REPORT TO THE CONGRESS

Action Needed To Discourage Removal Of Trees That Shelter Cropland In The Great Plains

Department of Agriculture

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

RED-75-375

JUNE 20, 1975

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-114833

To the President of the Senate and the
Speaker of the House of Representatives

This is a report on the removal of field windbreaks in the Great Plains, the potential problems if removals continue, and actions which the Department of Agriculture should take to discourage removals.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget, and the Secretary of Agriculture.

Comptroller General
of the United States

Contents

ABBREVIATIONS

ASCS	Agricultural Stabilization and Conservation Service
GAO	General Accounting Office
SCS	Soil Conservation Service
USDA	United States Department of Agriculture

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

ACTION NEEDED TO DISCOURAGE REMOVAL OF TREES THAT SHELTER CROPLAND IN THE GREAT PLAINS
Department of Agriculture

D I G E S T

This report is intended to alert the Congress to a developing problem of national interest--the removal of field windbreaks on the Great Plains.

Unless actions are taken to encourage farmers to renovate and preserve existing windbreaks rather than remove them, an important resource which has taken many years to develop could be lost and adjacent croplands could erode and become less productive.

For over 100 years planting trees to form field windbreaks, often called shelterbelts, to help prevent soil erosion has been an important conservation practice supported by the Federal Government.

GAO recommends that the Secretary of Agriculture have appropriate departmental agencies

--survey, especially in the Great Plains, the extent of windbreak removals and the renovation needed to preserve existing windbreaks;

--encourage counties to carry out a cost-sharing windbreak renovation program; and

--initiate an educational program supporting efforts to preserve and renovate existing windbreaks. (See p. 25.)

GAO-compiled information on 16 counties in Kansas, Nebraska, and Oklahoma showed that, although removals in these counties do not represent a serious problem now, the removal rates in some counties warrant concern. (See p. 11.)

Besides, when removals are considered over a longer period and for larger areas, it is

apparent that an important resource is slowly disappearing. (See p. 11.)

Most field windbreaks were being removed to make more land available for production or to install and use irrigation systems. (See p. 13.)

Most farmers and State, Federal, and local conservationists agree windbreaks prevent wind erosion and are still needed in the Great Plains.

Some conservationists, however, believe windbreaks are no longer needed to prevent wind erosion or that the need has decreased because other conservation practices, such as strip cropping, crop rotation, stubble mulching, and emergency tillage, have been introduced.

According to Department officials, however, these practices depend on adequate moisture, correct tillage operations, and proper land management.

Properly planned and maintained windbreaks, on the other hand, remain a permanent protection against wind erosion even during periods of drought when most other conservation practices become less effective. During severe drought periods windbreaks could be the only source of protection against wind erosion. (See p. 15.)

Wind erosion is a problem in the Great Plains. According to Soil Convervation Service statistics, 3.8 million acres in 10 Great Plains States were damaged by wind erosion from November 1973 to May 1974. (See p. 15.)

Some Federal programs encourage planting and routine maintenance of windbreaks. But no Federal or State program exists which is specifically designed to discourage windbreak removals or to assist farmers on a wide scale to renovate old field windbreaks. (See p. 18.)

According to Agriculture officials, a cost-sharing field windbreak renovation program could be implemented under existing legislation. Such a program would be helpful in discouraging farmers from removing field windbreaks. (See p. 20.)

CHAPTER 1

INTRODUCTION

Under a variety of Federal programs over the past 100 years, millions of trees have been planted on the Great Plains. Many of these trees were planted to form either field or farmstead/feedlot windbreaks. Field windbreaks are designed to help reduce wind erosion of agricultural land. Farmstead/feedlot windbreaks are designed primarily to protect farm buildings and livestock.

In recent years, some windbreaks, particularly those planted in the 1930s and early 1940s, have been removed. This has caused concern that continued removals will lead to increased soil erosion. Accordingly, we made this review to determine

--to what extent field windbreaks were being removed,

--why they were being removed, and

--what efforts were being made at the Federal and State levels to preserve this resource.

Our review, which was concentrated on field windbreaks, covered 16 counties in 3 Great Plains States--Kansas, Nebraska, and Oklahoma.

FEDERAL TREE-PLANTING PROGRAMS

The Timber Culture Act (ch. 277, 17 Stat. 605), passed in 1873, offered homesteaders, in addition to the land offered under the Homestead Act, 160 acres of land solely on the provision that they plant trees on 40 acres. Until 1891, when the law was repealed, homesteaders on the Great Plains planted millions of trees.

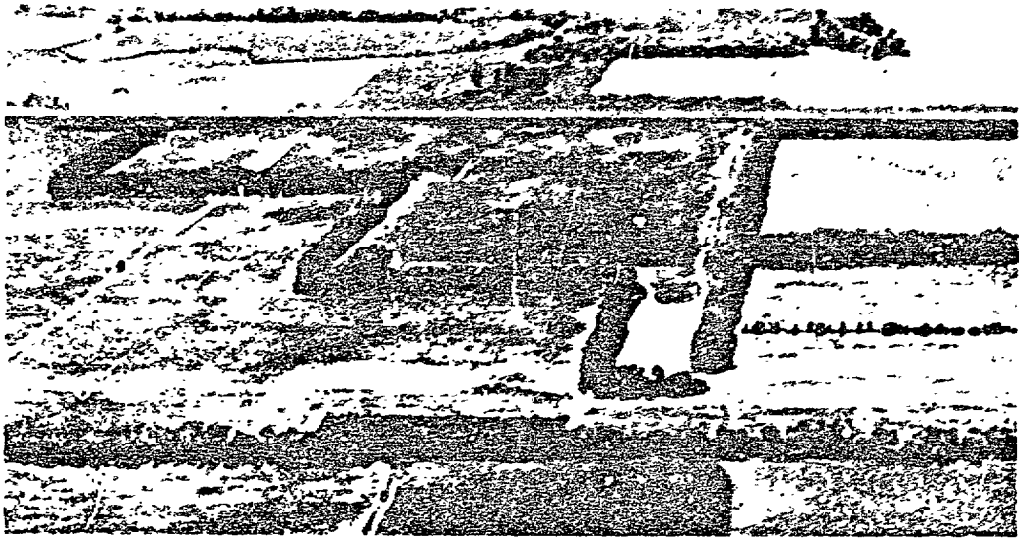
The summer of 1974 was the 40th anniversary of possibly the most important tree-planting project in the Great Plains area. In fiscal year 1935 President Roosevelt established the Prairie States Forestry Project putting Works Project Administration workers and Civilian Conservation Corps boys to work on a project to alleviate the effects of the disastrous drought which was then building up to its dust bowl days.

From fiscal year 1935 through fiscal year 1942, more than 200 million seedling trees and shrubs were planted to form windbreaks on 30,000 farms in 6 Great Plains States (North Dakota, South Dakota, Kansas, Nebraska, Oklahoma, and Texas). These trees and shrubs covered about 238,000 acres.

The windbreaks (often referred to as shelterbelts) were 8 to 21 rows wide and varied in length from a few hundred feet to a mile. Their combined total length exceeded 18,500 miles.

The main purposes of these windbreaks were to prevent wind erosion, protect crops and livestock, reduce dust storms, and provide useful employment for a drought-stricken people. The picture below shows windbreak plantings in one area of Oklahoma.

Two major Federal programs, the Agricultural Conservation Program and the Great Plains Conservation Program administered by the U.S. Department of Agriculture (USDA), provide financial and technical assistance on a cost-sharing basis to help private landowners carry out approved soil and water conservation practices, including planting trees for windbreaks.



Source: Oklahoma State Forestry Division

Prairie States Forestry Project windbreak plantings in Oklahoma.

The Agricultural Conservation Program, called the Rural Environmental Assistance Program from 1971 through 1973, and the Rural Environmental Conservation Program in 1974, was authorized 1/ in 1936. This program, administered by USDA's Agricultural Stabilization and Conservation Service (ASCS), is carried out in the field by State and county committees in the 50 States, Puerto Rico, and the Virgin Islands.

Annual appropriation acts authorizing the program's continuation enable ASCS to enter into agreements with farmers and thereby make cost-sharing commitments on conservation practices for each ensuing year. USDA's Soil Conservation Service (SCS) and Forest Service provide participants with technical assistance on conservation practices. The 1975 program authorizes sharing 50 to 75 percent of the cost of establishing windbreaks.

The Great Plains Conservation Program was authorized 2/ in 1956 as a special program to provide technical and financial assistance to Great Plains farmers who establish soil and water conservation practices. It is intended to supplement other conservation programs, such as the Agricultural Conservation Program. The Federal cost share cannot exceed 80 percent on any one practice. SCS administers the program through State, area, and field offices in the Great Plains States.

The law authorized Federal appropriations of up to $150 million for cost sharing and provided the authority to enter into cost-sharing contracts through 1971. In 1969 the Congress amended the law 3/ to increase appropriation authority for cost sharing to $300 million and extended the time for entering into cost-sharing contracts to December 31, 1981.

1/The Soil Conservation and Domestic Allotment Act, approved Feb. 29, 1936, as amended and supplemented (16 U.S.C. 590g-590o, 590p(a), and 590q), and sections 1001-1008 and 1010 of the Agricultural Act of 1970, as added by the Agriculture and Consumer Protection Act of 1973 (16 U.S.C. 1501-1508 and 1510).

2/Public Law 84-1201, enacted Aug. 7, 1956 (70 Stat. 1115-1117), to amend the Soil Conservation and Domestic Allotment Act, as amended (16 U.S.C. 590 p(b)), and the Agricultural Adjustment Act of 1938, as amended (7 U.S.C. 1334).

3/Public Law 91-118, enacted Nov. 18, 1969 (83 Stat. 194), to amend the Soil Conservation and Domestic Allotment Act, as amended.

Although tree planting for field windbreaks is an authorized practice under the Great Plains Conservation Program, most cost sharing on windbreaks has been done recently under the ASCS program.

RECENT WINDBREAK-PLANTING ACTIVITY

Most recent windbreak-planting activities in the three States we visited involved planting farmstead/feedlot windbreaks, as shown in the following table.

Acres of Windbreaks Planted (note a)

	Nebraska		Kansas		Oklahoma	
	Field	Farmstead/ feedlot	Field	Farmstead/ feedlot	Field	Farmstead/ feedlot
1970	221	4,754	16	430	9	-
1971	198	2,614	22	931	-	-
1972	172	2,483	23	431	76	84
1973	101	1,837	19	1,508	3	102
1974	198	2,300	13	172	-	1

a/Field windbreak statistics were converted from feet to acres on the basis of a 3-row windbreak 1-mile long occupying about 5 acres. Modern windbreak plantings are generally 1, 3, or 5 rows wide.

CHAPTER 2

VALUE OF FIELD WINDBREAKS

Windbreaks are valuable resources which protect soil and field crops and provide environmental and other benefits to humans, wildlife, and livestock. On cultivated fields they reduce wind erosion, improve climatic conditions, and tend to increase crop yields. Windbreaks provide short-term and long-term economic benefits to farmers--short term in the sense that greater crop yields have been found in windbreak-sheltered areas resulting in increased profit to individual farmers. In the long term they help sustain high yields by protecting the thin layer of topsoil in the Great Plains.

DECREASED SOIL EROSION

Various Government and independent studies and experiences on the Great Plains over the past 40 years show that windbreaks achieve their primary purpose of reducing wind velocity and soil erosion. Although wind reduction depends on such factors as the windbreak's width, density, and height, wind velocity can be reduced for distances up to 15 to 20 times the windbreak's height.

The percentage reduction in wind velocity at any particular distance from a dense windbreak is relatively constant and does not depend on the strength of the wind. This does not hold true for the more permeable-type windbreaks. However, more important is a windbreak's ability to reduce some wind velocity below 12 to 15 miles an hour--the velocity above which soils begin to blow. The illustration on page 6, taken from a 1964 USDA study 1/, shows how windbreaks in three different conditions reduced wind velocity.

IMPROVED AGRICULTURAL CLIMATE

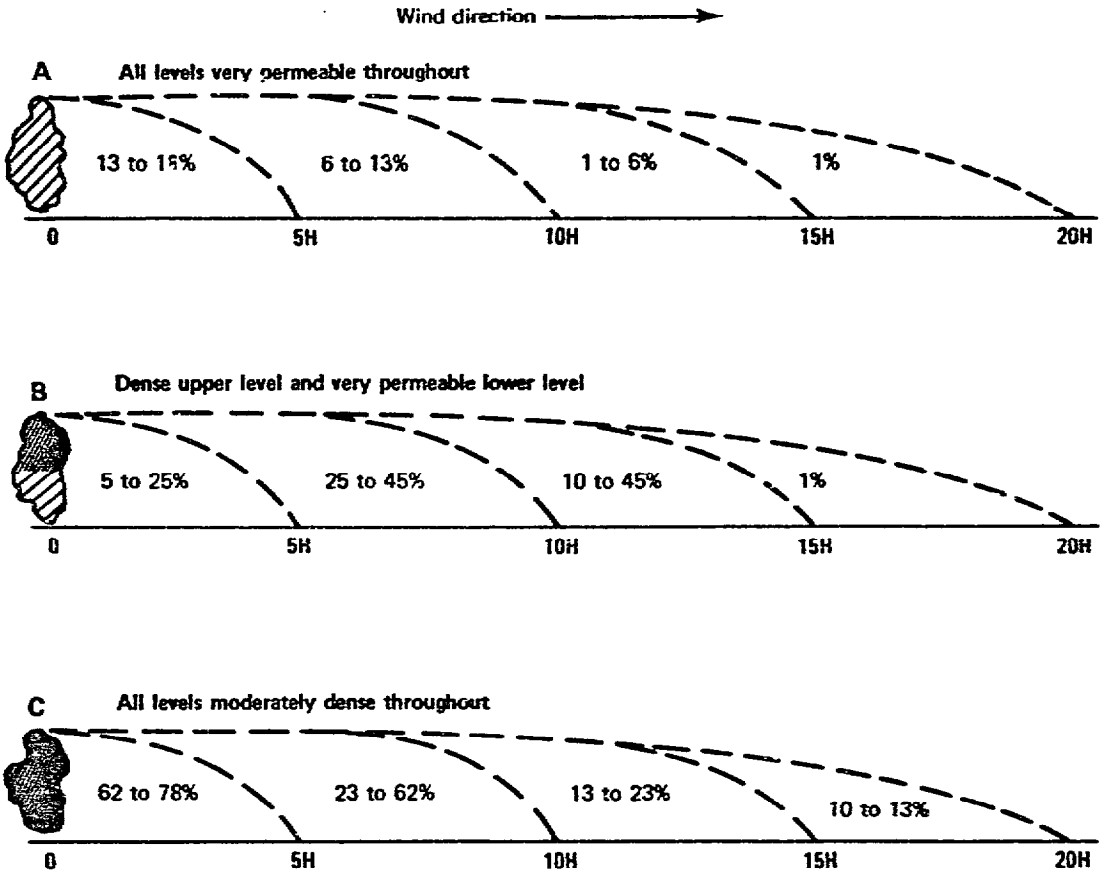
Windbreaks have been shown to have a positive effect on climatic conditions on the agricultural fields they protect. A 1959 study 2/ showed that, in Nebraska, the relative humidity was over 80 percent during half the growing season in

---

1/Ralph A. Read, "Tree Windbreaks for the Central Great Plains," Agriculture Handbook No. 250, Forest Service, USDA, Feb. 1964.

2/Summarized in 1964 by USDA. See above footnote.

Percent of Reduction in Wind Velocity on
Protected Side of a Windbreak



NOTE: Distance is measured in barrier height (H) units; for example, 5H represents 5 times the windbreak's height.

windbreak-sheltered areas while, in open areas, the humidity exceeded 80 percent for only one-third the growing season. Higher humidity helps to increase plant growth. Midday humidity averaged 2 to 4 percent higher in sheltered areas than in open areas.

The table below summarizes the results of a 1962 USDA study 1/ showing how windbreaks reduce evaporation.

Percent of Evaporation Reduction
in Relation to Open Field Controls

Distance from barrier	Evaporation reduction
1H	23%
5H	31
10H	26
15H	12
20H	8

In addition to reducing evaporation on protected fields, windbreaks increase soil moisture by distributing and holding snow, preventing this valuable water source from blowing off fields, and reducing runoff during the spring thaw. Several studies have shown that soils on which spring moisture has been built up due to snow cover generally produce higher yields. The illustration on page 8, adapted from one of these studies 2/, shows the beneficial effect of the moisture buildup from melting snow on wheat yields, particularly in the area 2 to 10 times the barrier height. (See right side of illustration.) Yields were also higher in the area 11 to 20 times the height of the barrier but, according to the study, this increase in yield was not directly attributed to increased soil water or to wind protection.

Other climatic benefits of windbreaks have also been noted. Studies show that windbreaks are effective in modifying soil and air temperatures, especially in the cooler Northern Great Plains areas and during early spring and late fall. Farmers, conservationists, State, and Federal officials said that windbreaks protect

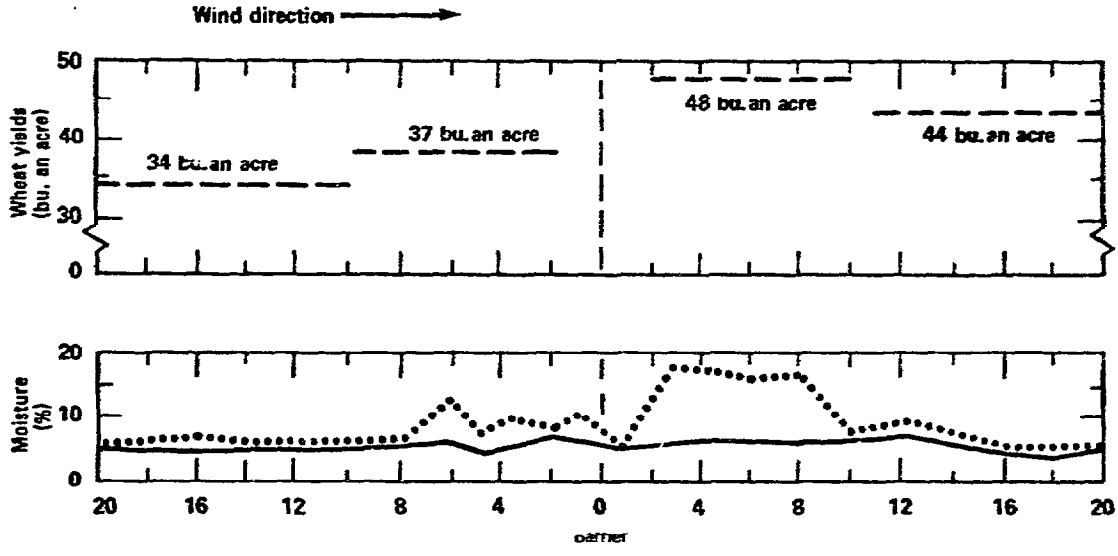
--crops from windburn and wilting during hot, dry spells;

--newly planted seeds from being uncovered and blown away;

1/J.H. Stoeckeler, "Shelterbelt Influence on Great Plains Field Environment and Crops," Production Research Report No. 62, Forest Service, USDA, Oct. 1962.

2/E.J. George, "Effect of Tree Windbreaks and Slat Barriers on Wind Velocity and Crop Yields," Production Research Report No. 121, Agricultural Research Service, USDA, Jan. 1971.

Spring Moisture Buildup From Melting Snow
and Its Effect on Wheat Yields



--young plants from blown-sand damage; and

--mature crops from being blown down and lost.

Farmers in Nebraska and Oklahoma related instances where windbreaks protected fields and saved crops from destruction during severe windstorms and a prolonged hot, dry spell.

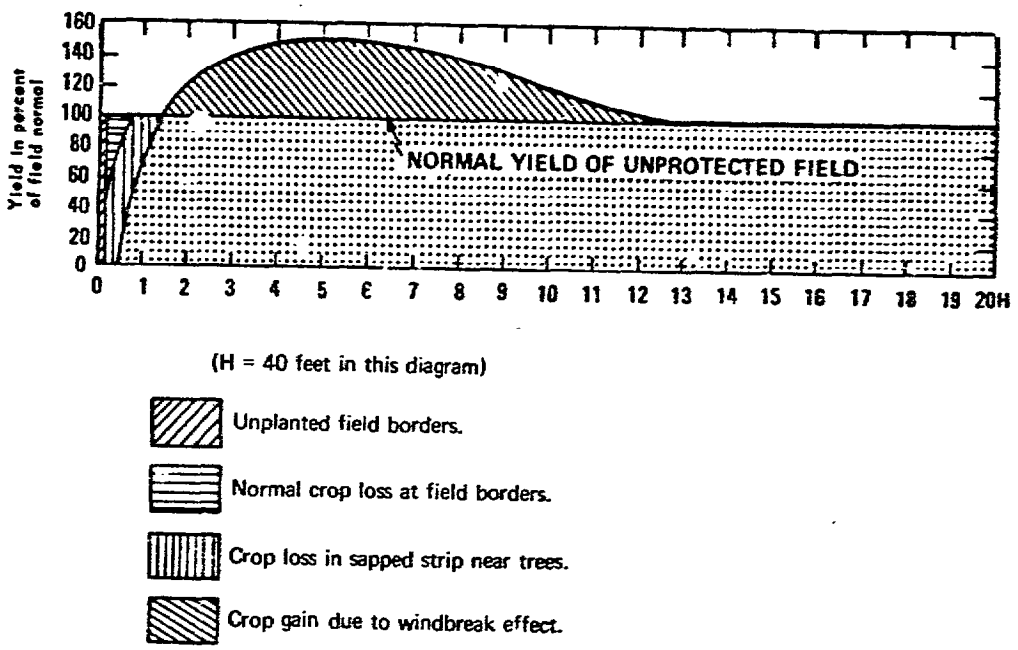
Several individuals also noted that windbreaks improved the efficiency of sprinkler irrigation systems by reducing evaporation and stabilizing the water distribution pattern. Others said that sprinkler irrigation systems used in conjunction with windbreaks resulted in more efficient and effective use of cropland.

INCREASED CROP YIELDS

Government and independent studies have shown greater yields of crops in fields protected by windbreaks than in unprotected fields. In general, the average yield for an entire windbreak-protected field is increased although the

yield on a narrow strip of land next to the windbreak may be reduced due to the trees sapping moisture and nutrients. However, as shown in the following illustration, taken from the 1964 USDA study (see p. 6), this area is small compared with the favorably affected area.

Windbreak Effect on Crop Yield



According to the 1962 USDA study (see p. 7), small grain (wheat, rye, barley, and oat) yields in windbreak-protected areas of high-yielding fields in North and South Dakota showed an average total increase over unprotected areas of 36 bushels per half mile of windbreak. For low-yielding fields in these States, the same crops showed an average total increase in yield in the protected areas of 74 bushels per half mile of windbreak. The study also showed that corn yields in Nebraska averaged 19 percent more in protected areas 2 to 10 times the windbreak height.

A 1955 survey of South Dakota farmers showed that 83 percent of the 331 farmers interviewed estimated increased crop yields on protected fields. Their estimated average increases for specific crops from 1952 to 1954 were

--8-1/2 bushels an acre for corn, oats, and barley;

--3-1/2 bushels an acre for wheat and flax; and

--5-1/2 bushels an acre for rye and soybeans.

Examples of published studies made in other countries on windbreaks' effects on climate and crop yields are in appendix I.

OTHER BENEFITS

Windbreaks also provide environmental benefits, such as producing oxygen, and such other incidental benefits as

--beautification and landscaping;

--small wood products, such as fenceposts and fuel;

--food and cover for wildlife; and

--improvement of living conditions for humans and livestock.

CHAPTER 3

REMOVAL OF FIELD WINDBREAKS MAY BECOME A PROBLEM

Field windbreaks are being removed in the Great Plains. According to available data, the annual rate of removals in most areas is insignificant. When removals are considered over a longer period and for larger areas, however, it is apparent that an important resource is slowly disappearing.

In Kansas, Nebraska, and Oklahoma, windbreaks were removed primarily so more land could be put into production or so irrigation systems could be installed and used. Normal deterioration of trees and poorly maintained windbreaks also lead indirectly to removal.

A USDA nationwide conservation-needs inventory made during 1967-69 showed that 64 percent (278 million acres) of the land used for crops needed conservation treatment, including measures to prevent soil erosion. USDA's report summarized the conservation needs as follows:

> "Although we have abundant soil resources for foreseeable future needs, three-fifths of locally controlled land is not being cared for in a way that protects the soil resource for sustained production."

Recent SCS data shows that soil erosion in the Great Plains is a problem.

WINDBREAK REMOVALS

USDA does not systematically gather or keep statistical information on windbreak removals; however, some Federal and State surveys, have included such information. For example, in 1944 a Forest Service survey of the development of windbreaks planted under the Prairie States Forestry Project showed that 2 percent had been removed by that time. Another survey in 1954 showed that 8 percent had been removed.

ASCS and SCS officials said that information on windbreak removals needed to be gathered and that this could be done with existing staff and resources.

During our review we developed or obtained statistical data on removals in 16 counties in Kansas, Nebraska, and Oklahoma, as shown in the following table. Although windbreak removals in these counties do not represent a serious problem now, the removal rate in some counties is a source of concern.

County	Number standing (note a)	Number removed (note b)	Percent removed	Miles removed	Approximate time frame
Kansas:					
Clay	18	-	-	-	1957-71
Pratt	687	11	1.6	2.3	1963-70
Reno	743	7	1.0	1.6	1963-71
Sedgwick	284	13	4.6	4.9	1963-70
Stafford	996	22	2.2	6.0	1963-70
Nebraska:					
Holt	2,117	165	7.8	35.4	1967-74
Madison	1,240	41	3.3	19.7	1970-74
Merrick	560	20	3.6	4.1	1969-73
Seward	143	19	13.3	5.9	1965-70
Oklahoma:					
Alfalfa	104	3	2.9	.6	1961-73
Caddo (note c)	413	84	20.3	40.5	1935-72
Garfield	104	9	8.7	4.0	1961-73
Grant	107	-	-	-	1954-73
Greer	663	140	21.2	73.0	1935-72
Kingfisher	263	10	3.8	d/26 acres	1964-70
Washita	866	301	34.8	139.8	1935-74

a/Number of windbreaks used in our analysis, except for Oklahoma's Caddo, Greer, and Washita counties, shown on aerial photos at the beginning of the time frame. For these counties, maps showing plantings from 1935 to 1942 were used.

b/Number of windbreaks removed includes those totally removed and those where a large part was removed.

c/Information furnished by Oklahoma State Forestry Division.

d/Data available in acres only.

As shown in the table the highest rate of removal, considering the time frame involved, occurred in Seward County, Nebraska. Of this county's field windbreaks, 13 percent were removed during the 5-year period ended in 1970. No statistical data was available on more recent removals in this county, but farmers indicated that removals were occurring and would probably continue because of emphasis on increased production. Should windbreaks continue to be

removed in Seward County at the 1965-70 rate, this resource will be virtually destroyed over the next several decades.

The table also shows that three Oklahoma counties, Caddo, Greer, and Washita, had lost large portions (20.3, 21.2, and 34.8 percent, respectively) of the trees planted under the Prairie States Forestry Project. Although we did not try to project figures for the entire State, some officials told us they believed the removal rate would be the same or higher in other counties in Oklahoma.

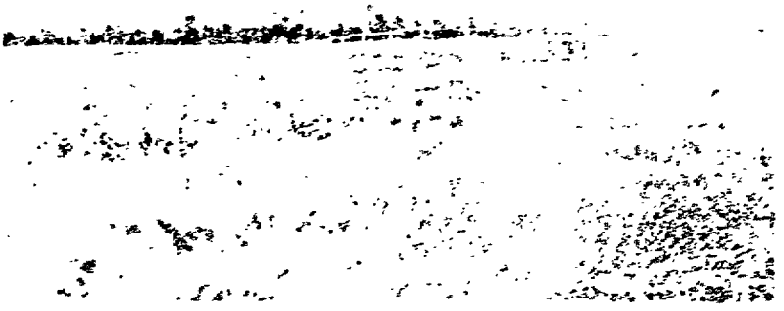
Field windbreaks are not only being removed but emphasis on tree planting to prevent wind erosion appears to be decreasing. USDA officials in Nebraska said that other conservation practices to prevent wind erosion are being emphasized because farmers are reluctant to give up productive land for trees.

Of the three States visited, Oklahoma had the least field windbreak-planting activity. USDA officials in that State said that cost sharing for field windbreaks had been deleted from Oklahoma's 1974 ASCS conservation program, primarily because of a lack of interest in using this practice.

REASONS FOR REMOVALS

According to some farmers, the windbreaks planted under the Prairie States Forestry Project are a nuisance because they occupy too much land and because certain tree species sap so much moisture that crops will not grow next to the windbreak. They believe that high land values and prices of commodities raised on the land offset any benefits received from the windbreaks. One farmer in Oklahoma said that a mile-long windbreak he removed had added about 16 acres to his production. About half of the 16 acres was covered with trees and the other half was land adjoining the windbreak on which crops would not grow.

The installation of irrigation systems, primarily center pivot systems, was also causing removal of windbreaks in Kansas, Nebraska, and Oklahoma. The center pivot system has a long boom, operates in a circular motion, and can irrigate up to 160 acres at one time. A quarter of a mile of windbreak was removed so the center pivot irrigation system, as shown in the picture on page 14, could be installed.



Center pivot irrigation system.

According to the landowner, the windbreak was needed to prevent wind erosion but, since he was going to sow the land with grass and irrigate, the trees would no longer be needed. As long as the land was covered with grass, it probably would not be susceptible to wind erosion.

In Holt County, Nebraska, which had 2,117 windbreaks standing in 1967, 165 had been removed during 1967-74. Of these, 147, or 89 percent, were removed so center pivot irrigation systems could be installed. Nebraska officials believe that the increase in acres irrigated in that State (about 20 percent over the last 3 years) will continue.

Irrigation, along with other conservation practices, can be a substitute for windbreaks; however, some observers have noted that long-term difficulties may develop in parts of the Great Plains as the demand for water for other uses increases.

Normal deterioration of trees and poorly maintained windbreaks also indirectly cause farmers to want windbreaks removed. Disease, age, crop sprays, and poor maintenance have left many trees dead, thus making some windbreaks unsightly and ineffective. In addition, dead trees and branches often end up in the fields and cause problems. One farmer in Nebraska complained that after windstorms he had

to remove dead trees and branches from the field next to his windbreak.

POTENTIAL PROBLEM OF CONTINUAL WINDBREAK REMOVALS

The continual removal of windbreaks in the Great Plains could have an adverse effect in future years on soil conservation, wildlife, and the environment.

To prevent wind erosion, Federal cost-sharing programs have encouraged farmers to plant field windbreaks. Although not as great as during the drought periods of the 1930s and 1950s, wind erosion is a problem in the Great Plains. In 1974, SCS reported that 3.8 million acres in the 10 Great Plains States had been damaged by wind erosion from November 1, 1973, to May 31, 1974. In its report, SCS stated:

> "Major contributing factors to wind erosion this season include: (1) Lack of moisture; (2) Inadequate plant growth and ineffective residues; (3) Poor soil structure; (4) Land clean tilled for seedbed preparation and unsatisfactory tillage operations; and (5) Excessive grazing of small grain and grasslands."

SCS data on 17 Oklahoma counties showed that wind erosion damaged about 63,500 acres in the counties from January 1 to May 31, 1974. This included one county we visited where 18,400 acres were damaged. Of the windbreaks planted in this county under the Prairie States Forestry Project, 21 percent had been removed.

Most farmers and State, Federal, and local conservationists agree that windbreaks prevent wind erosion and are still needed in the Great Plains. However, some conservationists believe that windbreaks are no longer needed to prevent wind erosion or that the need has decreased because other conservation practices, such as strip cropping, crop rotation (planting grass or legumes during periods when erosion occurs), stubble mulching, and emergency tillage, have been introduced.

According to the 1974 SCS report and USDA officials, however, these practices depend on adequate moisture, correct tillage operations, and proper land management. On the other hand, properly planned and maintained windbreaks remain a permanent protection against wind erosion even during periods of drought when most other conservation practices

become less effective. During severe drought periods windbreaks could be the only source of protection against wind erosion.

In Oklahoma, we observed a field where wind erosion was occurring even though stubble mulching was used. (See photograph below.) The objective of stubble mulching is to leave enough plant residue on the ground to protect top soil during critical erosion periods.

Stubble-mulched field in Oklahoma where wind erosion occurred. Note the soil piled up along the roadbed.

SCS officials said that the farmer had not left enough residue on this field to hold the soil down.

Continual removals could also lessen the environmental and other incidental benefits that windbreaks provide. In a 1974 publication, the Chief of the Oklahoma Department of Wildlife Conservation's Game Division said:

> "* * * There's no doubt that the belts have been instrumental in bringing deer and turkey back in many sections of western Oklahoma, often into areas where they didn't even exist before. A good belt even an old one with many dead trees is prime

habitat for squirrels, quail, rabbits, pheasants, and a host of nongame animals including songbirds and furbearers.* * *"

Windbreaks also have environmental benefits, such as the production of oxygen. One Government official has estimated the value of trees in the following way:

"One tree left alone to do work is worth $128.00 per year. This work consists of: cleaning air, stabilizing of the water cycle, stabilizing soil by preventing erosion, providing air conditioning, aesthetic beauty and tertiary treatment of waste."

CONCLUSIONS

Because demand for this country's agricultural products is expected to remain strong, emphasis on food production will probably continue. The installation of irrigation systems, especially center pivot systems, is expected to continue on the Great Plains. As the windbreaks get older, more and more trees will die thus increasing the problems resulting from deterioration. Therefore, it appears that farmers will continue to remove windbreaks.

The continual removal of windbreaks, however, can only make the erosion problem in the Great Plains more serious. Although there may be less need or desire for windbreaks because of other conservation practices, windbreaks are still needed to supplement these other practices because of their permanency and their effectiveness during prolonged drought periods. Unless windbreak removals are discouraged, a valuable resource which has taken many years to develop may disappear in some areas.

CHAPTER 4

ACTIONS NEEDED TO DISCOURAGE THE REMOVAL OF FIELD WINDBREAKS

We found no evidence of Federal or State programs specifically designed to discourage windbreak removals and no program currently exists to assist farmers on a wide scale to renovate old field windbreaks. Current USDA educational programs on trees do not address windbreak removals.

LACK OF PROGRAMS

USDA headquarters officials and Federal, State, and local conservationists in Kansas, Nebraska, and Oklahoma did not know of any programs specifically designed to discourage the removal of windbreaks.

Because field windbreaks planted with Federal assistance are generally located on private lands, the Government has no recourse against a farmer who removes a windbreak after the cost-sharing contract expires. If a windbreak is removed before the term of the contract expires (up to 10 years for trees under 1974 contracts), the Government can ask for a refund. In the 15 counties visited, records showed only 2 cases where the Government had collected refunds from farmers who had removed field windbreaks. However, most of the windbreaks being removed would not be subject to such action since they were planted in the 1930s and 1940s. Another problem, according to Government officials, is that any land ownership change makes collection virtually impossible.

USDA's Extension Service coordinate the Department's education activities. Federal, State, and local governments cooperatively share in the financial support and direction of Extension Service programs. These programs are flexible and can be quickly adjusted to meet new needs. The Extension Service educates people through personal contacts (county agents), meetings, demonstrations, distribution of educational material, and the mass media. Most of their educational activities on windbreaks encourage farmers to plant trees for new windbreaks rather than preserving existing ones.

Other Federal and State agencies also distribute educational material to encourage windbreak plantings; and some agencies' personnel, through their day-to-day contacts with farmers, encourage them to plant and maintain windbreaks. However, these agencies rely primarily on the Extension Service to carry out educational programs on windbreaks.

Extension Service personnel in the three States agreed that an educational program could be directed toward preserving existing windbreaks; however, one official believed that additional resources would be necessary to carry out such a program. Other Federal and State officials in the field agreed that increased educational efforts are needed not only to discourage the removal of windbreaks but also to encourage the planting of trees for new windbreaks. One official, however, expressed doubt as to how effective such efforts alone would be in discouraging farmers from removing windbreaks.

No cost-sharing program currently exists which is specifically designed to assist farmers to renovate windbreaks. From 1965 to 1971, ASCS, as part of a beautification-conservation program, authorized cost sharing for improving windbreaks that were visible to the public. Cost sharing covered thinning, removing undesirable undergrowth and dead timbers, and planting new trees. Based on information made available, this has been the only Federal program specifically directed at improving windbreaks on a wide scale in the Great Plains.

In some States, USDA has sponsored special efforts to improve windbreaks but these were limited to specific projects and were discontinued after completion. For example, in North Dakota, USDA assisted farmers in removing every other tree in single-row windbreaks so there would be a more even distribution of snow on the fields.

USDA has programs to improve forest trees for timber production; however, windbreaks to prevent soil erosion generally do not qualify under such programs.

POSSIBLE WAYS TO DISCOURAGE WINDBREAK REMOVALS

An educational program addressing the reasons why farmers remove windbreaks could help to counteract the removal trend. For example, one of the main reasons farmers remove windbreaks is to increase the productive capacity of their land and thereby increase income. Research has shown, however, that field windbreaks can also increase farmers' income. (See ch. 2.)

Also many windbreaks are removed so center pivot irrigation systems can be used. Information on how windbreaks can supplement these systems should be made known to farmers. Although some windbreaks, particularly those in

the middle of fields, must be removed to install some irrigation systems, those on the edges of fields can often be saved.

Some farmers in Oklahoma, for example, were removing entire windbreaks to install irrigation systems, while some farmers in Nebraska were removing only those windbreak portions which were directly in the way of the center pivot irrigation system. (See photograph on the following page.)

State officials in Kansas told us that some farmers in their State were narrowing the windbreaks and leaving a few rows, instead of removing entire sections. According to these officials, this is a more desirable practice.

An educational program could also point out that, although other conservation practices help prevent soil erosion, properly planted and maintained trees are still needed to supplement these practices. In some instances, particularly during periods of severe drought when most of these other practices become less effective, windbreaks may provide the only source of protection against wind erosion. Also it has been noted that people tend to forget long dry periods and the benefits the trees provide. An educational program could serve as a reminder.

In April 1975, ASCS released operating instructions for the 1975 Agricultural Conservation Program. These instructions authorized developing conservation practices at the county level with approval at the State level. Approval may be granted for:

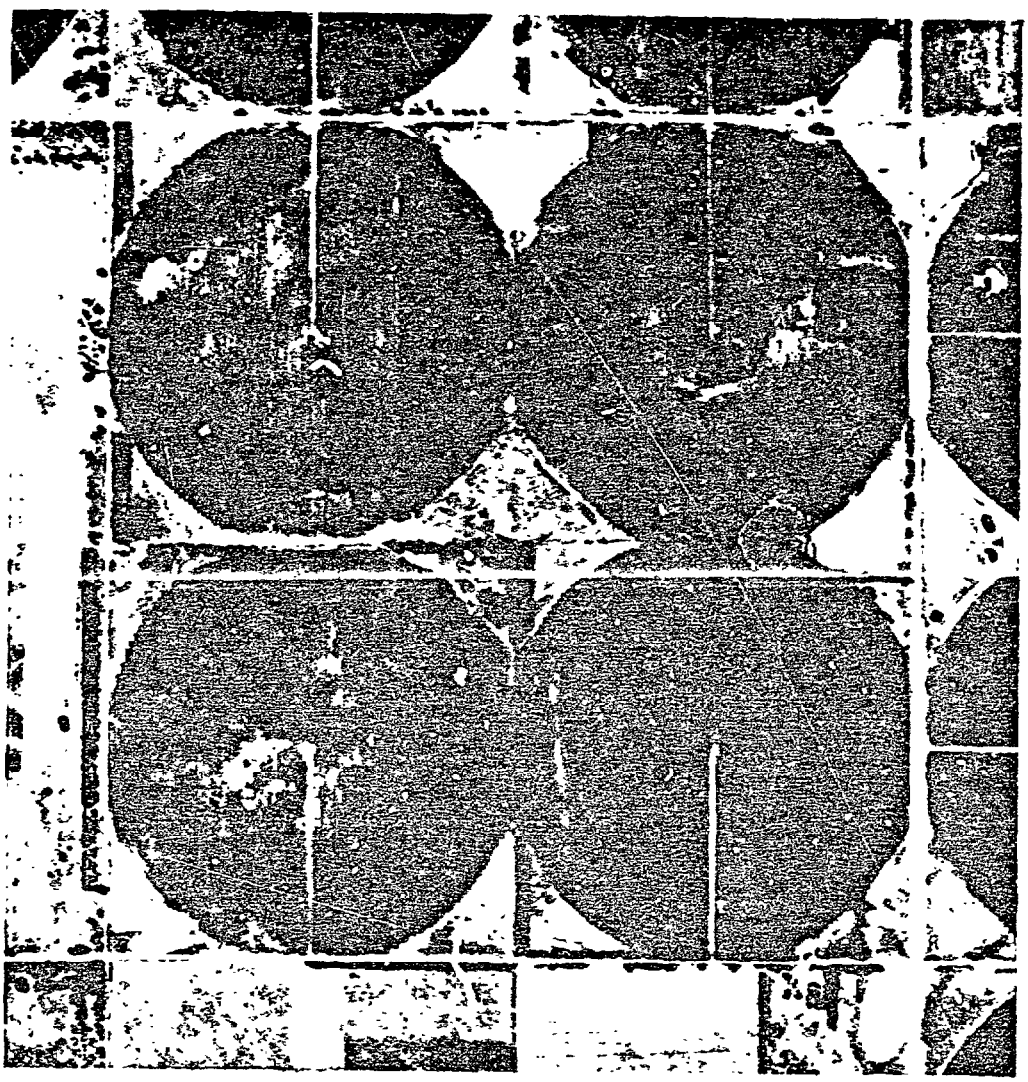
1. All practices in effect under the 1970 Agricultural Conservation Program.

2. Practices developed in accordance with the guidelines for the 1974 Rural Environmental Conservation Program.

3. Additional practices needed to solve local conservation problems for which the practices developed under 1 and 2 are not adequate.

According to ASCS officials a cost-sharing windbreak renovation program could be implemented on a county-by-county basis under the above guidelines. We believe such a program would be helpful in further discouraging farmers from removing windbreaks.

Farmers remove windbreaks to have more land for production. According to a Forest Service official, an



ASCS photograph

Center pivot irrigation systems and field windbreaks in Nebraska.

average 10-row wide, 1-mile long windbreak, planted under the Prairie States Forestry Project, covers about 8 acres. In addition, many of these old windbreaks have species of trees which sap so much moisture that little or nothing will grow next to the windbreak. This low-yield area will often include a strip of land as wide as the windbreak. Thus a farmer who removes an average 10-row windbreak 1-mile long can gain up to 16 acres for production.

USDA research has shown that windbreaks 3 to 5 rows wide can be as effective against wind erosion as those 8 to 21 rows wide. Old windbreaks could be narrowed and, in the process, trees which cause serious moisture problems could be removed. Where necessary, new trees could be planted. Under such a program, farmers with Government technical and financial assistance could end up with more land for production and still keep their windbreaks. Farmers and State and Federal officials generally agreed that a cost-sharing program to renovate windbreaks was needed and that it would discourage farmers from removing them.

Major renovation of old windbreaks is also needed to improve their effectiveness and longevity. Although general maintenance and upkeep of windbreaks have always been the farmers' responsibility, this work is often not done. Due to disease, age, crop sprays, and poor maintenance, many of the trees in the old windbreaks have died, while others have not grown adequately because of overcrowding. Some fast-growing trees have suppressed the growth of more desirable species, such as evergreens. Evergreens are among the most valuable trees in windbreaks because they provide year-round protection. Many of those planted during the 1930s and 1940s, however, have died or are dying out.

The 1954 Forest Service survey mentioned on page 11 covered windbreaks planted under the Prairie States Forestry Project in North and South Dakota, Nebraska, Kansas, Oklahoma, and Texas. It showed that, of the windbreaks sampled, 42 percent were rated good or excellent as effective windbreaks, 31 percent were rated fair, and 19 percent were rated poor. The other 8 percent had been removed. The survey report included the following recommendations to improve existing windbreaks.

--Release suppressed conifers (evergreens) from overcrowding so growth can continue.

--Replant and cultivate large gaps in conifer rows.

--Reinforce inadequate shrub rows by planting new rows of redcedar, pines, and low shrubs.

--Reduce width of plantings wherever practicable by removing rows of trees that contribute little to barrier density.

The Oklahoma State Forestry Division, which surveyed 16 standing windbreaks in 1 county in 1972, found that 81 percent were in poor condition and needed to be improved to prevent further deterioration.

The Forest Service has done some research on how to improve deteriorating windbreaks. In Nebraska we were shown two such research projects. One project involved the removal of Russian-olive trees from a windbreak to release suppressed evergreens. The Forest Service had removed part of the Russian-olive tree row and left part to show the effect of the removal on the evergreens' growth. The following pictures of this project show the comparative growth of the evergreens where thinning was and was not done.

Evergreen growth where thinning was done.

Evergreen growth where thinning was not done.
Note that most of the evergreens have died.

The other project showed the benefits of thinning near the center of a windbreak. A portion of the inside row of trees had been removed so the rows on each side had more growing room. As a result, the trees next to the row removed grew taller and larger in diameter than the trees where thinning was not done.

According to SCS officials, renovation practices, such as those involved in the Forest Service research projects, will save and improve certain tree species, prolong the life of the windbreaks, and improve their efficiency in protecting the soil from wind erosion.

CONCLUSIONS

A cost-sharing renovation program, carried out by county committees and offices under the Agricultural Conservation Program, could encourage farmers to improve and preserve existing windbreaks rather than remove them. An educational program emphasizing the benefits farmers receive from windbreaks and the dangers of soil erosion if removals continue could serve to counter the pressures farmers now face for removing them.

Together, these efforts would (1) discourage farmers from destroying a resource which has taken many years to develop, (2) make more land available for food production,

and (3) increase the longevity and effectiveness of existing windbreaks.

RECOMMENDATIONS

We recommend that the Secretary of Agriculture have the appropriate USDA agencies

--survey, especially in the Great Plains, the extent of windbreak removals and the renovation needed to preserve existing windbreaks;

--encourage counties to carry out a cost-sharing windbreak renovation program; and

--initiate an educational program supporting efforts to preserve and renovate existing windbreaks.

AGENCY COMMENTS

We discussed the matters covered in this report with ASCS, SCS, and Extension Service officials. They agreed that a cost-sharing windbreak renovation program was needed and could be implemented under existing legislation. ASCS officials said that, under the 1975 ASCS conservation program, each county could decide the priority it would give to renovating windbreaks within its existing funding level.

ASCS and SCS officials said that USDA needed to gather windbreak removal data and that this could be done with existing staff and resources. Extension Service officials said that the Extension Service could provide educational support to a program designed to discourage windbreak removals. They also said that more-current data on windbreak benefits would be helpful in carrying out an educational program.

CHAPTER 5

SCOPE OF REVIEW

We discussed windbreaks, windbreak removals, and efforts to preserve this resource with USDA and State conservation officials, officials of the Wildlife Management Institute, and Great Plains farmers. We reviewed legislation on windbreak planting programs and documents on program accomplishments. We also examined agency files and educational materials dealing with conservation and windbreaks.

Our fieldwork was done in Kansas, Nebraska, and Oklahoma. We compared maps of Prairie States Forestry Project plantings with recent aerial photographs of counties in Oklahoma to determine the number of the old windbreaks that had been removed. We also compared old aerial photographs of counties in Kansas, Nebraska, and Oklahoma with more recent ones to determine the extent of removals.

We did not attempt to project the extent or rate of removals in the counties visited to the States or to the entire Great Plains, because very little statistical data on removals had been gathered and because the data we gathered varied greatly from county to county within the States.

APPENDIX I

EXAMPLES OF STUDIES DONE ABROAD AND IN CANADA ON THE EFFECTS OF WINDBREAKS ON CLIMATIC CONDITIONS AND CROP YIELDS (note a)

Air temperatures

1. Air temperatures near the ground averaged 2 to 3° F cooler on oat fields between windbreaks than on oat fields in the open on hot days.

Air temperatures were up to 4° F warmer on protected oat fields than on unprotected fields on cool days and during the night.

Type: Series of parallel field windbreaks
Season and year: 4-year study in summer, 1950s
Place: Russia
Reference: Molchanov, A.L., 1956 [Soils and Fert. Abs. 20 (2): 89 (1957) No. 485.]

Evaporation

2. Evaporation rates on protected side of windbreak compared to open field were:

60% less at 5H
40% less at 10H
20% less at 20H

Type: Windbreak of Japanese Black Pine, 5 feet tall and 20 feet wide
Year: 1940s
Place: Japan
Reference: Iizuka, H., Tamate, S., Takakuwa, T., and Sato, T., 1950 [Forestry Abs. 15: 48 (1954) No. 286.]

---

a/Source: Ralph A. Read, "Tree Windbreaks for the Central Great Plains," Agriculture Handbook No. 250, Forest Service, USDA, Feb. 1964.

Snow distribution

3. Average depths during 3 years of heavy snowfall were:

26 inches at 0 to 6H
7 inches on stubble at 25H
3 inches on summer fallow at 25H

Average depths during 2 years of medium snowfall were:

15 inches at 0 to 3H
4 inches on stubble at 25H
3 inches on summer fallow at 25H

Type: Series of parallel barriers consisting of 1-row caragana hedges 8 feet tall and 3-row field windbreaks 25 feet tall
Season and year: Winter, 1950-52 (heavy) and winter, 1953-54 (medium)
Place: Manitoba and Saskatchewan, Canada
Reference: Staple, W. J., and Lehane, J.J., 1955 [Canad. Jour. Agr. Sci. 35: 440-453, illus.]

4. Snow depth was greater and freezing depth was less on sheltered area as compared to open area. As a result, soil moisture was increased in the 0 to 20H protected zone.

Type: 12- to 16-year-old field windbreaks, 16 to 20 feet tall
Season and year: Winter, 1949-50
Place: Russia
Reference: Dautov, R.K., 1953 [Forestry Abs. 15: 49 (1954) No. 287.]

Soil Moisture

5. Moisture content of soil was high on protected fields as compared to low moisture content and drought on unprotected fields.

Type: Series of field windbreaks
Year: 1946-47
Place: Russia
Reference: Burnatski, D.P., and Suchalkina, M.I., 1949 [Forestry Abs. 11: 65 (1949) No. 296.]

Field Crops

6. Average wheat yields on the protected side of windbreaks during 3 years of heavy snow were:

27 bushels an acre at 0 to 15H
20 bushels an acre at 15 to 25H

Average wheat yields on the protected side of windbreaks during 2 years of medium snow were:

24 bushels an acre at 0 to 15H
22 bushels an acre at 15 to 25H

Type: Series of 1-row caragana field windbreaks 8 feet tall
Year: 1950-54
Place: Saskatchewan, Canada
Reference: Staple, W.J., and Lehane, J.J., 1955 [Canad. Jour. Agr. Sci. 35:440-453, illus.]

7. Winter wheat, with equal amounts of moisture at start of growth, yielded twice as much in 18H zone on protected fields as on open fields.

Type: Ash-locust windbreak, 18 feet tall and 50 feet wide
Year: 1950
Place: Russia
Reference: Kalashnikov, A.P., 1955 [Forestry Abs. 17: 225 (1956) No. 1590.]

8. Crop yields on sheltered compared to open fields were:

Wheat--27 vs. 11 bushels an acre
Oats--65 vs. 19 bushels an acre
Corn--45 vs. 17 bushels an acre
Hay--5,240 vs. 1,057 pounds an acre

Type: Field windbreaks
Year: 1952-53
Place: Rumania
Reference: Lupe, I., 1954 [Forestry Abs. 16: 217 (1955) No. 1758.]

9. Wheat yielded 20 to 50% (6 bushels an acre) more on sheltered than on open fields. Oats yielded 18% more.

Type: Field windbreaks at 800- to 1,000-foot intervals
Year: 1952-53
Place: Rumania
Reference: Lupe, I., Catrina, I., and Marcu, G., 1956 [Forestry Abs. 18(2): 212 (1957) No. 1626.]

10. Cotton stands in 5 to 10H protected zone as compared to open field stands:

Germinated 2 to 3 days earlier
Grew 2 to 8 inches taller
Flowered 4 to 5 days earlier
Fruited more heavily
Yielded 1.6 to 3.1 percent more fibers.

Year: 1950s
Place: China
Reference. Anonymous, 1960 [Forestry Abs. 21(4): 589 (1960) No. 4408.]

PRINCIPAL OFFICIALS OF

THE DEPARTMENT OF AGRICULTURE

RESPONSIBLE FOR ADMINISTRATION OF THE ACTIVITIES

DISCUSSED IN THIS REPORT

	Tenure of office From	To
DEPARTMENT OF AGRICULTURE		
SECRETARY OF AGRICULTURE:		
Earl L. Butz	Dec. 1971	Present
Clifford M. Hardin	Jan. 1969	Dec. 1971
Orville L. Freeman	Jan. 1961	Jan. 1969
ASSISTANT SECRETARY, CONSERVATION, RESEARCH, AND EDUCATION (note a):		
Robert W. Long	Mar. 1973	Present
Thomas K. Cowden	May 1969	Mar. 1973
John A. Baker	Aug. 1962	Jan. 1969
ASSISTANT SECRETARY, INTERNATIONAL AFFAIRS AND COMMODITY PROGRAMS:		
Clayton Yeutter	Mar. 1974	Present
Carroll G. Brunthaver	June 1972	Jan. 1974
Clarence D. Palmby	Jan. 1969	June 1972
AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE		
ADMINISTRATOR:		
Kenneth E. Frick	Mar. 1969	Present
Horace D. Godfrey	Jan. 1961	Jan. 1969
EXTENSION SERVICE		
ADMINISTRATOR:		
Edwin L. Kirby	Feb. 1970	Present
Lloyd H. Davis	Oct. 1963	Feb. 1970
SOIL CONSERVATION SERVICE		
ADMINISTRATOR:		
Ronello M. Davis	June 1975	Present
Kenneth E. Grant	Jan. 1969	May 1975
Donald A. Williams	Nov. 1953	Jan. 1969

a/Title changed from Assistant Secretary, Rural Development and Conservation, in January 1973.