1972

Reduce Wind Erosion : Eastern South Dakota

Lyle A. Derscheid

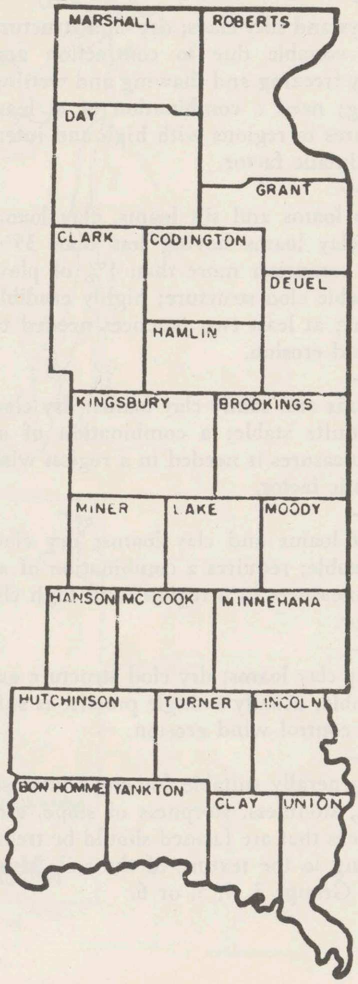
Edward J. Williamson

Paul Boden

FS 545

Reduce Wind Erosion

Eastern South Dakota



Cooperative Extension Service
South Dakota State University, Brookings
U. S. Department of Agriculture

In Eastern South Dakota . . .

Reduce Wind Erosion

By
Lyle A. Derscheid, Extension agronomist;
Edward J. Williamson, Extension agronomist—soils; and
Paul Boden, conservation agronomist—SCS

Annually, from 50,000 to 100,000 acres of South Dakota farmland are severely damaged by wind erosion. In 1971, this figure zoomed to 637,000 acres.

This damage can be prevented. Losses can be reduced by growing crops, crop residues, ridging, and strip cropping with solid-seeded crops in alternate strips. Width of strips or fields and amount of residue needed depends on texture of the soil, average annual rainfall, yield of crop residue and tillage implements used.

Tables and maps in this Fact Sheet can help you determine the width of the area on your farm that can be protected from wind erosion during the spring of the average year.

Step 1. Determine the amount of crop residue on your field. You do this by finding the total number of ounces of residue on three representative 1-square-yard areas in the field. Multiply this total number of ounces by 100 to estimate the total amount of residue per acre in pounds. Example: 8 ounces of residue times 100 equals 800 pounds of residue per acre. (This works for small grain stubble. Use Table 2 to convert other types of residue to small grain equivalent).

Step 2. Locate your farm on Map 1 to determine climatic *(C)* factor. Example: Farms in Brookings County have a *C* factor of 30.

Step 3. Locate your farm on Map 2 to determine *W*ind *E*rodibility *G*roup *(WEG)*. Example: Farms immediately west of the city of Brookings have a *WEG* of 4L.

Step 4. Use Table 1 to determine width of area that can be protected. Locate the *WEG* for your farm in column 1 (4L for farms near Brookings). Locate the lb/A of crop residue on your field in column 2 (800 lb/A in above example). Locate the *C* factor for your area in columns 3, 6, or 9 (*C* factor of 30 for Brookings County is in column 3).

For the above example, reading across *WEG* of 4L, crop residue of 800 lb/A, *C* factor of 30 shows that a smooth area 15 rods in width (column 4) will be protected from serious wind erosion in an average spring if the prevailing wind is from the northwest and strips run straight north and south or east and west.

If the prevailing wind is from the north-northwest this distance should be multiplied by 112.5% to determine width of area that will be protected in east-west strips and by 87.5% for north-south strips. If these strips are too narrow to be practical, use shelterbelts or mechanical ridging to help protect the area. Trees will normally protect an area 10 times as wide as the height of the trees.

Table 1 shows that, in the above example, an area 275+ rods in width can be protected if the field is ridged. Ridging should be done at right angles to the prevailing winds with ridges that have a 1:4 ridge-spacing ratio (3-in. depth for 12-in. spacing) similar to ridges left by a deep and semi-deep furrow drill or shovel-type implement.

On corn silage or soybean fields, it is impossible to maintain the equivalent of 800 lb/A of small grain residue (Table 2). It might be possible to maintain the equivalent of 250 lb/A. Then the width of the protected area will be only 4 rods if left smooth, and 35 rods if ridged, indicating that all corn silage or soybean fields in *WEG* 6, 3, 4, or 4L with a *C* of 30 should be ridged.

Blade-type implements that do not turn under as much residue may need to be used. Chemical weed control may reduce tillage operations and help retain crop residue. Shelterbelts may reduce wind velocity so that residue will protect wider areas.

Causes of Erosion

Although drought frequently precedes wind erosion and dust storms, drought alone does not cause severe wind erosion. Soil blowing occurs only when high winds come in contact with loose, unprotected soil. Sufficient vegetation will protect land from blowing, regardless of how dry it gets, unless blowing soil from nearby fields kills or covers protective vegetation.

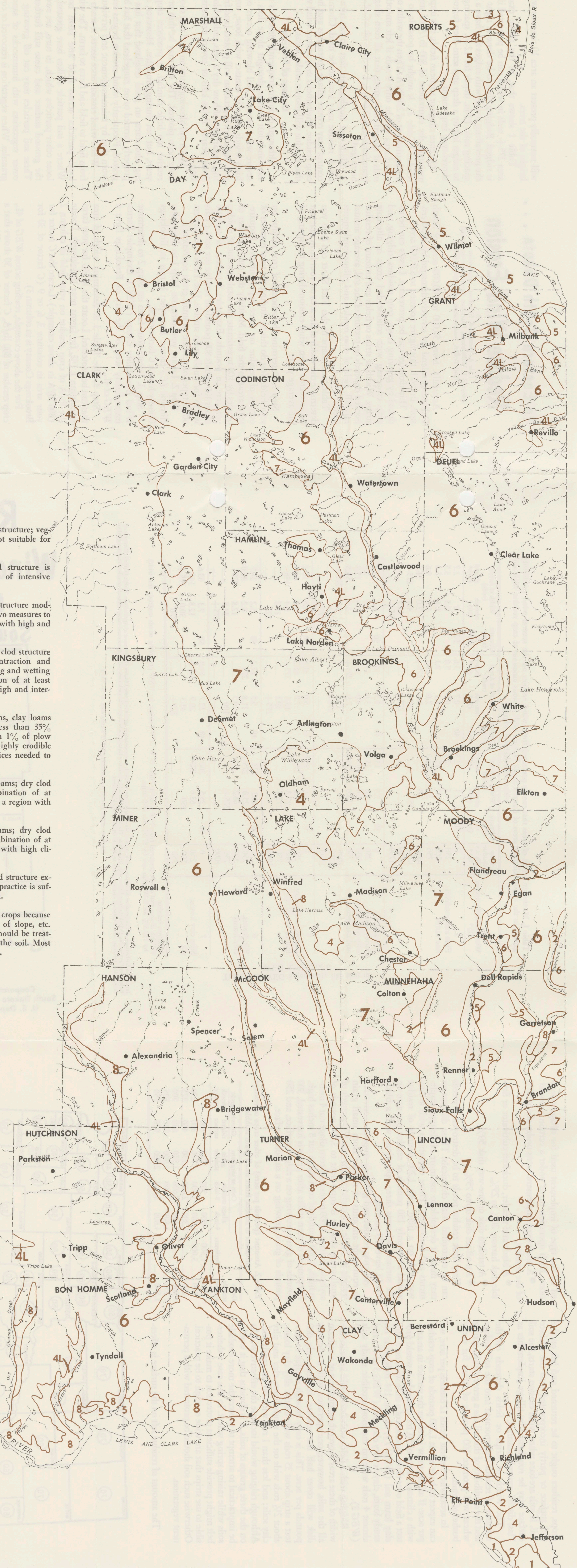
Much soil blowing starts on land that should never have been plowed. The soil may be thin or sandy or receive too little rainfall. It produces crops in wet years, but not during droughts. However, soil blowing also starts on good cropland that has been improperly farmed or on rangeland that has been overgrazed. Frequently wind erosion begins on hill tops worn thin by mismanagement and previous erosion.

When wind erosion once starts, it tends to spread from field to field and farm to farm. The wind carries loose particles across field and farm boundaries. Where a soil particle strikes bare ground, it blasts loose other particles which, in turn, are swept across the ground surface and cause still further erosion. These soil particles may cut off growing plants or cover vegetation with hummocks of sand or clay granules. When vegetation is removed or covered, the soil is likely to blow during the next windstorm. If high winds persist for several weeks, the soil blowing that started from a few fields may spread over an entire community.

Control Measures

Control measures for wind erosion depend on keeping a growing crop or crop residues on land at all times. Because it is difficult to establish cover on sandy and clayey soils during dry periods when cover is needed most, it is safest to keep these soils in perennial vegetation. Should these soils be used for grain or row

Wind Erodibility Groups
Eastern South Dakota



Map No. 2

Legend:

Group 1—
Mostly dune sand; single grain structure; vegetation difficult to establish; not suitable for cropland.

Group 2—
Mostly loamy sands; dry clod structure is weak; requires a combination of intensive practice.

Group 3—
Mostly sandy loams; dry clod structure moderately stable; requires at least two measures to control wind erosion in regions with high and intermediate climatic factor.

Group 4—
Mostly clays and silty clays; dry clod structure extremely variable due to contraction and swelling by freezing and thawing and wetting and drying; need a combination of at least two measures in regions with high and intermediate climatic factor.

Group 4L—
Calcareous loams and silt loams, clay loams and silty clay loams having less than 35% clay; lime comprises more than 1% of plow layer; variable clod structure; highly erodible due to lime; at least two practices needed to control wind erosion.

Group 5—
Mostly loams and sandy clay loams; dry clod structure quite stable; a combination of at least two measures is needed in a region with high climatic factor.

Group 6—
Mostly silt loams and clay loams; dry clod structure stable; requires a combination of at least two measures in a region with high climatic factor.

Group 7—
Mostly silty clay loams; dry clod structure extremely stable; usually a single practice is sufficienet to control wind erosion.

Group 8 —
Soils not generally suitable for crops because of wetness, stoniness, steepness of slope, etc. Isolated areas that are farmed should be treated according to the texture of the soil. Most will be in Groups 3, 4, 5, or 6.

crops, residues ought to be returned and left on the soil surface or partly incorporated into the surface soil. If soils are bare when wind erosion starts, the soil surface may be roughened by tillage implements as "last ditch" control measures.

The width of strips or fields depends on the amount of residue incorporated into the soil surface and the erodibility of the soil. As a general rule, spring wheat will produce 100 pounds of straw for every bushel of grain.

In areas where wheat yields 12 bushels per acre, we can expect to have about 1,200 pounds of crop residue per acre. If all the straw is left on the surface in an area with a climatic factor of 50, for example, it would protect a field over three-quarters of a mile wide on a silty clay loam soil (*WEG* 7); almost 114 rods wide on sandy loam, clay or silty clay soils (WEG 3 or 4); and almost 4 rods wide on the most erodible sandy soils (*WEG* 2).

Ridging with a field cultivator would increase the width of these areas to over three-quarters of a mile on all the soils, however, one operation with a one-way disk will cover half the residue, leaving only 600 pounds per acre. This is only enough residue to protect a strip about 35 rods wide on the silty clay loam; about 2½ rods wide on the sandy loam, clay and silty clay soils; and less than 1 rod wide on the sandy soil. Although ridging would increase the effective widths on the three groups of soils, it is obvious that it would be impractical to attempt to protect the more erodible soils while raising spring wheat. In this case a shelterbelt might provide sufficient protection to make it possible to use strips that are wide enough to be practical. Otherwise such soil should be protected with a permanent vegetation.

The amount of residue left on the surface is affected by the type of implement used for tillage operations. Each operation turns under a certain amount:

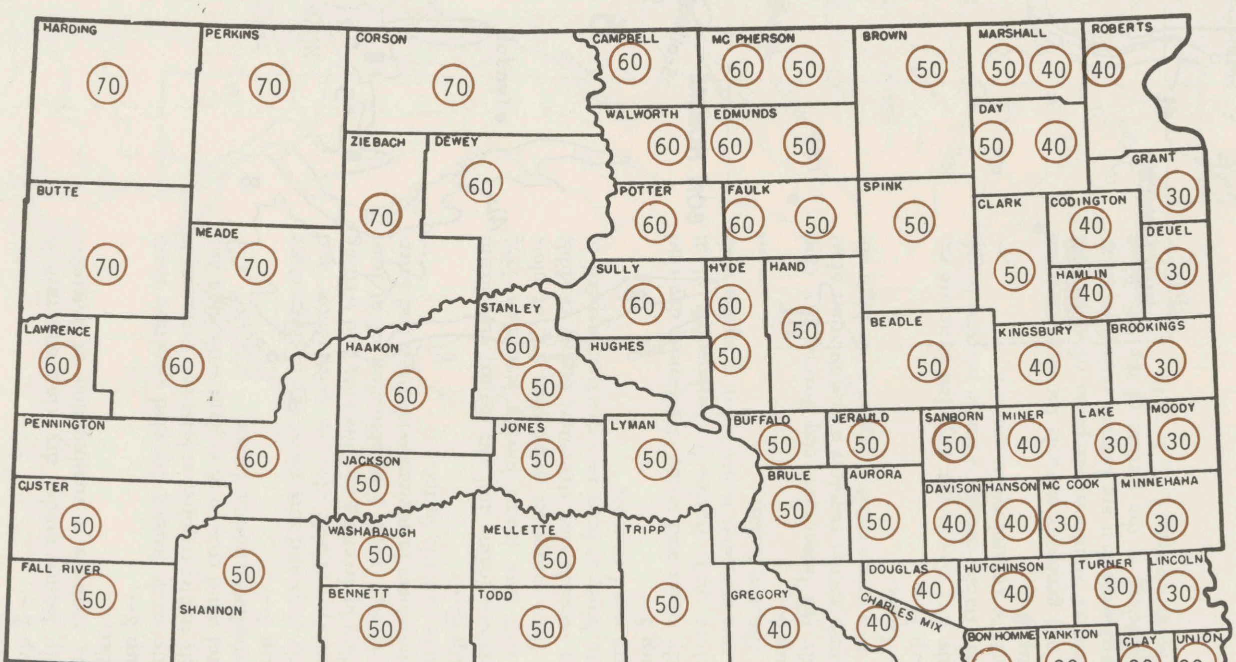
- A blade-type implement turns under about 10% of the residue,
- A blade and treader, duckfoot cultivator or flexible disk harrow 20% to 25%,
- A tandem disk or one-way disk 50%,
- An off-set disk up to 75%.

Very little residue needs to be destroyed if weeds can be controlled with chemicals. These differences may make it desirable to use more blade-type implements and herbicides. Three operations with a one-way disk on a field with 1,200 pounds of residue would leave only 150 pounds of residue per acre on the surface; whereas three operations with a blade would leave 875 pounds.

All crop residue and growing crops are converted to equivalent amounts of residue from small grain stubble in Table 2. It indicates that the 500 pounds of small grain stubble is equivalent to 3,000 pounds of soybean residue, 1,500 pounds of corn silage cut 4 inches high, 1,300 pounds of corn silage cut 8 inches high, 720 pounds of corn stalks after grain is harvested, 300 pounds of grain growing on a ridged surface, and 250 pounds of grain growing on a smooth surface.

Table 2. Amount (pounds per acre) of other crops or residue equivalent to residue from small grain stubble.

Grain stubble residue	Soybeans	Corn or sorghum silage stubble 4-inch	Corn or sorghum silage stubble 8-inch	Corn or sorghum grain stubble	Growing grain ridged surface	Growing grain smooth surface
250	1,300	600	500	270	150	
500	3,000	1,500	1,300	720	300	250
750	--------	2,300	2,000	1,150	460	375
1,000	--------	3,100	2,600	1,550	620	500
1,250	--------	3,800	3,200	1,900	780	625
1,500	--------	4,600	3,800	2,300	920	750



Map 1. Climatic (C) Factors for Various Areas of South Dakota

Table 1. Maximum width of areas that can be protected from wind erosion on the several wind erodibility groups in the various climatic areas of Eastern South Dakota with various amounts of crop residue with and without mechanical ridging.

Wind erodibility groups (1)*	Crop residue (lb/A) (2)*	Climatic factor C (3)*	Width of Area† (rods) smooth (4)*	ridged (5)*	Climatic factor C (6)*	Width of Area† (rods) smooth (7)*	ridged (8)*	Climatic factor C (9)*	Width of Area† (rods) smooth (10)*	ridged (11)*
2	0	30	1.1	12.5	40	0.7	3.6	50	0	2.7
Fine and medium	250		1.5	7.3		0.8	5.0		0.5	3.5
fine sands	500		2.0	15.9		1.1	9.1		0.6	5.0
	750		3.4	68.0		2.0	22.7		0.8	9.6
	1000		7.8	--------		3.4	275+		2.0	36.4
	1250		157	--------		10.9	--------		4.0	275+
	1500		--------	--------		275+	--------		12.7	--------
	1750		--------	--------		--------	--------		275+	--------
3, 4 and 4L	0	30	2.5	15.9	40	2.3	6.8	50	1.2	4.8
Sandy loams,	250		4.0	35.0		3.0	13.6		1.8	7.5
silty clays, clays	500		6.0	109		4.0	29.6		2.4	12.7
and calcareous	750		15.0	275+		7.8	275+		3.5	54.5
	1000		227	--------		35.0	--------		9.6	275+
	1250		--------	--------		275+	--------		114	--------
	1500		--------	--------		--------	--------		275+	--------
5	0	30	8.6	95.5	40	5.0	31.8	50	3.5	18.2
Loams, sandy clay	250		14.1	273		7.8	68.2		4.0	36.4
loams, sandy clays	500		27.3	--------		13.6	275+		6.4	136
	750		275+	--------		59.1	--------		18.2	--------
	1000		--------	--------		275+	--------		227	--------
6	0	30	13.2	123	40	5.5	77.2	50	5.2	38.7
Silt, loams,	250		25.0	275+		11.8	275		8.2	82.0
clay loams	500		68.2	--------		20.5	--------		12.8	275
	750		275+	--------		100	--------		34.5	--------
	1000		--------	--------		--------	--------		275+	--------
7	0	30	25.5	200	40	12.7	84.0	50	7.3	63.6
Silty clay loams,	250		63.6	275+		20.9	275+		12.8	145
silt	500		250	--------		41.3	--------		30.0	275+
	750		--------	--------		275+	--------		270	--------

Texture of WEG 8 generally like that of WEG 3, 4, 5, or 6

*Column number

†Width of area that can be protected from NW wind by either E- W or N-S strips; for NNW prevailing winds multiply this width by 112.5% for E-W strips and by 87.5% for N-S strips.

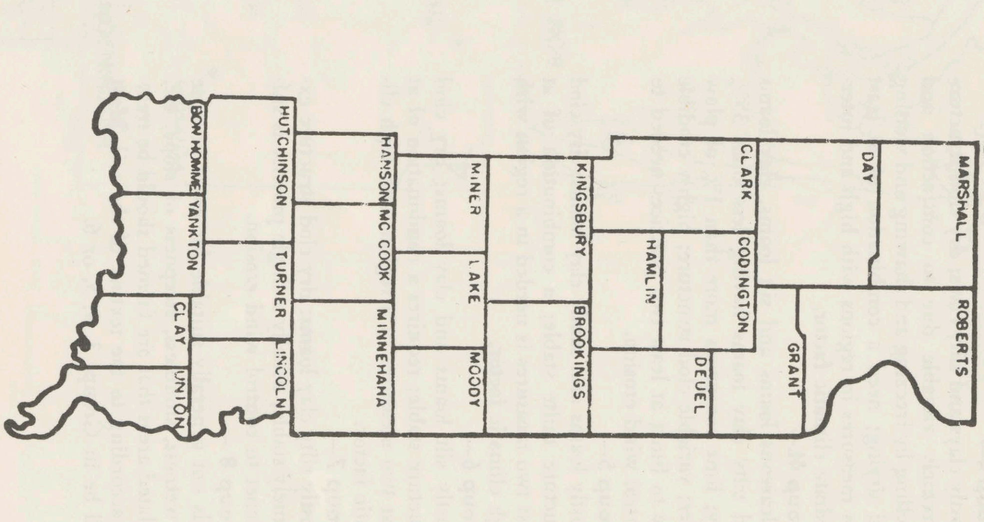
Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. Hollis D. Hall, Director of Extension Service, South Dakota State University, Brookings. The South Dakota Cooperative Extension Service offers educational programs and materials to all people without regard to race, color, religion, sex or national origin, and is an Equal Opportunity Employer.

File 3.4-1—2,000 printed at an estimated cost of 8 cents each. 1-76—5525

FS 545

Reduce Wind Erosion

Eastern South Dakota



Cooperative Extension Service
South Dakota State University, Brookings
U. S. Department of Agriculture