TABLE 1.

SOIL ERODIBILITY INDEX (I) DETERMINED
BY PERCENTAGE OF NON-ERODIBLE AGGREGATES

Units→ ↓Tens	0	1	2	3	4	5	6	7	8	9
0	---	310	250	220	195	180	170	160	150	140
10	134	131	128	125	121	117	113	109	106	102
20	98	95	92	90	88	86	83	81	79	76
30	74	72	71	69	67	65	63	62	60	58
40	56	54	52	51	50	48	47	45	43	41
50	38	36	33	31	29	27	25	24	23	22
60	21	20	19	18	17	16	16	15	14	13
70	12	11	10	8	7	6	4	3	3	2
80	2	---	---	---	---	---	---	---	---	---

Wind Erodibility Groups and Soil Erodibility Index

The "I" value is assigned for named soils based on Wind Erodibility Groups (WEG). The WEG is included on Soil Interpretation Records. If the soil name is not known but the surface texture is known, Table 2, taken from the National Agronomy Manual, can be used to determine the WEG and "I" factor from the surface soil texture. Note that the "I" factors for WEG 1 vary from 160 to 310. An "I" of 160 is for coarse sands and an "I" of 310 is for very fine sand.

A soil erodibility index based solely on the percentage of aggregates larger than 0.84 mm has several potential sources of error. These include: a) changes in erodibility due to crusting, b) the fact that some aggregates are more stable than others, c) the size of the aggregates is not accounted for, d) erodibility for a given soil can change with a change in wind velocity, and e) the equation is based on volume while the index is based on weight. These potential sources of error are outlined in the National Agronomy Manual, Section 502.31(d).

TABLE 2.

WIND ERODIBILITY GROUPS
and SOIL ERODIBILITY INDEX

Predominant Soil Texture Class of Surface Layer	Wind Erodibility Group (WEG)	Soil Erodibility Index (I) (Tons/Acre/Year)[1]
Very fine sand, fine sand, sand, or coarse sand	1	310[2] 250 220 180 160
Loamy very fine sand, loamy fine sand, loamy sand, loamy coarse sand, or sapric organic soil materials	2	134
Very fine sandy loam, fine sandy loam, sandy loam, or coarse sandy loam	3	86
Clay, silty clay, noncalcareaous clay loam, or silty clay loam with more than 35 % clay	4	86
Calcareous loam and silt loam, or calcareous clay loam and silty clay loam	4L	86
Noncalcareous loam and silt loam with less than 20% clay, or sandy clay loam, sandy clay, and hemic organic soil materials	5	56
Noncalcareous loam and silt loam with more than 20% clay, or non-calcareous clay loam with less than 35% clay	6	48
Silt, non-calcareous silty clay loam with less than 35% clay, and fibric organic soil material	7	38
Soils not susceptible to wind erosion due to coarse surface fragments or wetness	8	---

[1] The soil erodibility index is based on the relationship of dry soil aggregates greater then .84 mm to potential soil erosion.

[2] The "I" factors for WEG 1 vary from 160 for coarse sands to 310 for very fine sands. Use an I of 220 as an average figure. For coarse sand with gravel, use a low figure. For no gravel and very fine sand, use a higher figure.

Adjustments to "I"

Adjustments to "I" factors can be made for knolls, surface soil crusting, and cloddiness created by tillage operations designed to bring non-erodible clods (>0.84 mm) to the soil surface. An additional adjustment is currently being considered for irrigation. Adjustments for knolls will increase "I" factors, while adjustments for crusting and clod-forming tillage will decrease "I" factors. The irrigation adjustment will decrease "I" factors.

Adjustments to "I" - Knolls

Knolls are topographic features characterized by short, abrupt windward slopes. Wind erosion potential is greater on knoll slopes than on level or gently rolling terrain because wind flow lines are compressed and wind velocity increases near the crest of the knoll. (See Figure 3.)

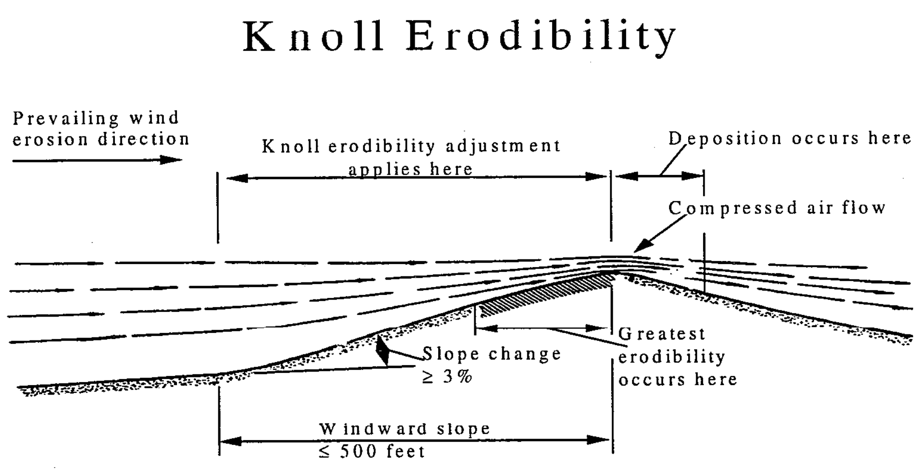

Figure 3. Knoll Erosion

Adjustments of the "I" factor for knolls is used where windward facing slopes are less than 500 feet long and the increase in slope gradient from the adjacent upwind landscape is 3 percent or greater. Both slope length and change in slope gradient are determined along the direction of the prevailing erosive wind.

TABLE 3.

KNOLL ERODIBILITY ADJUSTMENT FACTOR FOR I

Slope Change in Prevailing Wind Erosion Direction	A Knoll Adjustment to I	B Increase at Crest Area Where Erosion Is Most Severe
3	1.3	1.5
4	1.6	1.9
5	1.9	2.5
6	2.3	3.2
8	3.0	4.8
10	3.6	6.8
10 - 15*	2.0	--
15 - 20	1.4	--
20 +	1.0	--

*Factors above 10% slope change based on NRCS judgment. No research data available.

To adjust the "I" factor for knoll erodibility the "I" factor for the soil on the windward facing part of the knoll is multiplied by the factor shown in Column A of Table 3. Column B in the same table shows the increased erodibility near the crest (upper 1/3 of the slope), where the effect is most severe. This adjustment applies only to that portion of the knoll exposed to the prevailing wind erosion direction.

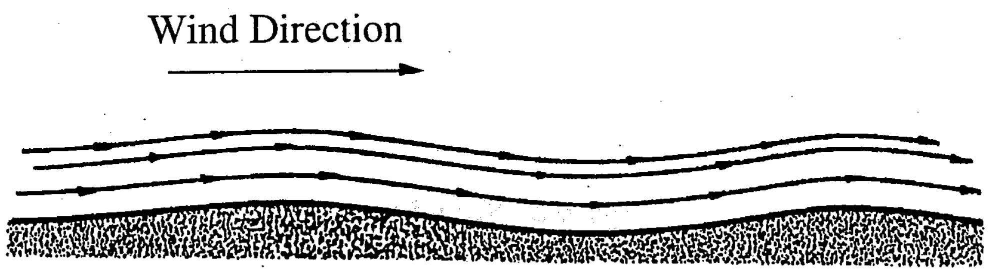

Figure 4. Wind Flow Pattern over Level to Rolling Terrain

On level fields or on rolling terrain where slopes are longer and slope changes are less than those used to describe a knoll, the wind flow pattern tends to conform to the surface and do not exhibit the flow constriction typical of knolls, as illustrated in Figure 4.

Adjustments to "I" - Surface Crusting

A surface crust forms when a bare soil is wetted and dried. Although the crust may be so weak that it has virtually no influence on the size distribution of dry aggregates determined by sieving, it can make the soil less erodible.

The resistance of the crust to erosion depends on the nature of the soil, intensity of rainfall, and kind and amount of cover on the soil surface. Under erosive conditions, the surface crust and surface clods on fine sands and loamy fine sands tend to break down readily. On silt loams and silty clay loams the surface crust and surface clods may persist.

A fully crusted soil will erode an average of only one-sixth as much as non-crusted soil. However a smooth crusted soil with loose sand grains on the surface is more erodible than the same field with a cloddy or ridged surface.

Because of the temporary nature of crusts, no adjustment for crusting is made for annual estimates based on the critical wind erosion period. Crust characteristics may be estimated and an adjustment to "I" may be made for management period estimates when no traffic, tillage, or other disruption of crusts is anticipated.

TABLE 4.

I ADJUSTMENT GUIDELINES FOR CRUSTS

WEG	I	Maximum Management Period Adjustment for Crust [1]	Minimum Crusted I	Available E Table
1	310	.7	217	220
	250	.7	175	180
	220	.7	154	160
	180	.7	126	134
	160	.7	112	134
2	134	.5	67	86
3	86	.4	34	38
4	86	.4	34	38
4L	86	.4	34	38
5	56	.3	17	21
6	48	.3	14	21
7	38	.3	11	12

[1] The management period adjustment to I has not been validated by research and is based on NRCS judgment.

Adjustments for crusts may not exceed the percentages shown in Table 4. This adjustment to "I" has not been validated by research and is based on NRCS judgment.

Adjustments to "I" - Clod-forming tillage

In some situations, there is need to manage for erosion control on fields with little or no vegetative cover, where the surface crust has been destroyed, or where loose grains are on the surface and can abrade an existing crust. Emergency or planned tillage to roughen the soil surface can increase the non-erodible clods on the soil surface and reduce the erosion hazard. This is accomplished by:

- Working the surface to create a ridge-furrow configuration (ridge roughness). This usually forms clods (random roughness) in the process.
- Working the soil surface to create clods. The clods create crevices where loose erodible sand grains can be trapped.
- Deep plowing to bring up finer textured soil material that will form more persistent clods, where soils are finer textured in the deeper layers.

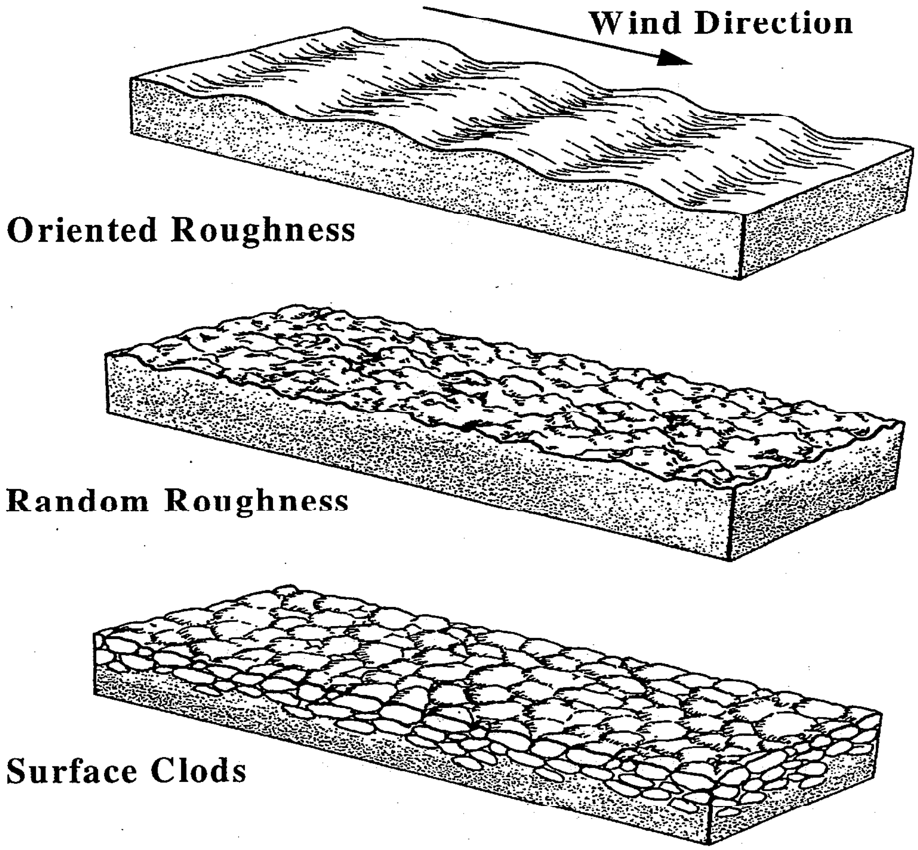

Figure 5. Erosion Resistant Surfaces.

Figure 5 shows the benefits of emergency tillage. Tillage patterns perpendicular or at an angle to the erosive winds leave ridges and valleys that help trap saltating soil particles and aggregates. Tillage also randomly roughens the soil surface and again traps saltating soil particles and aggregates.

Adjustments to "I"

Research has established the expected change in the non-erodible surface fraction during certain management periods, and a procedure has been developed by researchers to include the effects of random roughness in reducing erosion. The random roughness credit is given through an adjustment to the "K" factor value.

The adjustments to "I" reflect specific soil and management conditions and therefore are only applicable in the area from which samples were obtained and on sites with very similar soil and management conditions.

Studies to adjust "I" should be made systematically and include all related soils in a given area. Multiple-year sieving data is required before adjustments are to be considered. Use of adjusted soil erodibility "I" factors, arrived at by using standard rotary sieving procedures, is warranted provided they represent soil surface conditions during the appropriate management period. Adjustments to "I" must be approved and correlated across state and regional boundaries before implementation and must be within the framework of existing "E" Tables.

Adjustments to "I" - Clod-forming tillage

Adjustments to "I" for clod-forming tillage may be made up to, but should not exceed the limits assigned for crusting. This adjustment applies only to the management periods when the soil surface is influenced by the clod-forming tillage. "I" can be adjusted for cloddiness, based on sieving data, during the same period that the "K" factor value is adjusted for random roughness. These adjustments should not be used to calculate annual estimates based on the critical wind erosion period.

Adjustment to "I" - Irrigation

Data is limited on the amount of decrease in soil erodibility due to irrigation. NRCS field personnel have long observed this decrease in erodibility when the soil is wet. This relationship applies to all soils except the fine and very fine sands. Table 5 shows the adjustment that should be made on irrigated soils only. The table also includes the necessary information to adjust the Erosive Wind Energy (EWE) for irrigation.

New Mexico Erosion Modification Procedure

An erosion modification procedure, adopted by NRCS in New Mexico in 1987, addressed the benefits of irrigation and other factors in reducing wind erosion. The NM NRCS modification procedure was based on the technical judgment of NM NRCS personnel. On irrigated land, the New Mexico adjustment for wind erosion (WEQ) provides more acceptable erosion predictions than the recent irrigation modification procedure in the National Agronomy Manual, Circular No. 2. The New Mexico modification procedure will be used in place of the irrigation adjustment procedure on irrigated cropland until new technology (WEPS) is in place that more accurately estimates wind erosion on irrigated cropland in arid regions of the country. Both procedures will be discussed in the "C" factor section.

TABLE 5.

Wind Erodibility Groups and Soil Erodibility Index Irrigation Adjustment

EWE Texture Wetness Factor[1]	Predominant Soil Texture Class of Surface Layer	Wind Erodibility Group (WEG)	Soil Erodibility Index (I) (T/Ac/Yr)[2]	Soil Erodibility Index (I) for Irrig. Soils (T/Ac/Yr)[3]
1	Very fine sand, fine sand, sand or coarse sand.	1	310	310
			250	250
			220	220
			180	160
			160	134
1	Loamy very fine sand, loamy fine sand, loamy sand, loamy coarse sand, or sapric organic soil materials.	2	134	104
1	Very fine sandy loam, fine sandy loam, sandy loam, or coarse sandy loam.	3	86	56
3	Clay, silty clay, noncalcareous clay loam, or silty clay loam with more than 35% clay.	4	86	56
2	Calcareous loam and silt loam, or calcareous clay loam and silty clay loam.	4L	86	56
2	Noncalcareous loam and silt loam with less than 20% clay, or sandy clay loam, sandy clay, and hemic organic soil materials.	5	56	38
2	Noncalcareous loam and silt loam with more than 20% clay, or noncalcareous clay loam with less than 35% clay.	6	48	21
2	Silt, noncalcareous silty clay loam with less than 35% clay and fibric organic soil material.	7	38	21

1 Texture wetness factor for adjustment of Erosive Wind Energy (EWE) for the period for irrigated fields only.

2 The Soil Erodibility Index is based on the relationship of dry soil aggregates greater than 0.84 mm to potential soil erosion.

3 Value for irrigated soils is applicable throughout the year. Values for irrigated soils determined by Dr. E. L. Skidmore, USDA ARS, Wind Erosion Research Unit, Manhattan, KS.

"I" Factor Summary

The "I" factor represents soil loss in tons per acre per year as modified by the other equation factors "K," "C," "L," and "V."

The "I" factor is determined by sieving to establish the percent of the non-erodible fraction (>0.84 mm). These results are used to establish assigned "I" factors.

Adjustments that can be made to "I" include:

- Knolls, which increase "I"
- Surface crusts, which decrease "I"
- Clod-forming tillage, which decreases "I"
- Irrigation, which decreases "I

The I factor has a significant effect on the erosion rate. The "E" tables below, with the same K and C values, but with different I values, illustrate this.

Table 6.

E * - SOIL LOSS FROM WIND EROSION IN TONS PER ACRE PER YEAR
SURFACE - K = 1.0
V - FLAT SMALL GRAIN RESIDUE IN POUNDS PER ACRE

C = 90
I = 134

L UNSHELTERED DISTANCE IN FEET	0	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
10000	120.6	107.1	88.8	70.8	46.3	30.0	17.1	9.9	6.0	2.9	1.4	0.1	0.0
8000	120.6	107.1	88.8	70.8	46.3	30.0	17.1	9.9	6.0	2.9	1.4	0.1	
6000	120.6	107.1	88.8	70.8	46.3	30.0	17.1	9.9	6.0	2.9	1.4	0.1	
4000	120.6	107.1	88.8	70.8	46.3	30.0	17.1	9.9	6.0	2.9	1.4	0.1	
3000	120.6	107.1	88.8	70.8	46.3	30.0	17.1	9.9	6.0	2.9	1.4	0.1	
2000	120.6	107.1	88.8	70.8	46.3	30.0	17.1	9.9	6.0	2.9	1.4	0.1	
1000	115.5	102.4	84.6	67.1	43.5	27.9	15.7	9.0	5.3	2.5	1.3	0.1	
800	114.1	101.0	83.4	66.0	42.7	27.3	15.3	8.7	5.2	2.4	1.2	0.1	
600	108.7	96.1	79.0	62.1	39.8	25.1	13.9	7.8	4.6	2.1	1.0	0.1	
400	103.2	91.0	74.5	58.3	37.0	22.9	12.5	7.0	4.0	1.8	0.9	0.1	
300	98.9	87.1	71.0	55.2	34.8	21.3	11.5	6.3	3.6	1.6	0.8	0.1	
200	90.1	79.0	64.0	49.2	30.4	18.2	9.6	5.1	2.9	1.1	0.4		
150	82.6	72.2	58.1	44.1	26.8	15.6	8.1	4.2	2.3	0.9	0.3		
100	76.1	66.3	52.9	39.8	23.8	13.6	6.9	3.5	1.9				
80	71.0	61.6	48.9	36.5	21.6	12.0	6.0	3.0	1.6				
60	62.5	54.0	42.4	31.1	18.0	9.7	4.7	2.2	1.1				
50	57.9	49.9	38.9	28.3	16.1	8.5	4.0	1.9	0.9				
40	54.0	46.4	36.0	25.9	14.6	7.5	3.5	1.6	0.8				
30	47.3	40.4	31.0	22.0	12.0	6.0	2.7	1.2	0.4				
20	38.3	32.5	24.5	16.9	8.9	4.2	1.8	0.6					
10	26.8	22.4	16.5	10.9	5.4	2.3	0.9						

Table 7.

E * - SOIL LOSS FROM WIND EROSION IN TONS PER ACRE PER YEAR
SURFACE - K = 1.0
V - FLAT SMALL GRAIN RESIDUE IN POUNDS PER ACRE

C = 90
I = 56

L UNSHELTERED DISTANCE IN FEET	0	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
10000	60.3	52.0	40.8	29.8	17.1	9.1	4.3	2.1	1.0				
8000	60.3	52.0	40.8	29.8	17.1	9.1	4.3	2.1	1.0				
6000	60.3	52.0	40.8	29.8	17.1	9.1	4.3	2.1	1.0				
4000	58.6	50.6	39.5	28.8	16.4	8.7	4.1	1.9	1.0				
3000	57.5	49.5	38.6	28.1	15.9	8.4	4.0	1.9	0.9				
2000	55.6	47.9	37.3	26.9	15.2	7.9	3.7	1.7	0.9				
1000	49.9	42.7	32.9	23.5	13.0	6.6	3.0	1.3	0.4				
800	48.2	41.2	31.7	22.5	12.4	6.2	2.8	1.2	0.4				
600	44.8	38.2	29.2	20.5	11.1	5.5	2.4	1.1	0.3				
400	39.9	33.9	25.7	17.8	9.5	4.5	1.9	0.8	0.3				
300	36.8	31.2	23.4	16.1	8.4	3.9	1.6	0.6					
200	31.8	26.8	19.9	13.4	6.8	3.0	1.2	0.4					
150	27.5	23.1	16.9	11.2	5.6	2.4	0.9						
100	23.6	19.7	14.3	9.3	4.5	1.1	0.7						
80	21.1	17.5	12.6	8.1	3.8	1.5	0.5						
60	17.2	14.1	10.0	6.2	2.8	1.1							
50	14.8	12.1	8.5	5.2	2.3	0.8							
40	13.1	10.7	7.4	4.5	1.9	0.4							
30	10.1	8.1	5.5	3.2	1.3	0.3							
20	6.3	5.0	3.3	1.8	0.6								
10	2.2	1.6	1.0	0.4									