: subsoil type, slope, soil erodibility, the level of management, and the type of terrace. As slope increases, the cost of terrace construction increases. For example, on a three percent slope construction costs average $100.00 per acre, and on a 15 percent slope costs are near $650.00 per acre [12]. Every year, the SCS reports the costs of conservation practices in Nebraska. According to the SCS, construction of terraces in southeastern Nebraska ranges from 0.36 to 0.95 dollars per foot of terrace installed.

Mitchell analyzed the net benefits of terraces.[12] On gentle slopes (1% to 3%) the costs of terrace construction outweigh the benefits of erosion control. With 4 % to 10% slopes, the losses from erosion cancel out the construction costs. Net benefits were less than or equal to $40.00 per acre on slopes of 6 to 9 percent. Construction costs become so high on steep slopes that yield losses can not offset the cost, even though severe erosion was occurring.

Considering only the direct benefits of terracing, the researchers concluded that most farmers would lose personal income by investing in terraces. The only situation where terracing increases farm income is when a gradient terrace system is used on highly erodible land with unfavorable subsoil and a high level of management. However, several indirect costs which make terracing more economically attractive are not included in the calculations. These indirect costs result from excessive erosion such as reduced land values, the cost of removing sediment from waterways, reduced reservoir capacity, and water quality problems.

GRASSED WATERWAYS OR OUTLETS

A waterway is a natural or constructed depression which is shaped or graded and then seeded to safely carry runoff water from the field, diversion, terrace, or other structure. They are shaped so they can be crossed easily with all types of equipment.

TREE PLANTINGS

Trees are used in several ways to conserve soils. Forests, tree farms, and woodlots provide trees for harvest while maintaining soil cover. A shelterbelt is the planting of a single row or multiple rows of trees or shrubs which serve as a barrier against the wind.

Effectiveness

Tree plantings are used in several practices. Their use in shelterbelts and windbreaks has been evaluated. The purpose of a wind barrier is to shorten the length of the eroding surface. Trees placed perpendicular to the direction of the wind reduce the wind velocity near the ground surface and trap blowing soil particles. When the wind blows at right angles to a shelterbelt, the wind velocity near the belt is reduced 70% to 80%. The effect reaches to a distance equal to 20 times the height of the windbreak, where wind velocity is reduced 20 percent [3]. Research in Nebraska showed that shelterbelts reduced soil erosion, increased yields, and created wildlife habitat [5]. Once the shelterbelt was established (9 to 12 years), yields in protected fields were four bu/acre higher than in the fields without shelterbelts on average.

Physical Effects

Windbreaks reduce wind velocities near the land surface reducing wind erosion. Crop evapotranspiration and higher rates of snow capture are also primary impacts of windbreaks leading to increases in soil moisture and

recharge of ground water. Evapotranspiration losses may be increased near the tree plantings due to their water requirements.

Environmental Impacts

Tree plantings provide wildlife habitat and plant diversity as well as aesthetic benefits. Windbreaks can act as a buffer for protection of farmsteads, feedlots, wetlands, and other "ecologically sensitive areas" from severe weather, farming activities and road use. Trees absorb carbon dioxide and produce oxygen. Trees hold the soil in place and can filter runoff and trap sediment for the benefit of water quality. Trees can also act as an indicator of environmental quality.

Economic Impacts

The SCS reported the average costs of conservation practices in 1986 for Nebraska [21]. The cost of trees, site preparation, planting and chemical weed control is about $61.12 per 100 trees.

Brandle et al. investigated the economics of windbreaks and crop production [5]. The costs involved with windbreaks are land area taken out of production, the period for windbreak maturation, and alterations in the cost of production. Fully mature tree rows occupy about 6.25% of the crop land, and it usually takes 12 years for trees to reach a maximum effective height (about 20 feet).

They found that in the first seven years yields per acre were equal for the windbreak and unprotected fields, but total production was reduced because of the reduced acreage in the fields with windbreaks. After year eight the per acre yield of the protected fields began to offset the effect of the acreage reduction. By the twelfth year, the yield effect more than compensated for the reduced acreage of the windbreaks. Total production in the remaining years held constant at a 15% increase in yield compared to fields without windbreaks. The reason for increased yields in the fields with windbreaks seems to be protection from temperature extremes.

Windbreaks appear to be cost-effective in reducing wind erosion; however, it is difficult to assess the cost of inconvenience. In some cases, newer and larger equipment discourages the use of windbreaks because of the difficulties in using large machinery in small areas.

IRRIGATION MANAGEMENT

Irrigation management includes practices that efficiently convey and distribute irrigation water, and irrigation scheduling, which applies the water according to the plant needs and the water-holding capacity of the soil. Conveyance and distribution practices include lining field ditches, land leveling, tail water recovery systems, and buried pipelines. Irrigation scheduling and the type of irrigation system influence the efficiency of water application. Tailwater recovery systems collect water that runs off irrigated land, temporarily storing it in a pit for re-use in the farm irrigation system.

Effectiveness

Fischbach reported that an average of 8.0 to 11.2 inches of irrigation water produced maximum corn yields in Nebraska [7]. Top yields of sugar beets were produced with 8.5 to 9.7 inches of irrigation water. Surveys conducted in several counties showed that the amount of irrigation water used for both sprinkler and surface systems averaged 22 inches per acre from 1970 to 1975. A U.S. Geological Survey study showed that the amount of water pumped from the ground water reservoir from 1969 to 1972 varied from 14.2 to 25 inches per acre in the Upper Big Blue Basin. A survey of Imperial and O'Neill area irrigators showed water losses varied form 0 to 15.3 inches for sprinkler systems and 0 to 35 inches for surface applications. Fischbach estimated that nearly 35 percent of the water and energy used could be saved.

Excessive irrigation also imposes costs on the producer for lost nitrogen. Fischbach noted that excessive water application (water application beyond the field capacity of the soil) leaches some of the nitrogen from the root zone. The data show that the amount leached varies from five to ten pounds per inch of excess water. For example, on a fine sandy soil with 200 pounds of N per acre applied at preplant, ten pounds of nitrogen will leach for every inch of excess water applied.

Fischbach reported that surface irrigation with a reuse system could reduce runoff losses to zero. Surge valves can reduce irrigation

losses, but tests showed mixed results. In some cases surge flow improved advance time, which improved the uniformity of the water application and resulted in lower irrigation water requirements [23].

Improving the efficiency of the delivery system can save water. The Nebraska Farmer reported that ten percent of the water in the Red Willow Canal was lost through seepage from canals and field laterals [15]. Prior to 1978, 99 cfs or more usually was diverted into the Red Willow Canal. In 1978, the irrigation district started converting open ditch laterals to buried pipe. No more than 90 cfs was needed to meet peak irrigation demands by 1980.

Physical Effects

Planned irrigation systems could reduce the amount of water pumped or diverted for irrigation. Conveyance, distribution, and deep percolation losses could also be reduced and runoff could be minimized. Decreasing deep percolation could reduce the amount of dissolved agricultural chemicals reaching the ground water. It could also reduce the problems association with irrigation in areas with high water tables. Proper land shaping should eliminate land depressions where ponding might occur and reduce excessive slopes which cause runoff. A reduction in ground water pumpage would produce energy savings, and may help to extend the aquifer life in the area.

Environmental Impacts

Open ditches or canals may provide a water source for wildlife, but buried pipe may be less hazardous and disruptive to wildlife. Reducing the amount of water diverted from a stream could increase the flow in the stream below the diversion point, which might improve conditions for fish and wildlife, especially in periods of low flow.

Reducing the amount of water applied to fields could reduce runoff, both of irrigation water and rainfall. This would reduce the amount of sediment and dissolved agricultural chemicals reaching water courses. The consequent improvement in water quality could improve habitat for fish and wildlife.

Baker and Johnson evaluated the effectiveness of conservation practices in reducing the chemical loading of streams and lakes [1]. Timing of nitrogen fertilizer application affected the nitrate concentration in subsurface drainage water. When nitrogen was applied four times through the irrigation system, the nitrate concentration of the subsurface drainage water was 12 kg/ha (20%) less than when a single full application of nitrogen was used.

Economic Impacts

Irrigation management reduces the producer's costs, because energy requirements for irrigation from the ground water supply are directly proportional to the amount of water applied, the lift from the ground water reservoir, and the pressure on the irrigation system. Based on 1988 prices, energy savings from reduced irrigation water applications were estimated at $18.62 per acre for gated pipe and $30.73 per acre for a center pivot system [7]. Bockstadter found that irrigating every other furrow reduced irrigation costs by 16% [4]. He also found that fuel savings due to pumping plant performance tests averaged $19.07 per acre and savings from irrigation scheduling averaged $3.10 per acre. The combined savings of $22.17 per acre was achieved by implementing both procedures.

The SCS Technical Guide provides cost estimates of irrigation practices such as surge irrigation [21]. Based on 1987 fuel and crop prices, surge irrigation costs were compared with conventional furrow irrigation costs. Based on a system with a 1500 gpm capacity, a lift of 130 feet, irrigating 126 acres, and applying 15 inches per season, the annual operating and maintenance savings of a surge irrigation system compared to conventional furrow irrigation were $1162, and a labor cost savings of $190 for an annual savings of $1352. If the cost of a surge valve averaged $1200, the cost of a surge valve would be repaid in less than one year.

Reuse systems or pits were also evaluated by the SCS. The SCS found no yield difference among fields with and without reuse systems. They analyzed the cost of a reuse pit for a 160 acre field irrigated and 35 acres irrigated from the reuse pit. The estimated cost of farming without a reuse system was $2811.36, and with a reuse system, $2773.97. Although there is an increase in annual costs when the system is installed, annual operating and maintenance, and energy costs are lower for an irrigation system operating with a reuse system.

IRRIGATION SCHEDULING

Irrigation scheduling is the determination of the amount and timing of irrigation applications based on available soil moisture and crop water requirements. Sufficient water should be maintained in the root zone, so moisture is available to the plants. A portion of the water holding capacity in the root zone should be available for precipitation storage. Available soil moisture is the difference between the present soil moisture level and a minimum allowable moisture level. Depleting the soil moisture beyond this minimum level will cause plant stress and reduce yields.

Irrigation scheduling involves timing irrigation water applications and the amount of the application according to the crops needs during the growing season. Water is applied based on the effective use of stored rainfall and soil moisture, the crop stage and the weather conditions. Irrigation scheduling allows the grower to achieve high yields without lowering profits.

Economic Impacts

Irrigation scheduling can result in a savings of water and energy. The Cooperative Extension Service reported water savings of about 11 percent for pilot irrigation management projects [14]. An estimated 1.25 million acre-feet of water could be saved if irrigation scheduling was practiced on all irrigated lands in the state. About $24 million could be saved in reduced pumping costs. In 1984, Irrigation scheduling was practiced on about 2.8 million acres in the state.

ACTIONS AND ALTERNATIVES

The action items and alternatives in the Action Plan were developed through a long process involving many concerned and interested contributors. Hundreds of ideas for new or modified policies, programs, and laws were proposed, discussed, and refined. These ideas were collected through questionnaires, interviews, and meetings of those interested in the state's natural resources. Each idea was either advanced to the Action Plan, combined with other suggestions, or dropped from consideration.

DEVELOPMENT OF ACTIONS AND ALTERNATIVES

The process of developing action and alternative items for the Soil and Water Conservation Strategy began in the spring of 1984. From April to June, meetings were held with all of the natural resources districts. These sessions included NRD managers, some board members, and SCS liaison district conservationists, area conservationists, and other district conservationists. Participants were asked for their ideas on how to accelerate the application of soil and water conservation on those lands needing treatment. Suggestions included compulsory conservation education programs in schools, tax structure changes, improved public information and stewardship programs, and increased cost-sharing funds and technical assistance. Participants were also asked what limited their ability to accelerate or increase the application of practices. Their responses included a lack of available funding and technical assistance, a short construction season, and limited acceptance by landowners.

Following the initial meetings at each NRD, a questionnaire was developed which incorporated many of the suggestions received. It was designed to allow NRD directors to rate the importance of potential actions under the following headings: regulations, incentives, education in schools, education of farmers, and stewardship. This questionnaire was distributed to all of the NRDs during the second round of meetings from September 1984 to January 1985. Each NRD received copies for their managers, board members, and some SCS personnel. In most cases, meetings were held with the entire NRD Board of Directors or a committee of board members. Participants were updated on the suggestions received during the initial NRD visits and asked to complete the questionnaire. The importance of the issues raised in the first sessions were rated on the questionnaire to indicate which ideas and potential actions were supported and which were not.

The following categories were chosen from the answers to the questionnaire: Conservation Education in Schools, Public Information, Soil Stewardship, Research, Incentives, Management of State Owned Land, Regulations, Inter-Agency Coordination, and Technical Assistance. The last category was later incorporated into the other eight. These eight categories were

flexible enough to accommodate the many suggested actions.

At this time, an Executive Committee was formed. The heads of seven state and federal agencies served on this committee. They met regularly to provide suggestions and opinions on the strategy development process and to approve or disapprove the suggested actions.

The next step in the development of potential actions and alternatives was the Soil and Water Conservation Symposium, held in Omaha in February 1985. This symposium was the first attempt to seek public input to the developing Strategy. It brought 150 professionals and other interested people together to discuss the ideas collected during the NRD visits, primarily in committee meetings where specific issues were debated. The suggestions of the symposium participants added new ideas to the growing list of potential actions.

In the spring and summer of 1985, all of the suggestions made at various meetings and the symposium were discussed and considered by the Executive Committee. Some were deleted because of unpopularity or lack of interest and others were combined with similar suggestions. Approximately 90 potential actions items were identified from the hundreds of suggestions received.

Ad-hoc committees of individuals previously involved in the selection process were formed to review and comment on the list of 90 action items. One committee was formed for each group of action items.

The Executive Committee considered all of the comments and suggestions of the ad-hoc committees. Suggestions judged to be impossible to achieve, unnecessary, or duplications were eliminated. The remaining suggestions were combined or re-worded to form a list of 52 actions items.

These 52 action items were listed in a brochure as "high priority" actions. The brochure was mailed to state legislators, Soil Conservation Society of America members, SCS field offices, food and agriculture committees, NRD managers, and others interested in the evolving Strategy. A meeting to solicit comments from western NRD managers was held in North Platte and a similar meeting for eastern managers was held in Lincoln. Many more comments were received as a result of these brochures. Most comments at this point were suggestions for rewording or improving action items, rather than suggestions to add or delete items. The 52 action items were subsequently revised into a final list of 40 actions and alternatives.

All of the items on the final list were considered feasible and capable of being implemented. They were also considered to be actions which would make a positive difference in the acceleration and application of conservation practices. An Action Plan, which listed all of the items with enough detail so they could be implemented was produced. The NRC has the responsibility to implement the Strategy through the Action Plan.

The items in the Action Plan found in Appendix A fall under the following categories: (A)-Strengthen Public Information, (B)-Strengthen Conservation Instruction in Schools, (C)-Promote Soil Stewardship, (D)-Target Research Activities, (E)-Provide for Additional Incentives for Conservation, (F)-Enact Regulatory Authority, (G)-Management of State-Owned Land, and (H)-Inter-Agency Coordination.

IMPLEMENTATION OF ACTIONS AND ALTERNATIVES

The action items can be categorized by the agency or level at which the responsibility falls for implementation. Items categorized as Administrative actions can be implemented by local and state agencies with their current authority and funds. The governor must authorize or advocate the implementation of actions items falling under the category of Executive actions. Policy actions are those that require funding or authority from the governor and legislature.

Administrative Actions

The items selected for the Action Plan that can be accomplished by local districts and state agencies with their current authorities and funds are called Administrative Actions. The following fall under the category of Administrative Actions.

A. Strengthen Public Information.

5. Assemble and maintain a speakers bureau.

B. Strengthen Conservation Instruction in Schools.

4. Promote outdoor classrooms and field trip farms.

5. Provide for teacher scholarships.

C. Promote Soil Stewardship.
2. Provide resource information to schools of divinity.
3. Develop courses of study for youth religious classes.
4. NRDs provide stewardship materials.
5. Provide resource information to publishers of religious publications.

D. Target Research Activities.
2. Provide field trials on topsoil thickness v. production by SCS and ARS.
4. Encourage SCS-NTC to step-up evaluation of research for Tech. Guides and users.

E. Provide for Additional Incentives for Conservation.
4. Encourage NRDs promotion of conservation tillage.
7. Encourage NRD targeting for cost-share and complaints.

F. Enact Regulatory Authority
2. Require treatment above state funded reservoirs.
4. Include strategy in NRD Master Plan.
8. Aid implementation of LB 474.
9. Encourage city and county non-agriculture erosion control.

G. Management of State-Owned Lands.
4. Revise memorandum of understanding.
5. SCS-BELF reciprocate training sessions.
6. Use conservation easement to protect existing conservation on land.

H. Inter-Agency Coordination.
2. Provide for the Task Force on Conservation Tillage to coordinate publicity among agencies.

Executive Actions

The items selected for the Action Plan that require the Governor's authorization or advocacy are called Executive Actions. The following action items are Executive Actions.

A. Strengthen Public Information.
1. Strengthen public information activities of Natural Resources Commission.
2. Expand CES targeted energy program.
3. CES develop public conservation programs.
4. Develop computer technology on crop budgets v. erosion control.

B. Strengthen Conservation Instruction in Schools.
1. Provide for a conservation coordinator in the Dept. of Education.
2. Provide for teachers training workshops.
3. Develop a conservation class for Vo-Ag and high school students.
6. Require conservation training for teacher certification.

C. Promote Soil Stewardship.
1. Recognize soil stewards.

D. Target Research Activities.
1. Review research an agricultural chemicals.
3. Cooperative research seminars.

E. Provide for Additional Incentives for Conservation.
2. Add provision in NSWCP to provide for targeting set-aside programs and long term agreements.
5. Remove property tax inequities for conservation.

G. Management of State-Owned Land.
1. Conservation policy by each managing agency.
2. Multi-year conservation plans by BELF.
3. Variable lease periods as incentive for excellent management.

H. Inter-Agency Coordination.
1. Assign responsibility for implementing the Strategy to the NRC.

Policy Actions

Action items that require additional funds and authorities that can only be granted by the Actions. The items in the following list are alternatives that the legislature could act on.

E. Provide Additional Incentives for Conservation.
1. Increase NSWCP funding level.
3. Enhance NRD taxing authority for cost-sharing.

6. Expand purposes of NSWCP to allow funding of conservation practices that are more directly related to pollution control.

F. Enact Regulatory Authority.

1. Enact sediment and erosion control law.
3. NRDs restrict plow-out of fragile land.
5. Mandate county roadside erosion control.
6. Enact legislation for the state to fund conservation technicians.
7. Strengthen state and local authorities for management of ground water quality and quantity.

IMPACTS OF IMPLEMENTING STRATEGY ACTION AND ALTERNATIVES

Administrative, executive, and policy actions are intended to produce physical activities, especially installation of those conservation practices whose impacts were discussed previously. The following discussion explains some of the impacts of administrative, executive, and policy actions summarized above that could occur prior to the actual implementation of conservation practices.

Impacts of Administrative Actions

The lead agency has the authority to implement actions under the administrative category. Items such as revising and reviewing the agreement between the Board of Educational Lands and Funds, NRC, and SCS and requiring adequate treatment above state funded reservoirs are administrative items.

It should be noted, all the conservation practices and educational activities that the administrative actions are intended to implement have not yet been defined. It will be necessary to specify these activities before the full impacts of any proposed action, including the impacts of the administrative activities as well as the impacts of the practices, can be defined.

Institutional Impacts. Impacts on agencies and other types of organizations (institutions) could range from minor shifts in the duties of employees to complete changes in the methods of implementing programs, or even the discontinuation of a program and the transfer or layoff of employees. Institutional impacts of effective actions could be no more than changed or slightly increased workloads or duties for an agency or individual staff members. For example, revising and reviewing the Joint Memorandum among the Board of Educational Lands and Funds, NRC, and SCS (G.4.) would require a change in work by a committee comprised of representatives of each agency or additional time from those people to negotiate the changes in the language of the agreement. It would also require occasional work by those people to review the agreement and initiate changes when conditions change. It might also require changes by those people who implement the policies and programs covered by the agreement. It could require training for those people, and a change in the way they carry out their daily activities.

Implementing the requirement for a minimum percentage of adequately treated land to obtain funding from the Natural Resources Development Fund (F.1.) would impact the NRC and the NRDs. The NRC would have to update the guidelines used to determine eligibility for funding of reservoir construction. The NRC would also have to determine a method for validating the percent of land treated in a watershed. This could involve time consuming field checks. Requiring a minimum percent of land treatment could also affect the NRDs priorities.

Environmental Impacts. Most of the administrative actions do not directly impact the environment, and those impacts are generally minor. Perhaps the most serious is the subject of a common joke, that is, the number of trees destroyed to make the paper on which the memos, letters and reports are written. Other impacts might be such things as a little more air pollution if cars or trucks must be driven additional miles to administer or implement the administrative action.

Economic Impacts. Administrative actions may require additional personnel, educational and promotional materials, demonstrations, and training programs. This all costs money, and the agency must either absorb the costs or gain funds through increases in their budget.

The goal of the administrative actions is to increase the use of conservation practices. The economic impact of those practices is given in previous sections.

Impacts of Executive Actions

Strategy items which need the Governor's action to succeed include such items as C.1.,

recognize soil stewards; D.3., cooperative research seminar; and G.1., conservation policy by each agency managing state owned land. The last item, G.1., requires an executive order which mandates policy for all state agencies. Agencies such as the SCS, NARD, UNL Extension Service, and NRC would benefit if any of these three executive actions were carried out by the Governor, because their mission would be made easier and they could be more effective. Recognition of good soil stewardship from the highest office in the state shows the award recipient and others that conservationists are highly valued. Setting a good example by properly managing and adequately treating state owned land would show that the state cares about good soil stewardship. These actions would further promote and show the benefits of soil stewardship.

(All the conservation practices and educational activities that the executive actions are intended to implement have not yet been defined. It will be necessary to specify these activities before the full impacts of any proposed action, including the impacts of the administrative activities as well as the impacts of the practices, can be defined.)

Institutional Impacts. Impacts of executive actions on agencies and other institutions would be similar to the impacts of administrative actions. The impacts could be broader and greater, because the governor has more authority than most agency heads. In addition to a small shift in the workload in the governor's office, impacts on agencies and other organizations could range from minor shifts in the duties of employees to complete changes in the methods of implementing programs, or even the discontinuation of a program and the transfer or layoff of employees. Institutional impacts of effective actions could be no more than changed or slightly increased workloads or duties for an agency or individual staff members.

Recognizing soil stewards would only require review of the proposal by the governor's staff, gubernatorial approval of the program, and some staff work to train agency personnel in procedures for obtaining signatures on documents. Agency and NRD personnel would have to change their workload slightly to make nominations, keep records, and make awards.

Environmental Impacts. The environment would only be affected indirectly if any of the executive actions were implemented by the Governor. As in the case of administrative actions, environmental impacts would be minor.

Economic Impacts. The economic impacts of executive actions would be primarily the impacts on the agencies administering the programs. There would be very little impact on the executive office itself. For example, the economic impact of implementing the decision to proceed with the item providing for teacher training workshops to improve conservation instruction in schools (B.2.) would fall on state agencies and institutions of higher education. The Department of Eduction has many programs competing for funds; executive advocacy would speed the implementation process and help secure funding for teacher workshops. Of course, increased funding can lead to increased budget needs if other programs are not reduced or eliminated. This ultimately impacts state, county, and local entities, and the taxpayer.

Impacts of Policy Actions

Some strategy items require decisions on the policy of the state, including policy given in state law. In some cases, changes in existing policy may be needed and in others, new policy may have to be written into statutes. The strategy alternatives which need legislative action are those that provide incentives for conservation and authority for regulatory action. Those that involve regulatory authority are the most likely to involve policy decisions.

All the conservation practices and educational activities that the policy actions are intended to produce have not yet been defined. It will be necessary to specify these activities before the full impacts of any proposed action, including the impacts of the administrative activities as well as the impacts of the practices, can be defined.

Institutional Impacts. Legislative policy decisions could have impacts on legislators, their staffs, lobbyists and the general public. The legislative process generally involves drafting legislation, studying and discussing it, public hearings, and voting to enact it. Impacts of controversial proposals can be extensive.

The agencies that regulate or promote conservation practices would be affected the most by changes in funding or regulations. For example, the NRC and NRDs would be impacted by an increase in the Nebraska Soil and Water Conservation Program (NSWCP) funding. More

projects could be funded, which would increase the workload of NRD, NRC, and SCS personnel.

Environmental Impacts. The environmental impacts of policy actions by the legislature would be similar to those of administrative actions. They would be indirect and generally minor impacts.

Economic Impacts. Establishing and implementing regulatory programs and increasing funding programs would have economic impacts in addition to the economic impacts of the conservation practices they are intended to get constructed. Administering laws and enforcing regulations costs the agency time and money. If enforcement actions proceed to court action, additional impacts will fall on the agencies and the courts, as well as the offenders.

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Chapter 6. RECOMMENDATIONS

Fifty years of conscientious efforts by government agencies, private organizations, and individuals have produced great strides in conserving Nebraska's soil, water, and grassland resources. Nevertheless, much land in the state is still eroding faster than nature can restore it. Droughts and depressions come and go, but as the topsoil is lost, the natural productivity of the land is eroded away forever.

If the effort to conserve soil and water is not accelerated, it will take nearly 50 more years to reach a reasonable level of conservation. Even if the agencies currently involved in research, education, and stewardship improve their activities and coordination, much greater funding and regulation will be required to shorten the period to 25 years.

The actions and alternatives discussed in Chapter 5 would provide the means to accelerate conservation efforts to achieve the state's conservation goals. To be effective, the proper balance of alternatives must be selected by the Legislature, Governor, agencies, and NRDs. The recommendations of the Natural Resources Commission are presented in the following sections.

ADMINISTRATIVE ACTIONS

The actions listed in the Action Plan [Appendix A] under the first six elements, and part of the seventh, can be taken at this time by local districts and state agencies on their own initiative. They already have the necessary authority, responsibility and funds. There are also some state and federal programs that provide financial assistance to cooperating landowners that agencies can use to help in implementing those actions.

RECOMMENDATION #1

It is recommended that the actions designed to promote education, stewardship, research, public information, agency management and cooperation, and incentives, which are listed and explained in detail in the Action Plan, be implemented administratively by the designated agencies and organizations. These actions have been discussed by those involved, and it should be possible to implement them in a reasonable period of time. Some will be fairly simple to put into practice, others will require more time and effort, but they are all possible.

EXECUTIVE ACTIONS

Some recommended activities require action by the Governor to accomplish their intended results. Some require authorization by the Governor, and others require the Governor's advocacy.

RECOMMENDATION #2

The Commission recommends that the Governor take the following executive actions, and advocate actions by independent organizations and agencies as follows:

- Authorize the Director of Natural Resources to provide personnel to strengthen the public information activities of the NRC in soil and water conservation.
- Encourage expansion of the Energy Conservation Project and further involvement of the NRC in promoting conservation tillage statewide.
- Encourage coordination between NRC and the Departments of Agriculture and Education to strengthen conservation education in the school system.
- Encourage University of Nebraska-Lincoln research on soil and water conservation and the translation of research findings to water and land use decision makers.
- Encourage each state agency with responsibility for management of public lands to have and carry out a written conservation plan.
- Establish a coordinating committee under NRC leadership for implementing the Strategy and stress the importance of implementation by all state agencies.

POLICY ACTIONS

Some of the most effective means of convincing people to apply conservation practices require additional funds and authorities which can be provided only by the Governor and Legislature. The following incentives and regulations are recommended by the NRC.

INCREASE STATE FUNDS FOR COST-SHARING

The first alternative requiring legislation would be to increase appropriations to the Nebraska Soil and Water Conservation Fund to financially assist and encourage more farmers and ranchers in applying conservation practices. It has been estimated that a total of about $390 million in cost-sharing funds from state and federal sources would be required to adequately treat 80 percent of the remaining problem areas. An increase in annual funding would be needed to reach the newly established goal of 25 years for treating that 80 percent.

RECOMMENDATION #3

It is recommended that the Governor and the Legislature increase appropriations to the Nebraska Soil and Water Conservation Fund for cost-sharing with landowners to $6.9 million per year. This level of cost-sharing funds will be needed to meet the state's soil conservation goals within 25 years.

EXPAND THE AUTHORITIES OF THE SOIL AND WATER CONSERVATION PROGRAM

The next alternative would modify the way these cost-sharing funds could be spent. There are many practices not funded by the Nebraska Soil and Water Conservation Program that could have direct water quality and water conservation benefits. Included are nitrogen management, irrigation scheduling, feedlot waste control systems, and buffer strips. The statutes authorizing NSWCP would have to be amended to: (1) allow funding of practices for the purposes of protecting the quality and quantity of surface and ground water, and/or (2) fund practices with a life of less than 10 years. This would permit more emphasis to be placed on prevention of pollution.

RECOMMENDATION #4

It is recommended that the Legislature and Governor amend the statutory authorities in the Soil and Water Conservation Program to allow funds to be used for certain practices that have water conservation and water quality benefits, as well as soil conservation benefits. Draft legislation prepared as part of the Action Plan would serve as the basis for preparing a legislative bill.

INCREASE DISTRICTS' AUTHORITY FOR FUNDING

The third alternative would be to raise more cost-sharing funds at the local level in addition to providing them from the state's general fund. Natural resources districts could be given the authority to increase taxes specifically for this purpose. During fiscal year 1985, thirteen NRDs provided cost-sharing funds to landowners to assist in applying conservation practices. In several of these NRDs, the demand exceeded the available funds. Five of the 24 were at or very near the maximum levy of $0.035 per $100 valuation with no way to increase cost-sharing funds. Raising the NRD taxing limit to $0.040 per $100 valuation would permit an average NRD with a valuation of one billion dollars to bring in an additional $50,000 for cost-sharing.

RECOMMENDATION #5

It is recommended that the Legislature and Governor enact legislation authorizing NRDs to increase their maximum tax levy when necessary to provide additional funds for cost-sharing. Those districts with cost-sharing programs that have already reached the limit of their tax authority should be given the ability to increase it from $0.035 to $0.040 per $100 valuation for the specific purpose of cost-sharing.

PROVIDE MORE TECHNICAL HELP

Another alternative must be considered if action is taken to accelerate conservation

significantly. Many conservation measures can be applied only with the planning and help of trained technicians. More technicians will be needed if the level of work increases substantially over the current level. The total of federal, state, and local cost-sharing funds has been about $11 million per year, and it is estimated that more technicians will be needed when the level approaches or exceeds $15 million per year. Legislation would be required to authorize and fund the hiring of personnel for this job.

Given the need to reduce the federal deficit, it is unlikely that there can be an increase in federal funding for SCS technicians. Increases in funding will probably have to come from either the state or the NRDs.

The state could alleviate the potential shortage of technicians by providing state employees to work on the application of conservation practices. These employees could be assigned to work with and under the supervision of the SCS District Conservationist in the local field offices. Another option would be for the state to enact legislation that would authorize the transfer of state funds to the SCS so they could hire the technicians. A portion of the Nebraska Soil and Water Conservation Program funds could be transferred, similar to the transfer of funds between federal agencies. Still another option would be to provide additional state funds to NRDs to hire additional technicians where needed. The number of additional technicians that would have to be hired could be reduced if volunteers were used to help SCS personnel.

RECOMMENDATION #6

It is recommended that the Legislature and Governor authorize the expenditure of, and appropriate funds for, hiring temporary employees to help the SCS provide technical assistance during peak work-load periods. When total federal, state, and local cost-sharing funds reach about $15 million per year, funds should be appropriated to the NRC to be allocated for additional technical assistance.

SEDIMENT AND EROSION CONTROL REGULATIONS

The first regulatory alternative is to enact a Sediment and Erosion Control Law. Over 20 states have given some combination of state and local entities authority to prescribe and enforce soil erosion regulations. In this state, the NRC could be directed to establish state erosion control policies and guidelines. There would be several options for enforcement of those policies. The responsibility could be assigned to a state agency, such as NRC, or the NRDs could supplement and enforce state policies. Enforcement of the regulations could, at least initially, be dependent on receipt of complaints from agencies or landowners being damaged by sediment. As an alternative, initiation could be the responsibility of the NRD alone. Remedial action could also be dependent on the availability of cost-sharing funds.

Legislation of this type could provide some benefits before any enforcement action is ever taken. It could cause landowners to become more aware of the erosion on their land, and its effect on their neighbors. This increased understanding could produce more voluntary application of practices.

RECOMMENDATION #7

It is recommended that the Legislature and Governor enact a Sediment and Erosion Control Law similar to proposed legislation currently being considered by the Legislature that would promote fulfillment of the goals of the Soil and Water Conservation Strategy.

RESTRICT PLOWING OF ERODIBLE LANDS

This alternative would be to enact a state law similar to federal "sodbuster" legislation. It would prohibit tilling grassland or forested land if the soils are highly erodible, unless an erosion control plan has first been approved by the NRD. Soil survey maps will provide the information needed to develop the required management plans. Soil surveys have been completed for most of the state, and the whole state will be finished by 1989. Working with the SCS and local NRD, the landowner or developer could prepare a plan to control erosion. They could also learn more about the land and how to make their operation profitable. On borderline soils, a bond could be required in the amount that it would take to restore the land to grass in case the venture failed.

RECOMMENDATION #8

It is recommended that the Legislature and Governor enact a law restricting the plowing of grasslands or forested lands with highly erodible soils without approval of a conservation plan by the NRD. A state program would be more flexible and responsive than federal "sodbuster" legislation if proposed legislation prepared in conjunction with the Strategy were enacted.

PROVIDE FOR RESTORATION OF ABANDONED LAND

The next regulatory alternative would provide a means of correcting situations where erodible soils have already been plowed and excessive erosion is occurring. Legislation could provide authority for an NRD to use state funds to restore protective vegetation on abandoned, eroding land. The state could place a lien on the property to recover its costs, and it could authorize the NRD to enter bankruptcy proceedings to submit claims for the cost of revegetation.

RECOMMENDATION #9

It is recommended that a law be enacted to provide the means to restore vegetation on eroding, abandoned land. Natural resources districts should be given the authority to use state funds for treating the land and act on behalf of the state to recover costs.

REQUIRE CONSERVATION ON PUBLIC LANDS

There are some statutory requirements for development and implementation of conservation plans on state-owned lands, and most agencies attempt to control erosion on their lands. However, no agency has the authority or responsibility to monitor compliance with existing requirements or to enforce them when needed.

Existing requirements do not apply to lands owned by local governments, especially roads. Where federal and state funds are used for construction of state and county roads, erosion control practices must be used. Where counties construct roads without federal or state funds, there are no erosion control requirements or accountability.

RECOMMENDATION #10

It is recommended that the Legislature and the Governor enact legislation requiring that state agencies and political subdivisions control erosion on roadsides and other publicly owned land. An agency should be designated to establish standards, monitor compliance and enforce regulations.

IMPROVE GROUND WATER MANAGEMENT

The final alternative would be to strengthen state and local authority for management of ground water. Present ground water management laws could be improved in at least two respects. First, authorized regulations in both control areas and management areas are directed primarily at water supply problems. Little authority is given for control of water quality problems, particularly those that result from application of fertilizers and pesticides. Second, if an NRD is unwilling to initiate ground water management in an area of need, the state has no authority to act. The quantity and quality of ground water could be better protected if present laws were revised to provide the districts with additional tools and incentives needed for conserving the ground water resource.

RECOMMENDATION #11

It is recommended that legislation be enacted to strengthen state and local authority for managing ground water. A state agency should be given the authority to take the initiative to establish a ground water control or management area if the NRD does not act, and districts should be given more authority to protect ground water by controlling pollutants such as fertilizer and pesticides.

BALANCING INCENTIVES AND REGULATIONS

To reach the state's goals for soil and water conservation, a balanced program of education,

incentives, and regulations is needed. Incentives are needed to make some practices affordable, but they will have to be supplemented with regulations.

The cost of getting conservation on the land will not change regardless of how it is accomplished. If incentives are not provided, and there is no cost-sharing for mandatory conservation, the cost will simply be shifted from the public to the individual. In that case, the total cost of the program would undoubtedly increase because there would be some additional costs to the state. Enforcement of regulations would incur costs, and those costs would probably increase as regulations became more stringent. To be most effective, the costs must be balanced between the public and private sector, and between incentives and regulations. The NRC recommendations are intended to provide a balance between incentives and regulations. The proper balance of the two would conserve the state's resources, the base for the future quality of life of its citizens.

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APPENDIX A

The 1986
Soil and Water Conservation
Strategy

Action Items

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A.1.

Goal: TO STRENGTHEN PUBLIC INFORMATION ON THE NEED FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Strengthen the public information activities of the Nebraska Natural Resources Commission.

Description of Activities:

The Director of Natural Resources will align his staff to direct more activity towards dissemination of more public information on basic conservation. The staff should devote the equivalent of a full time or at least a one-half time person to this type of activity.

The duties of this person could be quite varied and would range from producing and making public information available to the media and users to negotiating with other agencies to do the same. He or she could begin by assisting with the implementation of the Soil Conservation Strategy.

This important person could work closely with the public affairs specialist of the Soil Conservation Service and the Cooperative Extension Service to ensure that the objectives of the Strategy are enhanced by their public information efforts. An example would be assembling data and targeting to users and technicians who work with the land users to accelerate conservation of soil and water resources. Areas needing this type of targeting include areas of irrigation where water quality and quantity and is being reduced, rangeland areas and areas where conservation tillage could make a significant impact on soil loss.

This public affairs person could catalog materials and information as it is developed and store it as appropriate in a library or in the Natural Resources Commission Data Bank.

This person would also use his or her skills to provide information on soil and water resources needs to raise the perception level of the Governor and the State Legislature and more closely align the NRC with the basic conservation of these resources.

Lead Agency: Nebraska Natural Resources Commission

A.2.

Goal: TO STRENGTHEN PUBLIC INFORMATION ON THE NEED FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Provide for expanding the Cooperative Extension Service (CES) targeted energy program on conservation tillage, irrigation water management, and eco-fallow.

Description of Activities:

The Cooperative Extension Service has had over 5 years activity on the promotion of this project which began with the signing of an agreement on December 9, 1983. The project should be fully evaluated and the successful actions should be duplicated to include other counties. A level of funding equal to the need of the targeted counties will not be available. However, existing funding and existing personnel of the CES, the SCS, and the NRDs could be used to push a campaign to the maximum.

Minimum funding needs should be budgeted by NRDs and the legislature through the NSWCP fund. An official challenge by the Governor and the legislature could help set the stage for the agencies and for the land users.

Lead Agency: Cooperative Extension Service

A.3.

Goal: TO STRENGTHEN PUBLIC INFORMATION ON THE NEED FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Provide for the development of educational materials on soil and water resources for the general public and ag-related business.

Description of Activities:

The basics of the importance and the management of soil, water and rangeland resources should be common knowledge if a public ethic for these resources is to be realized. This basic understanding should also be held by the owners and employees of all ag-related business since they do impact the use of these resources.

Being the educational arm of the USDA, the Cooperative Extension Service should seek funding to develop an educational package to support these needs. The material should consist of films, video tapes, slide tapes, and printed material that would be suitable for education television and for use at meetings and training sessions of ag-related businesses. The material should contain factual data, but also be made appealing and interesting to watch. Once developed, the material should be promoted to TV stations, extension clubs, meetings of sub-divisions of government, and businesses.

The programs could also be part of the educational packets for high school students. There should be several packets addressing the various land uses including dry cropland, irrigated cropland, range and pasture management and forest land. The subjects should also relate to the different areas of the state.

Lead Agency: Cooperative Extension Service

A.4.

Goal: TO STRENGTHEN PUBLIC INFORMATION ON THE NEED FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Accelerate the development of computer technology on crop budgets v. erosion control, water management, and range condition.

Description of Activities:

The Cooperative Extension Service (CES) and the Soil Conservation Service (SCS) have existing software on crop budgets for use with land users. The SCS is adapting computer analysis of crop budgets to show the effort on the soil and water resources.

This objective proposes that sustaining the soil and water resources is important enough that all crop budget programs that are provided to land users should relate the effect on the soil, water, and rangeland resources.

The program should solve the profit from the individual budgets in addition to soil loss, water usage, nutrients and water percolating below the root zone and runoff. A rangeland program should solve for profit from various management schemes and for trends in range condition.

These programs could even be developed to be adapted to the home computers which many land users now own so that those people can perfect them at home.

Lead Agency: Cooperative Extension Service
Agricultural Research Division, IANR-UNL

A.5.

Goal: TO STRENGTHEN PUBLIC INFORMATION ON THE NEED FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Assemble and maintain a speakers bureau of individuals willing to provide programs on conservation of soil and water related resources and make it available to potential users.

Description of Activities:

The Director of Natural Resources should assemble a list of names of individuals who are willing to speak to groups on the conservation of the soil, water, and related resources. It could include lay people and professionals.

Organizations with these types of speakers could include, but should not be limited to, the Nebraska Natural Resources Commission, the Soil Conservation Service, the Cooperative Extension Service, the Ag Research Division of the University of Nebraska, the natural resources districts, the Department of Environmental Control, the Department of Water Resources, the Conservation and Survey Division of the University of Nebraska, the Agricultural Research Service, the Soil and Water Conservation Society, the Society of Professional Soil Scientists, and others.

Speakers will be solicited and listed by name, address, phone, profession, other affiliations, and topic of program. The information will be maintained in the Natural Resources Commission.

Complete brochures will be sent to libraries, farm groups, schools, and others who may have a need for this type of speakers and will be available upon request from the Nebraska Natural Resources Commission.

The list will be updated once a year.

Lead Agency: Nebraska Natural Resources Commission

B.1.

Goal: STRENGTHEN CONSERVATION INSTRUCTION IN SCHOOLS

Objective: Provide for a conservation coordinator in the Department of Education to coordinate the development of curriculum and other teaching materials on soil, water, and rangeland resources management and to assist schools in improving conservation education.

Description of Activities:

A conservation coordinator could be provided by the Department of Education and funded by the Department. The coordinator should solicit assistance from the resources agencies such as the NRDs, the SCS, the CES, and the NRC to develop curriculum and other teaching materials and to identify resource people. He/she could utilize other groups such as the Soil and Water Conservation Society, the Society of Soil Scientists, and qualified retired individuals. Materials would show the need and basics of how to manage soil and water resources for sustained production under the major land uses such as dryland, cropland, irrigated cropland, grassland, forest, and wildlife land. The materials would also recognize the differences in conservation problems from east to west and north to south. The development of materials should be coordinated with the Nebraska Department of Agriculture work in Ag in the Classroom, and the current efforts of several of the natural resources districts.

As materials are developed, the coordinator should promote its use to school administrators and school boards. Using the same resource people, provisions should be made to train teachers to use the materials.

Lead Agency: Department of Education

B.2.

Goal: STRENGTHEN CONSERVATION INSTRUCTION IN SCHOOLS

Objective: Provide for teacher training workshops to utilize the materials being developed on the teaching of soil, water, and rangeland resource management.

Description of Activities:

The conservation coordinator should make plans to set up teacher training workshops for post school season attendance. He could utilize the existing training sessions operated by the Upper Big Blue, Lower Big Blue, and Little Blue NRDs as an example and duplicate it at least three more times throughout the state. This could allow for climatic, land use, and resources management differences from east to west and north to south in Nebraska.

One training session could be added per year throughout the state for three years to reach a total of four. Possible sites would include Kearney State, Wayne State, and Chadron State Colleges, McCook Community College, and the research stations.

The training sessions should be for college credit and should be considered as applying toward science and social studies majors.

In addition, the coordinator should develop a training procedure to take statewide during the school year to the school systems to reach teachers either during the school day or at evening classes. These classes should also be directed toward teaching teachers to use the conservation curriculum and materials.

A goal should be set to reach 90 percent of the science, social studies and Vo-Ag instructors in ten years. This should be considered an ongoing program with continuous follow-up.

Lead Agency: Department of Education

B.3.

Goal: STRENGTHEN CONSERVATION INSTRUCTION IN SCHOOLS

Objective: Develop a course of study for Vo-Ag departments and a course of study for general high school use.

Description of Activities:

The conservation coordinator should conduct a study to determine best options for introducing materials on conservation of resources into present Vo-Ag courses of study. He should develop materials allowing for two or three options for use. Example -- a structured one, two, three, or four week course with other materials to be incorporated into other Vo-Ag classes.

Materials should cover all of major land uses so the instructor could adapt it to the major land uses in their area. These would include dry cropland, irrigated cropland, pastureland, rangeland, and forest. It would also include the variance in management and conservation practices across the state.

For schools with no Vo-Ag programs, a class could be developed for general high school study that would raise the perception level of high school students to a level that would permit them to be good stewards of these resources. The course, as with the Vo-Ag course of study, should project a thorough understanding of the soil and more specifically the top soil and its relationship to sustained agricultural production. It should vividly explain the problems and solutions of maintaining a supply of high quality water and sustaining the soil, rangeland, and wildlife resources.

Lead Agency: Department of Education
Nebraska Natural Resources Commission

B.4.

Goal: STRENGTHEN CONSERVATION INSTRUCTION IN SCHOOLS

Objective: Assist school systems to develop outdoor classrooms and arrange for field trip farms for 5th and 6th grades.

Description of Activities:

The Nebraska Natural Resources Commission (NRC) with assistance from the Nebraska Association of Resources District (NARD) should encourage natural resources districts (NRDs) to promote outdoor classroom and field trip farms in each of their districts. The NRC could assemble existing data for teaching from outdoor classrooms. Much is available from the Cooperative Extension Service and from textbooks. It should be arranged in a packet and made available to NRDs. The NARD would assist in the promotion activities.

NRDs could encourage and assist the schools in their district to set up outdoor classrooms and teach the biology of the soils. The instruction should emphasize the value of maintaining the soil. Resources people could be from the Soil Conservation Service, the Cooperative Extension Service, or retired people who are knowledgeable of soil biology.

The NRD could also arrange for landowners to offer their farms, or part thereof, to be used as a field trip farm to extend the soils instruction. The owner should be a good soil steward and might even speak to groups on his operation. This instruction should show the relationship of soil biology and crop and livestock production. It should stress the dangers of misusing soil and water resources and demonstrate that the resources can be sustained with proper management.

Lead Agency: Nebraska Association of Resources Districts
Nebraska Natural Resources Commission

B.5.

Goal: STRENGTHEN CONSERVATION INSTRUCTION IN SCHOOLS

Objective: Provide for teacher scholarships for attending conservation workshops and classes.

Description of Activities:

There is past evidence that some incentive is needed to encourage teachers to attend workshop and classes to learn how to use conservation curriculum and materials. A scholarship to attend a class at which they could receive college credit could make a difference.

Some NRDs currently offer scholarships; however, to increase the numbers of teachers trained, this must be accelerated as the number of teacher training workshops are increased. NRDs could increase the funding to these scholarships and through school administrations, actively promote the use of them. Promotion by the conservation coordinator will increase the use and need for scholarships.

As good conservation materials are provided to schools, teacher interests and needs could increase. NRDs could also solicit funds from private industries to help satisfy those needs.

Lead Agency: Natural Resources Districts
Nebraska Natural Resources Commission

B.6.

Goal: STRENGTHEN CONSERVATION INSTRUCTION IN SCHOOLS

Objective: Require a conservation education course for teacher certification for elementary and secondary majors in science and social studies.

Description of Activities:

The long term survival of mankind is so closely related to sustaining the use of the soil and water resources that all youth should grow up realizing the implications of the misuse of these resources. To facilitate this level of knowledge, certain teacher requirements could be changed to include an education class on teaching soil and water conservation. It should apply to majors in science and social studies for both elementary and secondary education.

Lead Agency: Department of Education
Nebraska Natural Resources Commission

C.1.

Goal: PROMOTE SOIL STEWARDSHIP

Objective: Maintain a program to recognize good soil stewards throughout the state.

Description of Activities:

The Natural Resources Commission has taken the initiative to develop a recognition program for individuals who "stand out" as good stewards of the soil and water resources. It is used to recognize not only those who properly manage the land, but also those who contribute much to assist land users.

A token of this recognition is a lapel pin and a certificate signed by the Governor. The names of those honored should be displayed in an important place such as the state capitol or the state conservation farm.

Nominees for this honor are made throughout the state through the Natural Resources Districts (NRDs) and on the state level by the Natural Resources Commission. Anyone can make a nomination to the NRD by forwarding the name and a brief explanation of accomplishment to the NRC. Qualifying criteria are based upon past accomplishments and/or a demonstrated commitment.

Lead Agency: Nebraska Natural Resources Commission

C.2.

Goal: PROMOTE SOIL STEWARDSHIP

Objective: Provide resources information to schools of divinity.

Action: The Nebraska Association of Resources Districts should send a resolution to the National Association of Conservation District (NACD) to provide information on the condition of soil and water resources to schools of divinity.

Description of Activities:

It has been suggested that if religious leaders has more of a background in natural resources, they would be more apt to promote soil and water stewardship in their day-to-day ministries. To develop this background, they need a source of up-to-date information on the condition of the soil, water, and related resources.

The NACD could provide this information to them by assembling a package of basic data for each school of divinity and by including all schools on a mailing list for updated information and newsletters.

The Natural Resources Commission or the Soil Conservation Service of each state could provide more detailed information on individual states. They could also forward pertinent data to the state council offices of each denomination within Nebraska.

Religious schools could use the data as they saw fit. There is a good chance that it would be used to discuss the moral issues involved in rationally using these resources.

Lead Agency: Nebraska Association of Resources Districts

C.3.

Goal: PROMOTE SOIL STEWARDSHIP

Objective: Arrange for a group of the clergy to develop a four section course of study on the value of conserving the soil, water, and rangeland resources for religious classes for youth.

Description of Activities:

The NACD provides a course of study for one session with the stewardship packet. This action item proposes that materials be developed for at least three more sessions for religious classes of children whose ages are nine through twelve.

The Nebraska Association of Resources Districts could assemble a group of ministers and resource people who could develop the course of study and materials. Committee membership could contain representation from several denominations. Materials generated should be nondenominational so they could be used in any study group.

The different courses should allow for the differences in land use across the state and the differences in problems.

Inter-Church Ministries of Nebraska could give assistance and help to publicize the completed materials.

When completed, the NRDs could offer the course of study along with other stewardship materials. The NRD stewardship chairman, committee, or chaplin could promote the use of the material through their contact with the clergy.

Lead Agency: Nebraska Association of Resources Districts

C.4.

Goal: PROMOTE SOIL STEWARDSHIP

Objective: Encourage NRDs to renew efforts to provide resource information and stewardship materials to local clergy.

Description of Activities:

Many Natural Resources Districts (NRDs) are currently including the clergy of their districts in informational meetings and tours and are providing soil stewardship materials for use on Stewardship Sunday. This action item proposes that this is very beneficial and recommends accelerating this activity.

All NRDs should make this a high priority item and move to accelerate the activity. They could assign a stewardship committee to deal with it or a stewardship chairman, or even a chaplin. This committee or person could invite the clergy to appropriate informational functions, direct certain literature and news items to them, hold meetings of the clergy to evaluate their needs, and promote soil stewardship on Stewardship Sunday and all year long. They could publish a newsletter specifically for the clergy for mailing monthly or quarterly.

The Nebraska Association of Resources District and the Chairman of the NRD Managers Association could promote this among the 23 NRDs.

Lead Agency: Nebraska Association of Resources Districts

C.5.

Goal: PROMOTE SOIL STEWARDSHIP

Objective: Provide selected information on soil and water resources to publishers of religious magazines.

Description of Activities:

There is a moral connotation to the management of soil and water resources relative to the needs of the people. Therefore, editors of religious magazines could have a need for articles and information on these resources to provide an insight to their readers. The Nebraska Association of Resources Districts could prepare a resolution to the National Association of Conservation District proposing that they regularly provide informational data and news articles to the editors and publishers of religious publications.

In addition, the proposed public affairs specialist of the Natural Resources Commission should select resource data and news items that would be of interest and mail them to those editors. The data could alert this group of readers on resource needs and pending problems that could be dealt with by the minister.

Names and addresses to which the publication could be mailed should be assembled by the Inter-Church Ministries of Nebraska.

The information provided on a routine basis should be general with an offer to provide more specific resource data on request. A periodic follow-up letter could be sent to inquire as to uses of information and the recipients desire to remain on the mailing list.

Lead Agency: Nebraska Association of Resources Districts

D.1.

Goal: EXTEND RESEARCH ACTIVITIES

Objective: Evaluate existing research that monitors the movement of agricultural chemicals through the soil, to determine if there is adequate for the State of Nebraska and provide for increasing if necessary.

Description of Activities:

The movement of ag chemicals through the soil profile is presently being monitored in certain conditions by the Ag Research Division of the IANR, the Department of Health, the Agricultural Research Service, and the U.S. Geological Survey. In addition, some NRDs are monitoring the buildup of nitrates in wells.

The Department of Environmental Control should assess the situation throughout the state to determine where the potential dangers from deep percolation of agricultural chemicals are. They should evaluate the ongoing monitoring of agricultural chemical movement and the existing data. A research needs committee consisting of representatives from the ARD-IANR, the ARS, and the DEC could then apply the existing data and the ongoing research to those needs to determine if this was adequate.

If existing and ongoing projects were adequate, the DEC and the research needs committee could review periodically and report to involved agencies to keep projects on track.

If existing data and ongoing projects are inadequate, DEC could make plans to begin additional monitoring either through DEC or through a cooperative agency.

Lead Agency: Department of Environmental Control

D.2.

Goal: EXTEND RESEARCH ACTIVITIES

Objective: Provide for the Agricultural Research Service (ARS) and the Soil Conservation Service (SCS) to use field trials and demonstration plots to collect data on yields from soils with topsoil versus eroded soils with no topsoil and to demonstrate the topsoil value to land users.

Description of Activities:

The SCS field offices staff should search for eroded and non eroded sites on benchmark soils where yield comparisons could be made to demonstrate the value of protecting topsoil. The sites should be close together on the same slope grade, the same slope direction, the same aspect, and using the same management practices.

If natural sites cannot be found on the benchmark soils, plots could be prepared by starting with an eroded site and top dressing the "topsoil plots" with topsoil from the base of the slopes. The equipment used to prepare the plots should be farm-type equipment to keep compaction to a minimum.

The ARS should design the plot layout, collect dry matter and yield data, and analyze so the results are acceptable as research data. The SCS could physically lay out the plots, monitor rainfall, and assist in the data collection. Yields of dry matter and grain produced should be collected for a minimum of five years or until results are conclusive. Results should be summarized and placed in a simple table form in the hands of all SCS and NRD technicians who do conservation planning with land users.

The Natural Resources Districts (NRDs) where the plots are located should be involved to coordinate activities and provide needed funding. It is anticipated that funding needs will be minimal. The NRDs and SCS could arrange for tours to provide the data to land users.

Lead Agency: Agricultural Research Service
Nebraska Natural Resources Commission

D.3.

Goal: EXTEND RESEARCH ACTIVITIES

Objective: To provide for an inter-agency Cooperative Research Seminar among state and federal agencies for the purpose of (1) reviewing Nebraska research needs, (2) comparing priorities, (3) eliminating duplication, (4) presenting a unified effort in the search for funding, and (5) to improve technology transfer to users.

Description of Activities:

The Ag Research Division of the Institute of Agriculture and Natural Resources should take the leadership to arrange for a seminar once each year to include all agencies that conduct research on soil and water protection and conservation and the primary user agencies of such research data. The seminar would provide a forum of research agencies to represent their priorities on projects that are for the protection and conservation of the soil and water resources.

User agencies could present their research needs with research agencies responding to how those needs were being addressed or how they might be addressed.

A major objective of this seminar would be to compare research needs as determined by the various agencies, arrive at a consensus on the high priority needs and present a unified effort to Washington in funding requests. Another objective of this seminar could be to provide for a working procedure with assigned responsibilities for analyzing research data and getting the data to both the news media and the managers of soil and water resources.

The ARD, ARS, and SCS who send a priority listing to Washington to be considered for funding would then present a united front.

Lead Agency: Nebraska Natural Resources Commission

D.4.

Goal: TARGET RESEARCH ACTIVITIES

Objective: Encourage the Soil Conservation Service National Technical Center to step up efforts to evaluate research on soil, water, and related resources to facilitate its inclusion in tech guides and conversion to user form.

Description of Activities:

The National Technical Center (NTC) of the Soil Conservation Service should evaluate the research on the relationship of erosion to productivity and make the present and future costs of erosion known. This data could be compared and analyzed with a current project by the Ag Research Division of UNL, the Agricultural Research Service, and ongoing field trials conducted by the Soil Conservation Service.

Another project should be to analyze all the existing data on conservation tillage and present the materials adjusted to specific soil types.

Still other studies needed evaluation are in the area of irrigation water management. This effort should be targeted to the areas in Nebraska where agricultural chemicals are reducing the purity of the underground water.

The main thrust of this action item is to get good research data in the hands of users in a form that can be utilized as soon as possible.

Lead Agency: Soil Conservation Service National Technical Center

E.1.

Goal: PROVIDE ADDITIONAL INCENTIVES FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Increase the level of funding to the Nebraska Soil and Water Conservation Program (NSWCP) to a level that will complete 80 percent of the remaining needs in 25 years.

Description of Activities:

It has been decided that to achieve adequate land treatment on 80 percent of the land still needing erosion control, water management, and range management in 25 years would be a reasonable, reachable goal. The most limiting factor to accomplish this is cost-share funding.

To reach this goal in 25 years, it would take approximately $6.9 million per year. The legislature should increase the NSWCP fund to $4.0 million in FY 1988 and to $6.9 million in FY 89. An alternative would be to designate a specific tax on a product or designate a portion of sales or income tax and increase the fund to the $6.9 million level.

The funds would be used to provide a minimum of 90 percent cost-share where control of erosion and sediment was mandated under a sediment and erosion law. For a voluntary program, it would provide for a level of cost-share on practices as provided by the Nebraska Natural Resources Commission and the directors of the 23 Natural Resources Districts. The NRC determines the eligible practices and the maximum rate of cost-share and the NRDs can adjust priorities of practices and cost-share levels within the Commission guidelines.

Funds should be allocated to the NRDs based on the extent of needs according to NRC priorities.

Lead Agency: Nebraska Natural Resources Commission

E.2.

Goal: PROVIDE ADDITIONAL INCENTIVES FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Add provisions to the Nebraska Soil and Water Conservation Program (NSWCP) that would provide for (1) targeting toward critical areas, (2) establishing a set-aside program to extend the construction season on cropland, and (3) implementing long term agreements.

Description of Activities:

The Natural Resources Commission should take action to improve the use of the NSWCP to accelerate the treatment and protection of the soil and water resources by making changes in these three areas to adapt the program to problems areas.

Target to Critical Areas

Past experience has shown that conservation treatment in special project areas can be accelerated by targeting technical assistance and funding. Toward this end, the Commission should develop rules and criteria for designated special project areas. When the NSWCP fund reached $4,000,000 annually, the Commission could designate a minimum of 15 percent to special project areas for basic land treatment. The NRDs could write a plan for specific areas to be considered for funding by the Commission. Targeted areas could be for the purpose of erosion control, water conservation, or grassland management.

Set-aside Program

In some areas of the state where there is much cropland, the construction season is very short, usually in the spring and fall when there are no crops to contend with. A minimum payment to make it worth while for a land user to make cropland available for construction in the summertime would improve this situation. It would spread the workload of both technicians and contractors.

The Commission should develop rules to make a payment from the NSWCP fund for setting aside cropland for construction during the summer months. This would only apply to acres that were not in other set-aside programs. The result would be a longer construction season and more land adequately treated. The expenditures could be limited to a percent of the sum of the districts NSWCP allotment plus the NRD cost-share funds.

Long-Term Agreements

Some operators are more inclined to do conservation work when they can see that funds will be available to do a complete unit or a complete farm. This may be especially true in targeted special project areas.

The Commission should approve the use of "Long-Term Agreements" (LTA) to obligate funds to do a complete conservation plan over several years when the NSWCP fund reaches $4,000,000 per year. The LTA would be a binding contract between the Natural Resources Commission and the landowner with provisions for repayment for violations of the contract. All rules governing the present use of the NSWCP funds would apply.

Lead Agency: Nebraska Natural Resources Commission

E.3.

Goal: PROVIDE ADDITIONAL INCENTIVES FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Enhance NRD taxing authority to provide for cost-share funds.

Description of Activities:

During fiscal year 1986, sixteen Natural Resources Districts budgeted cost-share funds to assist landowners in applying conservation practices. In several of these NRDs, the demand for funds exceeded the available funds, and many are at or very near the maximum levy of $.035 per $100 valuation with no way to increase cost-share funds.

The Nebraska Association of Resources Districts should sponsor a legislative bill raising the NRD taxing limit to a least $.04 per $100 valuation. This would permit an average NRD with a valuation of one billion dollars to bring in an additional $50,000 for cost-share.

Lead Agency: Nebraska Association of Resources Districts

E.4.

Goal: PROVIDE ADDITIONAL INCENTIVES FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Provide for Natural Resources Districts (NRDs) to actively promote the use of conservation tillage to rapidly reduce soil losses on cropland.

Description of Activities:

The 23 NRDs should offer incentives to encourage farmers to try conservation tillage or eco-fallow systems. They could lease or buy equipment and make it available to farmers on a trail basis. Land users could have free use as an incentive; or the equipment could be leased at a reasonable rate. After one or two years, it could be sold at a reduced rate.

NRDs could make a per acre cost-share payment on plots 10 acres to 40 acres in size for one to three years for a predetermined level of cover. This would permit farmers to master the systems on a small scale before trying it on the whole farm. It would permit them to adapt their own equipment to the system rather than purchasing new.

The NRDs should sponsor workshops, where experts are brought in to discuss different conservation tillage systems. They should encourage and assist the Cooperative Extension Service to expand the "Targeted Energy Program" on Conservation Tillage and Eco Fallow.

The Soil Conservation Service personnel at the state, area, and field office levels should assist at all levels of this promotion.

Lead Agency: Nebraska Association of Resources Districts

E.5.

Goal: PROVIDE ADDITIONAL INCENTIVES FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Remove property tax inequities to conservation farming.

Description of Activities:

The tax commissioner should study the system for taxing farmland to eliminate procedures that would tend to discourage conservation farming.

New procedures could reduce land valuations on land taken out of production by conservation practices. This could include terrace backslopes, diversions, filter strips, turn rows, small areas planted to trees, and irrigation reuse pits.

The policy should be adjusted so that land is never put in a higher production class and subsequently a higher tax class because conservation practices have been applied. Land should not be placed in a lower production class and subsequently a lower tax class because someone permitted erosion.

The landowners should be responsible for furnishing the proof of qualification on land to be devalued because of conservation practices.

Lead Agency: Tax Commission

E.6.

Goal: PROVIDE ADDITIONAL INCENTIVES FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Expand the Nebraska Soil and Water Conservation Program to fund practices more directly related to protecting the quality and quantity of surface and ground water.

Description of Activities:

Many of the projects and practices presently authorized for cost-share assistance from the Soil and Water Conservation Fund (NSWCP) have water conservation and water quality benefits. For example, any practice that holds sediment and associated ag chemicals on the land rather than permitting it to reach streams has surface water pollution benefits as well as conservation benefits.

There are other practices that could be applied that are not funded by NSWCP which could have direct water quality and water conservation benefits. Included are nitrate management, irrigation scheduling, feedlot waste control systems, and buffer strips. The present NSWCP legislation would need to be modified to authorize these additional purposes and to recognize a practice with a life of less than ten years.

This modification should be in line with the efforts of the Department of Environmental Control to establish a funding mechanism to clean up and protect designated streams and ground water problem areas.

The implementation of this item should only be with additional funding so that the soil and water conservation provisions are not diluted.

Lead Agency: Nebraska Natural Resources Commission
Department of Environmental Control

E.7.

Goal: PROVIDE ADDITIONAL INCENTIVES FOR CONSERVING SOIL AND WATER RESOURCES

Objective: Encourage NRD targeting of specific land areas or specific types of erosion problems for purposes of cost-sharing and NRD initiation of complaints.

Description of Activities:

Adequate treatment of all remaining lands cannot be accomplished overnight either on a state-wide or district-wide basis. All complaints received by NRDs from other individuals and entities pursuant to LB 474 must be processed in an equal and fair manner, but each NRD will have opportunities to set priorities for other aspects of its conservation program. Included is the ability of the NRD to set priorities on the types of complaints it will initiate itself and on the utilization of available cost-share funds. For both purposes, a natural resources district could select either specific land areas or specific types of erosion problems for more concentrated NRD activity. For example, targeting could ensure a more intensive effort in the worst erosion areas or in areas where protection of public facilities was particularly important, such as above a flood control or recreation reservoir.

Targeting for cost-share purposes could be done either in conjunction with a targeting reserve established for the Nebraska Soil and Water Conservation Program (See Action Item E.2.) or by the district for its own cost-share program or for its regular share of the Nebraska Soil and Water Conservation Program funds. State encouragement for targeting can be given through providing and interpreting basic resources information and by providing educational and technical assistance in designating and implementing targeting programs.

Lead Agency: Nebraska Natural Resources Commission

F.1.

Goal: CONSERVE SOIL AND WATER RESOURCES WITH THE USE OF REGULATORY AUTHORITY

Objective: Enact a State sediment and erosion control law.

Description of Activities:

Approximately 20 states have now given some combination of state and local entities the workable authority to prescribe and enforce soil erosion regulations. The NRC could meet the objects of such a law, by establishing erosion control policies and guidelines. The NRC would then be responsible for implementation.

Enforcement of regulations could, at least initially, be dependent upon the receipt of complaints form landowners being damaged by sediment. Enforcement would also be dependent upon the availability of public cost-share funds.

Lead Agency: Nebraska Natural Resources Commission
Nebraska Association of Resources Districts

F.2.

Goal: CONSERVE SOIL AND WATER RESOURCES WITH THE USE OF REGULATORY AUTHORITY

Objective: Require that a certain percentage of land above reservoir sites be adequately treated before state funds could assist in the construction of those reservoirs, excepting structures valued at over $10,000,000.

Description of Activities:

The federal government currently requires that 50 percent of the land above watershed structures designed by the Soil Conservation Service for the purpose of storing water be adequately treated before the federal assistance is given. No similar requirements exist for the Soil and Water Conservation Fund, Resources Development Fund, the Water Management Fund, or the Small Watersheds Flood Control Fund. Such requirements should be imposed by the Natural Resources Commission for the Nebraska Soil and Water Conservation Fund, Resources Development Fund, and the Small Watersheds Flood Control Fund. Structures costing over $10,000,000 and funded by the Water Management Board for the Water Management Fund would be exempt from this ruling.

The level of treatment could vary from 50 percent to 75 percent of land adequately treated and could affect only those submitted for assistance after approval of rules change.

Lead Agency: Nebraska Natural Resources Commission

F.3.

Goal: CONSERVE SOIL AND WATER RESOURCES WITH THE USE OF REGULATORY AUTHORITY

Objective: Provide by state law for Natural Resources Districts to restrict the plow-out of grassland or tree covered land on fragile soils unless a plan to control erosion is first approved by the district and provide for NRD authority to restore vegetation on eroding abandoned land.

Description of Activities:

Legislation should be enacted to give the 23 Natural Resources Districts of Nebraska the authority to enact their own sodbuster legislation. This is needed because the amounts of fragile lands is being plowed and cropped only to find that it is either not economically feasible to crop or that expensive erosion control practices are needed. In these cases, either the federal, state, or local government is then asked for financial assistance to solve the erosion problem.

This should be solved in part by restricting the plow-out of the fragile soils. From the soil map, it is possible to apply the universal soil loss formula to the soil, using the various management systems and predict the average annual soil loss from which management plans could be made.

NRDs, with assistance from the SCS, could decide which soils under grass or tree covered lands have the capability for other land uses and which ones would be a costly nuisance to the state. A permit would be denied in cases where erosion could not feasibly be controlled.

On borderline soils, such as very sandy land, a bond should be required in the amount that it would take to restore grass to the land in case the venture failed.

Restore Grass on Eroding Abandoned Land

A section of the same legislative bill should make provisions for restoring vegetative cover on eroding abandoned land.

Provisions should be made for the NRDs acting on behalf of the state to use state fund to restore natural vegetation on land that has been abandoned and is eroding where there is no apparent owner or where there is an owner who cannot or will not take adequate action. The state could take a lien on the property in the amount of the revegetation practices.

In cases where no owner comes forth to manage the land, the NRD should manage it for wildlife land.

Lead Agency: Nebraska Association of Resources Districts

F.4.

Goal: CONSERVE SOIL AND WATER RESOURCES WITH THE USE OF REGULATORY AUTHORITY

Objective: Encourage Natural Resources Districts to include the Soil and Water Strategy into their Master Plans.

Description of Activities:

Soil and water conservation efforts by the NRDs could be more effective if they were done in accordance with the Soil Strategy. This would result in more efficient utilization of the soil and water conservation funds available to NRDs.

Lead Agency: Nebraska Natural Resources Commission
Nebraska Association of Resources Districts

F.5.

Goal: CONSERVE SOIL AND WATER RESOURCES WITH THE USE OF REGULATORY AUTHORITY

Objective: Pursue enactment of legislation to mandate erosion control on all roadsides and give an agency the authority to monitor and enforce such requirements.

Description of Activities:

If the state is to expect a significant reduction in erosion on privately owned lands, it and its government subdivisions must set a good example. Some present requirements exist for development and implementation of conservation plans on state-owned lands, but no agency has the authority or responsibility to monitor compliance of those requirements with regard to state highways and county roads or to enforce them when needed. This alternative would grant that authority.

Where construction of state and county roads use federal and state funds, the plans do include erosion control. Maintaining erosion control, however, may be lax. In the case of counties doing construction work on county roads with county funds, there is no overview.

The State Department of Roads should have the authority to review all road construction with the authority to withhold state and federal funds if counties fail to provide for controlling erosion.

Lead Agency: Nebraska Natural Resources Commission
Department of Roads

F.6.

Goal: CONSERVE SOIL AND WATER RESOURCES WITH THE USE OF REGULATORY AUTHORITY

Objective: Pursue state funding for conservation technicians.

Description of Activities:

With the ongoing efforts to cut federal spending, it is unlikely that there can be an increase in federal spending for Soil Conservation Service technicians and there could be a reduction of the present level. A plan to accelerate the application of practices must look to other sources of funding.

The state could alleviate the shortage of technicians by providing state employees to work on the application of conservation practices. These employees could be assigned to work with and under the supervision of the District Conservationist of the SCS in the local field offices.

Another option would be for the state to provide legislation that would authorize the transfer of state funds to the Soil Conservation Service, and the SCS could hire the technicians similar to the transfer of ACP funds by the Agricultural Stabilization and Conservation Service. This could be transfer of a portion of the NSWCP funds.

Still another option would be to provide additional state funds to NRDs who would hire additional technicians where needed.

The Natural Resources Commission should review these options, select one and submit a legislative bill to the Legislature.

Lead Agency: Nebraska Association of Resources Districts

F.7.

Goal: CONSERVE SOIL AND WATER RESOURCES WITH THE USE OF REGULATORY AUTHORITY

Objective: Strength state and local authorities for management of ground water quantity and quality.

Description of Activities:

NRDs presently have the authority to manage ground water either through the creation of ground water control areas, or through the designation of ground water management areas. Districts can take steps to eliminate waste in the use of water in either of the areas. The NRDs can prohibit additional well development in ground water control areas, if problems cannot otherwise be resolved.

The present ground water management laws are deficient in 2 ways. First, authorized regulations are directed primarily to water quantity, with little authorization given for the control of water quality. Secondly, if NRDs are not willing to initiate ground water management areas, the state has no ability to step in.

Present laws should be modified to: (1) authorize the state to designate, on its own initiative, ground water control or management areas, and (2) provide NRDs with the authority to regulate applications of fertilizer and pesticides.

Lead Agency: Nebraska Natural Resources Commission
Nebraska Association of Resources Districts

F.8.

Goal: CONSERVE SOIL AND WATER RESOURCES WITH THE USE OF REGULATORY AUTHORITY

Objective: Aid natural resources districts in implementation of the State Erosion and Sediment Control Act.

Description of Activities:

The 1986 Nebraska Legislature adopted LB 474, the State Erosion and Sediment Control Act. That Act authorizes the filing of complaints whenever sediment damage is caused by erosion. Installation and use of conservation practices can be required if excessive erosion is found to be occurring.

Passage of the Erosion of Sediment Control Act is viewed as a major accomplishment in achieving the objectives of the State Soil and Water Conservation Strategy. However, many tasks remain before the Act is fully implemented. The State Erosion and Sediment Control Program must be completed by January 1, 1987, with periodic updating and revision to occur. Each natural resources district must develop and implement its own erosion and sediment control program by July 1, 1987.

State assistance is needed and will be given to the districts in local program development and implementation. A model local program will be developed, including draft rules and regulations for enforcement of the complaint provisions. A slide tape show to aid districts in explaining of the provisions of LB 474 will be made available to each district. All state-possessed information that would be of assistance to the districts will also be made available. Finally, the Natural Resources Commission will help coordinate activities necessary to the development and implementation of the local programs.

Lead Agency: Nebraska Natural Resources Commission

F.9.

Goal: CONSERVE SOIL AND WATER RESOURCES WITH THE USE OF REGULATORY AUTHORITY

Objective: Encourage increased municipal and county control of erosion from non-agricultural land disturbing activities.

Description of Activities:

An amendment to LB 474 excluded many but not all non-agricultural land disturbing activities from the mandatory provisions of the Erosion and Sediment Control Act. Not required to be controlled is erosion and sediment from activities relating to the construction of housing, industrial, and commercial developments. Non-agricultural land disturbing activities that remain subject to the Act include construction of highways, pipelines, recreation areas, and schools and universities. In addition, cities and counties retain the authority to regulate, at their option, erosion and sediment from all land disturbing activities, including those exempted from the mandatory aspects of LB 474.

Cities and counties that have zoning are in the best position to control-non-agricultural land disturbing activities. Building permits are issued for other purposes and inclusion of sediment control regulations would be compatible with most permit programs. Because of the generally short-term nature of non-agricultural erosion problems, long-term productivity is not the primary reason to control sediment from such activities. Short term sediment damage is of greater concern and it can be best prevented through preparation and implementation of site development plans rather than by attempting to correct problems after they appear.

The NRC and the NRDs should encourage cities and counties to adopt ordinances providing for the control of erosion caused by non-agricultural land disturbing activities. Such encouragement should be provided in the form of education on the problems created by sediment and ont he means of preventing such problems. Model ordinances should be prepared and provided to cities and counties and assistance in implementation of the ordinances could be provided by natural resources districts.

Lead Agency: Nebraska Natural Resources Commission

G.1.

Goal: ENHANCE THE MANAGEMENT OF STATE-OWNED LAND

Objective: Provide that each agency that manages state-owned land formulate a policy statement that explains how those lands will be managed for long term sustained productivity by controlling erosion and managing water properly.

Description of Activities:

Each state agency that owns or controls land should formulate a policy statement to explain the uses of the land and a systematic procedure for controlling erosion and maintaining the resource for the long-term benefits of present and future generations. The policy on land use for transportation should include a statement on erosion control during construction, follow-up after construction, and maintenance.

A policy on land used for wildlife habitat should include a listing of types of cover used and how that cover will maintain the resource base. It should explain the use of row crops for diversity and food plots and the erosion control policy on those acres in row crops. It should explain erosion control policy on newly acquired land.

The Institute of Agriculture and Natural Resources should have a policy on the use of the land for crop production or for crop or soil research and a statement on predicted erosion. A policy statement on erosion control should be included for all of the possible land uses.

land being leased to individuals or corporations for agricultural uses should be analyzed for present condition and conservation needs. A policy statement could then show the intention for dealing with those conservation needs and the time frame anticipated for solving resource problems.

The Natural Resources Commission should take the leadership for this action item.

Lead Agency: Nebraska Natural Resources Commission

G.2.

Goal: ENHANCE THE MANAGEMENT OF STATE-OWNED LAND

Objective: Provide that the Board of Educational Lands and Funds develop a multi-year conservation plan and set a goal to complete a high percentage of the remaining conservation work to be done on BELF land in a reasonable period of time.

Description of Activities:

The BELF should make an inventory of the remaining conservation work to be done to be used in setting priorities. Since the Soil Conservation Service will be doing the technical work they should be included in the planning and goal setting.

A schedule should be organized to develop a conservation plan on each parcel of cropland needing conservation work outlining practices and scheduling application that will keep soil losses at an acceptable level in line with the state strategy.

Another schedule should be drawn up for developing rangeland conservation plans and applying the necessary practices on the 1.2 million acres of BELF rangeland. A policy could be written to manage the grassland resources for a minimum of "good" condition according to the SCS technical guide when ever possible.

The BELF should do the conservation work in line with the needs and goals and with the ability of the SCS to do the technical work.

Lead Agency: Board of Educational Lands and Funds

G.3.

Goal: ENHANCE THE MANAGEMENT OF STATE-OWNED LAND

Objective: Provide variable lease periods as incentives for excellent management.

Description of Activities:

The BELF could amend their leasing programs to provide an incentive to the good grass managers by allowing him to renew or extend his lease in return for good management. At the end of the lease period, the lessee could renew the lease or extend it, if the management has been proper. If the management has not been proper, the lease would end and the parcel of land would be offered for bidding as is the usual procedure.

G.4.

Goal: ENHANCE THE MANAGEMENT OF STATE-OWNED LAND

Objective: Establish a coordinating committee to revise and annually review the Joint Memorandum among the Board of Educational Lands and Funds, the Natural Resources Commission, and the Soil Conservation Service to incorporate changes since it was signed in 1971 and changes brought about by the Nebraska Soil and Water Conservation Strategy.

Description of Activities:

A coordinating committee representing the Board of Educational Lands and Funds, the Soil Conservation Service, the Nebraska Natural Resources Commission, and the Nebraska Association of Resources Districts could revise the Joint Memorandum to bring it up to date.

The elements to be covered in the revision should include (1) a policy statement, (2) an assessment of treatment needs and goals, (3) a procedure for prioritizing requests for technical assistance, (4) provisions for coordination of information and education for agency personnel and lessees, and (5) other agency responsibility as necessary.

The agreement could be reviewed by the coordinating committee once each year to test the adherence to policies and to recommend improvements.

Agencies involved in this alternative include NRC, BELF, and SCS, and could include the NARD. The Natural Resources Commission should take the leadership.

Lead Agency: Nebraska Natural Resources Commission

G.5.

Goal: ENHANCE THE MANAGEMENT OF STATE-OWNED LAND

Objective: Provide the Board of Educational Land and Funds managers to attend SCS training sessions on farm and ranch planning and application and for one SCS liaison person to attend selected BELF managers to solidify working relations between BELF, SCS, and NRDs.

Description of Activities:

Due to the close relationship of BELF and SCS in the application of conservation to BELF land, a better understanding of the others operation by both organizations is needed. The BELF managers could do more toward implementing conservation activity if more training were available. This could be arranged by the SCS inviting the BELF managers to all training meetings on the planning and application of practices. In addition to benefiting from the training, it would seem to put SCS and BELF on the same team in terms of applying practices.

In order to work effectively with BELF, the SCS needs an insight on BELF working policies, goals, and problems. This could be gained by having an SCS conservationist serve as liaison representative at selected BELF managers meetings when they discuss policy, leasing procedures, setting rental rates, conservation application, and other related subjects. The SCS liaison could report to the other field offices and to the Natural Resources District boards.

Agencies involved include BELF, SCS, and to a limited extent, the NRDs. The SCS should take the leadership by selecting training sessions that are scheduled during the year at which the managers could benefit and sending a schedule and invitations. A reminder could also be sent as the training date approaches.

The BELF could respond with a list of meetings at which an SCS liaison representative could attend where policies, goals, and conservation treatment would be discussed.

Lead Agency: Soil Conservation Service

G.6.

Goal: ENHANCE THE MANAGEMENT OF STATE-OWNED LAND

Objective: Require the use of conservation easements and/or deed covenants to provide for sustaining the soil and water resources on land that is being transferred to the private sector by a state or local government agency.

Description of Activities:

Present state statutes require that conservation plans be prepared and implemented on publicly-owned lands. However, there are currently no provisions to require that the conservation practices installed in accordance with such plans be maintained if those lands are later sold to the private sector. The state and local agencies responsible for specifying the terms for such sales could require that such practices be maintained by the new owners. Covenants to that effect could be inserted in the deeds transferring the land.

The covenant could limit the land use to perennial crops such as grass or trees in the case of fragile soils or it could specify practice maintenance and/or soil loss limits on arable land. Authority and responsibility for enforcement of that covenant could rest with the transferring agency.

In most cases, implementation of this alternative could be accomplished by individual agencies without additional statutory authority. For example, the Natural Resources Commission has the authority to specify the terms of sale for lands purchased in whole or in part with funds from the Small Watersheds Flood Control Fund. As part of those terms, the Commission should require the type of covenant identified here. Rule and regulation changes would be advisable. This objective would apply to BELF only to the extent of not adversely affecting sale prices. Most other agencies could also implement the recommendation without further legislative authority. Additional legislation would be needed to make this mandatory.

Lead Agency: Nebraska Natural Resources Commission

H.1.

Goal: IMPROVE INTER-AGENCY COORDINATION

Objective: Provide for implementation of the Soil and Water Conservation Strategy by the Director of Natural Resources assuming responsibility for the leadership role.

Description of Activities:

With the Governor's approval, the Director of Natural Resources should assume the responsibility for implementation of the Strategy. This responsibility will include assembling the cooperation of all agencies involved in the action items and using it to accelerate the conservation of the soil and water resources. Coordinating the activities of the agencies to produce timely implementation will be of utmost importance.

This charge to the director could include a schedule for updating the plan as time goes on and providing a yearly status report to the Governor and to the associated agencies.

The director could enlist the aid and guidance of the Natural Resources Commission in coordinating activities between the federal and state agencies and the natural resources districts. He should also enlist the aid of the Strategy executive committee which includes a representative from each of the resource agencies for overview, as a source of ideas, and for maintaining cooperation. A yearly follow-up report on progress should be made to the Governor, the resource agencies involved, and to the public.

Lead Agency: Cooperative Extension Service

H.2.

Goal: IMPROVE INTER-AGENCY COORDINATION

Objective: Arrange for the Cooperative Extension Service Ad Hoc Committee on conservation tillage to coordinate all information on conservation tillage with other resource agencies to present a yearly state-wide campaign.

Description of Activities:

In spite of all of the proven benefits from conservation tillage, there are areas in the state where it is not widely accepted. This could be remedied with a campaign by all resource agencies becoming involved.

The Cooperative Extension Service heads the task force which includes representation from the Agricultural Research Service, the Soil Conservation Service, and the natural resources districts. This task force could be expanded to include the Natural Resources Commission and the Department of Environmental Control.

The task force should coordinate the information activities of the collective agencies into a single effort that could be more effective than each agency conducting their own conservation tillage information program.

This committee should review the activities that have taken place in the past, by areas of the state, and prescribe a campaign based on the needs. It should recognize that land managers are in various stages of acceptance of conservation tillage and provide information for each of those stages.

The results of testimonials should be widely publicized and the task force could consider publishing a conservation tillage newsletter similar to the one from the Conservation Tillage Informational Center of the NACD.

While promotion of conservation tillage would be the main objective, this task force could always recognize the need for using this practice with complete resource management systems.

Lead Agency: Nebraska Natural Resources Commission