Soil Data for Wind Erosion Prediction System

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DISCUSSION

The information in this paper was generated using the Revised Wind Erosion Equation (RWEQ) version 6.03, 1997 (2/). The weather data are for the Crown Point, Indiana area (about 60 kilometers southeast of Chicago, Illinois). The soil was tilled often enough to have a bare surface for the entire year. Tables 1 through 6 show soil loss in Mg per hectare per year using different combinations of soil data elements. A really key aspect in the development of the wind erosion models was the national sieving study done by D. W. Fryrear, et. al. (3/). The sieving developed the comprehensive relationship among basic soil properties and soil-inherent wind erodibility (as Erodible Fraction, EF) that was derived from the sieving.

Table 1 shows the soil loss predicted by RWEQ for different soil textures with organic matter, calcium carbonates, and rock fragments being held at constant numerical value. Soil textures low in clay content have more soil loss then soils high in clay content. Sand has about 1.65 times the soil loss as a silt and about twice as much as clay.

Table 1. PREDICTED SOIL LOSS FROM WIND EROSION FOR DIFFERENT SOIL TEXTURES (REVISED WIND EROSION EQUATION, VERSION 6.03, 1997)

SOIL TEXTURE	SAND	SILT	CLAY	ORGANIC MATTER	CALCIUM CARBONATE	ROCK FRAGMENTS	SOIL LOSS
	%						(Mg/ha)
SAND	93	4	3	2	0	0	125
LOAMY SAND	84	10	6	2	0	0	105
SANDY LOAM	64	26	10	2	0	0	89
LOAM	41	41	18	2	0	0	76
SANDY CLAY	52	7	41	2	0	0	69
SILT	6	88	6	2	0	0	76
SILT LOAM	21	67	12	2	0	0	74
SILTY CLAY LOAM	10	56	34	2	0	0	60
SILTY CLAY	6	47	47	2	0	0	58
CLAY	20	20	60	2	0	0	65

Table 2 displays soil loss predicted, holding with clay separate ranging from 1 through 9 percent. Organic matter, calcium carbonate, rock fragments, and sand held constant, decreased from 170 to 98 Mg per hectare.

Table 2. PREDICTED SOIL LOSS FROM WIND EROSION FOR DIFFERENT CLAY PERCENTAGES FOR A SANDY SOIL (REVISED WIND EROSION EQUATION, VERSION 6.03, 1997)

SOIL TEXTURE	SAND	SILT	CLAY	ORGANIC MATTER	CALCIUM CARBONATE	ROCK FRAGMENTS	SOIL LOSS
	---------- % ----------						(Mg/ha)
SAND	90	9	1	2	0	0	170
SAND	90	8	2	2	0	0	137
SAND	90	7	3	2	0	0	123
SAND	90	6	4	2	0	0	116
SAND	90	5	5	2	0	0	112
SAND	90	4	6	2	0	0	106
SAND	90	3	7	2	0	0	105
SAND	90	2	8	2	0	0	103
SAND	90	1	9	2	0	0	98

Table 3 shows soil loss prediction for a loam with clay separate content ranging from 12 through 25 percent. Organic matter, calcium carbonate, and rock fragments held constant. Clay content increased from 12 to 25 percent, soil loss decreased from 80 to 72 Mg per hectare.

Table 3. PREDICTED SOIL LOSS FROM WIND EROSION FOR DIFFERENT CLAY PERCENTAGES FOR LOAM SOIL (REVISED WIND EROSION EQUATION, VERSION 6.03, 1997)

SOIL TEXTURE	SAND	SILT	CLAY	ORGANIC MATTER	CALCIUM CARBONATE	ROCK FRAGMENTS	SOIL LOSS
	---------- % ----------						(Mg/ha)
LOAM	40	48	12	2	0	0	80
LOAM	40	45	15	2	0	0	78
LOAM	40	40	20	2	0	0	73
LOAM	40	35	25	2	0	0	72

Table 4 depicts soil loss predicted for a loam with organic matter ranging from 2 through 6 percent with soil separates, calcium carbonate, and rock fragments held constant while organic matter content increases from 2 to 6 percent, soil loss decreased from 81 to 74 Mg per hectare. The decrease from 81 to 74 Mg per hectare is irregular with no change after 5.5 percent organic matter.

Table 4. PREDICTED SOIL LOSS FROM WIND EROSION FOR DIFFERENT ORGANIC MATTER PERCENTAGES FOR A LOAM SOIL (REVISED WIND EROSION EQUATION, VERSION 6.03, 1997)

SOIL TEXTURE	SAND	SILT	CLAY	ORGANIC MATTER	CALCIUM CARBONATE	ROCK FRAGMENTS	SOIL LOSS
	---------- % ----------						(Mg/ha)
LOAM	40	48	12	2	0	0	81
LOAM	40	48	12	3	0	0	74
LOAM	40	48	12	4	0	0	69
LOAM	40	48	12	5	0	0	72
LOAM	40	48	12	5.5	0	0	74
LOAM	40	48	12	6	0	0	74

Table 5 shows soil loss predicted for a loam with calcium carbonate ranging from 0 through 20 percent, soil separates, organic matter, and rock fragments held constant decreased from 69 to 36 Mg per hectare.

Table 5. PREDICTED SOIL LOSS FROM WIND EROSION FOR DIFFERENT CALCIUM CARBONATE PERCENTAGES FOR LOAM SOIL. (REVISED WIND EROSION EQUATION, VERSION 1997)

SOIL TEXTURE	SAND	SILT	CLAY	ORGANIC MATTER	CALCIUM CARBONATE	ROCK FRAGMENTS	SOIL LOSS
	---------- % ----------						(Mg/ha)
LOAM	40	48	12	4	0	0	69
LOAM	40	48	12	4	1	0	69
LOAM	40	48	12	4	3	0	67
LOAM	40	48	12	4	5	0	63
LOAM	40	48	12	4	10	0	54
LOAM	40	48	12	4	15	0	45
LOAM	40	48	12	4	20	0	36

Table 6 shows soil loss predicted for a loam with rock fragments ranging from 0 through 40 percent, soil separates, organic matter, and calcium carbonate held constant decreased from 69 to 11 Mg per per hectare.

Table 6. SOIL LOSS FOR DIFFERENT ROCK FRAGMENT PERCENTAGES FOR A LOAM SOIL. (REVISED WIND EROSION EQUATION, VERSION 6.03, 1997)

SOIL TEXTURE	SAND	SILT	CLAY	ORGANIC MATTER	CALCIUM CARBONATE	ROCK FRAGMENTS	SOIL LOSS
	%						(Mg/ha)
LOAM	40	48	12	4	0	0	69
LOAM	40	48	12	4	0	5	56
LOAM	40	48	12	4	0	10	45
LOAM	40	48	12	4	0	15	36
LOAM	40	48	12	4	0	20	29
LOAM	40	48	12	4	0	30	16
LOAM	40	48	12	4	0	35	13
LOAM	40	48	12	4	0	40	11

Soil surveys in the United States vary in age, some are several decades old. Many soil surveys need some of their soil data elements updated using current knowledge and techniques. Others need correlation and coordination of certain soil data elements. The updating, correlating, and coordinating of these soil data elements will generate the same soil loss using soil erosion models for the same or similar soils.

The critical judgment of a soil erosion model occurs during the develop of a conservation plan by farmers and ranchers to control erosion. Erosion prediction should follow a logical array based on soil data elements, climate, use, and management. If the amount of predicted and arrayal erosion loss for the soils seems unrealistic to the farmers and ranchers, then one or more of the following need attention: 1) soil data elements need to be reviewed for accuracy, 2) the science and algorithms in the erosion model needs refinement, and/or 3) farmers and ranchers need to be educated about the erosion hazard of their soils.

Acknowledgment: The author wants to thank D. W. Fryrear (USDA-ARS, Wind Erosion and Water Conservation Research Center, P.O. Box 909, Big Springs, TX 79721-0909) for his assistance with Tables 1 through 6.

CONCLUSION:

Soil erosion models are useful in predicting soil loss and checking the accuracy of soil data elements in the soil survey database. Soil data elements in the soil survey database record the soil properties for soil components of soil map units; therefore, the soil data elements used in erosion models are credited in the accuracy of the model for the projected area of use. The computer capability exists today that allows the predicted soil loss to be generated and verified for all the soils in the United States before being used to develop conservation plans or local, state, or federal regulations. Other models are also being used to test the accuracy of the soil data elements in the soil survey database (an example is the "Soil Rating for Plant Growth" 4/ computer model). The addition of soil erosion models (Wind Erosion Prediction System, WEPS 5/**,** 6/) will enhance the ability to evaluate the data elements in the soil survey database and provide opportunities to improve the technical accuracy of the data elements in the soil survey database.

Literature Cited:

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