Nebraska Soil and Water Conservation Strategy

1990 Update

Nebraska Natural Resources Commission

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STATE OF NEBRASKA
Planning and Review Process

NEBRASKA SOIL AND WATER CONSERVATION STRATEGY

1990 UPDATE

Nebraska
Natural Resources Commission

January 1991

State of Nebraska
E. Benjamin Nelson, Governor
January 1991

Nebraska Natural Resources Commission

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Foreword

Nebraska is blessed with abundant soil and water resources. These natural resources have been developed and used by industrious Nebraskans to make the state an international leader in agricultural production. This progress and success, however, has depleted the productivity of the natural resources base.

The notion that Nebraska's natural resources could be exhausted was foreign to early settlers. They saw endless prairie, and recognized the promise which the state's lands held for agriculture. As a result, settlement in Nebraska was rapid. By the turn of the century, pioneers had plowed nearly 15 million acres of virgin prairie. Federal settlement programs and the demand for grain increased cultivated acreage to over 20 million acres by the end of World War I.

With the depression and drought of the 1930s came a realization that large areas should not have been plowed or planted. Half of the organically rich layer of topsoil had washed or blown away in one lifetime. As a result, broad public support developed, as a nation and a state, for a policy that linked productivity to careful management.

Federal soil and water conservation programs which began in the mid-1930s were quickly linked to local and state efforts. These programs continue to be effective today. About 60 percent of the agricultural land in the state is now adequately protected—nearly all on a voluntary basis. The lands on which soil continues to erode excessively, where irrigation water could be more efficiently applied, where range and pasture management need improvement or where forestry practices and habitat management can be promoted are the focus of the Soil and Water Conservation Strategy. Development and use of geographic information systems (GIS) and accelerated mapping programs are new initiatives and hold the promise of developing better information for decision makers, particularly for natural resources management.

The Strategy respects private property rights, but also acknowledges that occasionally a part of those rights need to be sacrificed for the common good. When productive soil becomes damaging sediment and a pollutant, or when a water supply is diminished or contaminated, the resulting problems represent a direct concern to the greater society and often for the long term.

The impacts of this trade-off between private property rights and the common good are weighed in the Strategy. The impacts of past and current policies are also examined. The Strategy then looks to the future, and its long-range planning reaffirms the need for concern, commitment, and cooperation by farmers, ranchers, government agencies, interest groups, and citizens across the State of Nebraska.

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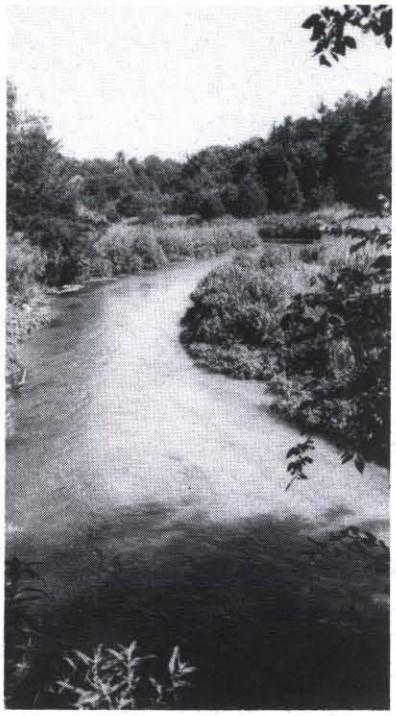
Chapter 1
INTRODUCTION TO THE STRATEGY

The Soil and Water Conservation Strategy is a policy statement, action plan and set of recommendations by the Nebraska Natural Resources Commission (NRC). It is a dynamic and cooperative endeavor to guide programs and practices of state agencies, natural resources districts (NRDs), and federal agencies that have an impact on the natural resources of Nebraska. The Strategy is premised on the principle of balancing the use and protection of natural resources to provide an enduring economic and aesthetic resource for the state. To achieve that end, the goals of the Strategy are to conserve soil and water, protect and enhance water quality, promote forestry management, protect and enhance wildlife habitat and improve the information base necessary for decision making. These goals for the public benefit are further refined and supported by stated objectives that offer benchmarks to measure progress. In turn, an action plan further defines what needs to be done, by which agency and when. This Strategy then makes a set of recommendations for legislative, executive and administrative decision makers.

The sense of purpose and sharp focus expressed in this Strategy reflect the immediate challenges of managing the natural resources of Nebraska with a long term perspective. The Strategy's action plan meets those challenges and will establish a legacy of enduring results.



LEGISLATIVE MANDATE

Section 2-1507 of the Nebraska Revised and Reissued Statutes of 1945 authorizes the Natural Resources Commission..."to plan, develop, and promote the implementation of a comprehensive program of resources development, conservation, and utilization for the soil and water resources of this state in cooperation with other local, state and federal agencies and organizations."

A STRATEGY FOR IMPROVING MANAGEMENT

Most of the land in Nebraska is adequately protected from erosion and responsibly managed through traditional concepts of soil and water conservation. Protecting the remaining land and expanding programs for water use efficiency, forestry management, and water quality improvement present formidable challenges. The original Soil and Water Conservation Strategy, published in 1986, presented a number of actions to accelerate the application of traditional conservation measures. The 1990 Update continues that effort with broadened scope and renewed vigor.

In the years since the original Strategy was published, many of its recommendations have been implemented, and many changes have taken place. The Legislature provided additional funds, many agencies worked hard to implement the recommended actions in the Strategy, and the federal Food Security Act (1985 farm bill) provided new directions and programs. As these recommendations and programs were being implemented, some associated problems surfaced, and new issues arose to prominence. Prevention of nonpoint source pollu-

tion of surface water and ground water became a priority issue to the nation and the state. Forestry management, wetlands protection, and habitat enhancement also increased in public awareness and priority. The Strategy needs to be revised to reflect these needs and address changed circumstances.

PURPOSE AND SCOPE OF THE STRATEGY

The aim of the Soil and Water Conservation Strategy is to sustain the ability of the natural resources of Nebraska to support a high quality of life for present and succeeding generations. It is a course of action for efficiently conserving and managing the state's natural resources, both in quantity and quality. It identifies problems and remedies; presents potential actions and makes recommendations for action by the Governor, Legislature, federal and state agencies, NRDs, and landowners.

The original Strategy, developed in 1986, accelerated the rate at which additional conservation land treatment, range management systems, water use efficiency and water quality management practices were applied as resource management systems. The purpose of revising the Strategy is to take stock of the current situation, re-focus attention on current problems, and develop a revised course of action.

Limited time narrowed the focus of the original Strategy to traditional soil and water conservation issues. The intent was to broaden the Strategy to cover water use efficiency, sediment control and water quality, forestry, and data management in future updates. The 1990 update continues the work on soil and water conservation, and expands coverage to those other areas.

This is a Strategy for the entire state. It must bring all the resources in the state, including federal assistance, to bear on the resource problems throughout the state. It must also be flexible enough accommodate the variety of conditions found in Nebraska. It must recognize the differences as well as the similarities in cropland and agricultural chemical management practices across the state as the climate varies from sub-humid to semi-arid. It must accord the same consideration to urban lawns as rural pasture, range, and forested areas. Municipal and industrial uses of land and water, which contrast with crop and livestock production, must all be given equal consideration and protection. All these uses have potential impacts on the environment, the economy of the state, and the quality of life.

PARTICIPANTS IN STRATEGY DEVELOPMENT

This Strategy is part of the State Water Planning and Review Process. The Director of Natural Resources and NRC are jointly responsible for the results of that process. The original Strategy was developed under their leadership with assistance from other state and federal agencies, and input from NRDs and the public. The heads of many state agencies or their representatives served on an executive committee which coordinated the development of the Strategy. The agencies and organizations that contributed to this update of the Strategy and reviewed drafts of the reports are listed in Table 1-1.

Managers of NRDs also made vital contributions to this update. They were consulted for suggestions on actions and comments on proposals, and reviewed drafts of reports.

Table 1-1

PARTICIPANTS IN THE 1990 STRATEGY STUDY

State Agencies and Organizations	
Department of Environmental Control	Department of Roads
Department of Water Resources	Department of Education
Department of Agriculture	Policy Research Office
Board of Educational Lands & Funds	Game and Parks Commission
Nebraska Association of Resources Districts	Department of Health
University of Nebraska-Lincoln	
Conservation & Survey Division	Nebraska Forest Service
Water Center	Cooperative Extension Service
Federal Agencies	
Soil Conservation Service	Bureau of Reclamation
Environmental Protection Agency	Agricultural Research Service
Agricultural Stabilization and Conservation Service	U.S. Geological Survey

STRATEGY PROCESS AND ORGANIZATION

Development of the Soil and Water Conservation Strategy is a continuing process. It will continue as long as there is a need to monitor the condition of the resources and the effectiveness of actions in the Strategy in order adjust the activities required to accomplish the established goals.

When the process was initiated in 1985, the NRC decided to involve as many agencies and organizations in the original Strategy as possible. Most of the planning work was done by the NRC and Soil Conservation Service (SCS), and dozens of individuals, districts, organizations, and agencies helped in formulating actions and alternatives and reviewing reports. After the initial Strategy was developed, the process was changed to better suit the requirements for implementation, monitoring, and updating. More emphasis was placed on inter-agency cooperative activities. Also, the scope was broadened to encompass water conservation and associated water quality. The methods used in the study were changed to meet these evolving requirements.

To remain current and viable, the Strategy must be updated every two years. Time and funding will not be adequate to study all problems in detail and gain acceptance for solutions within a two year period. Therefore, the study process has been structured to assign priorities to the most vital issues to complete them as quickly as possible, and schedule the study of other issues and problems over a longer period of time, so actions and alternatives can be recommended in succeeding updates of the Strategy.

Conservation of Nebraska's soil and water resources are important to its future.

In this process, studies are conducted primarily by the NRC, SCS, and cooperating agencies. Information and data are provided by NRDs, state, and federal agencies, and suggestions for study and actions are provided by all involved in the process.

The Soil and Water Conservation Strategy is a dynamic body of ideas, facts, agreements, and recommendations for directing the course of future conservation activities. These ideas change as conditions change, so any document published as "the Strategy" would become outdated quickly. Therefore, the actual Strategy is described in the compilation of agreements and documents retained by the NRC, and periodically the current contents are published as an update of the original summary of the Strategy. This is supplemented with an Action Plan that details the activities of all involved in implementing the actions and alternatives recommended in the Update publication. The Action Plan will guide continuing work on the Strategy, and it will be kept current by monitoring programs and activities, so action items can be revised as needed.

SCHEDULE FOR UPDATING THE STRATEGY

The Strategy is the result of the cooperative efforts of many agencies and organizations. In 1989 the NRC considered means of updating it, and a study proposal was prepared for review by the Governor's office, cooperating agencies, and districts. Consultation with agencies and districts on policy issues and action items began in April 1990, and data collection and analysis began shortly thereafter.

Research and analysis of data was conducted mostly by the NRC and SCS with some assistance from other state and federal agencies. Proposals, drafts, and reports were prepared by the NRC and reviewed by those concerned throughout the process. Completion of the 1990 Update was scheduled for December 1990 and biennial updates were scheduled to follow it.

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Chapter 2
NATURAL RESOURCES MANAGEMENT: PAST AND PRESENT

Fertile soil and clean water are two of the most valuable natural resources in this state. The people of Nebraska, our human resources, are both our most valuable assets and biggest challenge in conserving those natural resources.

LAND RESOURCES AND SOIL CONSERVATION

Only one percent of the area of this state is covered with water. The vast majority of the 99 percent that is land is productive. Most of it is suitable for agriculture, home-building, and many other uses as well. About 94 percent is privately owned. Nearly 95 percent is in agricultural use, and almost two-thirds has been given adequate protection to prevent erosion and maintain its productivity. The rest poses some difficult and challenging conservation problems.

LAND USE (PAST AND PRESENT)

A large majority of land the land in the state is used for agriculture. Table 2-1 shows the area in the major land uses in 1987. Although the trend in recent years has been toward growth in several other uses, the relative position of agricultural use has changed little.

Table 2-1
NEBRASKA LAND USE IN 1987

Land Use	Area (acres)
Irrigated Cropland	7,589,000
Non-Irrigated Cropland	13,011,700
Pasture	1,956,800
Rangeland	22,899,800
Forest	727,500
Urban and Built-up Land	430,400
Rural Transportation	820,000
Small Water Areas	216,800
Federal Land	1,072,800
Other	782,000
TOTAL	49,507,300

Agricultural Land Use

The 1987 National Resources Inventory (NRI) identified 46,967,300 acres of agricultural land. Figure 2-1 shows the relation of cropland to grasslands used for agriculture.

Total agricultural land use hasn't changed much since the mid-1940s. Shifts among those uses have occurred, and several trends in the shifts can be identified. Cropland increased from under 10 million acres before 1900 to a peak of more than 20 million acres during the mid-1940s. Total cropland has remained nearly stable since then. Acres of non-irrigated crops have declined while acres of irrigated

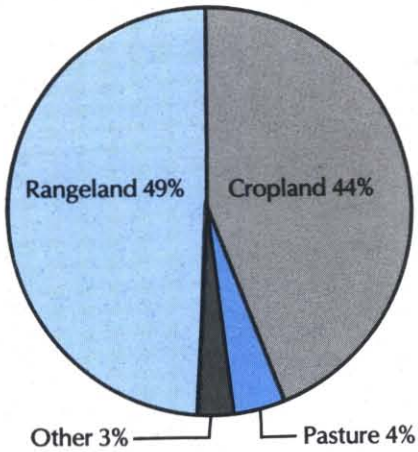


Figure 2-1
AGRICULTURAL LAND USE IN NEBRASKA

cropland have steadily increased, from 2 million acres in 1955 to 7.6 million acres in 1987.

Trends in other land uses have not been as dramatic as the shift from dryland agriculture to irrigated crops. Acres of rangeland have remained nearly stable while acres of pasture have varied over the years. A continuing loss of forest land, which does not include field windbreaks or trees in farmsteads, has occurred.

Forest Lands

In 1982, there were 732,400 acres of forest in Nebraska. By 1987, the number of acres had decreased to 727,500. The losses to cropland, range, and other minor land uses were almost equal.

The types of forests in Nebraska include woodlots, windbreaks, municipal parks and recreation areas, and natural forests. Most of the forests are located in the Pine Ridge region of Nebraska, or along the major streams in the state.

Forests in Nebraska are used for timber and livestock production. Most of the forest lands are grazed. Trees are also used for windbreaks and filter strips to reduce erosion and improve water quality. Windbreaks occupied 139,100 acres in 1983.

Urban Land

In 1950, less than 25 percent of the state's population lived in urban areas with a population of over 2,500. By 1987 urban population had increased to more than 60 percent of the total, and urban and built-up land had increased with it.

Another indicator of urban growth, residential construction, shows that much of the growth is concentrated in the Lincoln and Omaha metropolitan areas. Lancaster, Douglas and Sarpy counties accounted for 78 percent of the residential construction in Nebraska from 1985 through 1989. Buffalo, Cass, Madison, Platte and Washington counties accounted for another 10 percent.

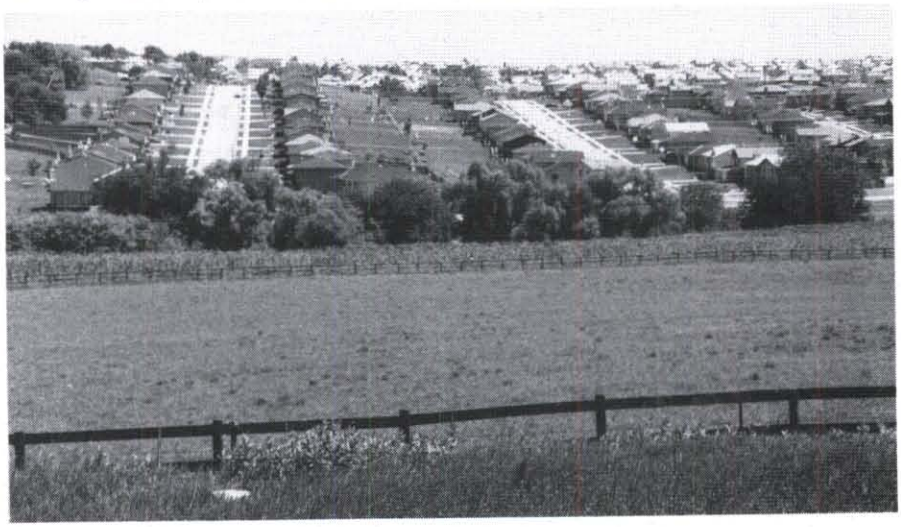
Miscellaneous Land Uses

Almost two percent of the land in Nebraska, 964,300 acres, was devoted to transportation in 1987. Roads accounted for 861,300 acres of this total. This included interstate, primary, secondary and local roads and streets. There also were 782,000 acres of other minor land uses that included farmsteads, mines, pits and other rural uses.

LAND OWNERSHIP

Almost 94 percent of the land in Nebraska is privately owned. Lands owned or managed by the state total about 1,750,000 acres, and the federal government owns about 708,000 acres. Local subdivisions of government, including cities and districts, own about 500,000 acres, or one percent of the total area.

Prime agricultural cropland is sometimes replaced by streets and subdivisions.



SOIL CONSERVATION: PAST AND PRESENT

Early settlers in this country, and many of those who followed, paid little attention to erosion. Land was plentiful in the West and they could move on if theirs became "worn out." By the 1930s, much of the land in the Midwest was being intensively farmed without benefit of conservation measures. The nation was in the midst of its worst depression when drought hit the Midwest. Drought, the Dust Bowl, and the depression forced many farmers to abandon their land, leaving an enormous erosion problem.

History of Conservation Programs

In April 1935, after skies over Washington, D.C. had been darkenedby Midwestern dust storms, both houses of Congress unanimously passed the Soil Conservation Act. That marked the beginning the modern era of soil conservation.

The SCS, which was established by that act, set up many demonstration projects across the country, including three in Nebraska. Limitations in the demonstration program made it apparent that soil conservation could be more effective if carried out through local conservation districts. Nebraska began forming local districts in 1938. It became the first state west of the Mississippi to complete the task 12 years later.

Nebraska's conservation efforts took a unique turn in 1972 when most local resources organizations were reorganized into 24, now 23 NRDs. They were created with a strong mandate for developing and conserving the state's soil and water resources. The NRDs are political subdivisions of state government with the authority to levy a tax to fund conservation programs.

The 1985 farm bill was entitled the "Food Security Act." It contained innovative provisions that required cooperation between the Agricultural Stabilization and Conservation Service (ASCS) and SCS to meet its conservation objectives. These provisions included: reducing erosion and sediment, protecting the soil's productive capacity, improving water quality, and preserving wetlands.

The Food Security Act contained four conservation provisions. The first was "Conservation Compliance," which requires a conservation plan for highly erodible land. Another was "Sodbuster," which restricted the conversion of highly erodible land from permanent vegetation to cropland. The third, "Swampbuster," prohibited the draining or filling of wetlands for crop production. Finally, the "Conservation Reserve Program" provided annual rental payments by USDA for cropland converted to permanent cover.

The conservation impacts of this new federal program will not be realized fully until after 1995. At that time, all programs must be fully implemented.

Current Status of Conservation

The percentage of land in different agricultural uses that has conservation measures applied varies. In 1987 about 48 percent of the cropland, 60 percent of the rangeland, and 53 percent of the pasture land were adequately treated to prevent excessive erosion. The SCS estimated only 49 percent of forest lands were adequately treated to protect them from erosion.

There was a two percent improvement in the amount of cropland adequately treated for water erosion between 1982 and 1987. The SCS determined that it was 76 percent in 1982 compared to 78 percent in 1987. There was no significant change in the number of cropland acres adequately treated against wind erosion between 1982 and 1987.

No significant change in the amount of rangeland adequately treated for water erosion was found between 1982 and 1987. Rangeland adequately treated to protect it from wind erosion was estimated at 98.8 percent in 1982 and 98.6 percent in 1987.

The status of conservation on urban, public, and transportation land is not known at this time. Some public lands rented to farmers and ranchers have been carefully treated according to erosion and management plans. The remaining public lands should follow this good example to encourage more private conservation activities.

SOIL CONSERVATION NEEDS

Soil erosion is caused by both water and wind. Erosion by water may be caused by rainfall or snowmelt, or by human activities, such as irrigation. The Dust Bowl of the 1930s was a dramatic example of the devastating effects of wind on bare, dry soil. Although wind erosion problems

today don't match those of the Dust Bowl, wind can cause serious damage, especially in western Nebraska.

Erosion affects everyone in Nebraska. Farmers and ranchers are directly affected by the loss of productivity on farmland and rangeland. Crop yields on non-eroded sites are 10 to 25 percent better than yields on severely eroded sites.

It also affects landowners through increased production costs. Farmers may be able to offset losses of topsoil with additional fertilizer and irrigation water, but continued erosion eventually causes production costs to increase. Overgrazed rangeland, pasture, or forest produces less forage, increasing the cost to maintain production.

Erosion causes other damages that directly affect landowners and the public. Eroded soil becomes sediment that can be deposited where it can cause damage, or it can remain suspended in water and pollute streams and lakes. Windblown and water borne sediments reduce productivity of fields by burying crops. Sediment also fills ditches and culverts and covers roads. Urban erosion and sediment deposits are costly because of damage to streets, landscaping and drainage areas.

Some progress has been made in reducing water erosion in the 5 years from 1982 to 1987. The estimated loss of soil due to wind erosion has not changed in that period.

About half of the state's cropland needs some type of conservation treatment or improved management. Of the 7.9 million acres of irrigated cropland, about 2.1 million acres need better water management, and 1.5 million acres need erosion control.

A little more than 40 percent of the rangeland in the state needs better management to protect the resource. About 47 percent of the pasture land needs a variety of treatment practices.

The SCS has identified areas throughout the state where erosion is a serious problem. There are 9.6 million acres of "highly erodible land" in the state, and they have the most urgent need for conservation practices to reduce soil losses. The Papio-Missouri River NRD estimates that only 30 percent of the highly erodible land in that district was adequately treated in 1989.

Erosion Affects Everyone in Nebraska

Erosion occurs in forests as well as croplands. Grazed forest lands are in greater need of erosion protection than ungrazed lands. In the NRI it was estimated that 211,300 acres of grazed forest lands need conservation treatment.

Appropriate treatment for deciduous forests would be the removal of grazing. Conifer forests can be grazed without significant soil erosion, but proper management is necessary. Young conifer seedlings must be protected from cattle and compaction of soil should be minimized.

The ability of trees to reduce soil erosion has long been known. However, the number of wooded acres has decreased over the 5 year period from 1982 to 1987 by 4900 acres. Since private landowners hold 71 percent of the forest land in this state, education will be an important factor in maintaining and increasing forest land to prevent erosion.

Urban construction can contribute to erosion and sedimentation problems. The amount of urban land that is adequately treated to prevent erosion at this time is unknown. Large tracts of land are sometimes cleared years before they are fully developed and grass and trees are established. Urban areas are currently exempted from the Erosion and Sediment Control Act of 1986. This is a major factor in the continuing erosion problems in cities.

Areas in other land uses, including transportation and other miscellaneous lands, have potential erosion problems. Transportation accounts for almost two percent of the land use in the state. The number of acres of transportation lands needing treatment and the treatment needs are not known. They probably vary from year to year. Lands in miscellaneous uses, including farmsteads and other rural uses, contain 133,000 acres that need some conservation treatment.

The 1985 farm bill required that each farmer in the program have a soil conservation plan by 1990. The plan must be fully implemented by 1995 or the producer will lose eligibility for farm program subsidies. Of the 9.6 million acres of cropland needing conservation plans, 3.5 million acres had plans that were fully implemented by February 1990. Those farms not in compliance by 1995 will present the biggest challenges to state and local conservation efforts.

Climate is vital to the existence, development, and use of land and water resources. Nebraska's climate is typical of an interior land mass - continental in nature and always variable. The variations include such climatic extremes as flood and drought.

CLIMATIC AVERAGES

Rain and snowfall patterns vary across the state from east to west. Average precipitation decreases from about 35 inches per year in the southeast corner of the state to less than 16 inches in the western panhandle. Fortunately, about 80 percent of average annual precipitation normally falls during the crop growing season from April through September. Winds are generally from a southerly direction in the summer and a northerly direction in the winter. Winds can have an important effect on erosion and evaporation in Nebraska.

Even under average rainfall, temperature, and wind conditions, Nebraska's climate can cause problems for agriculture. Normal moisture conditions in the eastern portion of the state provide adequate water for most crops. However, as rainfall decreases across the state from east to west, it becomes increasingly difficult to grow corn and other cash grain crops without irrigation. In addition, strong winds that occur during the winter and early spring can create wind erosion problems. Inadequately protected fields are especially vulnerable.

CLIMATIC EXTREMES: DROUGHT

Droughts have severely affected most of the state at one time or another. The drought and Dust Bowl years of the 1930s are the most well known, but other droughts have been more severe. The drought of 1894 had the driest years on record at some recording stations in Nebraska. Furthermore, studies that analyzed tree rings to reconstruct past climatic conditions show that much worse droughts occurred before any written records.

An additional factor in planning for future droughts needs to be considered in light of recent concern over possible climatic change. Some researchers predict that climatic changes will occur due to the increasing concentration of carbon dioxide in the atmosphere, called the Greenhouse Effect. Some predictions indicate that increased atmospheric warming could make future droughts worse or more frequent.

Resource Impacts

Very little information is available on the resource effects of past droughts, such as shortages of streamflow for irrigation and other uses. Some records from one of the worst droughts in recorded history give an indication of the extent of the impacts.

The "Biennial and Hydrographic Reports" of the Department of Water Resources (DWR) for the 1930s record the amount of water rights administration that was required. In normal years, such as 1933, very few diversions were closed in the Platte River Basin. In contrast, the DWR Hydrographic Report for 1936 stated, "...the deficiency began during the last few days of April and continued throughout the growing season." Water rights dated subsequent to 1892 were without water after May 1, 1936.

Information is available only on water rights administration in the Platte River Basin. Several reports note that the workload was so heavy that DWR was not able to administer water rights in the rest of the state.

Social Impacts

A severe drought like the one in the 1930s can have social impacts that reach beyond the individual farm to the surrounding community and eventually the entire state. In 1934, Nebraska had its lowest average yield per acre of corn, 3.2 bushels. Individuals, especially farmers who lost their crops, were directly impacted. As the extent and duration of the drought increased, more people lost their farms as well as their crops, and moved out of the state. The population of the state declined drastically during the decade.

The social impacts of a similar drought would not be the same as they were in the 1930s. Communication networks and public information programs were not as readily available as they are today. Now, federal and state agencies, with coordination by the Governor's Drought Assessment and Response Team, are better able to provide public information and emergency services during periods of drought.

Economic Impacts

The drought of the 1930s reduced yields and acres of crops harvested. This loss, combined with the reduced value of crops and livestock during the Depression caused severe hardships, including loss of farms.

Conditions in 1990 are different from those in the 1930s. Similar drought conditions would have less severe impacts on the farm economy. The increase in irrigated crop production, the use of water conserving farming practices, and the availability of crop insurance and other Federal farm programs all serve to stabilize the income of farmers.

WATER RESOURCES AND CONSERVATION

On average, water is plentiful in Nebraska. However, this water is not distributed uniformly over the entire state, nor is it distributed equally in time. In the eastern part of the state, the water supply in the streams usually exceeds the demand. In the west, demand frequently exceeds the supply in some streams even under average conditions.

Shortages of surface water have occurred since farmers first started irrigating about 100 years ago. Ground water table declines appeared only in the past 25 years. Conservation of surface water to meet shortages with storage projects started shortly after the turn of the century, and water use efficiency improvements began increasing about 30 years ago.

Widespread ground water declines first became apparent in the late 1960s and early 1970s. They prompted concerns about the future supply for irrigation and domestic use. They also caused concern about the potential for reducing the area of sub-irrigated meadows, and the depth and area of wetlands and lakes. State actions to encourage ground water conservation were not taken until the late 1970s.

Surface water availability in Nebraska streams and rivers changes with the seasons.

AVAILABILITY OF SURFACE WATER

Water supplies in streams vary daily, monthly and annually. Some streams have little or no water available for irrigation or instream flow frequently, and many have none available in severe droughts, like that of the 1930s.

Nebraska has about 637,400 acres of open water and over 1.1 million acres of sub-irrigated meadows. These wet meadows are valuable to ranchers for hay and to wildlife for habitat and food.

Average Surface Water Supplies

Average annual inflow to the state in streams other than the Missouri River and canals is about 1 million acre-feet. Most of this water enters in the western half of the state. Average annual outflow is about 7 million acre-feet, and nearly all of it flows out of the eastern half of the state. Precipitation falling on the state, mostly in the eastern part, provides this annual increase.

Surface water available for use by diversion or as instream flow varies with streamflow and current use. Records of streamflow at many gaging stations in the state are published by the U.S. Geological Survey (USGS) and DWR, but records of diversions and use are incomplete. The only sources of information on availability of water resources statewide are the 1971 Report on the Framework Study, and the Missouri River Basin Hydrology Study. Much of the data is now obsolete or not well accepted by some state agencies. Usable data for state water resources planning is not readily available at this time.

Streamflows Under Drought Conditions

Official records of rainfall and streamflow in Nebraska during severe droughts are sparse. The drought of the mid-1950s is the best documented, and some data is available from the 1930s.

Since rainfall in the 1930s was much less than normal, streamflow was low across the state. Table 2-2 shows the reductions in average annual streamflow between the decade of the 1930s and the period from 1929 to 1980 for four gaging stations. The Niobrara River at Spencer is a base flow stream fed by ground water. It shows the smallest overall difference. The South Platte River at Julesburg, which gets more of its streamflow from runoff than the other three streams, shows the greatest reduction.

Table 2-2

COMPARISON OF STREAMFLOWS IN THE 1930s TO AVERAGE STREAMFLOWS

Average Streamflow	Station: Big Blue R. at Barneston	Elkhorn R. at Waterloo	Niobrara R. at Spencer	S. Platte R. at Julesburg, CO
		cfs		
1930s[1]	299,700	446,100	874,200	167,100
1929-1980 Period of Record	612,900	716,000	1,037,000	397,800
% Difference	-51.1	-40.2	-15.7	-58.0

[1] 10-year average

SURFACE WATER USE AND CONSUMPTION

Surface water use for irrigation, hydropower production, and public supply are summarized in Table 2-3. The use of surface water for irrigation has basically doubled between 1960 and 1985. The amount of surface water available and used for irrigation varies greatly depending on the weather conditions. The estimates, only made every fifth year, do not provide enough information to track the actual use and fluctuations.

In general, the use of surface water for public water supplies has decreased over the last 25 years. Public water supplies to homes, businesses and waste treatment facilities made up 16 percent of the total surface water used in the state in 1985.

SURFACE WATER QUALITY

The quality of most streams in the state is adequate to meet the criteria of the uses assigned to them by the Department of Environmental Control (DEC). The beneficial uses assigned are: full body contact recreation, including swimming; partial body contact recreation, including wading and boating; propagation of fish and wildlife; domestic water supply source; agricultural water supply; and industrial water supply.

The pollutant most commonly found in surface water is sediment. Most of this sediment comes from nonpoint sources: agriculture and urban construction.

Table 2-3

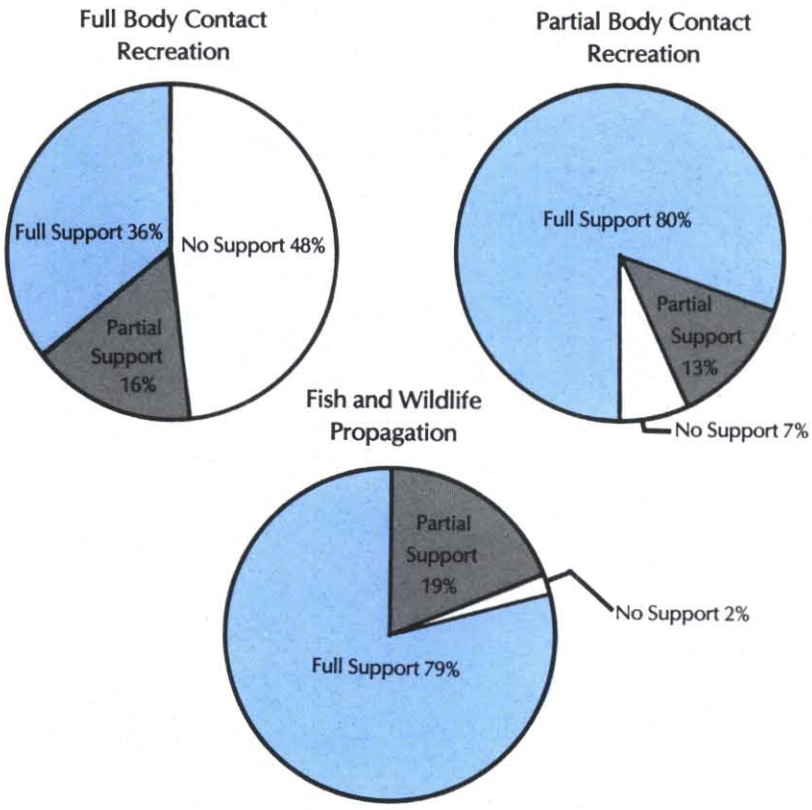
ESTIMATED SURFACE WATER USE

(in 1,000 acre-feet/year)

Year	Irrigation	Public Supply	Hydropower
1960	1,121.0	65.0	21,299.0
1965	2,129.9	74.0	23,541.0
1970	2,328.2	38.1	8,743.8
1975	2,333.9	74.0	6,277.6
1980	2,889.9	75.1	6,669.9
1985	2,321.6	43.7	7,936.7

Figure 2-2

WATER QUALITY ASSESSMENT FOR RECREATION ON NEBRASKA STREAMS



Summary of Water Quality Assessment

The DEC assessed the quality of water in streams designated for all recreation uses and propagation of fish and wildlife during 1986 and 1987. The percentage of assessed stream miles which support full body contact, partial body contact, and fish and wildlife propagation are shown in Figure 2-2. All other uses were fully supported in the streams assessed by DEC.

Water quality samples for toxic chemicals were collected quarterly during 1986 and 1987 from 11 of Nebraska's 13 major river basins. Lead, mercury, and copper accounted for 95 percent of the chemicals found in the samples that exceeded the EPA water quality criteria.

Sources of Pollution

Sediment is the most common pollutant in streams and reservoirs in Nebraska. Most of the sediment is from a nonpoint source, erosion from agricultural land. Not all soil eroded from fields becomes a pollutant; some settles out before it reaches a stream. The percentage of the eroded soil particles delivered to streams increases as the soil being eroded becomes finer.

Some nitrogen and phosphorus compounds are needed as nutrients by plants, so they are added to cropland and lawns as fertilizer. However, in surface water they can lead to water quality problems such as eutrophication.

Pesticide contamination of surface water prompts many concerns, mainly because of its impact on aquatic and terrestrial wildlife and their habitat. The Platte River and some tributaries were sampled for pesticides three times during the 1987 growing season. The first was prior to planting, the second during the corn planting season, and the third was late in the growing season. Atrazine was the pesticide detected most often and at the highest concentrations. Concentrations showed an increasing trend in the downstream direction.

Atrazine concentrations in the samples taken before planting and late in the season ranged from zero to 3.0 parts per billion (ppb), the EPA's health advisory level. The planting season samples were taken shortly after a rainstorm caused runoff in eastern Nebraska. High atrazine levels were found in that area. The maximum level was 23.5 ppb near Schuyler, while in western Nebraska the levels ranged from 0.14 to 0.42 ppb.

Data from 1966 to 1981 published by USGS shows a number of samples with concentrations in excess of the EPA criteria for maximum allowable concentrations of nine pesticides. Of the 25 stations sampled, Salt Creek above Ashland had the greatest percentage of excess concentrations. Since Salt Creek drains the Lincoln area, the high use of pesticides by urban residents in Lincoln probably contributed to this problem.

AVAILABILITY OF GROUND WATER

Over two billion acre-feet of good quality ground water can be found within usable depths in Nebraska. This does not include ground water in deeper aquifers that may be of poor quality or is too deep to pump profitably.

Although ground water is present throughout the state, the distribution of water available for use is not uniform. In some areas the quality of the water is too poor, the aquifers containing the water are too deep, or the material holding the water will not yield it fast enough to wells.

Aquifers of sand, sandstone, or gravel can yield usable quantities of water to a well. The principal ground water reservoir in Nebraska consists of aquifers of this type just below the surface deposits of silt and sand. In some areas of the state the saturated thickness of this reservoir exceeds 1,000 feet. In other areas it is very thin or absent. Figure 2-3 shows the saturated thickness of the principal ground water reservoir in the state.

The depth to the water table varies from zero to greater than 300 feet. In general, the depth to water is greater in the uplands and less in the valleys. Some lakes and wetlands are exposures of the water table at the land's surface.

GROUND WATER QUALITY

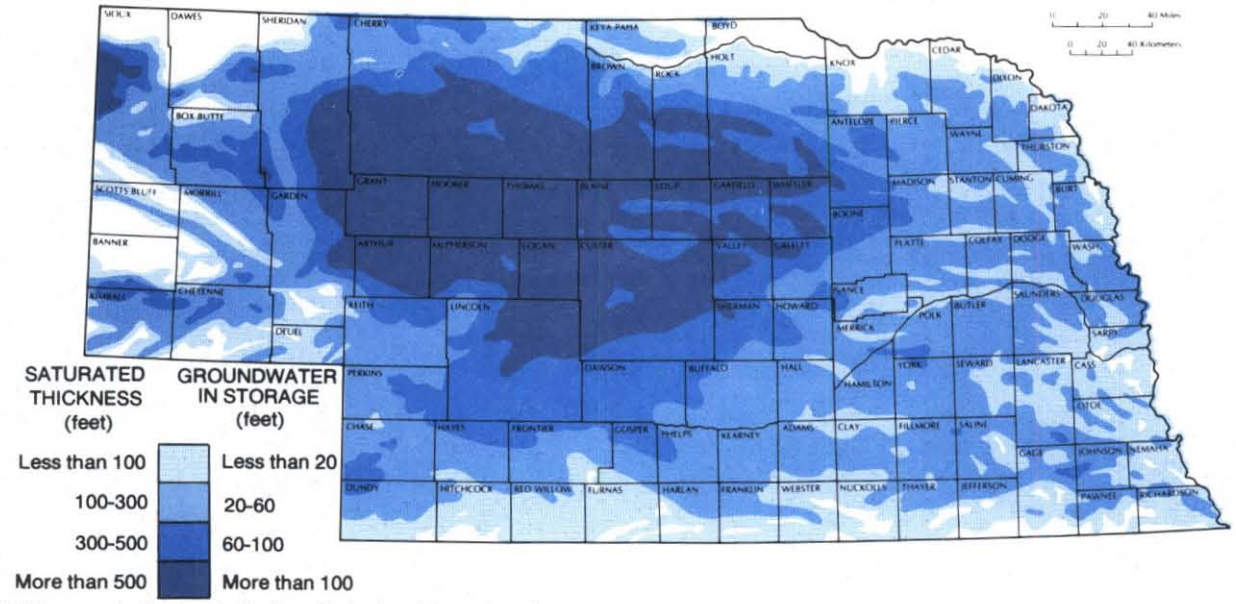
The quality of the water available is as important as the amount. The ground water in Nebraska is generally of good quality and is suitable for most uses. During the past 20 years, quality has been deteriorating in some areas, primarily due to increasing nitrate levels.

Ground water contains varying concentrations of a wide variety of dissolved inorganic chemicals, such as nitrate and phosphate. The concentration of total dissolved solids (TDS) in ground water across the state is shown in Figure 2-4. The EPA has established a recommended concentration limit for TDS of 500 milligrams per liter (mg/l) in drinking water.

Natural lakes and wetlands found in the sandhills region of Nebraska are important to the region's environment.

Figure 2-3

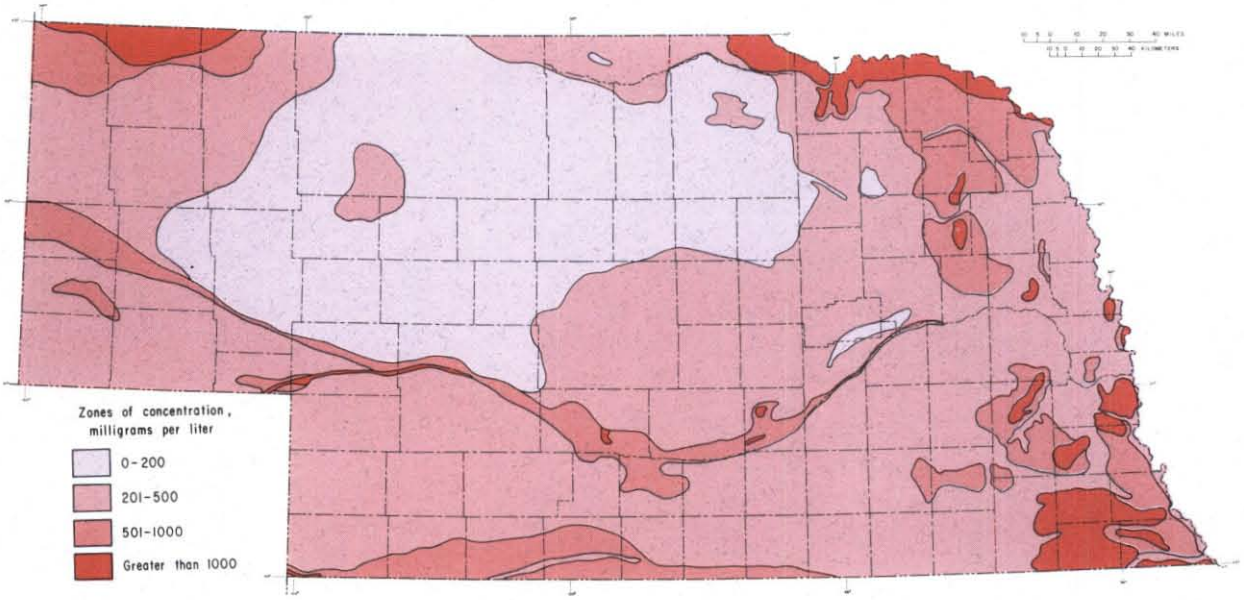
SATURATED THICKNESS OF THE PRINCIPAL GROUND WATER RESERVOIR



Source: Conservation and Survey Division, University of Nebraska-Lincoln

Figure 2-4

CONCENTRATIONS OF TOTAL DISSOLVED SOLIDS IN THE PRINCIPAL GROUND WATER RESERVOIR



Source: Conservation and Survey Division, University of Nebraska-Lincoln

Table 2-4 provides information on the ground water used in irrigation, public water supplies and self-supplied industries in Nebraska. Ground water supplies 55.7 percent of all water used in the state. It was estimated that 94 percent of the ground water used in 1985 was used in agriculture.

Since 1960, the amount of ground water used for irrigation increased dramatically from 1.7 to 5.8 million acre-feet per year. The number of irrigated acres increased just as dramatically.

In 1985, 84 percent of the public water supplies in Nebraska were pumped from ground water. Use of ground water for public supplies has been increasing steadily since 1960.

Self supplied domestic use and industrial use was almost entirely from ground water. Domestic use was only 0.4 percent of the total water used in 1985.

RECHARGE

Ground water and surface water are part of a dynamic system. Ground water in storage continually changes as some is lost to evapotranspiration, streams, and wells and is replaced by recharge. Without replacement, the water table level would show steady decline.

Quantity of Recharge

Ground water is recharged by water infiltrating the soil and percolating beyond the root zone to reach the water table. The most important source of water for recharge is rainfall and snow melting on the overlying land. Irrigation also provides a source of recharge. Deep percolation of water applied to irrigated fields is one source. Another is seepage from supply canals. Recharge from canal seepage has resulted in significant water table rises in several locations. Seepage also occurs from some streams, lakes, and wetlands.

Table 2-4
ESTIMATED GROUND WATER USE
(in 1,000 acre-feet/year)

Year	Irrigation	Public Supply	Industrial Self Supplied
1960	1,681.5	134.5	49.3
1965	1,793.6	123.3	47.1
1970	2,981.8	172.6	113.2
1975	5,885.2	250.0	139.0
1980	7,526.4	265.7	46.3
1985	5,829.2	234.3	242.2

Quality of Recharge

As water percolates through the soil to recharge the ground water, it can leach various contaminants from the soil. In Nebraska, agricultural chemicals are the primary concern. Nitrate contamination from fertilizer is the biggest problem, and it is still being studied intensively. One study in the sandy soils of the Sandhills found that nitrate moved downward at a rate of seven feet per year.

Contamination by pesticides is not as great or as widespread. Evidence suggests that atrazine leaching can be correlated with nitrates. Several well samples showed traces of atrazine were reaching the ground water, but very few samples exceeded the health advisory level of 3 ppb. Alachlor was second to atrazine in well sample detection frequency.

WATER CONSERVATION PAST AND PRESENT

Water can be conserved by saving precipitation that falls on the land, storing runoff in reservoirs, and by improving efficiency of use. Many soil and water conservation practices have been used for years to store more precipitation in the root zone and reduce the amount of irrigation water required. Farm ponds and reservoirs have also been used to store runoff for later use. Improvement of efficiency of water use, especially in irrigation, has not been as prevalent until recently.

Improvement in water use efficiency can be achieved through runoff control and irrigation scheduling and management. Capturing runoff in reuse pits allows reuse of the water, reducing losses and the amount that must be pumped from the aquifer, and allows recharge to the aquifer. Surge valves and cablegation have been shown to improve water use efficiency also.

Irrigation scheduling and management practices are now available that will conserve energy as well as water. An energy conservation project in Buffalo County investigated irrigation scheduling and determined that between 4.2 and 6.2 inches of water were needed to grow corn in the area. Farmers were using 5.2 to 41.4 inches of water per year, much of which was resulting in excessive runoff or deep percolation. Irrigation scheduling through the use of management techniques and flow meters was credited with significant water and fuel savings.

Ground Water Control Areas can be created by the DWR at the request of a NRD. In a control area a NRD has the authority to manage water use to meet their aquifer life goal. Control options include minimum well spacing, a moratorium on new wells, and other reasonable regulations. Currently, the Upper Republican, Upper Big Blue, and Little Blue NRDs have control areas.

The Upper Republican NRD has a fully operational ground water control program to extend the life of their aquifer. Restrictions on area irrigators include: required flow meters, pumping limits of 75 inches in 5 years, and minimum well spacing. Among the farmers in the district, changes in management strategies were much preferred to the expense of system modifications as the means for conserving water.

Ground Water Management Areas (GWMAs), similar to the control areas designed to maintain ground water quantity, can be established by NRDs to maintain either quantity or quality. Ground water quality is maintained through best management practices (BMPs). These include irrigation scheduling, agricultural chemical application timing, and other agricultural chemical management. Education and training activities can also be required. The Central Platte and Tri-Basin NRDs currently have GWMAs to maintain water quality.

Special Protection Areas (SPAs) may be created by the DEC at the request of a NRD. A NRD has more authority in a SPA than a GWMA to maintain and protect water quality from nonpoint source pollution. Protection is based on BMPs, and other reasonable regulations may be employed. A SPA has been established near Superior to control nonpoint source nitrate contamination of the ground water.

WATER USE PROBLEMS AND CONSERVATION NEEDS

Water from several sources, including precipitation, streamflow and ground water, is often managed improperly. Runoff is greater where precipitation falls on unprotected or inadequately treated land. Increasing runoff increases the chance of picking up the unprotected soil particles to produce sediment in the water. Some of this sediment is deposited elsewhere in the field, or in ditches and roads. The rest of this once-productive soil remains in the water as suspended sediment—the most common surface water pollutant in Nebraska. It damages lake ecosystems by reducing water quality. It also reduces hydroelectric power production and recreational potential.

Sediment causes more problems by carrying other pollutants into waterways. These include organic compounds, nitrogen, phosphorus, pesticide residue, and pathogens. These pollutants make water less desirable for municipal supplies, recreation, in-

Soil erosion and the deposit of sediment damages the environment in many ways.

dustrial consumption and cooling, and aquatic wildlife. Surface water pollution due to runoff and pesticide drift has caused fish kills in the past. Public use of many of our streams, lakes, and reservoirs is limited or denied due to pollution by sediment.

Where unprotected land causes more water to run off, less water is left to soak into the soil. This reduces the amount of soil moisture in the root zone for plant use. If irrigation water is required on crops and lawns to make up for this lost moisture, there will be greater demands on the other sources, streamflow or ground water. Inefficient irrigation which loses water to seepage and evaporation also increases the amount of water that must be diverted or pumped.

Mismanagement of precipitation can cause crop stress, reduced yields, and reduced income. On irrigated lands, more water must be applied to make up for the water that runs off. If irrigation is mismanaged, the damage is compounded. Over-irrigating not only wastes valuable water and increases erosion, it also uses more energy, which increases the irrigator's costs. If the source is ground water, excessive pumping can cause depletion of the ground water supply, which lowers the water table. This costs the irrigator even more because water must be pumped from greater depths and wells may need to be deepened. Over-irrigation can also add costs by leaching fertilizer and pesticides out of the root zone, wasting valuable agricultural chemicals.

Nitrates and pesticides leached below the root zone may move downward into the ground water and pollute the drinking water supplies of nearby farms and towns. Nitrate levels exceeding the Department of Health's safe drinking water standards have been measured in the water supplies of more than 30 Nebraska communities. In some cases, wells have been shut down, and the communities have had to find new drinking water supplies.

Surface Water Shortages

Surface water shortages that affect the amount of water available for irrigation or instream flows occur under normal climatic conditions. For example, Enders Reservoir has had over 20 consecutive years with below normal inflows. From 1977 to 1986, the water supply available from Box Butte Reservoir also was below average.

Under drought conditions, surface water shortages increase and affect the whole state. In the 1930s, irrigators suffered severe shortages. In 1936, water shortages began during late April and continued throughout the growing season. During the drought of 1974 through 1976, many streams in northern and eastern Nebraska had no flow for periods long enough to destroy their fishery value.

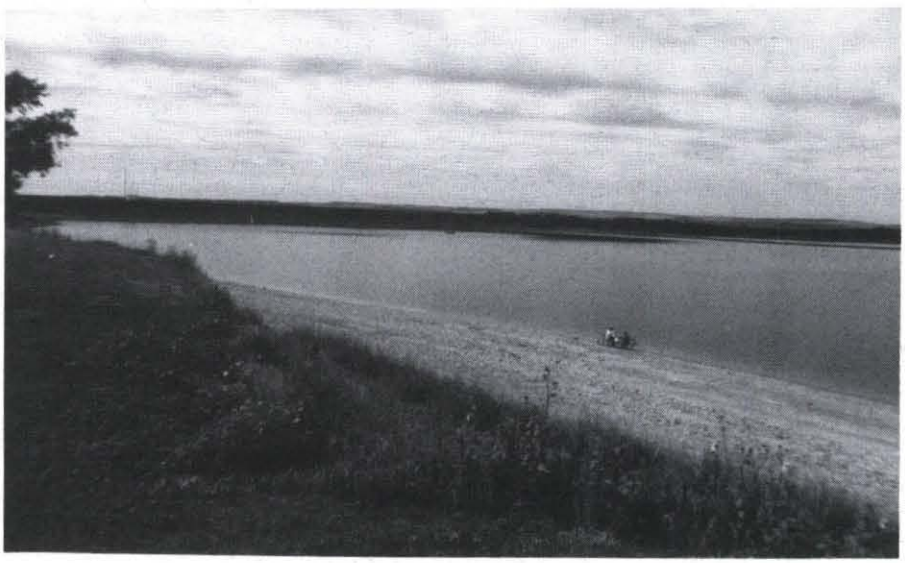
The area of lakes and reservoirs in Nebraska was reduced by over 50 percent in both 1934 and 1936. Surface water area in the state before 1941 averaged 640 square miles. In 1934 and 1936 this area was reduced to about 300 square miles.

Surface Water Inefficiencies

Very little data is readily available on the efficiency of surface water use in the state. Much of the use is for irrigation, and data is available only for a few projects. For seven of the U.S. Bureau of Reclamation projects, delivery losses in the 1970s and 1980s averaged from 31 percent to 54 percent, and ranged up to 65 percent. Reclamation projects are among the best designed and maintained in the state, so losses from others could easily exceed 54 percent.

Seepage from reservoirs and canals as well as irrigated land has caused problems by raising the water table in the area. In

Surface water shortages at Box Butte Reservoir affect the amount of water available for irrigation, recreation, and fish and wildlife enhancement.



some locations the water table has risen so much that basements have been flooded and croplands water-logged.

Many of the irrigation projects in Nebraska, especially in the Platte and North Platte River basins, date back to the turn of the century, or earlier. Some of their facilities have been well maintained, and a few have been rehabilitated with federal or state funds. Many are still in need of extensive rehabilitation.

Abandoned wells not properly sealed can become a point source for ground water pollution.

Surface Water Pollution

Sediment is the most widespread pollutant in Nebraska surface waters. This problem is greater in eastern Nebraska because it has soils with finer particles, which results in more sediment delivery to streams. Higher pesticide concentrations are also found in eastern Nebraska surface waters than the rest of the state, because of the greater number of farms and urban areas.

Ground Water Overdraft

Changes in ground water levels occur over time due to natural shifts in the recharge/discharge balance and also from variations in seasonal and yearly climate. These changes are small compared to rises and declines caused by development of Nebraska's water resources.

Significant declines have occurred in some areas where development of ground water for irrigation has been intensive. Problems include depletion of the aquifer, increased pump lifts, potential reduction in streamflow due to reduction in ground water discharge to the stream or induced aquifer recharge from the stream, and possible loss of lakes and wetlands as water tables decline.

Subirrigated meadows are important sources of hay production in the Nebraska Sandhills. The potential for loss of these subirrigated areas makes declines in the water table due to excessive pumping of ground water a concern to local ranchers. Studies have shown that a permanent decline in the water table of just two feet would cut hay production in half on many subirrigated meadows in the Sandhills. A permanent decline would also decrease wetlands and associated habitat.

Ground Water Pollution

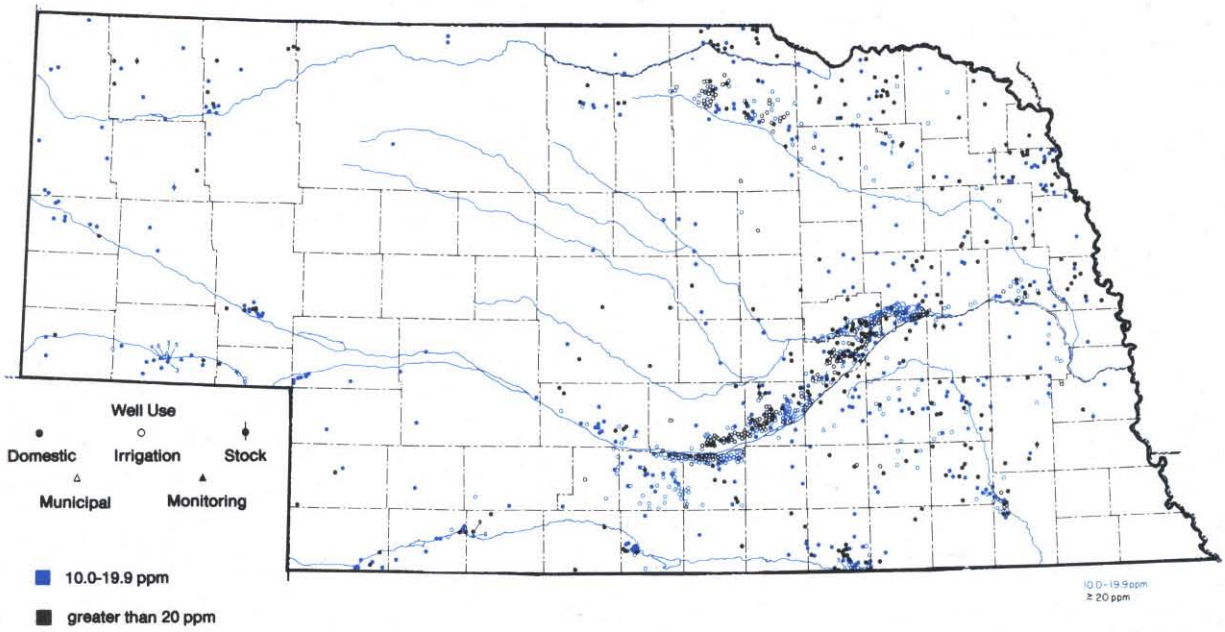
There are two types of ground water pollution sources: point and nonpoint. Abandoned wells, poorly sited wells, and those not constructed to current standards can often be point sources of pollution. Leaky underground storage tanks, chemical spills, back-siphoning events, and landfills are other potential point sources.

Nonpoint source pollution is from widely distributed sources, including fertilizer and lawn chemicals. Nitrate is the most common ground water contaminant. In areas vulnerable to nonpoint source pollution, nitrate concentrations in the ground water are increasing. Problem areas are also increasing in size and number. Figure 2-5 shows the areas with elevated levels of nitrates. At this time, it is not known if atrazine levels are increasing.

Some aquifers have greater potential for contamination than others. Over 50 percent of wells with nitrate-nitrogen concentrations greater than 10 parts per million (ppm) are found in areas where at least 10 percent of the land is in irrigated corn and the depth to water is less than 50 feet. The central Platte River valley exemplifies the conditions that make an area vulnerable to nonpoint source pollution. It is intensively cropped with irrigated corn, has a high water table, and the

Figure 2-5

NITRATE-NITROGEN CONCENTRATIONS ABOVE 10 PPM



Source: Water Center, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln

soils are well drained to excessively well drained.

Leaching potential of nitrate and other agricultural chemicals can be influenced by tillage practices and chemical application methods. Conservation tillage on fine textured soils tends to increase retention and infiltration of precipitation, leading to a higher leaching potential if excess chemicals are applied. Incorporation of agricultural chemicals reduces the chance of having it carried away by runoff, but increases the potential for leaching to ground water.

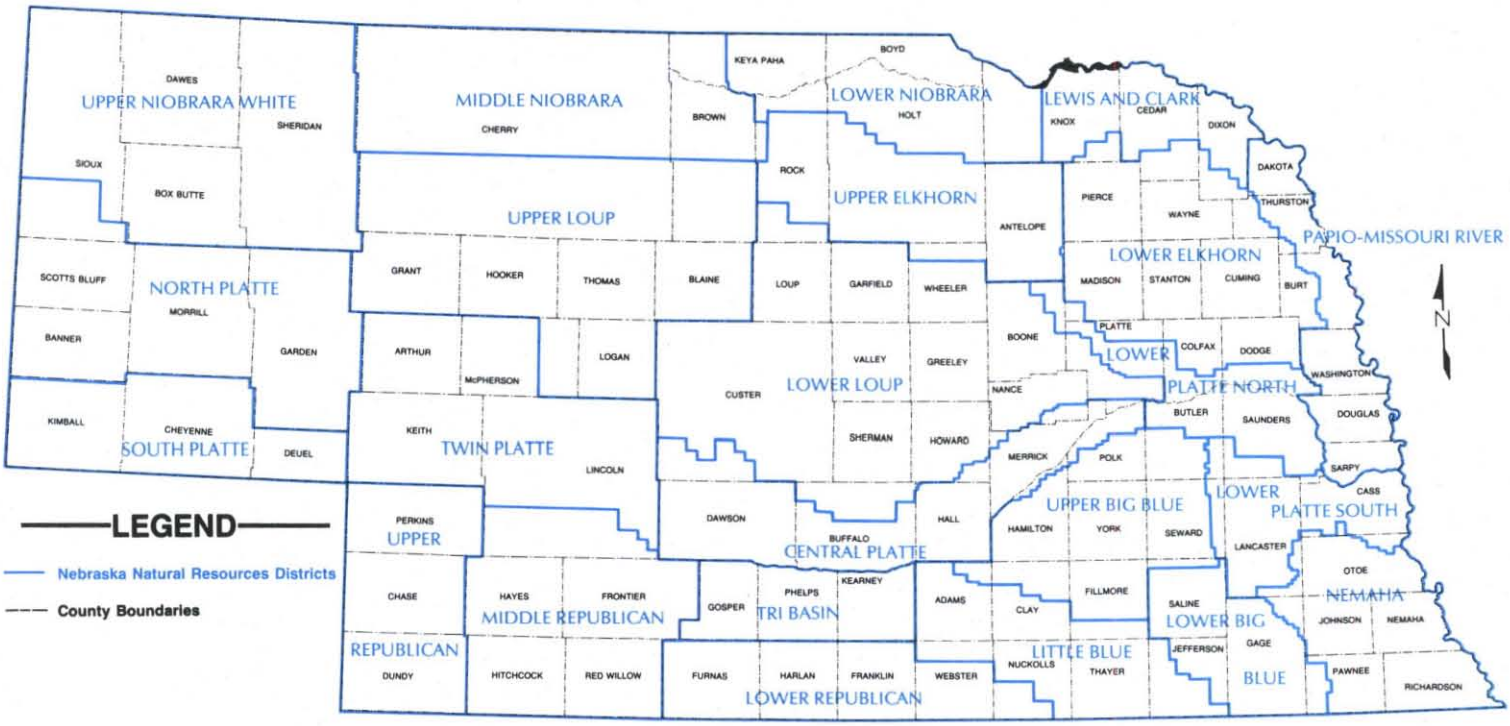
HUMAN RESOURCES AND CONTRIBUTIONS

Resource conservation and environmental protection are carried out by the people who own and operate farms and ranches with the aid of people in private organizations and government agencies. Federal, state, and local agencies supply many different types of funding, educational assistance, and technical assistance to land owners and operators in Nebraska.

CONSERVATION AGENCIES

At the local government level, the NRD is the principal conservation agency. At the state level, the NRC and the Conservation and Survey Division, Cooperative Extension Service, and Agricultural Research Division of the University of Nebraska-Lincoln work with the public on conservation of soil and water. At the federal level, the U.S. Department of Agriculture's SCS, ASCS, and Agricultural Research Service have been the leaders. Agencies

Nebraska Natural Resources District Boundaries



NRD OFFICE LOCATIONS

Upper Big Blue NRD
105 Lincoln Ave.
York, Nebr. 68467

Lower Big Blue NRD
805 Dorsey Street
Beatrice, Nebr. 68310

Upper Elkhorn NRD
128 No. 6th, #3
O'Neill, Nebr. 68763

Lower Elkhorn NRD
700 West Benjamin Ave.
Norfolk, Nebr. 68701

Little Blue NRD
2nd & Main Street
Davenport, Nebr. 68335

Upper Loup NRD
1st & Main
Thedford, Nebr. 69166

Lower Loup NRD
Hadar Ind. Park
Ord, Nebr. 68862

Lewis & Clark NRD
116 No. Broadway
Hartington, Nebr. 68739

Papio-Missouri River NRD
8901 South 154th St.
Omaha, Nebr. 68138

Nemaha NRD
125 Jackson Street
Tecumseh, Nebr. 68450

Upper Niobrara-White
807 East 3rd Street
Chadron, Nebr. 69337

Middle Niobrara NRD
526 East First St.
Valentine, Nebr. 69201

Lower Niobrara NRD
P.O. 350 Courthouse Block
Butte, Nebr. 68722

North Platte NRD
1054 Rundell Road
Gering, Nebr. 69341

South Platte NRD
551 Parkland Drive
Sidney, Nebr. 69162

Twin Platte NRD
215 South Jeffers
North Platte, Nebr. 69103

Central Platte NRD
215 North Kaufman
Grand Island, Nebr. 68801

Lower Platte North NRD
P.O. 126 Commercial Park Rd.
Wahoo, Nebr. 68066

Lower Platte South NRD
3125 Portia Street
Lincoln, Nebr. 68501

Upper Republican NRD
135 West 5th Street
Imperial, Nebr. 69022

Middle Republican NRD
P.O. 81 220 Center Street
Curtis, Nebr. 69025

Lower Republican NRD
P.O. 618 Courthouse
Alma, Nebr. 68920

Tri-Basin NRD
1308 2nd Street
Holdrege, Nebr. 68949

at all three levels often cooperate with one another to provide all the needed elements for managing soil and water resources. These activities include providing technical assistance, research, and demonstration projects; furnishing public information; assisting with education in schools; promoting a sense of stewardship; and furnishing funding as an incentive for resource management.

INFORMATION AND EDUCATION ACTIVITIES

The federal Agricultural Research Service and the Agricultural Research Division of the University often cooperate in research and demonstration projects. Public information programs are administered by the Cooperative Extension Service, the SCS, and the NRDs. These agencies also provide materials that are used by teachers to educate school children. The SCS provides most of the technical specifications and technical assistance for installing conservation practices. The Nebraska Forest Service is responsible for some aspects of land conservation practices.

INCENTIVE PROGRAMS

Four resource agencies provide cost-sharing funds as an incentive to apply conservation practices. Some of these practices require no more than management of crops, equipment, or techniques, and cost little. Others involve land shaping and construction and are very expensive. For an individual farmer, it could take as long as 15 to 20 years for the benefits to equal the costs of some practices. Public expenditures to share those costs are appropriate because of the long term cost to society from lost agricultural productivity and off-site damages from runoff and sediment.

Teacher workshops are used to help inform Nebraska teachers on ways to incorporate resources information into a wide spectrum of elementary curricula.

Funding for cost-sharing programs is provided by local, state, and federal agencies. At the local level, 16 of Nebraska's 23 NRDs now provide local funds for cost-sharing on conservation practices. In 1985, this assistance amounted to $2.3 million. State financial assistance has been provided through the NRC since 1977. In fiscal year 1985, this assistance amounted to $1.4 million. The ASCS has provided cost-sharing funds to individuals as an incentive for applying conservation practices since the 1930s. In 1985, this source of assistance amounted to $5 million. The SCS provided $1.5 million that year to cost-share with landowners in organized watershed projects and in the Great Plains Conservation Program.

PROGRAM NEEDS

The original Strategy addressed a number of program needs. Many have already been resolved, but changing conditions require new programs and flexibility in existing programs. At least three trends related to conservation programs have emerged: (1) a decrease in Federal funding for programs and projects, (2) a shift in emphasis from soil conservation to water conservation and water quality, and (3) linkage between farm program benefits and conservation practices.

Experience has proven the need for government participation in soil and water conservation and water quality programs. Since areas causing the problems may not be the areas suffering and those areas with water quality problems may not have the money needed to correct the situation, government intervention is appropriate. The reduction in Federal assistance makes it necessary for the state and local districts to do more.

Timely, detailed information is needed by state and local agencies to better manage the resources. Orthophoto quad maps, global referenced surveys, Geographic Information System (GIS) software, slide scanners, map scanners, high speed electrostatic plotters and computer hardware are all necessary components to increase the quality of information available to state agencies, NRDs, and local government planners. Coordination of system development is needed to facilitate information access, standardization, quality control, and compatibility of hardware and software. Hardware acquisition would include upgrades to computer workstations, creation of a local area network, acquisition of a state orthophotographic data base with global referencing, and development of a slide scanning process for ASCS landuse data.

Many good programs have been started locally to conserve water quality and quantity in the state. However, local resources are often very limited, so programs are not always as extensive as they could be. Revision of NRDs' authorities and more state assistance are needed to protect the quality of the soil and water of the state.

As water quality issues have become more important, concern has been expressed that the Ground Water Management and Protection Act does not provide adequate authority for water quality protection. Changes in state law are needed to strengthen the authority to establish management areas for water quality protection.

Chapter 3
GOALS AND OBJECTIVES

Goals are clear statements describing an intention or direction. They are by definition forward looking. They set the stage for defining objectives that integrate natural resources management; respond to national, state and local issues; and define information, monitoring, and evaluation needs. In addition, they provide planning guidance for program budgets.

Objectives offer a sharper focus to the goals and provide benchmarks to measure progress. They also serve as reference points to update the action items. As such, objectives bridge the gap between goals and action items and lead to recommendations for executive, legislative and administrative action.

GOAL #1: CONSERVE SOIL AND WATER

Objectives:

1. Complete 80% of remaining treatment needs (1985 base) by 2010.
2. Reduce soil loss on all lands to T by 2025.
3. Develop and implement a State Drought Plan.
4. Improve water use efficiency.
5. Develop and implement erosion and sediment control standards for roadsides and urban areas.

Traditional soil and water conservation practices need continued support and consistent application throughout the state. As a complement to conservation on agricultural land, additional emphasis on conservation programs is needed along county roadsides and in urban areas to control erosion and sediment. Water use efficiency and development of a drought plan will enhance the state's ability to weather the vagaries of nature. Water use efficiency can be improved by precipitation management for dryland and irrigated crop production. Improved irrigation water management on 3.3 million acres of irrigated land would also improve water use efficiency.

GOAL #2: PROTECT AND ENHANCE WATER QUALITY

Objectives:

1. Develop technical specifications for water quality best management practices (surface and ground water).
2. Promote the application of water quality best management practices (surface and ground water) and develop a field guide and other educational materials for local cooperators.
3. Support the Section 319 nonpoint source (NPS) program, plans and projects.
4. Develop and implement wetlands management programs.

Technical specifications for water quality BMPs to protect surface water and ground water will give the NRDs and state agencies a standard to apply when dealing with soil and water conservation projects. These standards, promotion efforts to accelerate adoption, and the Section 319 Nonpoint Source Pollution Program are complementary efforts. Currently there are numerous demonstration projects and water quality efforts across the state that should be coordinated and vigorously supported.

As part of that effort, wetlands protection needs to have a higher priority. Whether approached with an education program, a water bank program, permanent easements, acquisition, or long term cost-share, the continued degradation of the state's wetlands needs to be addressed.

GOAL #3: PROMOTE FORESTRY MANAGEMENT

Objectives:

1. Develop and implement a forestry program for water quality.
2. Accelerate forestry practices for soil and water conservation.
3. Increase the number and productivity of timber stands.

Forestry is an integral part of soil and water conservation. Forest management has an impact on water quality and produces an economic, esthetic and wildlife benefit. The intent of this goal is to heighten awareness of urban and rural forestry and encourage both monetary and programmatic support for timber stand improvement. Initiative by the state will complement federal programs and efforts by various forestry groups.

GOAL #4: PROTECT AND ENHANCE WILDLIFE HABITAT

Objectives:

1. Protect existing wetlands values.
2. Promote the wildlife habitat component of soil, water and forestry management programs.

A national policy of no net loss of wetlands is being implemented by federal agencies. Program and financial support by state agencies and NRDs can add to the federal effort. The activity may promote wildlife habitat, flood control, water quality or prevent of soil erosion. Wildlife habitat enhancement needs to be an integral part of current programs.

GOAL #5:
INCREASE THE AVAILABILITY, TIMELINESS, DETAIL, AND QUALITY ASSURANCE OF NATURAL RESOURCES INFORMATION

Objectives:

1. Provide information on drought conditions and management options.
2. Improve the level of detail of the state map base and map products.
3. Accelerate the production and distribution of computer maps and map products.
4. Establish an interagency system to coordinate the development and dissemination of natural resources information.
5. Develop a state-federal agency forum to address geographic information system and mapping requirements.

Timely production of maps with the necessary resources data and interpretations is essential to improve the management of the natural resources of Nebraska. The purpose of digitizing and scanning information, processing it with a GIS, and connecting users with a computer network is to improve baseline information about the state's natural resources and make it available to all levels of government. The information is an aid to decision makers managing Nebraska's natural resources.

To improve the process, better coordination between and by state and federal agencies with a state GIS coordinating organization would increase efficiency, improve data collection and sharing, as well as avoid costly duplication of services. A GIS subcommittee of NIDCAC (Nebraska Intergovernmental Data Communications Advisory Council) has been making progress on some of these issues. Accelerated coordination, however, is required between state, federal and local agencies.

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Chapter 4
RECOMMENDATIONS

Legislative Recommendations

It is recommended that the Legislature:

- Increase appropriations to the Nebraska Soil and Water Conservation Fund for cost-sharing with landowners to $4.8 million per year.
- Appropriate funds to contract with NRDs to expand technical assistance in the areas of soil and water conservation and water quality protection.
- Increase appropriations to the Nebraska Natural Resources Development Fund to satisfy all actual needs identified during the budget and appropriations process.
- Authorize and fund a drought information system established and operated by the University of Nebraska.
- Authorize and fund a nonpoint source pollution abatement fund with an initial annual appropriation of $500,000 administered by NRC and DEC.
- Amend the statutory authorities of the Soil and Water Conservation Fund to authorize the use of funds for water quality practices and wetlands enhancement and increase the fund to meet these additional authorized practices.
- Enact legislation to require state agencies and political subdivisions to control roadside erosion.
- Amend the Sediment and Erosion Control Act to remove the exemption for construction activities in urban areas.
- Amend the Ground Water Protection Act to clarify and strengthen NRD authority to protect the quantity and quality of ground water.

Executive Recommendations

It is recommended that the Governor:

- Adopt the Soil and Water Conservation Strategy as the policy of the State of Nebraska for natural resources management.
- Budget the necessary funds to attain the goals of the Soil and Water Conservation Strategy.
- Advocate interagency coordination and cooperation to implement the Soil and Water Conservation Strategy.

Administrative Recommendations

It is recommended that agency directors:

- Adopt and implement the Soil and Water Conservation Strategy as part of the agency's policy and operations.
- Budget the necessary funds to attain the goals of the Soil and Water Conservation Strategy.
- Coordinate and cooperate with other agencies to implement the Soil and Water Conservation Strategy.

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Chapter 5
1990 UPDATE ACTION ITEMS

Education in Schools

- Provide scholarships for teachers to attend conservation workshops and environmental training sessions.

Public Information

- Establish a one-stop conservation and environmental information and referral center.
- Develop educational materials to promote tree planting and forestry practices.
- Develop programs to promote the eco-fallow concept where applicable.
- Strengthen the water quality education programs in local, state, and federal organizations.
- Develop more detailed and timely information on drought conditions and related management options and a distribution system.
- Develop an interagency effort to expand and promote the Conservation Neighbor-to-Neighbor Program.
- Promote the implementation and maintenance of non-structural conservation practices to complement structural practices.
- Develop and continue information programs to promote the maintenance of existing practices.
- Develop a fertilizer management information program for use with pesticide certification and training programs.

Research

- Arrange an inter-agency cooperative research seminar.

Incentives

- Provide adequate funds through the NSWCP to meet the Strategy goals by the year 2010.
- Enact legislation to provide state funding for additional conservation technicians.
- Increase funds to the Natural Resources Development Fund to meet districts' needs and Strategy goals.
- Develop and fund a soil moisture monitoring system and an AVHRR receiving station to provide more detailed and timely information during droughts.
- Promote conservation practices designed specifically for improving water quality.
- Provide funds for a program administered jointly by NRC and DEC to assist NRDs with construction or cost-sharing of water quality management practices.
- Modify the Nebraska Soil and Water Conservation Program to allow cost-share for wetlands protection and forestry practices having a water quality impact.

Regulations

- Mandate county roadside erosion control.
- Amend the Sediment and Erosion Control Act to include urban areas under mandatory erosion control activities.
- Amend the Ground Water Management and Protection Act to provide clear authority for ground water quality management areas and strengthen NRDs' authorities to protect ground water quality.

Inter-Agency Coordination

- Develop a ground water quality sampling program that NRDs could carry out with DEC assistance that would standardize ground water sampling techniques, methods of analysis, and reporting of results.
- Develop a system for utilizing conservation practices and programs in well head protection areas.
- Establish an interagency task force of federal and state agencies and natural resources and irrigation districts and companies to study surface water irrigation system rehabilitation needs and potential programs, and propose a program for funding improvements.
- Accelerate and enhance forestry practices for conservation, water quality, and timber production.
- Develop wetlands and wildlife habitat policy and program options.
- Accelerate mapping initiatives, promote standardization of mapping, and accelerate placement of map products in the hands of users and decision makers.
- Develop technical specifications for water quality practices for consistent application by agencies of government.
- Enhance informal interagency coordination and sharing of data collection, data use, and multi-user computer access with compatible hardware and software.

Chapter 6
STATUS OF ITEMS IN THE 1986 ACTION PLAN

Education in Schools

Provide for a Conservation Coordinator in the Department of Education.

Completed. *An individual has been designated to coordinate the development of conservation curriculum and other teaching materials.*

Develop Conservation Classes for Vo-Ag and General High School Students.

Completed. *A curriculum outline for Vo-Ag Departments and for the Community Colleges was developed. A follow-up Program Management Guide was completed, covering all aspects of Agricultural education, including soil and water conservation and sustainable agriculture, for junior high and high school.*

Coordinate Teacher Training Workshops.

Completed. *Chadron State College now conducts a workshop similar to the one at Camp Jefferson. Fully utilized, the 2 workshops may be sufficient to cover teacher needs. Promotion of these workshops through the NRDs and colleges should be a continuing activity.*

Promote Outdoor Classrooms and Field Trip Farms.

Completed. *An information file containing instructions on how to conduct an outdoor classroom was sent to each NRD to distribute to area teachers requesting information.*

Provide Teacher Scholarships for Conservation Training Sessions.

Revised. *Some NRDs are providing scholarships and promoting conservation training sessions. Workshop and scholarship information should be made available to teachers colleges.*

Require Conservation Training for Teacher Certification.

Deleted. *This item was found to be infeasible.*

Public Information

Expand the Public Information Activities of the NRC.

Completed. *At this time, NRC staff members are providing information through referrals, participation in the Nonpoint Source Education Committee, and through Husker Harvest Days displays. Adding public information activities in cooperation with SCS and NRDs will be a continuing activity.*

Assemble Speakers Bureau.

Completed. *This item was completed in 1986 and updated in 1987. Further updates were discontinued and local agencies were asked to provide information on potential speakers when the need arose.*

Expand the Cooperative Extension Service's Targeted Energy Program.

Deleted. *Funding was not available to promote this program, but other programs by the CES, SCS, ASCS, and NRDs are accomplishing the same goals.*

Develop Public Conservation Programs for Meetings.

Revised. *The intent of this item was to provide video and slide tape programs to the general public and agricultural related businesses. This will be covered by one of the actions in the 1990 Strategy.*

Develop Computer Technology on Crop Budgets vs. Erosion Control.

Completed. *The SCS and CES have the capability to apply USLE to crop budgets, thereby emphasizing soil loss considerations in farming practices.*

Research

Review Research on Ag Chemical Leaching and Increase if Necessary.

Completed. *A study was conducted by the UNL Water Center and the report "Occurrence of Pesticides and Nitrate in Nebraska's Groundwater" was published. Further recommendations for monitoring were made as a result of the report.*

Collect Data on Topsoil Thickness vs. Production to Demonstrate Value of Topsoil.

In progress. *Currently CES, ARS, and selected SCS district conservationists are cooperating in collecting data. The project will continue until 1994.*

Arrange for an Inter-Agency Cooperative Research Seminar.

Revised. *The purpose of this item was to provide a forum for research agencies and users of research data to state their priorities for research and present a unified effort in the search for funding. This item has been carried over in the 1990 Strategy.*

Evaluate Research for Inclusion in Tech Guides and Conversion to User Form.

Completed. *The SCS and MNTC have reported on their activities related to this item.*

Incentives

Increase the Funds for the Nebraska Soil and Water Conservation Program (NSWCP).

Revised. *The appropriations to the NSWCP was $1.9 million in 1986 and in F.Y. 1990 it was $4.0 million, but dropped back to $3.5 million in 1991. The use of this fund and the use of NRD funds had been steadily increasing up to F.Y. 1990. Gradual increases have worked well, but further progress is essential to meeting the goal.*

Add Provisions to NSWCP for Targeting, Set-a-side Programs and Long Term Agreements.

Completed. *Authority has been provided to utilize these provisions. Set-a-side programs are provided by two NRDs. Long term agreements have not yet been requested by NRDs. The potential to use these provisions if the needs arise should be maintained.*

Raise NRD Taxing Limits to Provide More Funds for Cost Sharing.

Completed. *The limit for NRD tax was raised from $0.035 per $100 valuation to $0.045 per $100 valuation.*

Encourage NRD's to Promote Conservation Tillage.

Completed. *The requirements of the Food Security Act have promoted conservation tillage adoption in many areas.*

Remove Property Tax Inequities for Conservation Farming.

Deleted. *It was found that the difficulty in administering this type of policy would make it infeasible.*

Expand NSWCP to Allow Funding of Practices More Directly Related to Pollution Control.

Continuing. *Cost-share funds have been expanded to include surge-valves, but other practices, including filter strips, could be very effective.*

Regulations

Enact an Erosion and Sediment Control Law.

Completed. *The law has been enacted. The current recommendation is to amend it to include urban areas under the same controls.*

Require Land Treatment above State Funded Reservoirs.

Completed. *The NRC implemented this item by changing policy in 1988 to require 75 percent land treatment above any state funded reservoirs costing less than $10,000,000.*

Restrict the Plowout of Cover on Fragile Soils (Highly Erodible).

Deleted. *Proposed legislation was considered by the legislature in both 1986 and 1987, but it failed, primarily because it was felt that it would duplicate "Sodbuster" under FSA.*

Include the Strategy in the NRD Master Plans.

Completed. *The NRDs substantially completed the requirements of this action item by including the Strategy goals in their Erosion and Sediment Control Plans. Some of them have reinforced the goals in their Master Plan update.*

Mandate County Roadside Erosion Control.

Revised. *A three year educational program was adopted to alert county officials to the problems. The NRDs are responsible for implementing the educational program. Action to make erosion control mandatory is recommended in the 1990 Strategy.*

Enact Legislation to Allow the State to Fund Conservation Technicians.

Revised. *The recommendation is to provide authority to act at this time, and the necessary funds when a threshold in conservation activity is reached.*

Strengthen State and Local Authorities for Groundwater Management.

Revised. *LB 894 strengthened the NRD authorities in 1986. Amendments to the act are needed to clarify and improve it.*

Inter-Agency Coordination

Assign Responsibility for Implementing the Strategy to NNRC.

Completed. *Nearly all NRC promotion of Soil and Water Conservation activities is done in the name of the Strategy, striving to reach the Strategy goals.*

Coordinate Publicity Among Resource Agencies Through the CES Task Force on Conservation Tillage.

Deleted. *The interest in conservation tillage generated by the Food Security Act made additional efforts unnecessary.*

Provide for an Inter Agency Committee to Over See the Strategy.

Completed. *An inter-agency executive committee took part in the development of the Strategy and the update.*

Management of State Owned Land

Encourage a Conservation Policy by Each Managing Agency.

Completed. *The BELF completed this at the time the Memorandum of Understanding was updated in January 1989. The Game and Parks Commission and Department of Roads have standards that encourage conservation.*

Encourage the Board of Education Land and Funds to Develop a Multi-year Conservation Plan.

Completed. *Agreement has been reached and action is expected by January 1991.*

Offer a Variable Lease Period on BELF Land as a Management Incentive.

Deleted. *The BELF determined that is not a workable policy because of a shortage of managers.*

Revise Memorandum of Understanding Among BELF, SCS, and NNRC.

Completed. *This agreement was signed in January 1989.*

Reciprocate Training Sessions.

Completed. *The SCS State Resource Conservationist will hold training sessions and invite BELF managers to SCS meetings as needed.*

Require the Use of Conservation Easements to Protect Conservation Practices on Public Land being Sold to Private Owners.

Completed. *This was implemented in December 1988 on land purchased with Small Watershed Flood Control funds. The BELF indicated that trust laws will not permit them to attach anything to the abstract that could reduce the value of the land.*

Recognize Soil Stewards.

Completed. *Soil stewards are recognized with a pin and certificate by the State. This is now a continuing program.*

Provide Resource Information to Schools of Divinity.

Provide Resource Information to Publishers of Religious Papers.

Completed. *At the State level the NRC action was completed on both, but neither was implemented because funding was not available through the National Association of Conservation Districts.*

Develop a Course of Study for Youth Religious Classes.

Deleted. *The lack of funding through the Inter-Church Ministries in the Lincoln Center prevented implementation of this item.*

NRD's Provide Stewardship Information to Local Clergy.

Completed. *Many NRDs currently include clergy in conservation stewardship promotions and provide information to them for Stewardship Sunday.*