Part 502 Wind Erosion

Contents

Subpart 502A Introduction 502–1

502.00 Overview 502–1

Subpart 502B Wind Erosion 502–1

502.10 The wind erosion problem 502–1

502.11 The wind erosion process 502–2

502.12 Principles of wind erosion control 502–3

502.13 Tolerances in wind erosion control 502–4

(a) Crop tolerance to blowing soil 502–4

(b) The effects of wind erosion on water quality 502–4

Subpart 502C Estimating Wind Erosion 502–5

502.20 How, why, and by whom wind erosion is estimated 502–5

502.21 Development of wind erosion prediction technology 502–5

502.22 Data to support the previous WEQ for program purposes 502–6

502.23 Wind Erosion Prediction System 502–6

502.24 Using WEPS estimates with RUSLE2 calculations 502–7

Subpart 502D Using WEPS 502–7

502.30 Using WEPS 502–7

(a) Selection the location to run WEPS 502–7

(b) Generic soils list 502–8

(c) Guidance using CMZ Templates 502–10

(d) Soils with rock on the surface 502–10

(e) Muck soils 502–11

Subpart 502E References 502–12

Figures

Figure 502–1	The wind erosion process	502–3
Figure 502–2	Screen shot of location box in WEPS program	502–8
Figure 502–3	Rock fragments pull-down and the 2% Soil DB Value for rock	502–10

Tables

Table 502–1	Crop tolerance to blowing soil	502–2
Table 502–2	Generic Soils List for WEPS	502–9

Part 502 Wind Erosion

Subpart 502A Introduction

502.00 Overview

This part presents U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) policy and procedures for estimating wind erosion. It explains the Wind Erosion Prediction System (WEPS) and provides guidance and reference on wind erosion processes, prediction, and control. NRCS technical guidance related to wind erosion conforms to policy and procedures in this part.

This part will be amended as additional research on wind erosion and its control is completed and published. The national agronomist is responsible for updating this chapter and coordinating wind erosion guidance with Agricultural Research Service (ARS).

Understanding the erosive forces of wind is essential to properly use WEPS and interpret wind erosion data. NRCS predicts erosion rates, assesses potential damage, and plans control systems to address wind erosion.

The ARS has primary responsibility for erosion prediction research within the USDA. Wind erosion research is conducted by the Wind Erosion Research Unit at Manhattan, Kansas, and the Cropping Systems Research Unit at Big Spring, Texas.

Subpart 502B Wind Erosion

502.10 The wind erosion problem

Wind is an erosive agent. It detaches and transports soil particles, sorts the finer from the coarser particles, and deposits them unevenly. Loss of the fertile topsoil in eroded areas reduces the rooting depth and, in many places, reduces crop yield. Abrasion by airborne soil particles damages plants and constructed structures. Drifting soil causes extensive damage to adjacent land, roads, and drainage features. Sand and dust in the air can harm animals, humans, and equipment. Wind erosion events have caused major highway accidents.

Some wind erosion has always occurred as a natural land-forming process, but it has become detrimental as a result of human activities. This accelerated erosion is primarily caused by improper use and management of the land (Stallings 1951).

Few regions are entirely safe from wind erosion. Wherever the soil surface is loose and dry, vegetation is sparse or absent, and the wind sufficiently strong, erosion will occur unless control measures are applied (1957 Yearbook of Agriculture). Soil erosion by wind in North America is generally most severe in the Great Plains. The NRCS annual report of wind erosion conditions in the Great Plains shows that wind erosion damages from 1 million to more than 15 million acres annually, averaging more than 4 million acres per year in the 10-State area. USDA estimated that nearly 95 percent of the 6.5 million acres put out of production during the 1930s suffered serious wind erosion damage (Woodruff 1975). Other major regions subject to damaging wind erosion are the Columbia River plains; some parts of the Southwest and the Colorado Basin, the muck and sandy areas of the Great Lakes region, and the sands of the Gulf, Pacific, and Atlantic seaboards.

In some areas, the primary problem caused by wind erosion is crop damage. Some crops are tolerant enough to withstand or recover from erosion damage. Other crops, including many vegetables and specialty crops, are especially vulnerable to wind erosion damage. Wind erosion may cause significant short-term

economic loss in areas where erosion rates are below the soil loss tolerance (T) when the crops grown in that area are easily damaged by blowing soil (table 502–1).

502.11 The wind erosion process

The wind erosion process is complex. It involves detaching, transporting, sorting, abrading, avalanching, and depositing of soil particles. Turbulent winds blowing over erodible soils cause wind erosion. Field conditions conducive to erosion include:

- loose, dry, and finely granulated soil
- smooth soil surface that has little or no vegetation present
- sufficiently large area susceptible to erosion
- sufficient wind velocity to move soil

Winds are considered erosive when they reach 13 miles per hour at 1 foot above the ground or about 18 miles per hour at a 30 foot height. This is commonly referred to as the threshold wind velocity (Lyles and Krauss 1971).The WEPS model sets this threshold by the hourly conditions in the field. As the field or wind conditions change the threshold changes.

The wind transports single grain particles or stable aggregates, or both, in three ways (fig. 502–1):

Saltation—Individual particles/aggregates ranging from 0.1 to 0.5 millimeter in diameter lift off the surface at a 50- to 90-degree angle and follow distinct trajectories under the influence of air resistance and gravity. The particles/aggregates return to the surface at impact angles of 6 to 14 degrees from the horizontal. Whether they rebound or embed themselves, they initiate movement of other particles/aggregates to create the avalanching effect. Saltating particles are the abrading bullets that remove the protective soil crusts and clods. Most saltation occurs within 12 inches above the soil surface and typically, the length of a saltating particle trajectory is about 10 times the height. From 50 to 80 percent of total transport is by saltation.

Table 502–1 Crop tolerance to blowing soil

Tolerant T	Moderate tolerance 2 ton/a	Low tolerance 1 ton/a	Very low tolerance 0 to 0.5 ton/a
Barley	Alfalfa (mature)	Broccoli	Alfalfa seedlings
Buckwheat	Corn	Cabbage	Asparagus
Flax	Onions (>30 days)	Cotton	Cantaloupe
Grain Sorghum	Orchard crops	Cucumbers	Carrots
Millet	Soybeans	Garlic	Celery
Oats	Sunflowers	Green/snap beans	Eggplant
Rye	Sweet corn	Lima beans	Flowers
Wheat		Peanuts	Kiwi fruit
		Peas	Lettuce
		Potatoes	Muskmelons
		Sweet potatoes	Onion seedlings (<30 days)
		Tobacco	Peppers
			Spinach
			Squash
			Strawberries
			Sugar beets
			Table beets
			Tomatoes
			Watermelons

Surface creep—Sand-sized particles/aggregates are set in motion by the impact of saltating particles. Under high winds, the whole soil surface appears to be creeping slowly forward as particles are pushed and rolled by the saltation flow. Surface creep may account for 7 to 25 percent of total transport (Chepil 1945 and Lyles 1980).

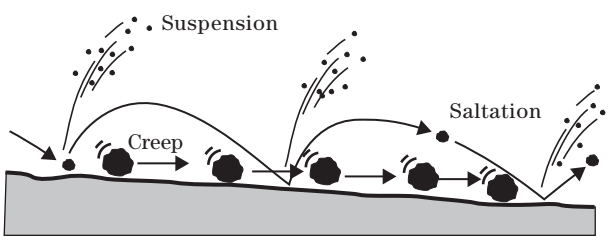
Suspension—The finer particles, less than 0.1 millimeter in diameter, are dislodged from an eroding area by saltation and remain in the air mass for an extended period. Some suspension-sized particles or aggregates are present in the soil, but many are created by abrasion of larger aggregates during erosion. From 20 percent to more than 60 percent of an eroding soil may be carried in suspension, depending on soil texture. As a general rule, suspension increases downwind, and on long fields can easily exceed the amount of soil moved in saltation and creep.

Saltation and creep particles are deposited in vegetated strips, ditches, or other areas sheltered from the wind, as long as these areas have the capacity to hold the sediment. Particles in suspension, however, may be carried a great distance.

The rate of increase in soil flow along the wind direction varies directly with erodibility of field surfaces. The increase in erosion downwind (avalanching) is associated with the following processes:

- the increased concentration of saltating particles downwind increases the frequency of impacts and the degree of breakdown of clods and crusts
- the accumulation of erodible particles and breakdown of clods tends to produce a smoother (and more erodible) surface

Figure 502–1 The wind erosion process



The distance required for soil flow to reach a maximum for a given soil is the same for any erosive wind. The more erodible the soil surface, the shorter the distance in which maximum flow is reached. Any factor that influences the erodibility of the surface influences the increase in soil flow.

502.12 Principles of wind erosion control

Five principles of wind erosion control have been identified (Lyles and Swanson 1976; Woodruff et al. 1972; and Woodruff and Siddoway 1965). These are:

- Establish and maintain adequate vegetation or other land cover.
- Reduce unsheltered distance along wind erosion direction.
- Produce and maintain stable clods or aggregates on the land surface.
- Roughen the land with ridge and/or random roughness.
- Reshape the land to reduce erosion on knolls where converging windflow causes increased velocity and shear stress.

The cardinal rule of wind erosion control is to strive to keep the land covered with vegetation or crop residue at all times (Chepil 1956). This leads to several principles that should be paramount as alternative controls are considered:

- Return all land unsuited to cultivation to permanent cover.
- Maintain maximum possible cover on the surface during wind erosion periods.
- Maintain stable field borders or boundaries at all times.
- Keep all residue standing as long as possible (standing residue is at least 3 time more effective at controlling wind erosion than flat residue

502.13 Tolerances in wind erosion control

In both planning and inventory activities, NRCS compares estimated erosion to soil loss tolerance (T). T is expressed as the average annual soil erosion rate (tons/acre/year) that can occur in a field with little or no long-term degradation of the soil resource, thus permitting crop productivity to be sustained for an indefinite period.

Soil loss tolerances for a named soil are recorded in the soil survey database in National Soil Information System (NASIS). WEPS can use the .mdb soil database from field office NRCS server or go directly to the National Soil Survey site for the data needed to make a soil loss estimate.

The normal planning objective is to reduce soil loss by wind or water to T or lower. In situations where treatment for both wind and water erosion is needed, soil loss estimates using the WEPS and RUSLE2 are not added together to compare to T, but are solved separately to find a treatment system that will adequately address both the wind and water erosion. Additional impacts of wind erosion that should be considered are damage to crops (crop tolerance) and the potential off-site damages, such as air and water pollution and the deposition of soil particles.

(a) Crop tolerance to blowing soil

Crop tolerance to soil blowing is an important consideration in wind erosion control. Wind or blowing soil, or both, can have an adverse effect on growing crops. Most crops are more susceptible to abrasion or other wind damage at certain growth stages than at others. Damage can result from desiccation, abrasion, and twisting of plants by the wind.

Crop tolerance can be defined as the maximum wind erosion that a growing crop can tolerate, from crop emergence to field stabilization, without an economic loss to crop stand, crop yield, or crop quality.

Many common crops have been categorized based on their tolerance to blowing soil. These categories of some typical crops are listed in table 502–1. Crops may tolerate greater amounts of blowing soil than shown in table 502–1, but yield and quality will be adversely affected.

(b) The effects of wind erosion on water quality

Some of the adverse effects of wind erosion on water quality include:

- Deposition of phosphours (P) into surface water
- Increased Biochemical Oxygen Demand (BOD) in surface water
- Reduced stream conveyance capacity because of deposited sediment in streams and drainage canals

Local water quality guidelines under Total Maximum Daily Loads (TDML) for nutrients may require that wind erosion losses be less than the soil loss tolerance (T) in order to achieve local phosphorus (P) or other pollutant reduction goals.

Subpart 502C Estimating Wind Erosion

502.20 How, why, and by whom wind erosion is estimated

NRCS estimates erosion rates to:

- help land users plan and apply conservation management systems
- inventory natural resources
- evaluate the effectiveness of conservation programs and conservation treatment applied to the land

Wind erosion is difficult to measure. Wind moves across the land in a turbulent, erratic fashion. Soil may blow into, within, and out of a field in several directions in a single storm. The direction, velocity, duration, and variability of the wind all affect the erosion that occurs from a wind storm. Much of the soil that erodes from a field bounces or creeps along near the surface; however, some of the soil blown from a field may be high above the ground in a dust cloud by the time it reaches the edge of a field (Chepil 1963).

502.21 Development of wind erosion prediction technology

Drought and wind erosion during the l9th century caused wind erosion to be recognized as an important geologic phenomenon. By the late 1930s, systematic and scientific research into wind erosion was being pioneered in California, South Dakota, Texas, and in Canada and England. This research produced information on the mechanics of soil transport by wind, the influence of cultural treatment on rates of movement, and the influence of windbreaks on wind flow patterns. The publication, The Physics of Blown Sand and Desert Dunes (Bagnold 1941), is considered a classic by wind erosion researchers.

In 1947, USDA began the Wind Erosion Research Program at Manhattan, Kansas, in cooperation with Kansas State University. That program was started under the leadership of Austin W. Zingg, who was soon joined by W.S. Chepil, a pioneer in wind erosion research in Canada. The research project's primary purposes were to study the mechanics of wind erosion, delineate major influences on that erosion, and devise and develop methods to control it.

By 1954, Chepil and his coworkers began to publish results of their research in the form of wind erosion prediction equations (Chepil 1954; Chepil 1957; Chepil et al. 1955; Woodruff and Chepil 1956).

In 1959, Chepil released an equation:

$$E = IRK\int BWD$$

where:

E = quantity of erosion
I = soil cloddiness
R = residue
K = roughness
f = soil abradability
B = wind barrier
W = width of field
D = wind direction

Wind velocity at geographic locations was not addressed in this equation (Chepil 1959).

In 1962, Chepil's group released the equation:

$$E = \int(ACKLV)$$

where:

E = estimated average annual soil loss in tons per acre per year
f = indicates relationships that are not straight-line mathematical calculations
A = percentage of soil fractions greater than 0.84 millimeter;
K = soil surface roughness factor
C = climatic factor
L = the unsheltered distance
V = the vegetative cover factor

A C-factor map for the western half of the United States was also published in 1962 (Chepil et al. 1962).

In 1963, the form of WEQ was released as E =*f*(IKCLV) (Chepil 1963).

where:

E	=	estimated average annual soil loss in tons per acre per year
f	=	indicates relationships that are not straight-line mathematical calculations
I	=	soil erodibility index
K	=	soil surface roughness factor
C	=	climatic factor
L	=	the unsheltered distance
V	=	the vegetative cover factor

The Wind Erosion Prediction System (WEPS) is a process-based, daily time-step model that simulates weather, field conditions, and erosion. The WEPS project was initiated in 1985 to overcome the shortfalls of WEQ. Leon Lyles, ARS, Manhattan, Kansas began the WEPS project, and Larry J. Hagen, ARS, lead the project from 1988 to 1994. Ed L. Skidmore, ARS, completed WEPS and made an official hand-off to NRCS in 2005.

WEPS uses climate generators for Cligen and Windgen to simulate 30 year records for wind, temperature and precipitation. A highly modified version of the Erosion Productivity Impact Calculator (EPIC) model is used to grow crops in the model. Soil information comes from the NRCS Soil Survey Geographic (SSURGO) Databases. User inputs are needed for the region (field) shape, size, and orientation; location is added from drop-downs; and management is added using a management editor. WEPS uses a Java-based interface to drive seven sub-models (hydrology, management, soil, crop, decomposition, erosion, and weather).

In 2010 WEQ was replaced by the WEPS for use by NRCS. See part 502D for the description and use of WEPS.

502.22 Data to support the previous WEQ for program purposes

Since 1963 the WEQ technology has been used by NRCS to assist farmer assess, plan, and implement wind erosion control systems on their farms. WEQ has also been used to determine Highly Erodible Land (HEL) land based on wind erosion and plan conservation systems to keep producers in HEL compliance. NRCS at the national, state, and field office levels will need to archive the procedures and WEQ data to continue to support the HEL determinations for wind erosion and to support current producer HEL plans based on the WEQ technology.

Data to support WEQ shall be archived when WEPS is implemented in the Field Office in 2010. The Climate (C) factors and soil erodibility (I) factors will be used to make Highly Erodible land determinations when land is sod busted or put into crop production.

Any existing localized values that were in use at the time WEPS was introduced shall be maintain and marked as archived.

502.23 Wind Erosion Prediction System

Wind Erosion Prediction System (WEPS) is the current technology used by NRCS to assess, plan, and implement wind erosion control systems on cropland and on other land (disturbed areas) where the inputs and data can be adequately defined. WEPS currently is not adapted to rangeland and woodland type land uses.

The WEPS is a process-based, daily time-step, wind erosion simulation model. It represents the latest in wind erosion prediction technology and is designed to provide wind erosion soil loss estimates from cultivated, agricultural fields.

The NRCS version of WEPS consists of the computer implementation of the WEPS science model with a graphical user interface designed to provide easy to use methods of entering inputs to the model and obtaining output reports. WEPS was developed by the Wind Erosion Research Unit (WERU) of the United States Department of Agriculture, Agricultural Research Service in Manhattan, KS. WEPS greatly expands the type of information about the soil loss.

WEPS uses many of the parameters that WEQ uses. Unsheltered distance (L) is now the Region with the shape, length, width, area, and orientation described. Random Roughness is calculated daily and has a similar influence as it did in WEQ. Oriented Roughness or ridge roughness is applied with each tillage operation and is degraded over time. Standing and flat residue is accounted for in several age pools. Green growing crops accumulate mass on a daily basis. Erodible Fractions related to the I factor for WEQ are calculated on a daily basis and displayed in the detailed report section of WEPS.

502.24 Using WEPS estimates with RUSLE2 calculations

The WEPS provides an estimate of average annual wind erosion and saltation, creep, and suspension erosion from all four sides of a field. RUSLE2 provide an estimate of average annual sheet and rill erosion from the slope length (L) entered into the model. Although both wind and water erosion estimates are in tons per acre per year, they are not additive unless the two equations represent identical flow paths across identical areas.

Subpart 502D Using WEPS

502.30 Using WEPS

WEPS has a very good user's manual located on the Web at: *http://www.weru.ksu.edu/weps/download/WEPSUsersManualDec07.pdf* Most of the information needed to run WEPS is contained in the manual. It will be updated periodically so users will need to check for the latest version. The following information is in addition to the material in the user's manual.

On the same Web site mentioned above there are training exercises. These exercises are designed to teach the use of the WEPS model on many of the common farming systems. New users should take the time to run these to become familiar with the model.

National crop management zone (CMZ) management files are stored on the same Web site. These can be downloaded and placed in the C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\man subdirectory. They will then show up on the pull-down list inside WEPS.

Small changes in the management system can have significant changes in the soil loss output. It is recommended that until a user knows how the model works that they not assume that a change will not change the erosion rate. Make the run before a conclusion is made. With WEPS, areas around the Great Lakes and the Coastal Plains in the east may now predict some wind erosion where the WEQ did not predict erosion.

(a) Selection the location to run WEPS

Background—WEPS has a box, Location, in the right upper part of the main interface to identify where the model will run (fig. 502–2).

States with predetermined polygon maps (HI, AK, WA, OR, CA, AZ, NV, ID, UT, WY, parts of MT, parts of CO, parts of NM, and parts of TX) will use the Map Viewer button to select the approximate location to run the model. These states have developed Windgen and Cligen maps to designate the appropriate climate data station to be used in the map locations.

The remaining states will use the Cligen station closes to the latitude and longitude (decimal degrees) location and the Windgen station will be a weighted average of the three closest stations. WEPS uses this approach for Windgen because the climate stations are far apart, have sometimes very different data, fewer mountain ranges, and sharp changes in soil loss if a single station were used. This method produces a more gradual change moving from one station to another.

Selection process—To deal with this, within NRCS, States have the option and requirement to use the model in one of two ways.

- Option 1: NRCS Mode (with county centroids). This will give the user the option to select the county. The latitude and longitude boxes will only be changed by selecting the county. The map viewer will not be used to select the location of the Windgen file.
- Option 2: NRCS Mode (with sub-county zones). This mode allows the user to select the location by using the map viewer and double clicking to change the location to any location within a county. This will select a sub-county polygon with a predetermined Windgen station location for that zone. The State will need to do a great deal of testing to be sure the variability of the WEPS runs are within reasonable limits when moving from zone to zone within a given county. A GIS shape map will need to be developed for the State and counties. The state wind erosion specialist and GIS specialist should work together to make the needed shape file. The NTSCs will help if the states chooses this option.

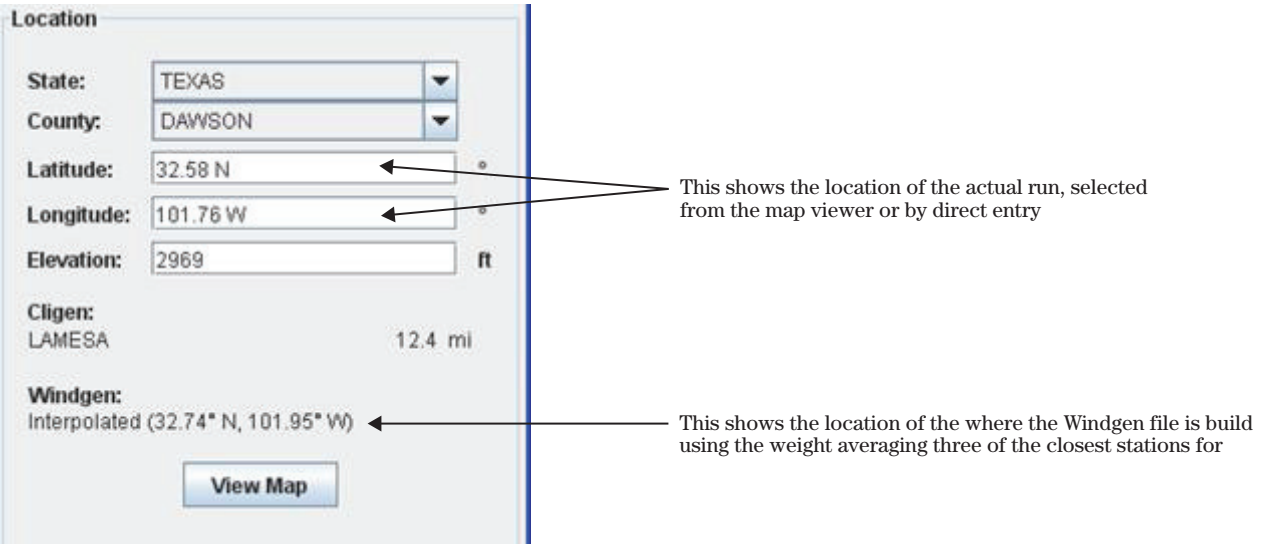
  Note that the western States (listed) with Windgen and the Cligen maps will use the Option 2 and select the location on the map viewer. The preselected station for each location will be used. The weight averaging will not be used in those States.

Those States using option 2 should set one location in the center of a group of fields. It is recommended that fields beyond 5 miles of the center be given a new latitude and longitude location. The distance from the center should be set by state policy.

(b) Generic soils list

Background—There is about 5 percent of the land in the United State without a soil survey. Some of the land is cropland with a wind erosion potential. There also is a need to provide a way to run WEPS on disturbed lands. A set of generic soils has been developed for use with WEPS.

Figure 502–2 Screen shot of location box in WEPS program



Method—The first set of 12 soils was selected from the centroid points of the standard USDA textural triangle. The centroid set the sand, silt, and clay percentages for the files. Bulk density was set using, BD = (1 – pore space) × 2.65. In the equation, percent pore space has to be expressed as a decimal. Eight important additional subclasses of sandy soil were added to the major group of 12 to make a total of 20 generic soils.

The fine sand, very coarse sand, coarse sand, medium sand, fine sand, and very fine sand were added to each of the soils as five-way split to start with. Then the sand values were hand adjusted to fit the rules in the National Soil Survey Handbook. Classification was checked using *http://soils.usda.gov/technical/aids/investigations/texture/* to see if they fit the textural classifications rules.

Soil depth was set to 1,500 mm or 60 inches and a 1 percent slope is assumed. Organic Matter was set to 1.5 percent as a mid range for arid and semi-arid soil where wind erosion is most common. No surface rock was assumed. Users can add the rock surface percentage on the main interface. T was set to 5 tons per acre as a deep soil is assumed. Table 502–2 shows the values used to make the WEPS generic (.ifc) records.

Table 502–2 Generic Soils List for WEPS

Tex abr	Tex. Name	Sand Tt (%)	Sand (percent fraction of Tt sand)					Silt (%)	Clay (%)	BD (g/cm)
			V coarse	Coarse	Med	Fine	V fine			
SiC	Silty clay	7	1	2	2	1	1	48	45	1.22
CL	Clay loam	33	6	6	7	7	7	34	33	1.32
SiCL	Silty clay loam	11	2	2	2	2	3	56	33	1.28
C	Clay	18	3	3	4	4	4	17	65	1.21
SC	Sandy clay	53	10	10	11	11	11	7	40	1.33
L	Loam	41	8	8	8	8	9	41	18	1.43
SiL	Silt loam	21	4	4	5	4	4	66	13	1.44
SL	Sandy loam	65	11	11	11	16	16	24	11	1.55
CosSL	Coarse sandy loam	63	15	30	6	6	6	27	10	1.55
FSL	Fine sandy loam	63	5	6	6	31	15	27	10	1.55
SCL	Sandy clay loam	63	11	11	11	15	15	27	10	1.41
VFSL	Very fine sandy loam	63	2	3	3	18	37	27	10	1.55
Si	Silt	7	1	1	2	2	1	88	5	1.48
LFS	Loamy fine sand	83	7	7	7	55	7	12	5	1.67
LCosS	Loamy coarse sand	83	16	16	17	17	17	12	5	1.64
FS	Fine sand	93	7	7	8	60	11	4	3	1.67
LS	Loamy sand	83	10	10	10	23	30	12	5	1.64
S	Sand	93	20	20	20	15	18	4	3	1.67
LVFS	Loamy very fine sand	83	5	5	5	8	60	12	5	1.64
VFS	Very fine sand	93	3	4	4	22	60	4	3	1.67

Note: Sand and clay values were established using the USDA NRCS Textural Triangle. Sand textures were normalized to match the rules listed the USDA National Soil Survey Manual. They were checked by entering the listed values on the Web Soil Texture Calculator tool (*http://soils.usda.gov/technical/aids/investigations/texture/*).

Use of the Generic Soils—The generic soils can be use in at least three ways.

- NRCS has not completed a soil survey in an area where WEPS need to be run on cropland. In that case a field visits must be made to determine the texture of the soil(s) in the simulation area (field). It is advised that planner must be able to hand texture soil or take a person that can to the field. Once the planner has determined the critical dominant texture, a corresponding WEPS generic soil .ifc file can be selected from the NRCS Generic Soils subfolder.
- The soil has be removed or altered from the original soil mapped. These are likely to be construction sites; mine reclaim sites; or land-fill sites. Sometimes there will be lab data that will indicate the soil texture. In that case use the texture from the lab to select the corresponding WEPS file as stated.
- On fields that have a long history of wind erosion, a planner will find that the texture of the field is different than the soil map indicates. This has been documented in Texas and Idaho on fine sandy loams that are now loamy sand or loamy fine sand. Over the years the fine material on the surface has left the field by suspension. In these cases a planner can ask for a soil scientist to determine a more correct soil within the county survey or select a generic soil after making a field texture determination.

(c) Guidance using CMZ Templates

Crop Management Zone (CMZ) templates are available from the ARS Website in Manhattan, Kansas (*http://www.weru.ksu.edu/nrcs/wepsnrcs.html*). Click on the download button on the left side of the screen and navigate to the /WEPS database files/WEPS_Management_templates (CMZ files). In that directory any of the 75 CMZs can be downloaded and placed in the C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\man folder of the computer. Do not unzip the folders.

The user must be careful using the management files from the CMZ folders. Some of the files that were converted from RUSLE2 have 2 years listed when they are a 1 year crop. In some cases the 0 year and year 1 were converted as 2 years in WEPS. Fall tillage was converted as a different year. All files must be opened and the operations and years checked for correctness of the dates.

Irrigation must be added by the user. There are no national management files with irrigation operation included. The user must open the management and add the appropriated irrigation operation to the file.

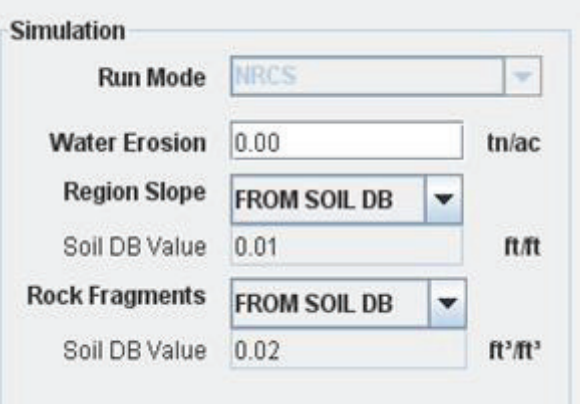
Once a CMZ file is corrected and the calibrated to a location it is highly recommended that a local record of the file be stored in the C:\Documents and Settings\All Users\Application Data\USDA\WEPS\Databases\nrcs\man\local subdirectory. This will reduce the time needed to recalibrate the next time the management is used.

(d) Soils with rock on the surface

WEPS estimates the surface rock from the soils data. Percent vertical surface rock in the first layer is converted to horizontal surface rock expressed as a percentage. Figure 502–3 has the Soil DB Value shown. The 0.02 indicates that the soils record has 2 percent rock on the surface.

Surface rock reduces the soil loss from wind greatly. It is critical for the user to evaluate whether there is surface rock present or not. The model will use the default (the soil survey data) unless the user clicks the pull down and changes it to override rock fragments.

Figure 502–3 Rock fragments pull-down and the 2% Soil DB Value for rock



(e) Muck soils

Histosols (muck or high organic soils) require special treatment when used in WEPS. WEPS 1.1.16 does not estimate Muck soils correctly. About 25 percent of the Histosols mapped by NRCS in the United States have the needed soil data WEPS. Much of the texture data in those records is populated with conceptual or estimated data not well-suited for use in WEPS. Wind erosion can be a serious problem on these high organic sites in Minnesota, Wisconsin, Michigan, North Carolina, and Florida. Representatives made up of ARS, NRCS, and university personal in 2008 met to review and discuss alternatives that might better reflect wind erosion on organic soils.

Short term
WEQ used an I factor of 134 tons per acre for Sapric Histosols. A group of I 134 mineral soils with a textural range of LFS, VFSL, LS, LCOS were evaluated to find the range of soil loss. A soil with the average soil loss of the group was selected to establish the sand, silt, and clay fractions to use in the generic organic soil file. By selecting the mid range soil texture WEPS would simulate a similar soil used in WEQ. The additional data needed for the organic soil file record comes from NRCS National Soils Lab in Lincoln, Nebraska.

WEPS has coding to assist users to select the generic organic soil file when Histosol is in the order name of the record. Any soil that has predominately Sapric organic material in the tillage layer is required to use the organic soils file in WEPS. Users should check to be sure that all “muck” soils are using the generic organic soil file listed in the NRCS Generic Soils list in WEPS.

WEPS is coded to use the first mineral layer on soils that have smaller amounts of organic material. Soils that have a thin organic surface layer such as Histic or Histic integrated will use the first mineral layer in the calculation. If the organic layer depth is greater than 4 inches, the model should use the organic soils file listed in WEPS. User should check to be sure the correct soil file is loaded.

Long term
ARS in Lubbock, Texas, and Manhattan, Kansas, have initiated efforts to better characterize wind erosion on organic soils. Plans include taking actual measurements in the field with a portable wind tunnel in Florida and Michigan. There is a plan to study soil from Florida and Michigan in the soils lab at ARS Manhattan, Kansas. It is anticipated that in 3 to 5 years, an improved method of estimating soil loss on organic soil will be available.

Subpart 502E References

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