Iowa Agronomy Technical Note 29: Dominant Critical Area

Choosing the Planning Area of a Field Using Dominant Critical Area

General

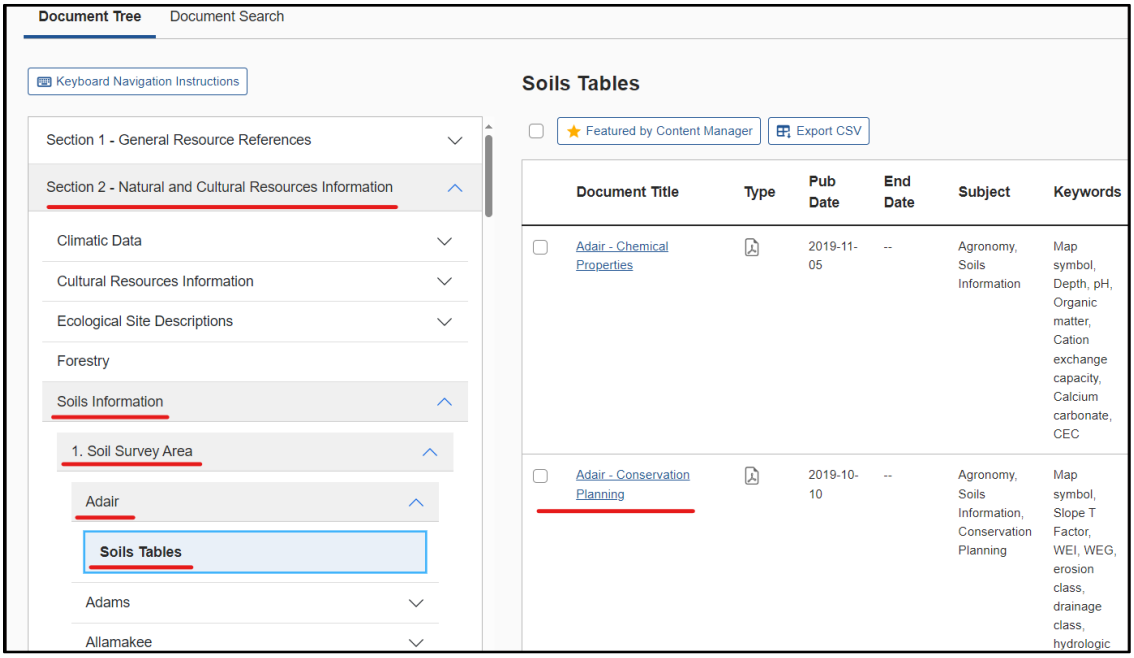
The dominant critical area is the area of the field used to represent the entire field or conservation management unit (CMU). Fields are rarely comprised of uniform topography or a single soil map unit (SMU). To ensure the planned system is adequate for the field or CMU, the dominant critical area needs to be identified. This method is used to evaluate sheet and rill erosion for the critical areas of the field.

When determining the dominant critical area for sheet and rill erosion, planners will observe the field from multiple locations. Then using a soil map, the field may be divided into several landscapes. Fields may contain several types of landscape areas (e.g, flat upland, sloping, depositional, bottomland). Erosion, nutrient, and pesticide loss rates are different in each type of area, but sloping areas typically have higher erosion rates. Since erosion rates vary between areas, planning decisions need to address the planning criteria for dominant critical areas. Dominant critical areas are areas significantly large enough to effect a change in management in the field or CMU, not the average site characteristic or the worst-case scenario.

Some fields or CMUs may also have small, insignificant areas of less than 10% of the field that cannot be feasibly managed separately but are still very erosive. (In small fields of 25 acres or less, the cut off is less than 20% of a field that cannot be feasibly managed separately). Such areas are critical but not considered dominant. Opportunities may exist to split this area out and develop it for wildlife or recreation with permanent cover or apply additional supporting practices to the cropping and tillage system planned for the dominant critical area.

Soils information to help determine dominant critical areas can be found in FOTG>Section 2>Soils Information>1.Soil Survey Area>choose county>Soils Tables. Use the “Conservation Planning” and “Engineering Properties” documents for selecting the dominant critical area for water and wind erosion.

Picture 1: Example of where to find the Conservation Planning document in FOTG.



Water Erosion

When conservation planning involves sheet and rill erosion, NRCS requires the use of the current erosion prediction tool to estimate the erosion rate on the field or CMU. RUSLE2 is used to compare erosion rates of alternative treatment systems to the soil loss tolerance (T) value to assist the producer in making sound treatment decisions.

Determining the erosion rates for the sloping areas of the field involves determining slope lengths and average slope steepness (%). In Iowa, due to the accuracy of the soil survey, planners will utilize the "Conservation Planning" document found in FOTG>Section 2>Soils Information>1.Soil Survey Area>choose county>Soils Tables. Use the Slope RV column for the slope steepness and the USLE Slope Length column for the slope length for the erosion prediction tool. Field information can be used if the planner has been on site to take field measurements and provided written documentation to justify the changes. See Appendix 1, "Measuring Slope Lengths and Grades".

Selecting the Dominant Critical Area for Water Erosion

Identify the most erosive SMU in the field or CMU:

Using a soil report, select the SMU with the highest slope class that comprises ≥ 10% of the acres in the field/CMU. For fields ≤ 25 acres in size select the SMU that comprises ≥ 20% of the acres in the field. Note: If a soil is a complex, use the factors for the soil that is the highest percentage of the map unit, which will be listed first.

1. If the field/CMU consists of multiple SMUs that are ≥10% select the SMU with highest slope class with the largest percentage of acres.

   Example: 120D2 15% Use the 120D2 since it has the largest percentage of acres.
   192D2 11%
   = 26%

2. If the field/CMU consists of multiple SMUs that are ≥ 10% and have the same percentage of acres, then select the SMU with the highest erosion phase or the SMU with lowest T value.

   Example: 120D2 12%
   65D3 12% Use the 65D3 since it has a most eroded phase and the lowest T value.
   = 24%

3. If the field/CMU consists of several SMUs that are < 10%, add the SMUs with like slope classes together to determine if the slope class is **≥** 10%. (i.e. 120D2, 192D2).

   a) If the sum is < 10% then it is not the dominant critical area.

   b) When the sum is ≥ 10%, then select the SMU with the largest percentage of acres.

   Example: 120D2 9% Use the 120D2 since it has the largest percentage of acres.
   192D2 6%
   = 15%

   c) If the sum is ≥ 10% and the SMUs have the same percentage of acres, then select the SMU with the highest erosion phase.

   Example: 120D2 6%
   65D3 6% Use the 65D3 since it has a most eroded phase.
   = 12%

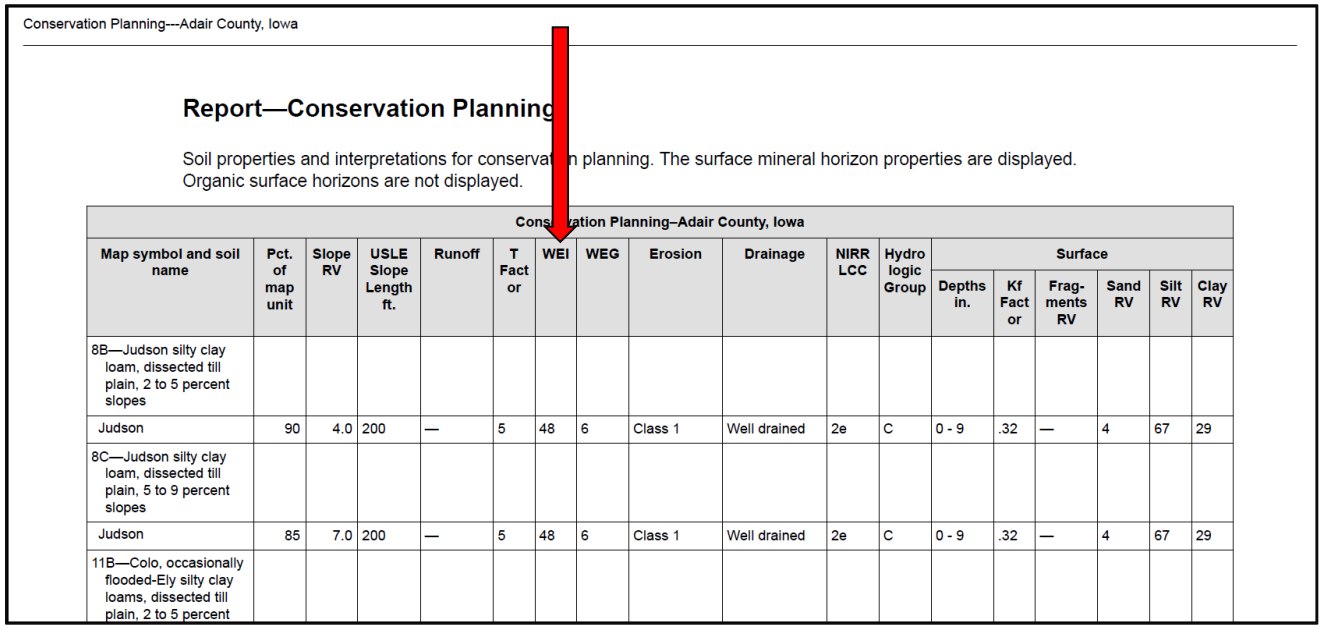
Wind Erosion

When conservation planning includes wind erosion resource concern, use the current erosion prediction model to estimate the erosion rate on the field or conservation treatment unit. WEPS is used to compare erosion rates of alternative treatment systems to the soil loss tolerance (T) value to assist the producer in making sound treatment decisions.

Some fields/CMUs may also have a small, insignificant area less than 10% of the field that cannot be feasibly managed separately. (In small fields of 25 acres or less the cut off is less than 20% that cannot be feasibly managed separately). Such areas are critical but not considered dominant.

To determine the wind erosion rate of a field, the planner will use the Wind or Soil Erodibility Index (WEI) and the T factor. In Iowa, due to the accuracy of the soil survey, planners will utilize the "Conservation Planning" document, and if needed the "Engineering Properties" document found in FOTG>Section 2>Soils Information>1.Soil Survey Area>choose county>Soils Tables. The Wind or Soil Erodibility Index (WEI), or "I" factor, is the average annual wind erosion loss in tons per acre per year that would occur on a soil having the following conditions: wide, level, unsheltered, isolated, bare, smooth, loose, and non-crusted.

Picture 2: Example of where to find the WEI in the Conservation Planning document.



Conservation Planning---Adair County, Iowa

Report—Conservation Planning

Soil properties and interpretations for conservation planning. The surface mineral horizon properties are displayed. Organic surface horizons are not displayed.

Conservation Planning–Adair County, Iowa

Map symbol and soil name	Pct. of map unit	Slope RV	USLE Slope Length ft.	Runoff	T Factor	WEI	WEG	Erosion	Drainage	NIRR LCC	Hydrologic Group	Surface					
												Depths in.	Kf Factor	Frag-ments RV	Sand RV	Silt RV	Clay RV
8B—Judson silty clay loam, dissected till plain, 2 to 5 percent slopes																	
Judson	90	4.0	200	—	5	48	6	Class 1	Well drained	2e	C	0 - 9	.32	—	4	67	29
8C—Judson silty clay loam, dissected till plain, 5 to 9 percent slopes																	
Judson	85	7.0	200	—	5	48	6	Class 1	Well drained	2e	C	0 - 9	.32	—	4	67	29
11B—Colo, occasionally flooded-Ely silty clay loams, dissected till plain, 2 to 5 percent																	

Selecting the Dominant Critical Area for Wind Erosion

Identify the most erosive SMU in the field or CMU:

Using a soil report, select the SMU with the highest WEI that comprises ≥ 10% of the acres in the field/CMU. For fields ≤ 25 acres in size select the SMU that comprises ≥ 20% of the acres in the field. Note: If a soil is a complex, use the factors for the soil that is the highest percentage of the map unit, which is listed first.

1. If the field/CMU consists of multiple SMUs the same WEI, select the SMU with the lowest T factor, comprising 10% or more of the field/CMU.

2. If the SMUs have the same WEI and T factors, select the SMU with the largest composition of sand in the top layer.

    - Use the "Engineering Properties" document to select the soil(s) that has "sand" in the "USDA texture" (ex. Fine sand, Fine loamy sand)- see example below. See Picture 3 for an example of where to find the USDA texture for the top layer of soil (0-8 in depth).

    - Histosols or SMUs comprised of a histic epidon, such as Palms or Houghton muck, are highly erodible by wind and should always have the highest wind erodibility index (WEI).

3. If there are several SMUs with the same WEI that are < 10% of the field, add the SMUs with like WEI to determine if the combined SMUs is ≥ 10%.

    1. If the sum is < 10% than it is not the dominant critical area for wind erosion.

    2. If the sum is ≥ 10%, select the SMU with the largest percentage of acres.

Picture 3: Example of where to find the USDA texture for the top layer of soil (0-8 in depth).

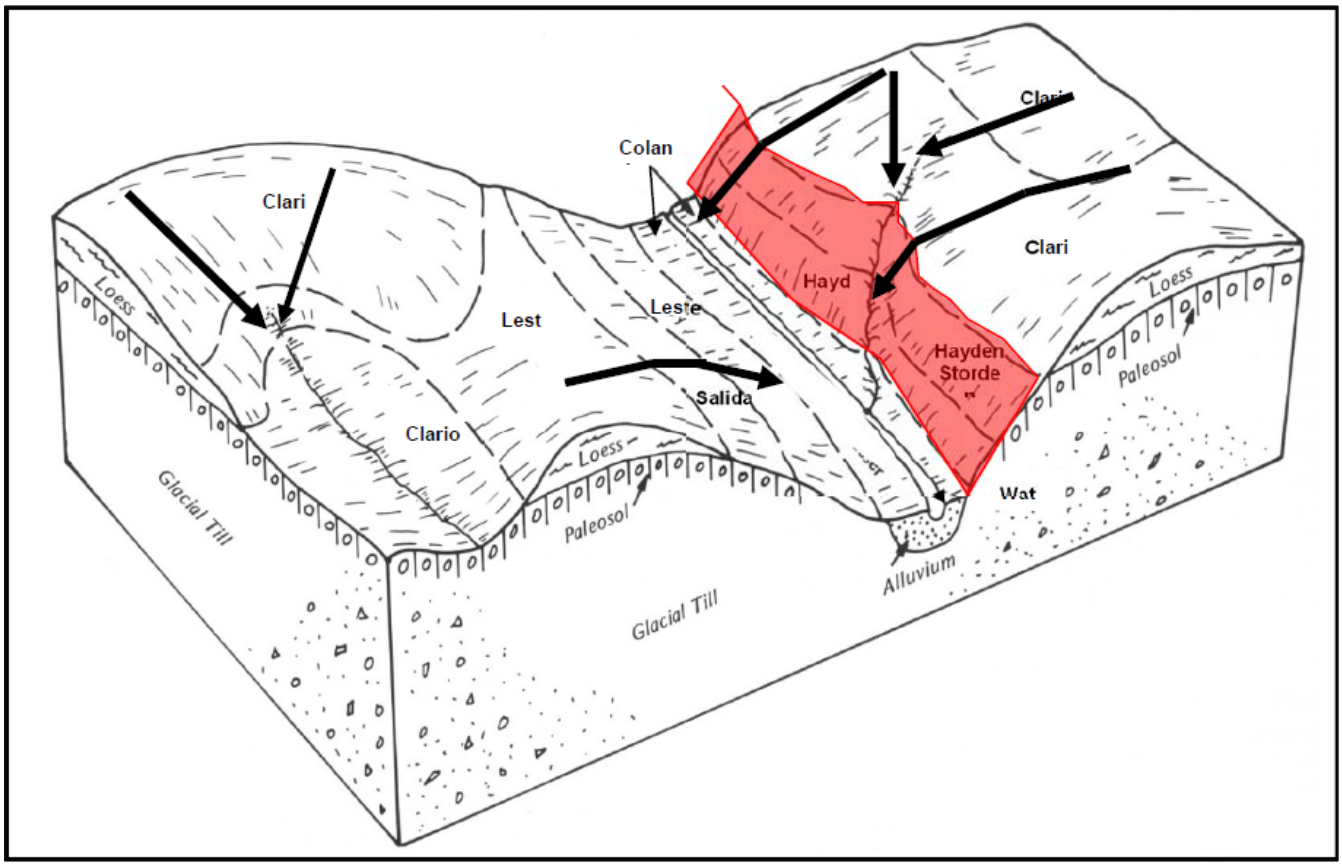
Engineering Properties---Adair County, Iowa

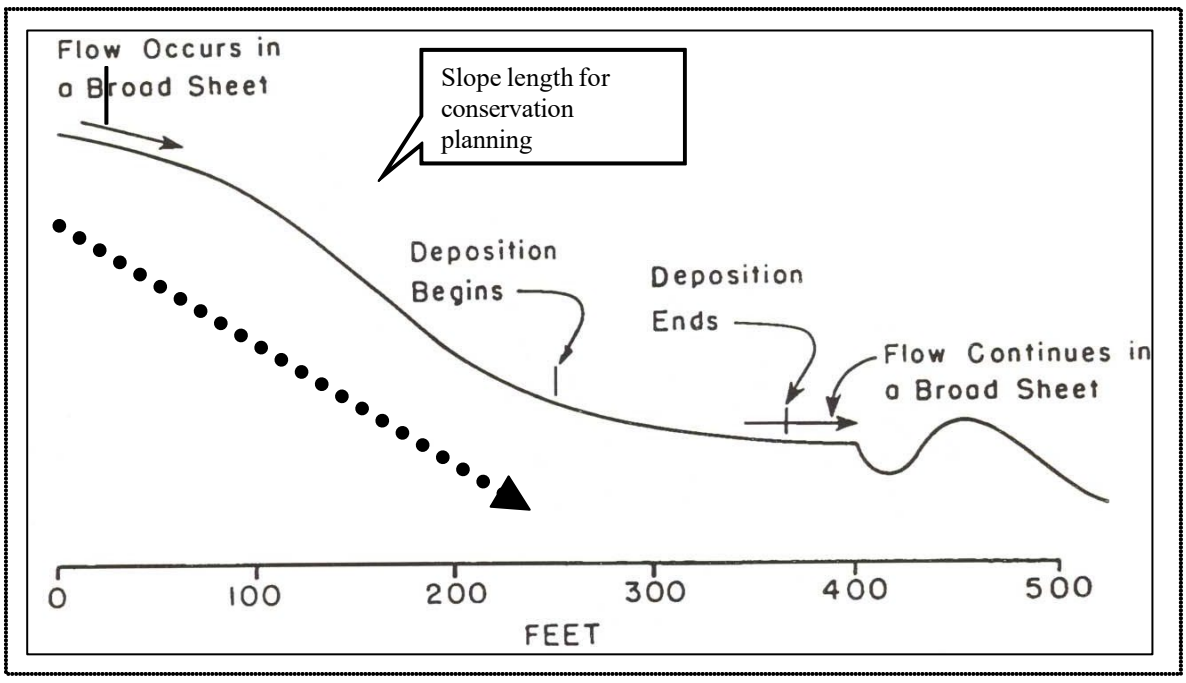
Engineering Properties–Adair County, Iowa

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
175C2—Dickinson fine sandy loam, 5 to 9 percent slopes, moderately eroded														
Dickinson, moderately eroded	90	A	0-8	Fine sandy loam	SM, SC-SM, SC	A-2, A-4	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	85-90- 95	30-40- 50	15-23 -30	NP-5 -10
			8-24	Fine sandy loam, sandy loam	SM, SC-SM, SC	A-4, A-2	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	85-90- 95	30-40- 50	15-23 -30	NP-5 -10
			24-30	Loamy sand, fine sandy loam, sandy loam	SC-SM, SM, SC	A-4	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	85-90- 95	35-43- 50	15-23 -30	NP-5 -10
			30-60	Sand, loamy fine sand, loamy sand	SM	A-2, A-3	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	70-80- 90	5-13- 20	0-7 -14	NP

Appendix 1 - Measuring Slope Lengths and Grades.

For onsite evaluation of slope length and grade, several slope measurements should be made until the planner determines a common length and grade that represents the dominant critical landscape in question.





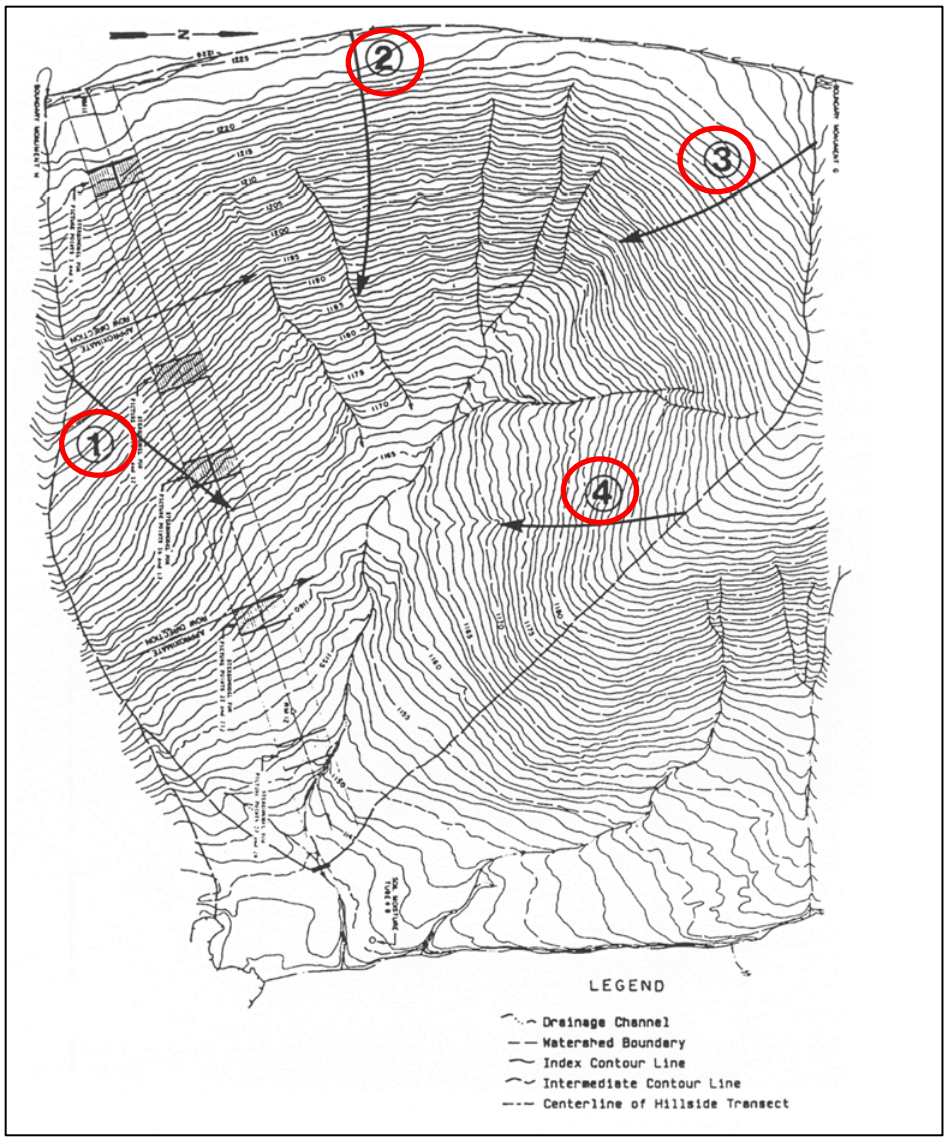
Determining slope grade

Slope is always measured perpendicular to the contour or directly up and down the slope in the direction that gravity forces the water to run.

Slope grades can be measured using a hand level, clinometer, or Abney level. Another person or a range pole or other device is used to establish the “eye height” at a point on the slope and is placed at either the top or bottom of the slope or at the points where major slope breaks occur when dealing with slopes having segments with different grades. When using a hand level a sighting is made from a measured or paced distance such as 50 or 100 feet up or down from the range pole or helper and the difference in elevation recorded and converted into percent slope. When using the clinometer or Abney level the cross hair is lined up with the “eye height” on the distant range pole or helper and the grade read directly.

Determining slope lengths

Slopes for RUSLE2 are measured perpendicular to the contour line starting at the origin of overland flow near the top of the hillslope and terminate at either significant deposition where the slope flattens significantly or at the point where flow concentrates in a larger channel, ephemeral gully, or gully.



In the picture above, slopes 2, 3, and 4 end at concentrated flow, while slope 1 ends at the point of deposition. Slopes are generally shorter on low gradients, longer at moderate gradients and shorter again on steeper gradients. This is because the flow of water tends to spread out and be more diffuse at low gradients and tends to become more concentrated at steeper gradients. Concentrated flow channels tend to form higher on the slope as gradients increase, thus slope lengths tend to be shorter since they terminate at these concentrated flow channels rather than at depositional areas. RUSLE2 currently does not estimate gully or ephemeral gully erosion and is confined to sheet and rill erosion. Slope lengths are restricted to the erosion processes modeled by the program.