AGRONOMY TECHNICAL NOTE

US DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE
AGRONOMY - 28 Albuquerque, NM
October, 1999

REVISED UNIVERSAL SOIL LOSS EQUATION

PREFACE

Revised October 1999

This technical note replaces the USLE with the Revised Universal Soil Loss Equation (RUSLE). The FOTG Sec. I refers the user to this note for sheet and rill water erosion estimates for planning and applying resource management systems.

The national office has asked that all states fully implement RUSLE.

The Field Office Computing System (FOCS) will not be used because our **C**-factor batch loading opportunity has passed, and the FOCS will not be maintained in the future.

This note does not cover support practices applied to systems. The **P**-factor is assumed to be 1.0. If sheet and rill soil loss from water is greater than the quality criteria, and alternative conservation practices are needed, then the State Agronomist must be contacted for a computer generated **P**-factor. If continued assistance is needed in this area, training and further development of the model will be done.

Please remove Agronomy Technical Note 28, dated April 1984 and replace it with the attached note.

Revised by Mike Sporcic, State Agronomist.

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INTRODUCTION
TO THE REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE)

The Universal Soil Loss Equation (USLE) was developed in the late 1950's and became widely used in conservation planning on cropland in the 1960's. Beginning in the 1970's the USLE was applied to many other land uses in addition to cropland and to other applications besides conservation planning.

It was updated in 1978, but by 1985, with the passage of the Farm Bill and much new research information, the USLE needed another update. A project led by G.R. Foster, USDA Agricultural Research Service (ARS), was initiated at a workshop in Layfayette, Indiana in 1985 to update USLE. This workshop, attended by leading U.S. erosion research scientists and USLE users from the USDA-Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS) and Forest Service (FS), USDI-Bureau of Land Management (BLM), and U.S. Army Corps of Engineers set objectives and approaches for the update.

By 1987 when K.G. Renard, USDA-ARS assumed leadership of the project, much-of the background work on updating the USLE was well underway and some had been completed. However, the project evolved into much more. The USLE was undergoing a major revision, and hence it became the Revised Universal Soil Loss Equation. Also, another major addition to the project was the development of a DOS based computer program.

The first version of USLE was described in Agricultural Handbook No. 282, published in 1965. The second major version of the USLE was described in Agricultural Handbook No. 537, published in 1978. RUSLE is the third version of the USLE and is described in Agricultural Handbook No. 703 (in print). It retains the equation structure of USLE, but each of its factor relationships has been either updated with recent data or new relationships have been derived based on modern erosion theory and data.

WHAT IS RUSLE?

RUSLE is represented by the following equation.

$$A = R\ K\ (LS)\ C\ P$$

Where:

- **A** = average annual soil loss from sheet and rill erosion caused by rainfall and associated overland flow in tons/ac/yr, computed by selecting values for each factor and multiplying them together.
- **R** = the factor for climate effect on erosivity
- **K** = the factor for soil erodibility measured under a standard condition
- **LS** = the combined effect for slope length and slope steepness
- **C** = the factor for cover-management
- **P** = the factor for support practices

RUSLE is an empirical equation derived from theory of erosion processes and more than 10,000 plot-years of data from natural runoff plots and an estimated 2,000 plot-years of rainfall simulator data. It is an exceptionally well-validated and documented equation that has been proven by more than three decades of use of its predecessor, the USLE. Modern theory on erosion processes of detachment, transport, and deposition of soil particles by rain drop impact, surface runoff and snowmelt runoff on thawing soil was used to derive some of the RUSLE relationships. In contrast to process-based models that consider erosion processes individually, RUSLE has a lumped equation structure that does not explicitly consider runoff or the individual erosion processes of detachment, transport and deposition.

RUSLE can be used with full confidence that the equation meets high scientific standards because it has been developed by a group of experienced and nationally recognized erosion scientists. In some instances, data needed to develop and validate RUSLE were not complete, which necessitated using judgement by both scientists and its users of the equation to fill gaps. Publications on RUSLE and various components have been reviewed by peer scientists in a process typical of the reporting of rigorous research results.

The soil loss computed using RUSLE is the amount of **sediment lost from the landscape profile** represented by the particular RUSLE computation; not the amount of sediment leaving a field or watershed. This soil loss computation is an average erosion rate for the landscape profile. A landscape profile is defined by a slope length, which is the length from the origin of overland flow to the point where the flow reaches a major flow concentration or an area of deposition like that on concave slopes and near field boundaries.

RUSLE is used to guide the choice of conservation practices that will control erosion to within soil loss limits. Soil loss limits are expressed in terms of tolerable soil loss (“T” value). Soil losses less than T will prevent soil degradation and indefinitely sustain the potential level of productivity. Natural Resources Conservation Service (NRCS) has assigned soil loss limits to soils in the US. Soil loss “T” values can be found in Field Office Technical Guide Sec. II for all soils in the US, and can range from one ton per acre to five tons per acre

Even on a uniform slope, erosion varies along the slope, and erosion at the end of the slope length is about 1.5 times the average erosion for the entire slope length. This variation can be significantly greater if the slope steepness at the-end of the slope length is much greater than the average steepness of the profile.

In a typical RUSLE application, values are selected for each factor **R**, **K**, (**LS**), **C**, and **P** based on site specific conditions. If the computed soil loss is less than the T value, control of sheet and rill erosion is assumed to be adequate. If it exceeds the “T” value, sheet and rill erosion is considered to be excessive and additional erosion control is needed. Alternative conservation practices or Conservation Management Systems

(CMS) may be evaluated with RUSLE. Those CMS or practices that result in estimated values of soil loss less than or equal to the “T” value are considered acceptable.

It is again emphasized that RUSLE is not a sediment yield equation. Sediment yield is soil movement beyond the end point of the slope and past the field edge. RUSLE can be used to estimate sediment yield from watersheds by multiplying soil loss estimates by a sediment delivery ratio that depends primarily on watershed area. To estimate sediment yield with RUSLE, assistance from an experienced geologist or sedimentation specialist is needed. In addition, erosion in concentrated flow areas (ephemeral gullies), classic gullies, stream channels and mass movement of materials into channels are other major sources of sediment that contribute to sediment yield but are not estimated by RUSLE.

Sediment yield from most watersheds is often less than sediment production within the watershed. Thus, much sediment is deposited within a typical watershed. RUSLE does not consider this deposition in its computations.

EROSIVITY (R and Req) FACTORS

R-Values:
The erosivity of rainfall varies greatly by location. For example the erosivity in Tucumcari, NM is about 6 times that in Farmington or Deming, NM. The **R**-factor represents these differences in erosivity among locations. Values for **R** computed from weather records were used to produce the **R**-factor maps for the state of New Mexico and individual Resource Areas in NM are included in this Technical Note. See **Figure 1 RUSLE R – Factor Values for New Mexico (NMSO-TS 15_1)** for the **R**-factors.

Values are to be looked up on the map for the given location where the soil loss estimate is being made. The values on the map are isobars by 10s. **Do not split the values more than to the nearest 5.** For example a field falls about one half way between the two lines on the map, say between 10 and 20, it is appropriate to use 15.

Req Values:
RUSLE has a northwestern version of **R** called **Req** (R equivalent). This version of **R** is not appropriate for New Mexico.

United States Department of Agriculture

RUSLE R - Factor Values for New Mexico

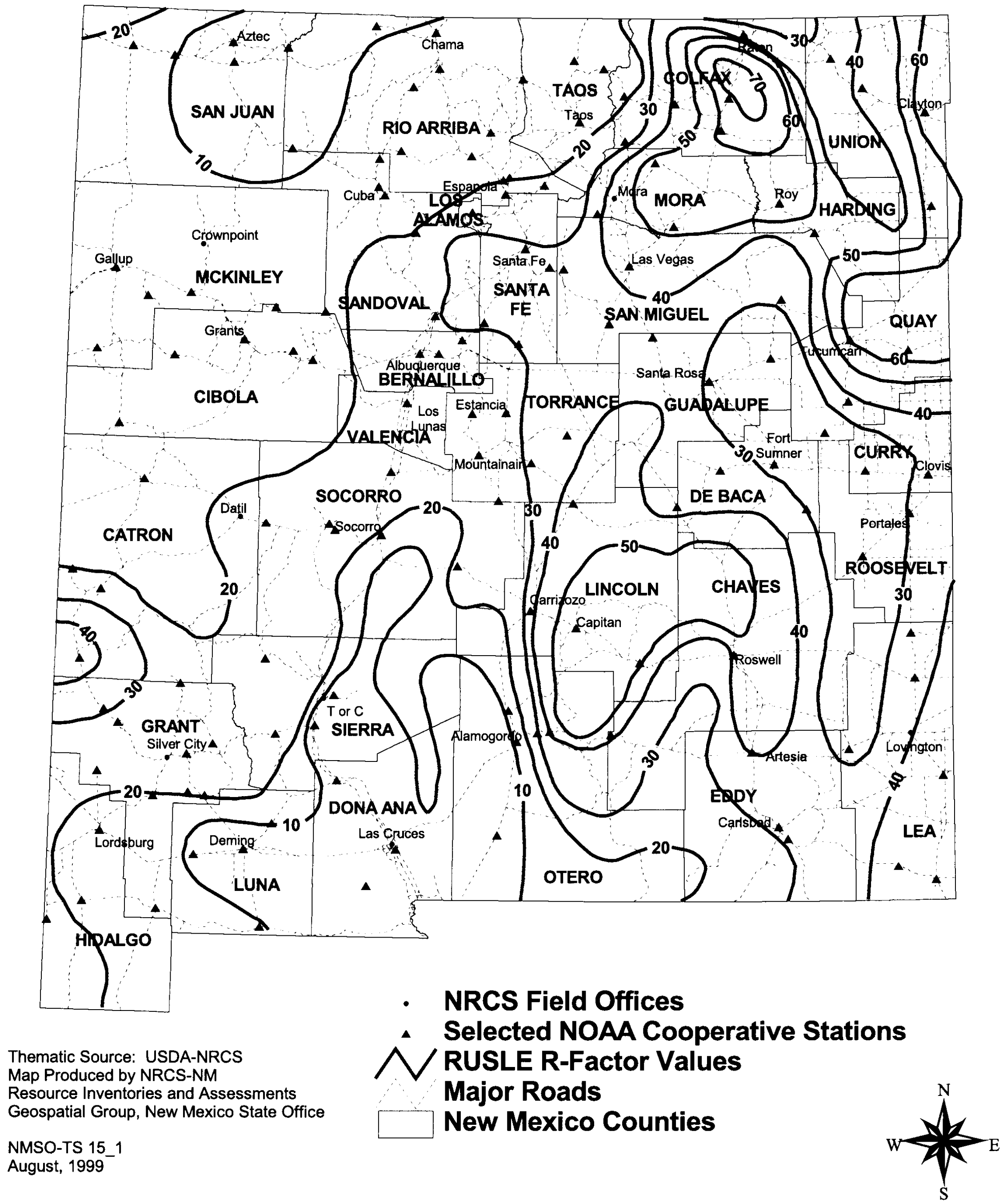
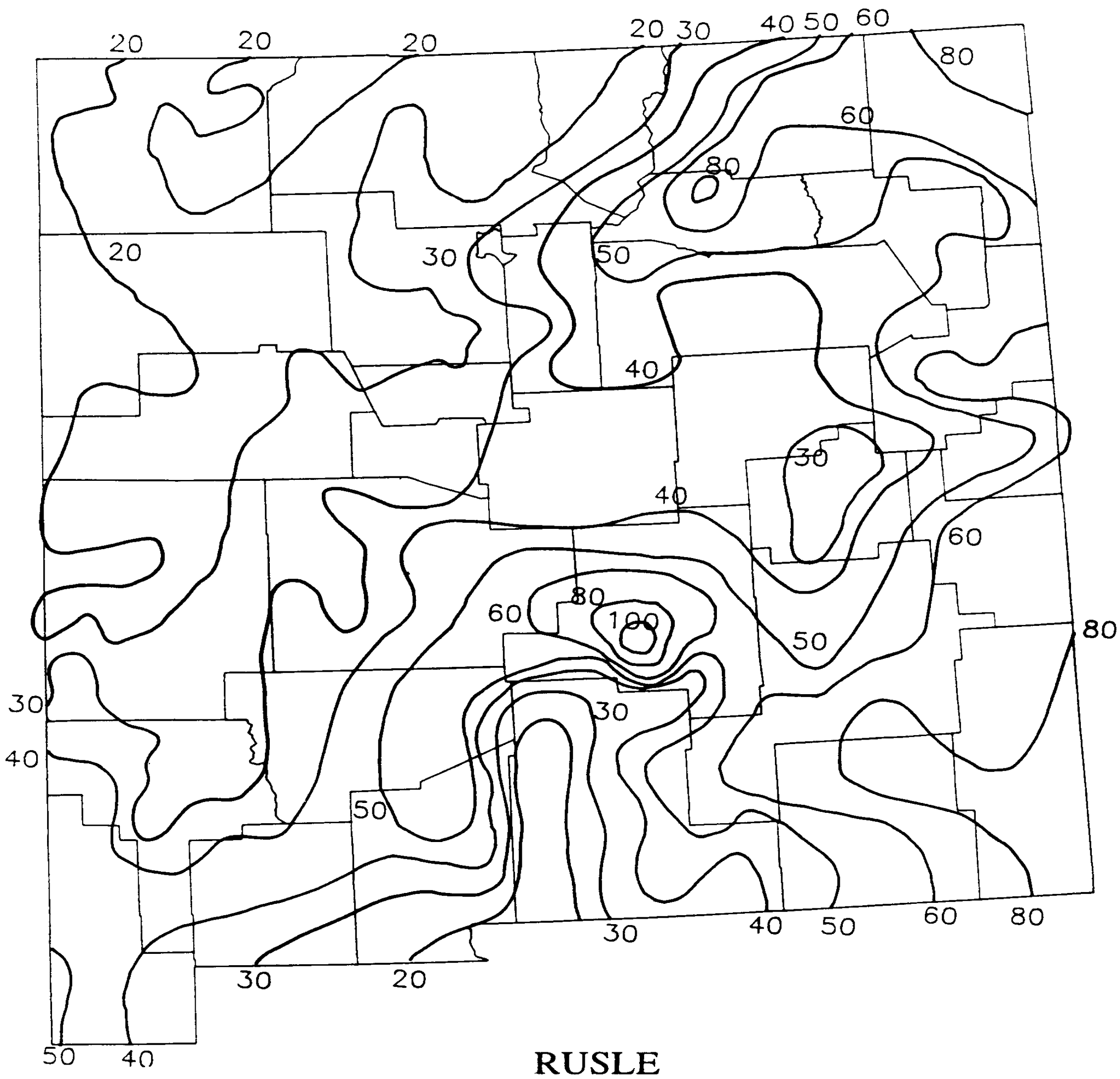


Figure 1 – R-Factor Map of NM

EI Parameter

The **EI** parameter is used in the K, C, and the P factors calculation. **EI** is the rainstorm energy times the intensity. The 10-year EI map (Figure 2) shows the 10 % probability of having a storm of the intensity listed in any given year. The map can be used to determine criteria for water erosion conservation support practices.



RUSLE

Ten Year EI Curves for New Mexico

Source: ARS Update of Ag. Handbook 537 -
Draft Ag. Handbook (Unnumbered)
Figure 2-10 pp 38. 10/30/92

Figure 2 – 10 year frequency EI data for New Mexico

SOIL ERODIBILITY (K) FACTOR

Soils vary in their susceptibility to erosion. The soil erodibility factor **K** is a measure of erodibility for a standard condition. This standard condition is the unit plot, which is an erosion plot 72.6 ft. long on a 9 percent slope, maintained in continuous fallow, tilled up and down hill periodically to control weeds and break crusts that form on the soil surface. The plots are plowed, disked, and cultivated the same as for a row crop of corn or soybeans except that no crop is grown on the unit plot.

The soil erodibility factor **K** is a measure of the susceptibility of soil particle detachment by water. Soil properties affecting soil erodibility are: soil texture, organic matter, soil structure (type and grade), and soil permeability

Fine-textured soils that are high in clay have low K values (about 0.05 to 0. 15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust producing high rates and large volumes of runoff.

For the purpose of soil interpretations the factors are grouped into 14 classes. The representative values are as follows: 0.02, 0.05, 0.10, 0.15, 0.17, 0.20, 0.24, 0.28, 0.32, 0.37, 0.43, 0.49, 0.55 and 0.64.

K-factors are expressed two ways for each soil layer. The **K**-factor values in published soil survey reports are commonly equivalent to **Kw**. The soil survey database in Field Office Computing System (FOCS) contains **Kf** and **K** (**Kw**) factors. Factor **Kf** represents soil erodibility of only the fine earth fraction (<2mm size). Factor **K** or **Kw** represents the fine earth fraction along with any rock fragments that occur in the layer.

Temporal Variable K

In the far eastern counties of New Mexico, RUSLE calculates a time variable **K** value (**Kav**) to account for the effect of freeze thaw processes and changes in soil moisture content of the surface soil layer throughout the year. **Figure 3** "**K** Factor Adjustment Boundary for RUSLE" delineates regions for which the **Kav** and **Kf** values should be used in New Mexico. **Kav** values are needed in **C**-factor Zones 78B, 79A, 79B, 79C, 91C, and 91D. **Table 1** “**Kav** multipliers”, shows the multiplier factors used to adjust **Kf** values to **Kav** shown by **C**-factor Zones. All other locations will use the **Kf** from the Soil Database.

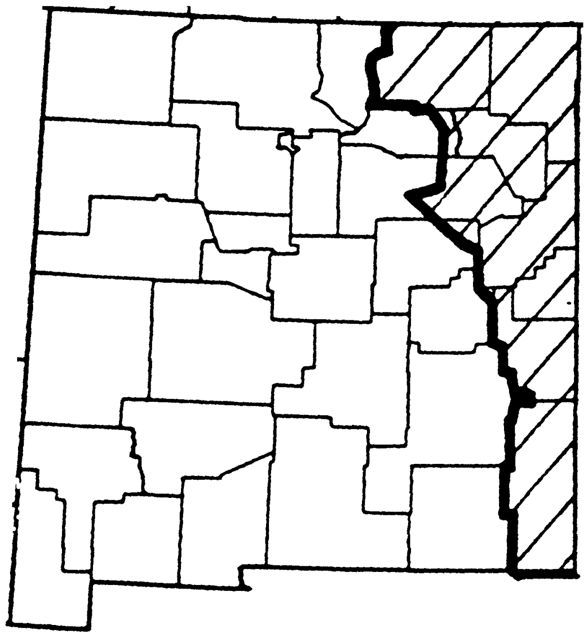


Figure 3 – K factor Adjustment Boundary for RUSLE, NM.
The hash-marked area to the right of the bold vertical line is the area of NM that must use the Kav adjustment.

Kf values are provided for the appropriate county soil survey(s) in the Soil Data table (Chemical and Physical Properties) located in Field Office Technical Guide (FOTG) Section II and in FOCS. The data table also contains soil loss tolerance (**T**) values for each soil map unit.

Table 1 Kav Multipliers

C-factor Zone	Climate Station	County	Kav Multiplier
78B	Des Moines	Taos, Colfax, & Union	**0.981**
79A	Clayton	Union	**1.16**
79B	Mosquero	Harding, San Miguel, & Guadalupe	**1.14**
79C	Cameron	Quay & Curry	**1.18**
91C	Muleshoe	Roosevelt	**1.20**
91D	Plains	Lea	**1.20**

SLOPE LENGTH and STEEPNESS (LS) FACTORS

The slope length/slope steepness (**LS**) factor is the combined effect of slope length and slope steepness on erosion. The **LS** value equals 1 for the unit plot conditions of 72.6 ft length and 9 percent slope steepness. **LS** is a relative value and represents how erodible the particular slope length and steepness is relative to the 72.6 ft long, 9% slope unit plot. Thus some values of **LS** are less than 1.0, and some values are greater than 1.0.

Sheet and rill erosion is composed of two components, interrill erosion that is caused primarily by raindrop impact detachment, and rill erosion that is caused primarily by surface runoff detachment.

Interrill erosion is nearly uniform along the slope. If soil loss is entirely produced by interrill erosion, the length (**L**) factor will equal 1 for all slope lengths.

Rill erosion increases as runoff increases along a slope. If soil loss is entirely produced by rill erosion, the **L** factor will increase linearly with the slope length.

Since soil loss is typically a combination of both, interrill and rill erosion, the **LS** factor ranges between these two extremes of no variation with slope length and varying linearly with slope length. Similarly, interrill erosion varies less with slope steepness than does rill erosion.

Selection of Landscape Profiles and Slope Lengths to Determine Field LS

RUSLE estimates average soil loss for the selected landscape profile (field slope). Many landscape profiles exist in a field and one or more slope profiles should be used for the RUSLE computation. In conservation planning, the slope profile representing a significant portion of the field having the most severe erosion should be used. Good judgement must be used in selecting the LS profile. The representative area must be of a manageable size.

If an average soil loss estimate is needed for the field, soil loss is computed for several slope profiles. The individual soil loss values for each slope profile are weighted according to the portion of the field represented by each to obtain an average soil loss value for the field.

Slope length:
is defined as the distance from the origin of overland flow along its flow path to the location of either concentrated flow or deposition. At times these features are not readily apparent and users will determine different slope lengths for the same general slope profile. Fortunately, computed soil loss values are not especially sensitive to slope length, differences in slope length of + or - 10% are not important on most slopes, especially flatter landscapes such found in New Mexico.

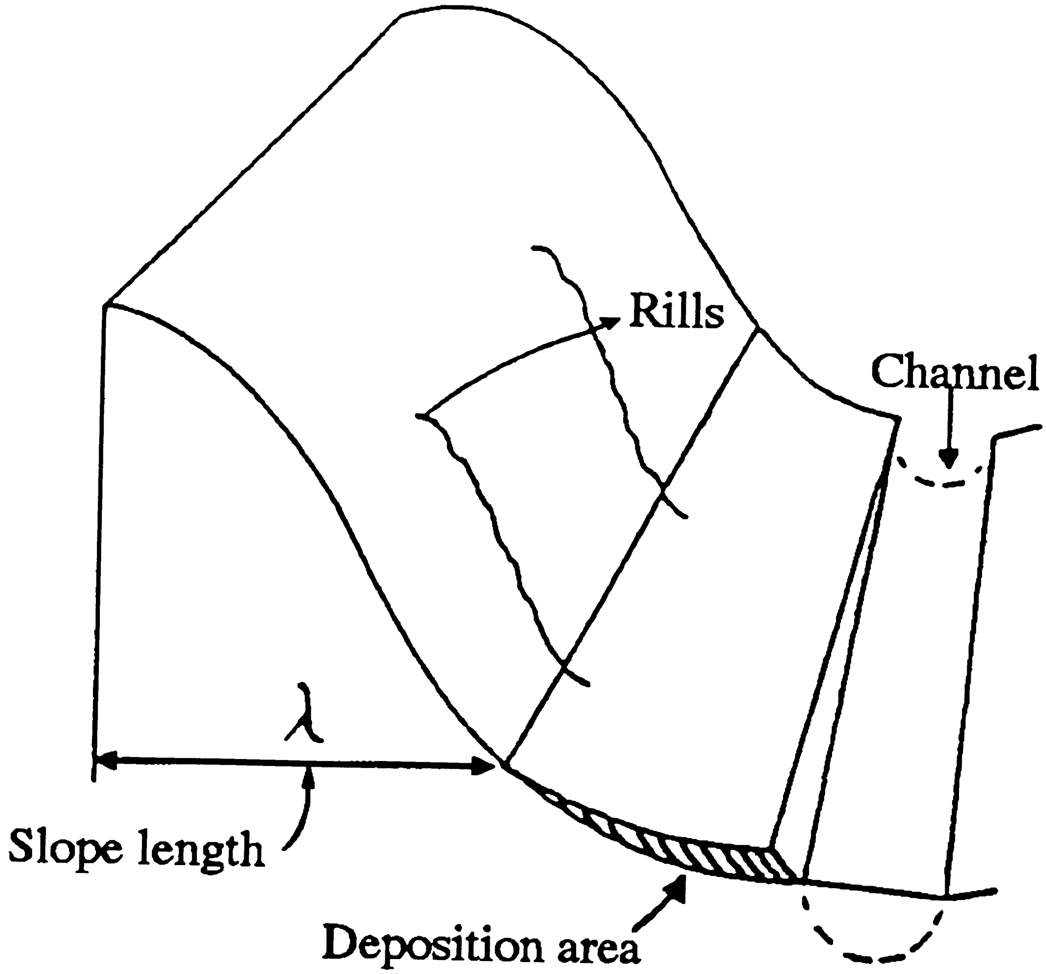


Figure 4 – Selecting the slope length:
Length of slope ends where deposition and/or rills converge down slope.

Slope lengths (L) are best determined in the field, pacing out flow paths, and making measurements directly on the ground. Contour maps having contour intervals greater than 2-ft. can be used cautiously to determine slope lengths for conservation planning. Slope length values are generally too long when contour maps are used to choose slope length. **Figure 4** shows the relative location of slope length.

Locations of deposition are often apparent on cropland immediately after a rainstorm or runoff event. The main areas of deposition that end a slope length are those on concave slopes. Deposits in row middles and in depressions like that left by tillage or cattle traffic are not slope-ending depositional areas.

If no signs of deposition are present, **L** will end where rills come together or an ephemeral gully starts. **Figure 5** shows an example where **L** ends at the head of an ephemeral gully. Note that **L** does not extend to the main draw. There may be many different **Ls** in the same field. Choose the one that best represents the field or the sub-region of the field being inventoried.

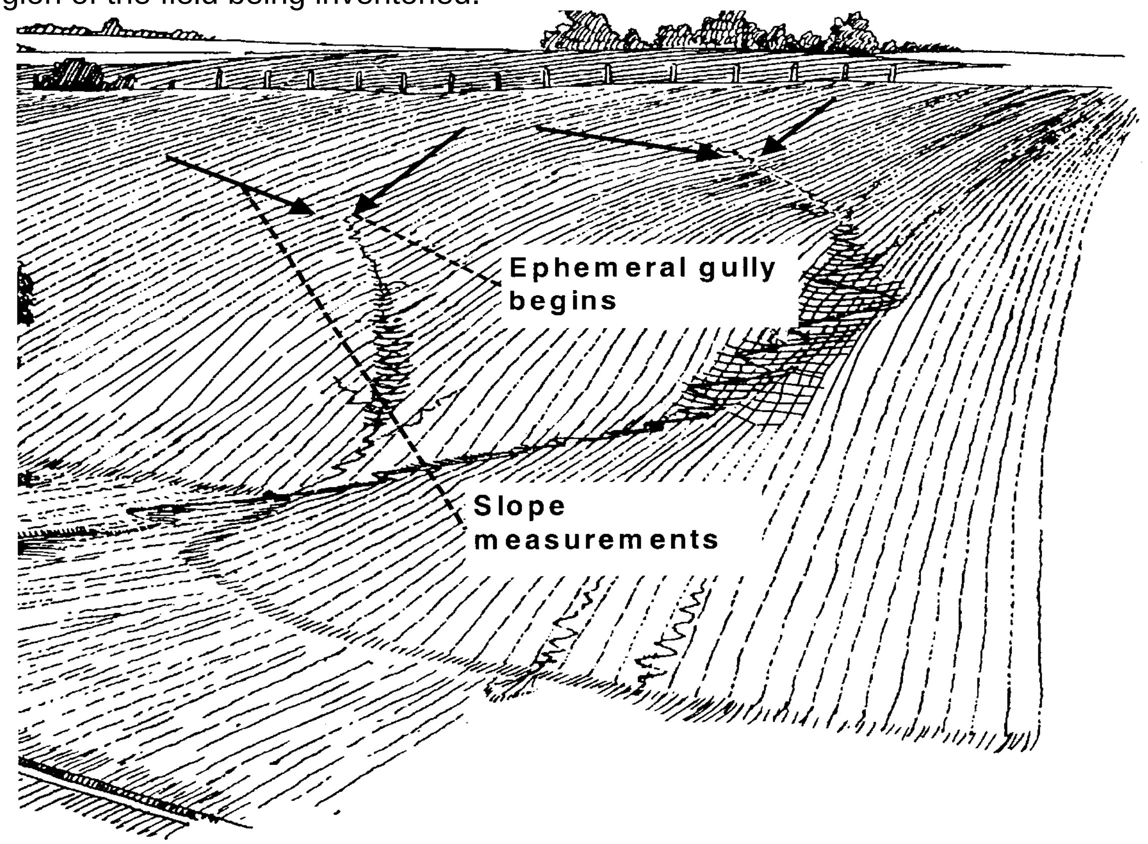


Figure 5 – Illustration of RUSLE slope lengths.
Length of slope ends where an ephemeral gully begins or where rills converge.

In NM, most slopes on cropland fields are long and may not resemble the above illustrations. Most slopes are 0 to 2 percent on irrigated land. On surface irrigated fields, most slope lengths will be the lengths of run. In no case should the **L** extend beyond 1000 feet.

Figure 6 shows several typical starting and stopping points in a complex landscape. Note there are many LS values in the illustrated field.

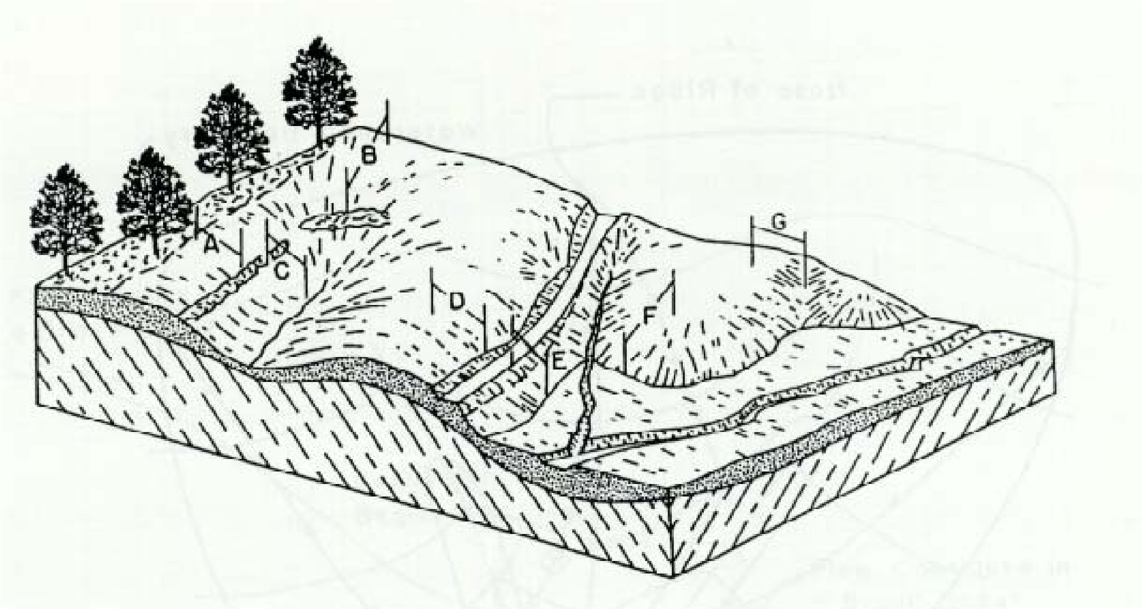


Figure 6 - Typical Slope Lengths.
Slope A-If undisturbed forest soil above does not yield surface runoff, the top of the slope starts with the edge of the undisturbed forest soil and extents down slope to windrow if runoff is concentrated by windrow. **Slope B**-Point of origin of runoff to windrow if runoff is concentrated by windrow. **Slope C**-From windrow to flow concentration point. **Slope D**-Point of origin of runoff to road that concentrates runoff. **Slope E**-From road to flood plain where deposition would occur. **Slope F**-On nose of hill, from point of origin of runoff to flood plain where deposition would occur. **Slope G**-Point of origin of runoff to slight depression where runoff would concentrate.

Horizontal vs. "Down the Slope" Slope Length

The slope length used in the RUSLE equations to compute **LS** is a horizontal measure. However, either a horizontal or "down the slope" measurement of slope can be used. Measuring down or along the slope in the field is easier than measuring horizontal distance. Slope length measured from maps is horizontal distance. The difference in the two measures for computed **LS** is small for slope steepness less than 20 percent. Most cropland in New Mexico is less than 20% slope, so down slope measurements can be used as horizontal on the look up tables for the **LS** values.

Determining RUSLE LS Values

After the slope length and percent of the slope profile are determined, the **LS** value may be determined from the RUSLE **LS** Tables (see **Table 2 thought 5**) or the RUSLE **LS** computer program. **LS** can be computed for uniform (simple) and non-uniform (complex or segmented) slopes. **LS** Tables may be used for simple slopes and the **LS** computer program for either simple or complex slopes. If complex slopes are being evaluated contact the State Agronomist.

LS Tables for RUSLE:
Four different sets of equations are used to compute **LS** values for the four tables. Tables are based on the ratio of rill to interrill erosion. All distances in the **LS** tables are based on horizontal measurement.

Table 2 - Used for **rangelands, pasturelands and other situations** where soil is consolidated, resistant to rill erosion and most soil loss is caused by interrill erosion. Use in the entire state of New Mexico for these conditions

Table 3 - Used for **cultivated cropland in row crops, small grains, and rotation grass/legumes** where interrill and rill erosion are balanced. Use in the entire state of New Mexico for these conditions.

Table 4 - Used for **freshly disturbed construction sites or other highly disturbed soil conditions** where most erosion is caused by rill erosion. Use in the entire state of New Mexico for these conditions.

Table 5 - Used for **cropland in the Northwest Wheat and Range Region** where is erosion is primarily caused by surface runoff on thawing soil. **Do not** use this table in New Mexico.

Tables 2-5 are included in this Technical Note.

LS Computer Program

The **LS** computer program is DOS software available to each NRCS field office. It will compute **LS** for complex slopes with up to ten slope segments that vary in length and slope steepness. If a field office has a need to compute an **LS** value for a segmented slope, please contact the State Agronomist. They will either make the run needed and send out the results or install the software and train staff on the use of the program.

Table 2 – Values for Rangeland Topographic Factor, LS, for low ratio of rill to inter-rill erosion.[1]

Slope (%)	Horizontal slope length (ft)																
	<3	4	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.5	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
1.0	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.17	0.17
2.0	0.20	0.20	0.20	0.20	0.20	0.21	0.23	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.33	0.34	0.35
3.0	0.26	0.26	0.26	0.26	0.26	0.23	0.33	0.36	0.38	0.40	0.43	0.44	0.46	0.48	0.52	0.65	0.57
4.0	0.33	0.33	0.33	0.33	0.33	0.36	0.43	0.46	0.50	0.54	0.58	0.61	0.63	0.67	0.74	0.78	0.82
5.0	0.38	0.38	0.38	0.38	0.38	0.44	0.52	0.57	0.62	0.68	0.73	0.78	0.81	0.87	0.97	1.04	1.10
6.0	0.44	0.44	0.44	0.44	0.44	0.50	0.61	0.68	0.74	0.83	0.90	0.95	1.00	1.08	1.21	1.31	1.40
8.0	0.54	0.54	0.54	0.54	0.54	0.84	0.79	0.90	0.99	1.12	1.23	1.32	1.40	1.53	1.74	1.91	2.05
10.0	0.60	0.63	0.65	0.66	0.68	0.81	1.03	1.19	1.31	1.51	1.67	1.80	1.92	2.13	2.45	2.71	2.93
12.0	0.61	0.70	0.75	0.80	0.83	1.01	1.31	1.52	1.69	1.97	2.20	2.39	2.56	2.85	3.32	3.70	4.02
14.0	0.63	0.76	0.85	0.92	0.98	1.20	1.58	1.85	2.08	2.44	2.78	2.99	3.21	3.60	4.23	4.74	5.18
16.0	0.65	0.82	0.94	1.04	1.12	1.38	1.85	2.18	2.46	2.91	3.28	3.60	3.88	4.37	5.17	5.82	6.39
20.0	0.68	0.93	1.11	1.26	1.39	1.74	2.37	2.84	3.22	3.85	4.38	4.83	5.24	5.95	7.13	8.10	8.94
25.0	0.73	1.05	1.30	1.51	1.70	2.17	3.00	3.63	4.16	5.03	5.76	6.39	6.96	7.97	9.65	11.04	12.26
30.0	0.77	1.16	1.48	1.75	2.00	2.57	3.60	4.40	5.06	6.18	7.11	7.94	8.68	9.99	12.19	14.04	15.66
40.0	0.85	1.36	1.79	2.17	2.53	3.30	4.73	5.84	6.78	8.37	9.71	10.91	11.99	13.92	17.19	19.96	22.41
50.0	0.91	1.52	2.08	2.54	3.00	3.95	5.74	7.14	8.33	10.37	12.11	13.65	15.06	17.59	21.88	25.55	28.82
60.0	0.97	1.67	2.29	2.86	3.41	4.52	6.63	8.29	9.72	12.16	14.26	16.13	17.84	20.92	26.17	30.68	34.71

[1] Such as for rangeland and other consolidated soil conditions with cover, (applicable to thawing soil where both inter-rill and rill erosion are significant).

Table 3 -Values for Cropland Topographic Factor, LS, for moderate ration of rill to inter-rill erosion.[2]

Slope (%)	Horizontal slope length (ft)															
	<3	4	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06
0.5	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10
1.0	0.11	0.11	0.11	0.11	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.20	0.20
2.0	0.17	0.17	0.17	0.17	0.17	0.19	0.22	0.25	0.27	0.29	0.31	0.33	0.35	0.37	0.41	0.44	0.47
3.0	0.22	0.22	0.22	0.22	0.22	0.25	0.32	0.36	0.39	0.44	0.48	0.52	0.55	0.60	0.68	0.75	0.80
4.0	0.26	0.26	0.26	0.26	0.26	0.31	0.40	0.47	0.52	0.60	0.67	0.72	0.77	0.86	0.99	1.10	1.19
5.0	0.30	0.30	0.30	0.30	0.30	0.37	0.49	0.58	0.65	0.76	0.85	0.93	1.01	1.13	1.33	1.49	1.63
6.0	0.34	0.34	0.34	0.34	0.34	0.43	0.58	0.69	0.78	0.93	1.05	1.16	1.25	1.42	1.69	1.91	2.11
8.0	0.42	0.42	0.42	0.42	0.42	0.53	0.74	0.91	1.04	1.26	1.45	1.62	1.77	2.03	2.47	2.83	3.15
10.0	0.46	0.48	0.50	0.51	0.52	0.67	0.97	1.19	1.38	1.71	1.98	2.22	2.44	2.84	3.50	4.06	4.56
12.0	0.47	0.53	0.58	0.61	0.64	0.84	1.23	1.53	1.79	2.23	2.61	2.95	3.26	3.81	4.75	5.56	6.28
14.0	0.48	0.58	0.65	0.70	0.75	1.00	1.48	1.86	2.19	2.76	3.25	3.69	4.09	4.82	6.07	7.15	8.11
16.0	0.49	0.63	0.72	0.79	0.85	1.15	1.73	2.20	2.60	3.30	3.90	4.45	4.95	5.86	7.43	8.79	10.02
20.0	0.52	0.71	0.85	0.96	1.06	1.45	2.22	2.85	3.40	4.36	5.21	5.97	6.68	7.97	10.23	12.20	13.99
25.0	0.56	0.80	1.00	1.16	1.30	1.81	2.82	3.65	4.39	5.69	6.83	7.88	8.86	10.65	13.80	16.58	19.13
30.0	0.59	0.89	1.13	1.34	1.53	2.15	3.39	4.42	5.34	6.98	8.43	9.76	11.01	13.30	17.37	20.99	24.31
40.0	0.65	1.05	1.38	1.68	1.95	2.77	4.45	5.87	7.14	9.43	11.47	13.37	15.14	18.43	24.32	29.60	34.48
50.0	0.71	1.18	1.59	1.97	2.32	3.32	5.40	7.17	8.78	11.66	14.26	16.67	18.94	23.17	30.78	37.65	44.02
60.0	0.76	1.30	1.78	2.23	2.65	3.81	6.24	8.33	10.23	13.65	16.76	19.64	22.36	27.45	36.63	44.96	52.70

[2] Such as for row-cropped agricultural and other moderately consolidated soil conditions with little-to-moderate cover, (not applicable to thawing soil).

Table 4 - Values for Disturbed Site Topographic Factor, LS, for high ratio of rill to inter-rill erosion.[3]

Slope (%)	Horizontal slope length (ft)																
	<3	4	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.5	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.13
1.0	0.09	0.09	0.09	0.09	0.09	0.10	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.24	0.26	0.27
2.0	0.13	0.13	0.13	0.13	0.13	0.16	0.21	0.25	0.28	0.33	0.37	0.40	0.43	0.48	0.56	0.63	0.69
3.0	0.17	0.17	0.17	0.17	0.17	0.21	0.30	0.36	0.41	0.50	0.57	0.64	0.69	0.80	0.96	1.10	1.23
4.0	0.20	0.20	0.20	0.20	0.20	0.26	0.38	0.47	0.55	0.68	0.79	0.89	0.98	1.14	1.42	1.65	1.86
5.0	0.23	0.23	0.23	0.23	0.23	0.31	0.46	0.58	0.68	0.86	1.02	1.16	1.28	1.51	1.91	2.25	2.55
6.0	0.26	0.26	0.26	0.26	0.26	0.36	0.54	0.69	0.82	1.05	1.25	1.43	1.60	1.90	2.43	2.89	3.30
8.0	0.32	0.32	0.32	0.32	0.32	0.45	0.70	0.91	1.10	1.43	1.72	1.99	2.24	2.70	3.52	4.24	4.91
10.0	0.35	0.37	0.38	0.39	0.40	0.57	0.91	1.20	1.46	1.92	2.34	2.72	3.09	3.75	4.95	6.03	7.02
12.0	0.36	0.41	0.45	0.47	0.49	0.71	1.15	1.54	1.88	2.51	3.07	3.60	4.09	5.01	6.67	8.17	9.57
14.0	0.38	0.45	0.51	0.55	0.58	0.85	1.40	1.87	2.31	3.09	3.81	4.48	5.11	6.30	8.45	10.40	12.23
16.0	0.39	0.49	0.56	0.62	0.67	0.98	1.64	2.21	2.73	3.68	4.56	5.37	6.15	7.60	10.26	12.69	14.96
20.0	0.41	0.56	0.67	0.76	0.84	1.24	2.10	2.86	3.57	4.85	6.04	7.16	8.23	10.24	13.94	17.35	20.57
25.0	0.45	0.64	0.80	0.93	1.04	1.56	2.67	3.67	4.59	6.30	7.88	9.38	10.81	13.53	18.57	23.24	27.66
30.0	0.48	0.72	0.91	1.08	1.24	1.86	3.22	4.44	5.58	7.70	9.67	11.55	13.35	16.77	23.14	29.07	34.71
40.0	0.53	0.85	1.13	1.37	1.59	2.41	4.24	5.89	7.44	10.35	13.07	15.67	18.17	22.95	31.89	40.29	48.29
50.0	0.58	0.97	1.31	1.62	1.91	2.91	5.16	7.20	9.13	12.75	16.16	19.42	22.57	28.60	39.95	50.63	60.84
60.0	0.63	1.07	1.47	1.84	2.19	3.36	5.97	8.37	10.63	14.89	18.92	22.78	26.51	33.67	47.18	59.93	72.15

[3] Such as for freshly prepared construction and other highly disturbed soil conditions with little or no cover (not applicable to thawing soil).

Table 5 - Values for Frozen Soil Topographic factor: L for thawing soils where most of the erosion is caused by surface flow.[4]

Slope (%)	Horizontal slope length (ft)												
	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.10	0.12	0.15	0.17	0.19
0.5	0.04	0.05	0.07	0.09	0.10	0.12	0.14	0.16	0.17	0.20	0.24	0.28	0.31
1.0	0.06	0.08	0.11	0.14	0.16	0.20	0.23	0.26	0.28	0.32	0.40	0.46	0.51
2.0	0.11	0.14	0.20	0.25	0.29	0.35	0.41	0.46	0.50	0.58	0.71	0.82	0.91
3.0	0.16	0.21	0.29	0.36	0.42	0.51	0.59	0.66	0.72	0.83	1.02	1.17	1.31
4.0	0.21	0.27	0.38	0.47	0.54	0.66	0.77	0.86	0.94	1.08	1.33	1.53	1.71
5.0	0.26	0.33	0.47	0.58	0.67	0.82	0.94	1.06	1.16	1.34	1.64	1.89	2.11
6.0	0.31	0.40	0.56	0.69	0.79	0.97	1.12	1.26	1.38	1.59	1.95	2.25	2.51
8.0	0.41	0.52	0.74	0.91	1.05	1.28	1.48	1.65	1.81	2.09	2.56	2.96	3.31
10.0	0.48	0.62	0.88	1.08	1.25	1.53	1.77	1.98	2.16	2.50	3.06	3.54	3.95
12.0	0.54	0.70	0.98	1.21	1.39	1.71	1.97	2.20	2.41	2.78	3.41	3.94	4.40
14.0	0.59	0.76	1.08	1.32	1.53	1.87	2.16	2.41	2.64	3.05	3.74	4.31	4.82
16.0	0.64	0.82	1.17	1.43	1.65	2.02	2.33	2.61	2.86	3.30	4.04	4.67	5.22
20.0	0.73	0.94	1.33	1.63	1.88	2.30	2.66	2.97	3.25	3.76	4.60	5.31	5.94
25.0	0.83	1.07	1.51	1.85	2.13	2.61	3.02	3.37	3.69	4.27	5.23	6.03	6.75
30.0	0.91	1.18	1.67	2.05	2.36	2.89	3.34	3.73	4.09	4.72	5.78	6.68	7.47
40.0	1.07	1.38	1.95	2.39	2.75	3.37	3.90	4.36	4.77	5.51	6.75	7.79	8.71
50.0	1.19	1.54	2.18	2.67	3.08	3.77	4.35	4.87	5.33	6.16	7.54	8.71	9.74
60.0	1.30	1.67	2.37	2.90	3.35	4.10	4.74	5.30	5.80	6.70	8.20	9.47	10.59

[4] (**New Mexico does not have conditions to use this table**).

COVER-MANAGEMENT (C) FACTOR

The cover management factor (**C**) represents the effect of plants, soil cover, soil biomass, and soil disturbing activities on erosion. RUSLE uses a subfactor method to compute soil loss ratios, which are the ratios of soil loss at any given time in a cover management sequence to soil loss from the unit plot. Soil loss ratios vary with time as canopy, ground cover, roughness, soil biomass, and soil consolidation change. A **C**-factor value is an average soil loss ratio weighted according to the distribution of **R** during the year. The subfactors used to compute a soil loss ratio value are canopy, surface cover, random surface roughness, prior land use, and antecedent moisture.

Canopy

Canopy is vegetative cover above the soil surface that intercepts raindrops but does not contact the surface runoff. The portion of the canopy touching the soil surface is treated as surface cover. The two characteristics of canopy used by RUSLE are percent of the soil surface covered by the canopy, and the effective height in the canopy from which water drops fall. Drops falling from the canopy generally do not have the erosivity of raindrops not intercepted by canopy.

Surface Cover

Surface cover is material in contact with the soil surface that intercepts raindrops and slows surface runoff. The total percent of the surface covered is used by RUSLE to compute how surface cover affects erosion. This includes all cover that is present, including plant residue, live vegetation and rock fragments. Rock fragments include all fragments > 2mm in diameter. To count as surface cover, the material must be of sufficient size or attached to the surface such that it is not removed by runoff.

The RUSLE computer program estimates both percent residue cover and reduction of residue by tillage and decomposition. Percent residue cover is computed from the mass of residue using input variables from crop database files. Residue remaining and incorporated by tillage is computed from operations database files. Loss of residue by decomposition is computed using equations that are a function of air temperature and precipitation values available in city (climate) database files and residue decomposition factors available from crop database files.

Random Surface Roughness

Surface roughness ponds water in depressions. It also reduces erosivity of raindrop impact and the erosivity of runoff flow. Roughness values are assigned based on field measurements of surface micro-elevations. Making such measurements in the field is not practical for routine application of RUSLE. A visual estimate of roughness can be made by comparing a soil surface to the photographs in Figures C-1 through C-9 in Agriculture Handbook 703, page 339-347.

Over time, roughness disappears as the depressions fill with sediment and soil subsides after the tillage operation that formed the depressions. Roughness is reduced in RUSLE as a function of cumulative rainfall after the last tillage operation. Roughness also indicates the degree of clodiness and the likelihood that the surface will seal, producing increased runoff and increased soil erodibility.

Prior Land Use

Current erosion is affected by prior land use. For example, soil freshly plowed out of grass/legume hay is only about 25 percent as erodible as the same soil in continuous cropping. Soil consolidates over time and becomes less erodible. Cropland soils take about 7 years to fully consolidate. When fully consolidated they erode at a rate of about 40 percent, of that when the soil is in continuous cultivation.

RUSLE considers the effect of consolidation in two areas. These are the soil area disturbed by tillage and that soil area left undisturbed. Tillage loosens the soil and restarts consolidation on the portion of the soil disturbed by tillage. The undisturbed portion of the soil continues to consolidate at the current rate.

A part of the effect of prior land-use is computed by relating to the amount of biomass in the soil at any given time. Biomass in the soil is from three sources, "live" plant roots, "dead" roots and residue buried by tillage. Tillage transfers the "live" root biomass to the residue pool that includes the "dead" roots and incorporated residue. Decomposition of biomass in the soil is computed by the same equation used to compute decomposition of surface residue. Root biomass in the top four inches for selected crops is included in crop database files. Tillage also redistributes biomass within the depth of tillage. Biomass concentrated near the soil surface by tillage or root growth reduces erosion.

Soil Moisture

In the low rainfall areas of the western U.S., the amount of soil moisture from a previous cropping sequence affects erosion during the present sequence. If soil moisture is very low entering the present period, runoff and erosion will be low. This subfactor is used only for dryland cropping in the Northwest Wheat and Range Region. This factor is not used in New Mexico.

Variation of C Factors by Location

C-factors computed by RUSLE will vary by areas within a state or region for two reasons. Even when operations, dates, and soil loss ratios are the same for two locations **C**-factor will differ if the distribution of erosivity differs between the locations. The other reason for different **C**-factor values between locations is that soil loss ratios can differ. The prior land use effect is related to amount of biomass in the soil that changes with decomposition, which depends on moisture and temperature. Therefore, decomposition and the prior land use effect differ between locations as rainfall and temperature differs between locations.

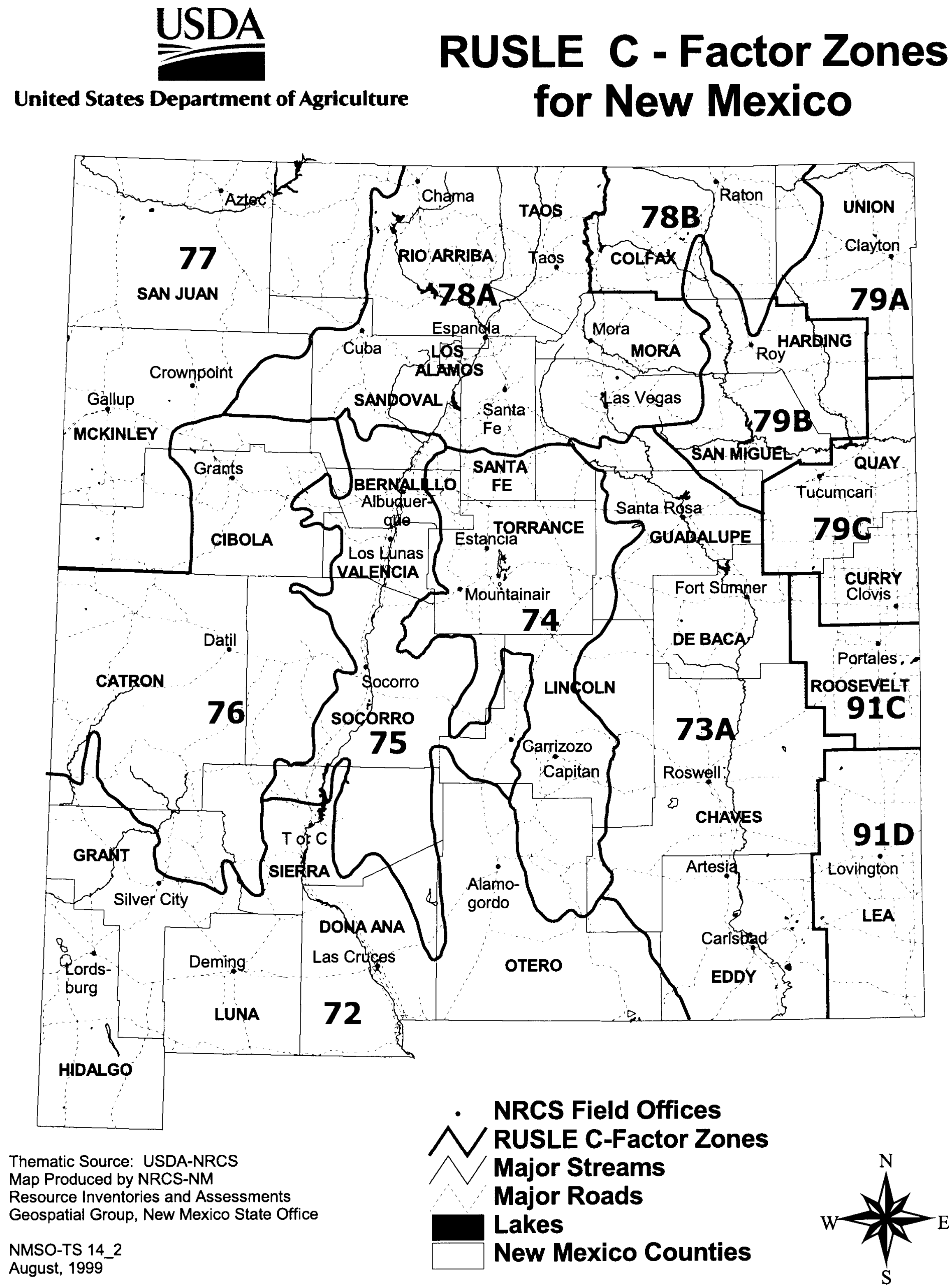
Selecting C-Factors for RUSLE

Because of the variations in computing **C**-factor, NRCS and ARS have designated areas within New Mexico that have similar erosion distribution and decomposition rates. **Figure 7** - RUSLE **C**-Factor Zone Map (NMSO-TS 14_2) included in this Technical Note illustrates those areas.

For each New Mexico **C**-factor zone, **C**-factors have been computed for typical cover-management systems in various crop rotations common to the area. The appropriate **C**-factor "file" or "files" and it’s computed **C**-factor(s) are selected and used to estimate soil loss (**A**) in **A** = **R K (LS) C P**. See **Attachment 2 “C Factors for RUSLE by C-Factor Zone”** for a C-factor for a given location.

If a crop rotation is not listed, or a mulch-till or no-till system is needed please contact the State Agronomist. A run will be produced and the new C-factor run sent out to cover the situation.

Figure 7 – RUSLE C Factor Zones for New Mexico



SUPPORT PRACTICES (P) FACTOR

The effects of supporting practices like contour farming, stripcropping, and terraces are described by the **P** factor. Most support practices affect erosion by redirecting runoff or reducing its transport capacity. Redirection of the runoff frequently results in deposition and reduced erosion.

The **P** factor for conservation planning assigns a benefit to the deposition caused by the support practice, taking only reduced credit for the deposition if it occurs a significant distance from the location of detachment.

Combination of Support Practices

Support practices are often used in combination. For, example contour farming is almost always used with stripcropping. Contour farming, stripcropping and terracing can also be used in combination. Thus the **P**-factor for a combination of support practices is computed as a product of **P**-factors for the individual practices used in the system.

Cover-Management Conditions

Surface cover and surface conditions affect **P**-factor values. These conditions are used to select runoff index values to compute **P**-factor values for contour farming and stripcropping on cropland. **Table 6** shows the descriptions of the seven cover-management conditions used in RUSLE.

The cover-management condition selected is the one that best describes the system during the 1/4 of the year when rainfall and runoff are most erosive and the soil is most susceptible to erosion. No provision is made for varying the cover-management condition class during the year. The reason is that the P-factor effects are approximate.

Contour Farming

Contour Farming is the practice of using ridges and furrows left by tillage to redirect runoff from a path directly downslope to a path around the hillslope. If ridges were perfectly on the contour, the grade along the furrows is zero and water spills uniformly over the ridges along their length. If furrows are not level, runoff flows along the furrows until it reaches low areas on the landscape. Break-overs and ephemeral gully erosion can occur in these areas. The effectiveness of contour farming increases as ridge height increases.

As the grade along the furrow increases, the effectiveness of contour farming decreases. To compute this effect, RUSLE uses the planned or actual furrow grade. The effect of furrow grade is based on limited data and represents the best judgement of the scientists developing RUSLE.

Table 6. Description of cropland cover-management conditions used in RUSLE for estimating P-factor values.

No.	Categories of Conditions	Description of condition
C1.	Established meadow (very dense cover)	Grass is dense and runoff is very slow, about the slowest under any vegetative condition. Becomes condition 2 when mowed and baled.
C2.	1st yr meadow, hay (moderately dense cover)	Hay is a mixture of grass and legume just before cutting. Meadow is a good stand of grass that is nearing the end of I st yr. Becomes condition 4 when mowed and baled.
C3.	Heavy (dense) cover or very rough	Ground cover for this condition is about 75-95%. Roughness is like that left by a high-clearance moldboard plow on a heavy-textured soil. Roughness depressions or both appear 7 in or more deep. Vegetative hydraulic roughness like that from a good legume crop (such as lespedeza) that has not been mowed.
C4.	Moderate cover or rough or both	Ground cover for this condition is about 40-65%. Roughness is like that left by a moldboard plow in a medium-textured soil. Depressions appear 4-6 in deep. Vegetative hydraulic roughness is similar to that produced by winter small grain at full maturity.
C5.	Light cover or moderate roughness or both	Ground surface cover is 10-30%. Surface roughness is like that left by first pass of tandem disk over a medium-textured soil that has been moldboard plowed. This roughness could also be similar to that left after a chisel plow through a medium textured soil at optimum moisture conditions for tillage. Roughness depressions appear 2-3 in deep. In terms of hydraulic roughness produced by vegetation, this condition is similar to that produced by spring small grain at about 3/4 maturity.
C6.	No cover or minimal roughness or both	This condition closely resembles the condition typically found in row cropped fields after the field has been planted and exposed to a moderately intense rainfall. Ground cover is less than about 5%. Roughness is like that of a good seedbed for corn or soybeans. Surface is rougher than that of a finely pulverized seedbed for seeding vegetables.
C7.	Clean-tilled, smooth, fallow	Surface is essentially bare, 5% or less of cover. Soil has not had a crop grown on it in the last 6 months or more, so much of the residual effects of previous cropping has disappeared. Surface is smooth; similar to the surface that develops on a very finely pulverized seedbed exposed to several intense rainfalls. This condition is most likely found in fallow and vegetable fields.

Beyond a critical slope length, contour farming is assumed to completely lose its effectiveness. On a slope where slope length exceeds the critical slope length, the soil loss is computed in two parts. One part is for the slope length shorter than the critical slope length. For this part, the value for **P** is that computed by the **P**-factor equation. A **P**-factor of 1.0 is used to compute the soil loss on the portion of the slope that extends beyond the critical slope length.

Stripcropping

Stripcropping is a support practice where strips of clean-tilled or nearly clean-tilled crops are alternated with strips of close growing vegetation, such as grasses and legumes or crop stubble. It may also be accomplished by alternating narrow strips of grass (contour buffer strips) with clean or nearly clean-tilled crops.

The contouring **P**-factor is computed independently of the stripcropping **P**-factor. When computing the **P**-factor for contouring with stripcropping, the contouring computation is for the most erodible strip. Critical slope length for stripcropping is assumed to be 1 to 1/2 times those for contouring.

Terraces

Terraces are support practices where large ridges of soil are constructed across the slope at intervals of typically 100 ft. or greater. These ridges and their accompanying channels intercept runoff, divert it around the slope to a disposal point, or store it until water infiltrates the ground.

Terraces affect sheet and rill erosion in two ways. One way is to reduce slope length, which is reflected in the **L** in the **LS** factor. The other effect of terraces is to cause deposition in the terrace channel, if the grade is less than 1%, or in the impoundment associated with a tile outlet terrace. For conservation planning, only a part of the deposition is credited as protecting the soil resource. When terraces are closer than 90 ft., one half of the deposition is credited for conservation planning. As terrace spacing increases, the amount of credit taken for deposition is decreased to where almost no credit is taken if spacing exceeds 300 ft.

Farming operations are usually parallel to the terraces, and since the terraces may be near the contour, some benefit for contour farming is taken. Therefore, a value for the contour farming **P**-factor must be computed before computing the terrace **P**-factor, making sure that slope length is appropriately chosen as affected by terrace spacing.

Tile Drainage

Tile drainage can reduce soil loss up to 40 percent. Tile drainage reduces soil erosion by reducing runoff. To take full credit for a **P**-factor, the area must be uniform, the tile system must cover most of the area and tile drainage must significantly reduce runoff. If tile drainage has only a minimal effect on runoff, little or no credit should be taken for the reduction of soil loss by tile drainage.

Computing P-Factors

Procedures for computing P factors for contour farming, stripcropping and terraces are included in West NTC Bulletin No. 450-5-7, RUSLE **P** SUBFACTOR PROCEDURES FOR CONTOURING AND STRIPCROPPING. The computer version of RUSLE is available through the State Agronomist for developing **P**-factors for supportive practices.

RUSLE Paper Version P-factors

For all RUSLE calculations without supportive practices, assume the P-factor is 1.0. If supportive practices are used or are needed for alternative development, contact the State Agronomist.

INTERPRETATION AND USE OF RUSLE RESULTS

How to apply RUSLE

After RUSLE has been used to compute a soil loss, its result must be interpreted and an assessment made. The primary use of RUSLE is in conservation management systems (CMS) planning where the computed soil loss is compared against a soil loss limit or “T” value.

RUSLE is intended to be used as a guide in CMS planning and conservation practice evaluation. A great degree of confidence can be expected when computed values are larger rather than smaller. For example, you can have confidence that if RUSLE computes a soil loss of 20 tons/ac/yr. with one system or practice and 10 tons/ac/yr. with a second, the second system or practice will substantially reduce erosion. However, if you compute 2 ton/ac/yr and 1 ton/ac/yr, the difference between the two is not great. The most that can be said is that the soil loss will likely be less with one practice than with the other, and that soil loss will be low with both.

RUSLE possibly describes the effect of slope length more accurately than any other factor, although this seems to be the variable that give users the most problem when selecting a value. Fortunately the effect of slope length on soil loss is not great, especially on flatter slopes. An error of 10% in the slope length will result in about a 5% error in soil loss. RUSLE is more sensitive to the slope steepness than slope length. Slope steepness is more critical than slope length and the segmented slope length procedure should be used if the landscape profile is not uniform. Segmented slope procedure should be used when the slope changes along the slope length. It is a procedure to weight average segments of length into one LS value. This can best be done by the computer version of RUSLE. Contact the State Agronomist if assistance is needed.

Surface cover subfactor of the **C**-factor has more effect on soil loss than any other subfactor. Surface cover estimates shown in **Attachment 2** should be compared to what is observed in the field. However, make sure that you carefully estimate cover in the field considering that it can vary with location in the field, during the year and from year to year. Experience shows that when cover is accurately measured, it is often less than estimated. Although cover is the single most important subfactor, other subfactors such as canopy, roughness and below ground biomass are important and should not be overlooked when evaluating a result.

Of all the RUSLE factors, the **P**-factor is the one most subject to error. Ridges and other micro-topographic features vary greatly within a-field. The **P**-factors computed by RUSLE represent how these practices generally affect erosion, but the measured result for any particular field could be significantly different from that computed by RUSLE, because of the micro-topographic features.

SUMMARY

Summary of Use

RUSLE is a useful tool in CMS planning, inventory, assessment and estimation of sediment yield. Soil loss values computed by RUSLE should be used as a guide rather than considered absolute.

RUSLE computes average annual sheet and rill erosion for a landscape profile. The soil loss value computed for that profile is representative of an area to the degree that the profile represents the area. It does not compute average sheet and rill erosion for a field unless soil loss is computed for several profiles and the results weighted according to the fraction of the field that each profile represents. RUSLE does not compute sediment yield.

RUSLE is a revision of the universal soil-loss equation (USLE), which has been widely used by the USDA-NRCS and numerous other agencies in the U.S. and in other countries. Thus users of RUSLE can be confident that they are using a well-proven conservation technology.

An estimate of the sheet and rill erosion is obtained by multiplying all five subfactors together. This value is in ton per acre per year. It does not mean that this amount of soil is leaving the field. Just that it is lost from its original place. This loss must be compared to the quality criteria in Section III of the FOTG for inventory purposes. If there is a problem from water erosion (sheet and rill), as predicted by this model, it will be necessary to contact the State Agronomist to calculate alternative measures to solve the problem. This paper version of RUSLE does not contain many alternative measures (practices) to control sheet and rill erosion. It can let the user know when there is a problem.

Soil Loss Computation Sheet

The soil loss computation sheet, form NM-ECS-2 (**Attachment 1**) has been revised and is attached. It can be used as a paper worksheet to document the erosion rate for a group of fields with a common crop rotation or a group of sub-areas within a field. There is also an electronic spreadsheet version available to run at the Field Office. Contact the State Agronomist for a copy of the program.

Instructions for Use

R-factor

Instructions for Using R maps

1. **Find the appropriate R factor map for the land treatment area.** Individual Resource Area **R** factor maps (Attachment N) are used for CMS planning New Mexico for all land uses where RUSLE is used to estimate sheet and rill erosion. If the **R** factor for a given location is 20 or less, sheet and rill erosion may not be a consideration for conservation planning.

2. **Select the R-factor for the site (landscape profile) to be evaluated.** The factor is selected by locating the site on the map and selecting the **R** number from the closest isoerodent (**R**) line. Interpolation is to be done to the nearest one-half (1/2) isoerodent interval. For example, if the site is located two-thirds the distance between **R**-factor lines of 60 and 80 the appropriate **R** selected is 70. If the site is located one-third the distance between **R**-factor lines of 20 and 30 the appropriate **R** is 25.

K-factor

Instruction for selecting K

1. **Determine the Kf for the target soil for the field or the zone in the field where the soil loss estimate is to be made.** Draw the field boundary on the appropriate soil survey map. Then select the field map unit soil symbol from within the boundary. Look up the **Kf** in the Physical Properties table in section II of the FOTG. If **Kf** is not listed in the FOTG, reliable estimates of **Kf** can be made using the soil erodibility nomograph on page 11 of Agricultural Handbook 537 or by using the computer version of RUSLE.
2. **Find the site field location on figure 1 "K factor Adjustment Boundary Map".** Determine if the Kf value can be used without adjustment (left of the bold line on the map). If on left side use **Kf** from the soil survey. If on the right side, modify the value by using the Kav multipliers as shown below.
3. **Compute the Kav factor.** Find the C-factor Zone number from the C-factor Zone Map (Attachment 2) for the location. Find the multiplier for the corresponding **C**-Factor Zone on Table 1. Multiply **Kf** times the multiplier to get **Kav**. Example: **C**-zone is 87 and has a 1.15 multiplier. The **Kf** is 0.32. 1.15 X 0.32 is 0.368. Use 0.37.

LS-factor

Instructions for determining LS

1. **Determine slope of the area of soil loss estimate.** This is best done in the field standing at the bottom of the slope looking uphill, or standing at the top of the slope at the point where runoff starts, looking down slope. Determine the overall percent slope or slope of the segments if complex using a clinometer or abney level.
2. **Determine the length of slope.** Pace down slope from the top of the slope to the deposition or convergence spot on the slope.
3. **Look up the LS.** On the appropriate **LS** table (Table 2-5), look up the **LS** value from the length and the slope measured in the field.

C-factor

Instruction for determining a C-factor

1. **Find the appropriate C-factor zone number.** The attached C-factor zone map (attachment 2) can be used to locate the number.
2. **Determine the table C-factor.** Using the correct zone number find a rotation that best matches the field situation and corresponding C-factor number in the far right column.

P-factor

Instructions for P-Factors

1. **All paper runs of RUSLE will be made using a P-factor of 1.0.** This assumes that there are no supportive practices applied.

Soil Loss Estimate

1. Multiply all factors to determine the tons/acre per year erosion rate: **(R*K*LS*C*P=A)**

Example Run

The Clovis FO has a grower (Iam Windy) who requests a conservation plan on a 160-acre tract of land just north of the city. Iam raises Sorghum at 18 bu/ac; summer fallows one year, and grazes winter wheat the third year. The major soil map unit on the field is Pe or Pulman loam. The field is uniform. The slopes measure in the field at 1% to 3%. Slopes are long, 800 feet. Iam does not have any support practices at this time. He farms without regard to the slope.

Step 1- Find the R-factor. Go to **Attachment NMSO-TS 15_1** (R-factor map), **find** Clovis on the map. Notice that the 30 line runs north and south through the town of Clovis. **Select** an **R**-value of **30** from the map. **R=30**

Step 2-Find the K-factor. Determine the **Kf** value from the Chemical and Physical table in FOCS. The **Kf** for Pulman loam is 0.32. **K=0.32**
Step 3-Find the LS-factor. From our on site inventory we know the general slope is about 2% and that there was about 800 feet before the rills and draws seem to come together. Find the **LS** value on **Table 3** because cropland in NM uses **Table 3. Look** across the top and find 800 feet. **Look** down the side and find 2%. **Follow** across and read 0.44 where they cross. **LS=0.44**

Step 4-Find the C-factor. Iam told us his rotation. On **Attachment NMSO-TS 14_2, C factor Zone Map find** Clovis and **determine** the **C**-factor zone. The zone is **79C**. Now **go** to **Attachment 2, C factor table** and **look up** the sorghum-fallow- winter wheat rotation. **C**-factor zone 79C has 7 rotations. The fifth one is closest to our rotation, **select** the **C**-factor of 0.30. **C=0.30**.

Step 5-Find the P-factor. Iam told us there are no supportive practices. Therefore the **P**-factor default is 1.0. **P=1.0.**

Step 6-Find the product of the 5 subfactors. The **RUSLE** equation is

(**R**) x (**K**) x (**LS**) x (**C**) x (**P**) = (**A**)
Multiply Iam's five factors: 30 x 0.32 x 0.44 x 0.3 x 1.0 = 1.27 or about 1

Estimated rotational average soil loss for sheet and rill erosion for Iam is 1 ton/ac/yr.

Attachment 1 – NM-ECS-2

Attachment 2 – C Factor for RUSLE by C Factor Zones