Point Module VIII—Erosion Data

Erosion data for the Universal Soil Loss Equation (USLE) and the Wind Erosion Equation (WEQ) were obtained in the 1982, 1987, and 1992 National Resources Inventories (NRI). The concepts, definitions, and instructions are the same as those used in previous inventories.

A. Universal Soil Loss Equation (USLE) Data

Definition

Universal Soil Loss Equation (USLE) estimates average annual soil loss from sheet and rill erosion. Location specific data for the field in which the NRI point falls or that portion of the field surrounding the point that would be considered in conservation planning are used in the NRI calculations. The equation is: A = RKLSCP, where A is the computed soil loss per unit area, R is a rainfall factor, K is a soil erodibility factor, L is a slope length factor, S is a slope degree factor, C is a cover and management factor, and P is a support practice factor. [NAM]

Importance

The goal is to provide consistent data for the inventory years 1982, 1987, 1992, and 1997, so that trending comparisons will be credible, that resource concerns and accomplishments can be validly assessed, and that strategic planners and analysts will have a powerful data base to aid formulation of policy decisions and programs.

Guidelines and Clarification

USLE factors are determined only for points classified as land cover/use of cropland, pastureland, and CRP land.

Consistent interpretations for all years are essential. Do **not** use factor values developed for the Revised Universal Soil Loss Equation (RUSLE).

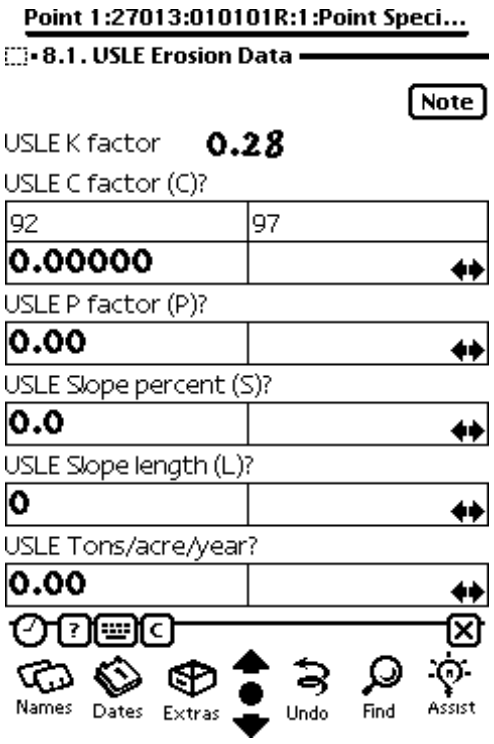
Erosion data for the 1997 NRI are gathered when land cover/use is classified as cropland, pastureland, or CRP land.

While making erosion factor determinations for the 1997 NRI, apply definitions and concepts uniformly for all inventory years—1982, 1987, 1992, and 1997.

Determinations of USLE factors are made for the field in which the point falls or that part of the field surrounding the point that would be considered in conservation planning. The R Factor (rainfall and runoff), K Factor (soil erodibility), and USLE calculation are displayed, but cannot be edited.

Determine the USLE cropping management, erosion control practice, slope percent, and slope length factors for 1997. Carefully check the 1982, 1987, and 1992 entries, and make changes to prerecorded entries if necessary.

1. C factor (cropping management)



Definition

Cover and management (C factor) is the ratio of soil loss from an area with specified cover and management to that from an identical area in tilled continuous fallow; one of the factors used in the Universal Soil Loss Equation (USLE). [See C factor]

C factor (USLE) is the cover and management factor for water erosion calculations using the Universal Soil Loss Equation (USLE). [NAM].

Cropping management. See C factor for USLE.

Guidelines and Clarification

Determine the cropping management C factor for the cropping systems employed. The C factor represents the entire rotation regardless of length of rotation. Do not record a C factor that represents only the current crop unless it is a continuous crop. For the NRI this reflects historical rather than planned cropping.

Areas with a land cover/use of pastureland or CRP land reflect C factor values based on percent of ground covered with grass, weeds, trees, and/or brush. The percent of ground cover is always determined by viewing vertically. The same Field Office Technical Guide tables and/or procedures must be used for all four years—1982, 1987, 1992, and 1997.

Review prerecorded historical data in PDA.

Documentation Required in the PSU Folder

Cite the source material used to determine the C factor.

PDA Instructions

Record to two decimal places if 0.10 or larger; otherwise, record to three decimal places. If prerecorded (historical) factors seem inconsistent, check and correct any discrepancies in the 1982, 1987, and 1992 interpretations.

Consistent interpretations for all years are essential. Do **not** use factor values developed for the Revised Universal Soil Loss Equation (RUSLE).

Examples

The land cover/use is pastureland and there are no obvious tall weeds, brush, or trees. The ground cover appears to be mostly grass. The C factor is recorded as 0.013.

The land cover/use is cropland and the cropping system is a 2-year rotation of corn and soybeans in a mulch tilled system. The soybean year has 30 percent residue cover after planting, and the corn year has 20 percent residue after planting. Based on ancillary material, the C factor for the rotation is 0.26.

2. P factor (support practice factor)

Definition

P factor in the USLE is the ratio of soil loss with specific support practice to the corresponding loss with upslope and downslope culture. [AH-537]

Guidelines and Clarification

A P factor of less than 1.0 is not valid unless contour farming, contour stripcropping, or terracing is recorded as a conservation practice in module X.

Note: Do not use values from the Revised Universal Soil Loss Equation (RUSLE).

Documentation Required in the PSU Folder

No documentation required.

PDA Instructions

Record the erosion control P factor from Agricultural Handbook 537, tables 13, 14, or 15 (page 4).

Review prerecorded historical data in PDA.

Table 13 P values and slope-length limits for contouring

Land slope percent	P value	Maximum length[1] (ft)
1 to 2	0.60	400
3 to 5	.50	300
6 to 8	.50	200
9 to 12	.60	120
13 to 16	.70	80
17 to 20	.80	60
21 to 25	.90	50

1 Limit may be increased by 25 percent if residue cover after crop seedlings emerge will regularly exceed 50 percent.

Table 14 P values, maximum strip widths, and slope-length limits for contour stripcropping

Land slope percent	P values[1]			Strip width[2] (ft)	Maximum length (ft)
	A	B	C		
1 to 2	0.30	0.45	0.60	130	800
3 to 5	.25	.38	.50	100	600
6 to 8	.25	.38	.50	100	400
9 to 12	.30	.45	.60	80	240
13 to 16	.35	.52	.70	80	160
17 to 20	.40	.60	.80	60	120
21 to 25	.45	.68	.90	50	100

1 P values:
- A For 4-year rotation of row crop, small grain with meadow seeding and 2 years of meadow. A second row crop can replace the small grain if meadow is established in it.
- B For 4-year rotation of 2 years row crop, winter grain with meadow seeding, and 1-year meadow.
- C For alternate strips of row crop and small grain.

2 Adjust strip width limit, generally downward, to accommodate widths of farm equipment.

Table 15 P values for contour-farmed terraced fields[1]

Land slope (%)	Farm planning	
	Contour factor[2]	Stripcrop factor
1 to 2	0.60	0.30
3 to 8	.50	.25
9 to 12	.60	.30
13 to 16	.70	.35
17 to 20	.80	.40
21 to 25	.90	.45

1 Slope length is the horizontal terrace interval. The listed values are for contour farming. No additional contouring factor is used in the computation.

2 Use these values for control of interterrace erosion within specified soil loss tolerances.

3 These values include entrapment efficiency and are used for control of offsite sediment within limits and for estimating the field's contribution to watershed sediment yield.

Examples

The point is on a 4 percent slope in a field that has gradient terraces that empty into a grassed waterway. Farming operations are on the contour with the terraces. The P factor value is 0.50.The point is on an 8 percent slope that has contour stripcropping applied. The P factor value is 0.25.

The point is on a 5 percent slope and has a slope length of 250 feet. There are no conservation practices in the field. The P factor value is 1.0.

The point is on a 5 percent slope and has a slope length of 250 feet. The field is contour farmed. The P factor value is 0.5.

The point falls in a field that has a rotation of 2 years row crops, 1 year of small grain overseeded to meadow, and 1 year maintained in meadow. The field has a 6 percent slope with contour strips 100 feet wide. The P factor value is 0.38.

3. Slope Percent

Definition

Slope percent is the amount of inclination of the soil surface from the horizontal expressed as the vertical distance divided by the horizontal distance, then multiplied by 100. For example, a difference in elevation of 1 foot over a horizontal distance of 100 feet is a 1 percent slope. Used in estimation of the S factor for USLE calculations for sheet and rill erosion. [Soil Survey Manual]

Guidelines and Clarification

Determine the percent slope through the point in the direction that water flows overland.

Slope is recorded to the nearest whole number for slopes of 1 percent or greater. Slopes less than 1 percent are recorded to the nearest 0.1 percent. A 0 (zero) is not recorded unless the slope is laser-leveled to less than 0.05 percent.

Documentation Required in the PSU Folder

No documentation required.

PDA Instructions

Enter percent slope. Review the recorded entries for 1982, 1987, and 1992.

Examples

The point falls on a slope that is 2.7 percent. The recorded slope is 3 percent.
The point falls on a slope that is 3.4 percent. The recorded slope is 3 percent.
The point falls on a slope that is 0.2 percent. The recorded slope is 0.2 percent.

4. Slope Length

Definition

Slope length is the length of slope from the point of origin of overland flow to a point of sedimentation or concentrated flow. (For the NRI, length of slope is taken through the sample point.) Used to estimate the L factor in the Universal Soil Loss Equation (USLE). [AH-537]

Guidelines and Clarification

Length of the slope is measured through the point in feet. On terraced land, this is generally the distance between terraces. Slope length is the distance from the point of origin (whether on or off the PSU) of overland flow to either of the following:

- The point where the slope decreases to the extent that deposition of sediment begins.
- The point where runoff enters an area of concentrated flow or a channel.

Documentation Required in the PSU Folder

No documentation required.

PDA Instructions

Record length of slope in feet. Check the recorded entries for 1982, 1987, and 1992.

Examples

The point falls on a terraced field between the terraces. The terrace interval is 100 feet. The length of slope recorded is 100 feet.

The point falls on a terrace in a terraced field. The terrace interval is 100 feet. The length of slope recorded is 100 feet.

Point Module VIII (Universal Soil Loss Equation) Glossary

(The following definitions were extracted from the 1997 National Resources Inventory Glossary.)

Conservation practices. A specific treatment used to meet a specific need in planning and carrying out soil and water conservation programs for which standards and specifications have been developed (NPM). The practices recorded have been applied to the area of land in which the NRI point falls or the portion of the field that would be used in conservation planning. The point need not fall on a specific practice. [NCPM]

Conservation treatment unit (CTU). A field or group of fields or other units of land with similar soil and water conservation problems requiring similar combinations of land use and conservation treatment. [NCPM]

Cropland. A land cover/use category that includes areas used for the production of adapted crops for

B. Wind Erosion Equation (WEQ) Data

Definition

Wind erosion equation (WEQ) is an erosion model designed to predict long-term average annual soil losses from a field having specific characteristics. E = f(IKCLV) where E is the estimated average annual soil loss expressed in tons per acre per year; I is the soil erodibility; K is the soil ridge roughness factor; C is the climatic factor; L is the equivalent unsheltered distance across the field along the prevailing wind erosion direction; and V is the equivalent vegetative cover. [NAM]

Importance

The goal is to provide consistent data for the inventory years 1982, 1987, 1992, and 1997, so that trending comparisons will be credible, that resource concerns and accomplish-ments can be validly assessed, and that strategic planners and analysts will have a powerful data base to aid formulation of policy decisions and programs.

Guidelines and Clarifications

For the 1997 NRI, WEQ data are collected: (1) for sample sites where wind erosion data have been collected for previous inventories and land cover/use is cropland, pastureland, or CRP land; and (2) for sample sites that are in areas where wind erosion data have previously been collected and where land cover/use has been converted to cropland, pastureland, or CRP land for 1997.

While making wind erosion factor determinations for the 1997 NRI, apply definitions and concepts uniformly for all years: 1982, 1987, 1992, and 1997. **Consistent interpretations for all years are essential.**

The following procedures are to be used to collect WEQ data for the 1997 NRI. Do not use different techniques that may be used locally for other applications.

Guidelines in effect as of June 1, 1991, are to be used for the 1997 NRI. This is necessary to ensure uniformity nationally and to provide consistency between the previous inventories.

For NRI data collection, determine factors for the field in which the point falls (or the area surrounding the point that would be considered in conservation planning) and relative to the prevailing wind erosion direction during the critical wind erosion period. Select from table 1 below the prevailing direction from the nearest location relative to the county in which data are being collected. Data collectors should contact their ICCS leader if they have questions. The ICCS leader will discuss deviation from table 1 with the Resources Inventory Support Branch.

Determine knoll erodibility, ridge roughness, unsheltered distance, vegetative cover, and length of rotation for 1997. Carefully check the 1982, 1987, and 1992 data, and make changes to prerecorded entries if necessary. Graphs and tables for determining factor values are in the National Agronomy Manual, Part 502, Subpart G - Exhibits. The C factor (climatic), I factor (soil erodibility), and calculated WEQ values are displayed, but not editable.

Table 1 Prevailing wind erosion direction for selected cities

Location	Direction in degrees clockwise from 0 degrees north	Location	Direction in degrees clockwise from 0 degrees north
Denver, CO	2	Albuquerque, NM	266
La Junta, CO	224	Hobbs, NM	237
Pueblo, CO	292	Roswell, NM	183
Burlington, IA	328	Bismarck, ND	321
Des Moines, IA	331	Fargo, ND	337
Sioux City, IA	335	Grand Forks, ND	337
		Minot, ND	314
Dodge City, KS	188		
Goodland, KS	342	Oklahoma City, OK	0
Kansas City, KS	175	Tulsa, OK	5
Salina, KS	182		
Topeka, KS	176	Huron, SD	329
Wichita KS	184	Rapid City, SD	329
		Souix Falls, SD	325
Grand Island, NE	344		
Lincoln, NE	342	Amarillo TX	197
North Platte, NE	344	Austin, TX	182
Omaha, NE	339	Brownsville, TX	143
Scotts Bluff, NE	307	Corpus Christi, TX	155
		Dalhart, TX	212
Duluth, MN	89	Dallas, TX	173
International Falls, MN	298	El Paso, TX	259
Minneapolis, MN	307	Galveston, TX	166
Rochester, MN	327	Laredo, TX	134
		Lubbock, TX	202
Cutbank, MT	268	Midland, TX	194
Glascow, MT	296	Port Arthur, TX	166
Great Falls, MT	228	San Angelo, TX	203
Lewiston, MT	302	San Antonio, TX	148
Helena, MT	278	Waco, TX	189
Missoula, MT	309	Wichita Falls, TX	170
Miles City, MT	312		
		Cheyenne, WY	301
		Sheridan, WY	317

Source: Craig, D.G., and J.W. Turelle "Guide for Wind Erosion Control on Cropland in the Great Plains States." July 1964.

1. Knoll erodibility

Definition

Knoll erodibility is the susceptibility to wind erosion caused by topographic features characterized by short, abrupt windward slopes. Used to adjust the Soil Erodibility Index, I factor, in Wind Erosion Equation calculations. [NAM]

Guidelines and Clarification

Knoll erodibility is **0** if slope length in the direction of the prevailing wind (table 1) is more than 500 feet or if the slope changes less than 3 percent.

If the slope length is less than 500 feet and change in slope is 3 percent or more, the change in the percent of slope is recorded up to 10 percent. (Permissible values for this inventory are **0** and **3** through **10**.)

Documentation Required in PSU Folder

Record wind direction used on the PSU support map with an arrow pointing in the direction wind is blowing. Label the arrow shaft **wind**.

PDA Instructions

Record the appropriate value. Review prerecorded historical data in PDA.

Examples

Percent slope in the direction of the prevailing wind approaching the knoll is 4 percent. The slope length of the knoll is less than 500 feet, and the slope is 10 percent. Knoll erodibility would apply. Record a value of **6** (10-4).

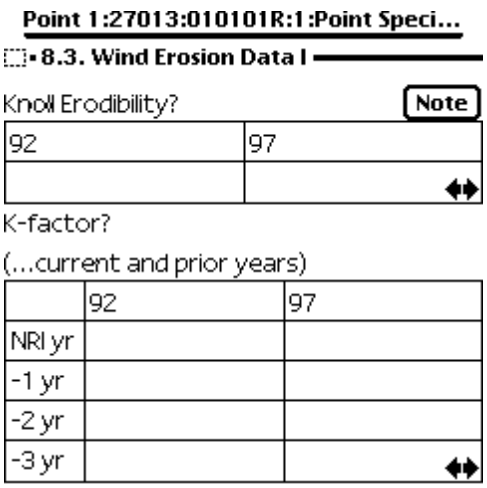
Percent slope in the direction of the prevailing wind approaching the knoll is 4 percent. The slope length of the knoll is more than 500 feet, and the slope is 10 percent. Knoll erodibility would not apply. Record a value of **0** because the slope length is more than 500 feet.

2. K factor (ridge roughness)

Definition

Ridge roughness (K factor) is a measure of the effect of ridges made by tillage and planting implements on the wind erosion process. [NAM]

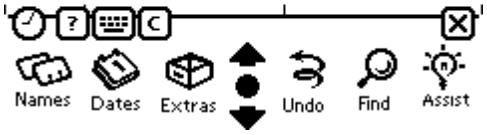
K factor. See factor for ridge roughness for wind erosion.



Guidelines and Clarification

K is a measure of the effect of ridges made by tillage and planting implements. Ridges absorb and deflect wind energy and trap moving soil particles.

The ridge roughness K factor is recorded for the current year and for each of the past 3 years for the critical erosion period. The appropriate entries are **1.0, 0.9, 0.8, 0.7, 0.6,** or **0.5**. A smooth surface will be **1.0**, and a ridged surface will be **0.5**. Semi-ridged will be **0.7**.



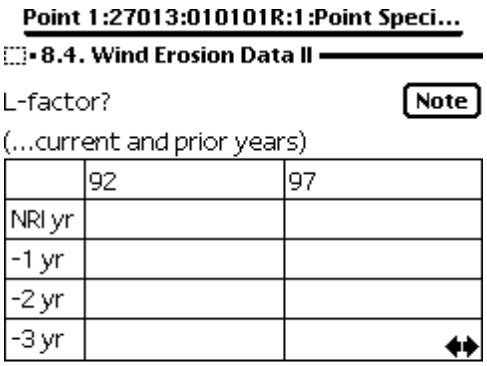
PDA Instructions

Record the appropriate ridge roughness value. Review prerecorded historical data in PDA.

3. L factor (unsheltered distance)

Definition

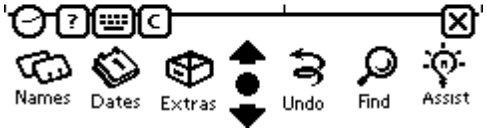
L factor (WEQ) is used in application of WEQ for wind erosion: unsheltered distance expressed in feet, measured through the point, parallel to the prevailing wind direction during the critical wind erosion period. Different in definition and value from the USLE L factor (1). [AH-537]



Guidelines and Clarification

Determine the unsheltered distance L in feet for the current year and for each of the last 3 years. These distances are determined relative to prevailing wind direction during the critical period (table 1). Valid distances range from **0** to **9999** feet. Record distance to the nearest foot.

The point identifies the field or conservation treatment unit (CTU) for which the NRI WEQ data are collected. It also establishes a location within the field through which the unsheltered distance is measured.



Determine L by beginning at the downwind (leeward) edge of the field, CTU, or wind barrier even though the next field or area downwind may not be stable. Then measure into the wind, along the direction of the prevailing wind, through the point until a protected area is encountered. L stops only at a protected area and does not necessarily end at the upwind edge of the field, CTU, or PSU boundary. A protected area is a stable point where saltation is controlled.

A barrier is a continuous strip or row that will stop saltation. Saltation is the process in which wind lifts soil particles from the land surface; the particles then strike the earth with sufficient force to dislodge additional particles. A barrier has sufficient height to reduce downwind velocity at the soil surface.

An area may be protected in two ways, with a buffer or a barrier. Buffers, vegetation, and crop residue in the field or CTU where the point falls are to be disregarded (consider the field or CTU as bare). However, when a buffer is encountered upwind from the field or CTU where the point falls, it is considered. The width of the buffer strip must be adequate to trap and store the soil that is anticipated to move off an upwind eroding area. Buffers do not have sufficient height to reduce downwind velocity. A grassed waterway with sufficient width and vegetation to stop surface soil movement could be a buffer. If a pasture is controlling saltation, but does not have tall grass or trees in a continuous strip, then it is a buffer.

A barrier reduces wind velocity downwind for a distance of 10 times the barrier height (10H). Unlike a buffer, a barrier in the field or CTU where the point falls is considered and is used to determine L. A barrier may be vegetative or nonvegetative, such as a field windbreak (trees), a row of tall grass, or a snow fence. A continuous stand of tall grass or trees in a pasture is also a barrier. Randomly spaced woody plants, such as might be found on rangeland, are not barriers.

To determine the unsheltered distance where barriers are present, measure from the downwind edge of the field, CTU, or barrier upwind through the point to the upwind barrier. Subtract 10 times the height of the upwind barrier (10H). If the downwind boundary of L is a barrier and the upwind boundary is a buffer, do not subtract 10H from L.

If the point falls on a barrier, measure **L** for the field or CTU downwind of the point. **L** is zero only if the entire field or CTU has barriers spaced close enough together (within 10H) to provide protection to all areas between the barriers.

If a pasture is overgrazed to the point that surface soil movement is not controlled, then it is neither a barrier nor a buffer.

Documentation Required in PSU Folder

Record wind direction used on the PSU support map with an arrow pointing in the direction wind is blowing. Label the arrow shaft **wind.**

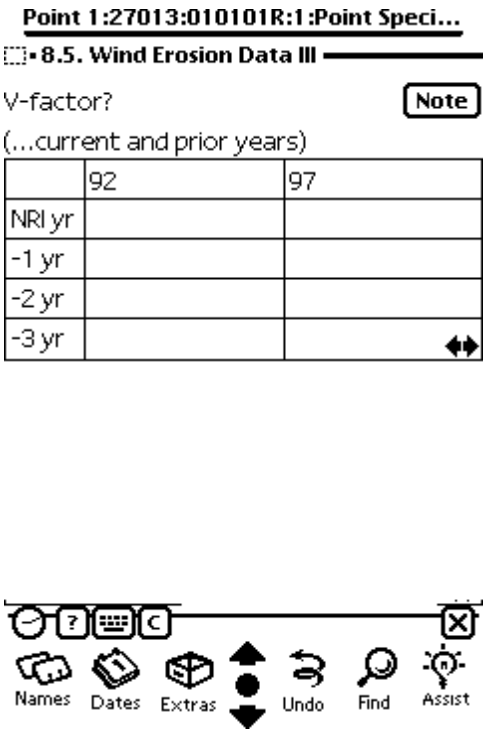
PDA Instructions

Record appropriate unsheltered distance for the current year and for each of the three prior years. Review prerecorded historical data in PDA.

Examples

Drawings to demonstrate how L should be measured are in exhibit 1 at the end of this module. They are shown as figures L-1 through L-12.

4. V factor (vegetative cover)



Definitions

Vegetative cover (V factor) is used in the Wind Erosion Equation (WEQ) to calculate soil loss due to wind erosion. Represents the kind, amount, and orientation of vegetation material expressed as equivalent pounds per acre of a small grain residue in a reference condition (SGe). [NAM]

V factor See vegetative cover.

Small grain equivalent (SGe) is the wind erosion control equivalent of vegetative cover, compared to a small grain standard. The standard (reference condition) is defined as small grain stalks 10 inches long lying flat on the soil surface in 10-inch rows that are perpendicular to the wind direction, with stalks oriented parallel to the wind direction. The small grain equivalent value is a function of kind, amount, and orientation of growing plants or plant residue on the soil surface. [NAM]

Guidelines and Clarification

The vegetative cover V is recorded in pounds of small grain equivalent (SGe) residue for the cover that is on the surface during the critical eroding period for the current year and for each of the past 3 years. SGe curves for estimating the V factor are in exhibit 502.65(a) through 502.65(d), 190-V-NAM, (National Agronomy Manual) Second Ed., March 1988, and in exhibit 2 at the end of this module. Assume 2,600 pounds if the point falls in trees or heavy cover. For crops that do not have SGe curves in the NAM or in the Field Office Technical Guide, it may be necessary to develop best judgment SGe curves based on judgment and field experience. The ICCS leader will develop these in consultation with the multistate agronomy team and the Resources Inventory Support Branch.

Documentation Required in PSU Folder

No documentation required.

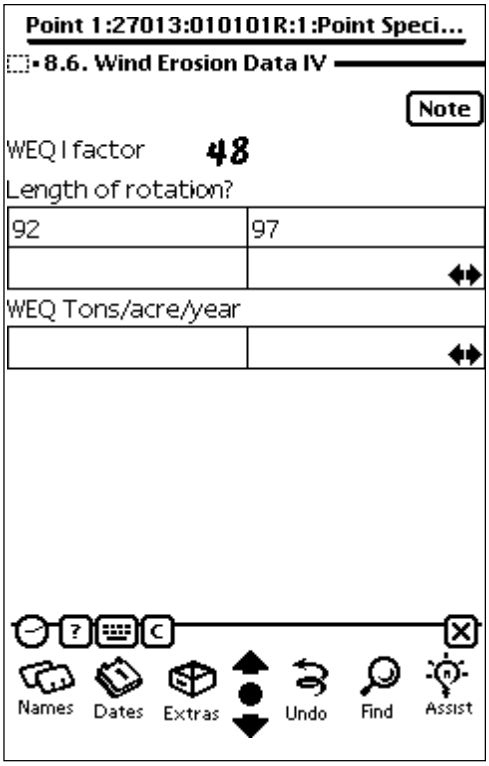
PDA Instructions

Record appropriate SGe values for the current year and each of the three prior years. Review pre-recorded historical data in PDA.

Examples

SGe curves for estimating the V factor are included in exhibit 2 at the end of this module. They are shown as figures weq a-1 through weq d-8.

5. Length of Rotation for WEQ



Definition

Length of rotation is the length of time required to grow a complete crop sequence pattern in which crops are grown in recurring succession on the same land. [See crop rotation] [SCSA]

Guidelines and Clarification

Length of rotation is recorded in years. A **0** is recorded if there is no regular rotation, for perennial crops, and for pastureland.

Documentation Required in PSU Folder

No documentation required.

PDA Instructions

Record length of rotation in years. Review prerecorded historical data in PDA.

Upon completion, tap the completion check box to verify data entry. Resolve any reported edit checks.

Point Module VIII Glossary

(The following definitions were extracted from the 1997 National Resources Inventory Glossary.)

Buffer. A row or area of plants that is capable of trapping soil particles moving, by the force of the wind, along the land surface. [NRI-97]

C factor (WEQ). The climatic factor for wind erosion using the Wind Erosion Equations (WEQ); expresses climatic erosivity, specifically windspeed and surface soil moisture at the location; the factor for any given locale is expressed as a percentage of the C factor for Garden City, Kansas, which has a value of 100. [NAM]

Climatic factor. See C factor.

Conservation practices. A specific treatment used to meet a specific need in planning and carrying out soil and water conservation programs for which standards and specifications have been developed (NPM). The practices recorded have been applied to the area of land in which the NRI point falls on the portion of the field that would be used in conservation planning. The point need not fall on a specific practice. [NCPM]

Conservation treatment unit (CTU). A field or group of fields or other units of land with similar soil and water conservation problems requiring similar combinations of land use and conservation treatment. [NCPM]

Critical wind erosion period. The time of year when most of the erosion from unprotected fields can be expected to occur. [NAM]

Cropland. A land cover/use category that includes areas used for the production of adapted crops for harvest. Four subcategories of cropland are recognized: cultivated cropland, horticultural cropland, hayland, and other cropland. [NRI-92]

CTU. See conservation treatment unit.

I factor (wind erodibility index). Used in wind erosion equation (WEQ) calculations, based on the wind erodibility group (WEG) of the soil. [NAM]

Meadow. A tract of grassland used for pasture or serving as a hayfield. [NRI-97]

Pastureland and native pasture. A land cover/use category of land managed primarily for the production of introduced or native forage plants for livestock grazing. Pastureland may consist of a single species in a pure stand, a grass mixture, or a grass-legume mixture. Management usually consists of cultural treatments: fertilization, weed control, reseeding, or renovation and control of grazing. (For the NRI, includes land that has a vegetative cover of grasses, legumes, and/or forbs, regardless of whether or not it is being grazed by livestock.) [NRI-92]

Residue cover. The stalks/stems and leaves remaining in the field after harvest covering the soil surface. [NRI-97]

SGe. See Small grain equivalent.

Saltation. Soil movement in wind where particles skip or bounce along the soil surface in response to wind forces. Particles range, in size, from 0.1 to 0.5 mm (0.0004 to 0.02 in) usually move in this manner. [NAM]

Unsheltered distance. Used in the application of the Wind Erosion Equation. It is the distance from the downwind edge of the field, conservation treatment unit, or wind barrier, in the direction of the prevailing eroding wind, to a protected area where saltation is controlled. (For the NRI, distance is taken through the sample point.) [NAM, AH-537]

Wind erosion. The process of detachment, transport, and deposition of soil by wind. [NAM]