ESTIMATING RAINFALL-EROSION SOIL LOSSES ON ꞏSTRUCTION SITES AND SIMILARLY DISTURBED AND UNVEGETATED AREAS

The method described here is based on modification of the Universal Soil-Loss Equation and is used to predict soil loss from sheet erosion. The rate of sheet erosion depends on several factors as follows: (1) rainfall energy and intensity, (2) soil erodibility, (3) slope gradient and length of slope, (4) surface conditions such as grass, woodland, farm crops or no cover, and (5) condition of the soil surface and management practice used. These factors may be assigned quantitative values to be used in estimating soil loss. However, the method does not account for soil loss by rill or gully erosion.

The equation is: $A = RK(LS)CP$

A = the computed soil loss expressed in tons per unit of area. Conversion to cubic yards per unit area is obtained by use of Tables 2A and 2B.

R = the rainfall factor is the number of erosion index units in a normal year's rain. The average annual erosive rainfall factor (R value) for Connecticut is 150.

K = the soil erodibility factor as shown in Table 1, is the erosion rate per unit of erosion index for a specific soil.

L = the slope length factor is the ratio of soil loss from a specific slope length to a 72.6 foot slope of the same soil and gradient.

S = the slope gradient factor is the ratio of soil loss from the field gradient to that from a nine percent slope.

C = the cropping management factor as shown in Table 3, is the ratio of soil loss from a field with specified cropping management to that from the fallow condition on which the factor K is evaluated.

P = the erosion control practice factor as shown in Table 4, is the ratio of soil loss with certain conservation practices to that of no practice.

The value A may be modified by a factor M shown in Table 5. The factor may be used to estimate the soil loss for a portion of ꞏear or longer periods.

Table 1 contains erodibility (K) values and textures of the A, B and C soil layers for the Connecticut soil series. Values for B or C layers are generally used in determining soil loss on construction sites because these layers are left exposed whe the site is disturbed. The values for the A layers are used when the soil is in a more natural state.

The soil layers are defined as follows:

1. Subsurface Soil -- The layer is generally dark in color and is 0-10 inches thick.

2. Subsoil -- It is below the surface layer and is 10-26 inches thick.

3. Substratum -- It is below the subsoil layer and is 26-60 inches thick.

Examples of How the Universal Soil-Loss Formula is Used

Assumption -- A disturbed area of 15 acres near Norwich, Connecticut. The Soil is Charlton and the B horizon is exposed. The average slope is eight percent and length of slope is 400 feet.

Example 1 -- Determine the estimated soil loss from this site if it remains unprotected for one year.

Refer to Table 1 and determine that the K value for the B horizons of Charlton fine sandy loam is 0.43. Note that the K values are not always the same for the B and C horizons of some soils. Also note texture, or fine sandy loam. Next refer to Soil Loss Table 2B, and determine that the soil loss is 208 cubic yards per acre per year. Multiply by K value of 0.43. Loss is 89 cubic yards. Multiply 89 cubic yards by 15 acres to find the average soil loss per year from this site. It is 1,335 cubic yards.

Quantities not included in Tables 2A and 2B may be estimated by interpolating between gradients and slope lengths.

Example 2 -- Determine the soil losses from this site during the period from October 1 to June 1.

Refer to Table 5 to obtain adjustment factor M for the period. During this eight-month period, 44 percent of the annual soil loss will occur. Therefore, in example 1, we determined the average annual loss to be 1,335 cubic yards. Forty-four percent of 1,335 cubic yards is 587, the amount of soil that would be lost between October 1 and June 1.

Example 3 -- Determine the soil losses from this site durin the period from June 1 to October 1, when perennial ryegrass ha been established.

Refer to Table 5 to obtain adjustment factor M for the period and the C factor for perennial ryegrass, Table 3. During this four-month period, 56 percent of the annual soil loss will occur. The C for ryegrass is 0.05. Therefore, in example 1, we determined the average annual loss to be 1,335 cubic yards. Fifty-six percent of 1,335 cubic yards is 748, the amount of soil that would be lost between June 1 and October 1. The effect of ryegrass is determined by multiplying 748 by 0.05 or 37 cubic yards, the amount of soil lost during the period.

The total soil loss for the year would be 587 cubic yards for the eight-month period (example 2) plus 37 cubic yards in the four-month period or a total of 624 cubic yards.

Example 4 -- Determine the estimated soil loss from this site if if remains unprotected for one year and the surface is compact and smooth, scraped with a bulldozer or scraper uphill and downhill.

Refer to Table 4 to obtain the P factor for this site condition, which is 1.3. The soil loss in example 1 was 1,335 cubic yards. The effect of the practice is determined by multiplying 1.3 by 1,335 or 1,735 cubic yards.

The Soil Loss Tolerance

The soil loss tolerance is used to denote the maximum rate of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely.

This rate is usually expressed in tons per acre per year. The average for Connecticut soils is three tons and the range is two to five tons.

TABLE 1
SOIL ERODIBILITY FACTORS (K) AND TEXTURES OF THE A, B, AND C SOIL LAYERS

SOIL Series	Layers	K Factors	Texture
Acton	A B C	.20 .43 .43	fsl fsl gr-sl
Adrian	All	--	--
Agwam	A B C	.28 .43 .17	fsl fsl s
Alluvial land	All	--	--
Amenia	A B C	.24 .28 .24	sil l gr-fsl
Au Gres	A B C	.15 .15 .15	s s s
Beaches	--	Variable	--
Belgrade	A B C	.49 .64 .17	sil sil grv-ls
Berlin	A B C	.49 .43 .28	sil sicl sic
Bermudian	All	--	--
Bernardston	A B C	.24 .24 .24	sil sil cn-sil
Biddeford	All	--	--
Birchwood	A B C	.20 .17 .17	fsl lfs gr-l
Birdsall	A B C	.49 .49 .49	sil sil sil
Borrow and fill land		Variable	--
Borrow and fill land, coarse materials		Variable	--
Borrow and fill land, loamy materials		Variable	--
Bowmansville	A B C	.20 .20 .20	sil sil sil
Branford	A B C	.24 .64 .17	sil l sr-sg
Bridgehampton	A B C	.49 .64 .17	sil sil sr-sg
Brimfield	A B Bedrock	.20 .43	fsl gr-fsl
Broadbrook	A B C	.43 .43 .17	sil sil gr-sl
Brookfield	A B C	.20 .43 .43	fsl fsl gr-sl
Buxton	A B C	.28 .49 .49	sil sicl sic
Canton	A B C	.24 .37 .24	fsl fsl gr-ls
Carlisle	All	--	--
Charlton	A B C	.20 .43 .43	fsl fsl gr-fsl
Cheshire	A B C	.20 .43 .43	fsl fsl gr-sl
Copake	A B C	.32 .24 .17	gr-l gr-l grv-ls
Cut and fill land	--	Variable	--
Dumps	--	Variable	--
Deerfield	A B C	.17 .17 .15	ls ls s
Dover	A B C	.32 .28 .24	fsl gr-fsl gr-sl

SOIL Series	Layers	K Factors	Texture
Eel	All	--	--
Ellington	A	.24	sil
	B	.64	sil
	C	.17	sr-sg
Elmwood	A	.32	fsl
	B	.32	sl
	C	.43	sicl
Enfield	A	.49	sil
	B	.64	sil
	C	.17	sr-sg
Farmington	A	.32	sil
	B	.28	sil
	Bedrock		
Fredon	A	.24	l
	B	--	fsl
	C	--	sr-sg
Genesee	All	--	--
Gloucester	A	.17	sl
	B	.17	gr-ls
	C	.17	gr-ls
Granby	All	--	--
Groton	A	.17	gr-sl
	B	.17	gr-sl
	C	.17	sr-sg
Hadley	A	.49	sil
	B	.49	sil
	C	.49	sil
Hamlin	All	--	--
Hartford	A	.17	sl
	B	.28	ls
	C	.17	sr-sg
Hartland	A	.49	sil
	B	.64	sil
	C	.64	sil
Haven	A	.43	l
	B	.64	l
	C	.17	sr-sg
Hero	A	.24	l
	B	.43	l
	C	.17	sr-sg
Hinckely	A	.17	gr-sl
	B	.17	gr-ls
	C	.15	sr-sg
Hollis	A	.20	fsl
	B	.43	fsl
	Bedrock		
Holyoke	A	.24	sil
	B	.43	sil
	Bedrock		
Jaffrey	A	.17	gr-sl
	B	.17	gr-ls
	C	.15	sr-sg
Kendaia	A	.32	sil
	B	.28	gr-sil
	C	.28	gr-l
Leicester	A	.17	fsl
	B	.43	fsl
	C	.43	fsl
Limerick	A	.20	sil
	B	.20	sil
	C	.20	sil
Ludlow	A	.24	sil
	B	.43	sil
	C	.17	gr-l
Lyons	A	--	sil
	B	--	sil
	C	--	gr-l
Made Land		Variable	
Manchester	A	.17	gr-sl
	B	.17	gr-ls
	C	.17	sr-sg
Melrose	A	.32	fsl
	B	.32	fsl
	C	.49	sic
Menlo	A	.24	sil
	B	.28	l
	C	.17	gr-l
Merrimac	A	.17	fsl
	B	.24	gr-ls
	C	.17	sr-sg
Montauk	A	.24	fsl
	B	.24	fsl
	C	.20	ls
Muck, Shallow	All	--	--
Narragansett	A	.32	sil
	B	.43	sil
	C	.28	gr-sl
Ninigret	A	.28	fsl
	B	.43	fsl
	C	.17	gr-ls

SOIL Series	Layer	K Factor	Texture
Ondawa	All	--	--
Palms	All	--	--
Pawcatuck	All	--	--
Paxton	A	.24	fsl
	B	.43	fsl
	C	.17	fsl
Peat & Muck Peats & Mucks	All	--	--
Peat & Muck, shallow Peat & Mucks, shallow	All	--	--
Penwood	A	.17	ls
	B	.17	ls
	C	.17	s
Pits, gravel		Variable	
Podunk	All	--	--
Poquonock	A	.20	lfs
	B	.17	ls
	C	.17	gr-l
Quarries		Variable	
Rainbow	A	.32	sil
	B	.43	sil
	C	.17	fsl
Raynham	A	.49	sil
	B	.49	sil
	C	.49	sil
Raypol	A	.49	sil
	B	.49	sil
	C	.17	sr-sg
Ridgebury	A	.24	fsl
	B	.24	fsl
	C	.24	fsl
Riverwash		Variable	

SOIL Series	Layer	K Factor	Te[xture]
Rockland		Variable	
Rockland, Hollis materials		Variable	
	A	.20	fsl
	B	.43	fsl
	Bedrock		
Rockland, Holyoke materials		variable	
	A	.24	sil
	B	.43	sil
	Bedrock		
Rock outcrop-Hollis	A	.20	fsl
	B	.43	fsl
	Bedrock		
Rowland	All	--	--
Rumney	All	--	--
Saco	All	--	--
Scantic	A	.49	sil
	B	.43	si[illegible]
	C	.37	c
Scarboro	All	--	--
Scio	A	.49	sil
	B	.64	sil
	C	.17	grv-ls
Shapleigh	A	.20	fsl
	B	.43	fsl
	Bedrock		
Stockbridge	A	.28	l
	B	.43	l
	C	.17	l
Sudbury	A	.17	fsl
	B	.17	gr-sl
	C	.17	sr-sg
Suncook	All	--	--
Sunderland	A	.24	sil
	B	.43	sil
	Bedrock		
Sutton	A	.20	fsl
	B	.43	fsl
	C	.43	gr-[illegible]