Soils: A renewable resource?

1


2


3


4


5

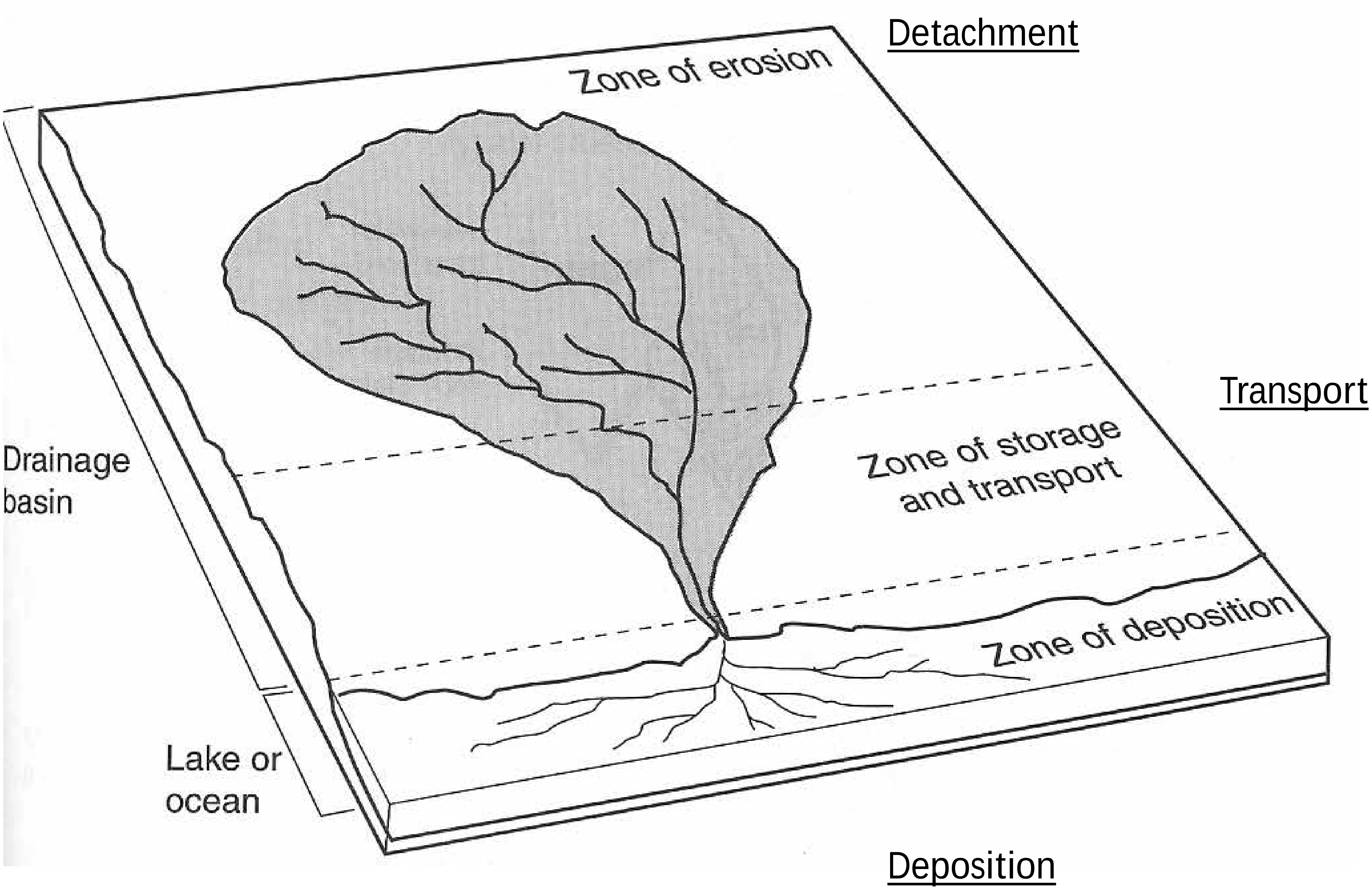

6


7


8


9


Soils: A renewable resource.



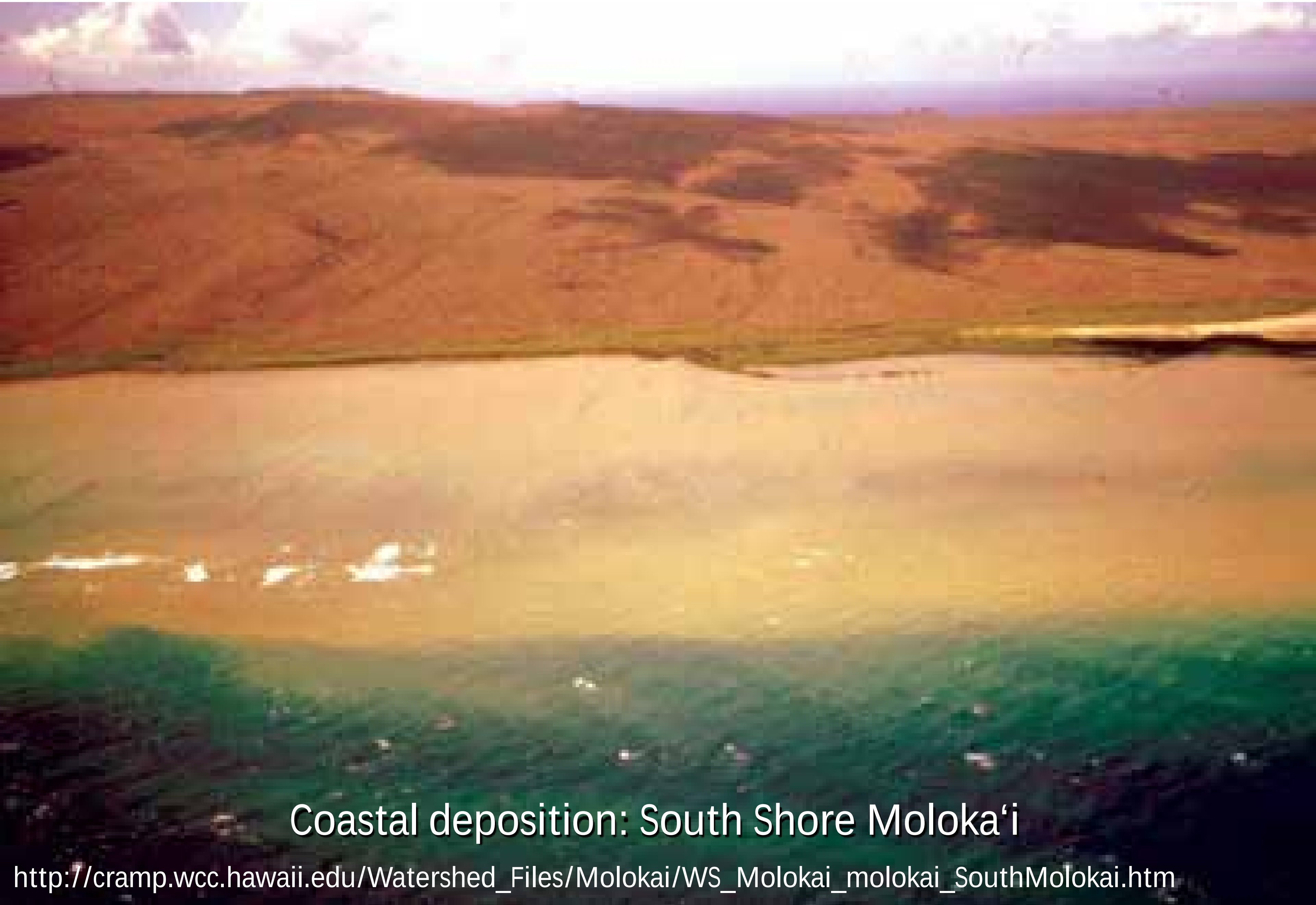
Soils: A renewable resource.

Arial Photos: STATE DEPARTMENT OF LAND AND NATURAL RESOURCES

Soils: A renewable resource.

Zones of erosion & deposition in Guilin, China

Soils: A renewable resource.

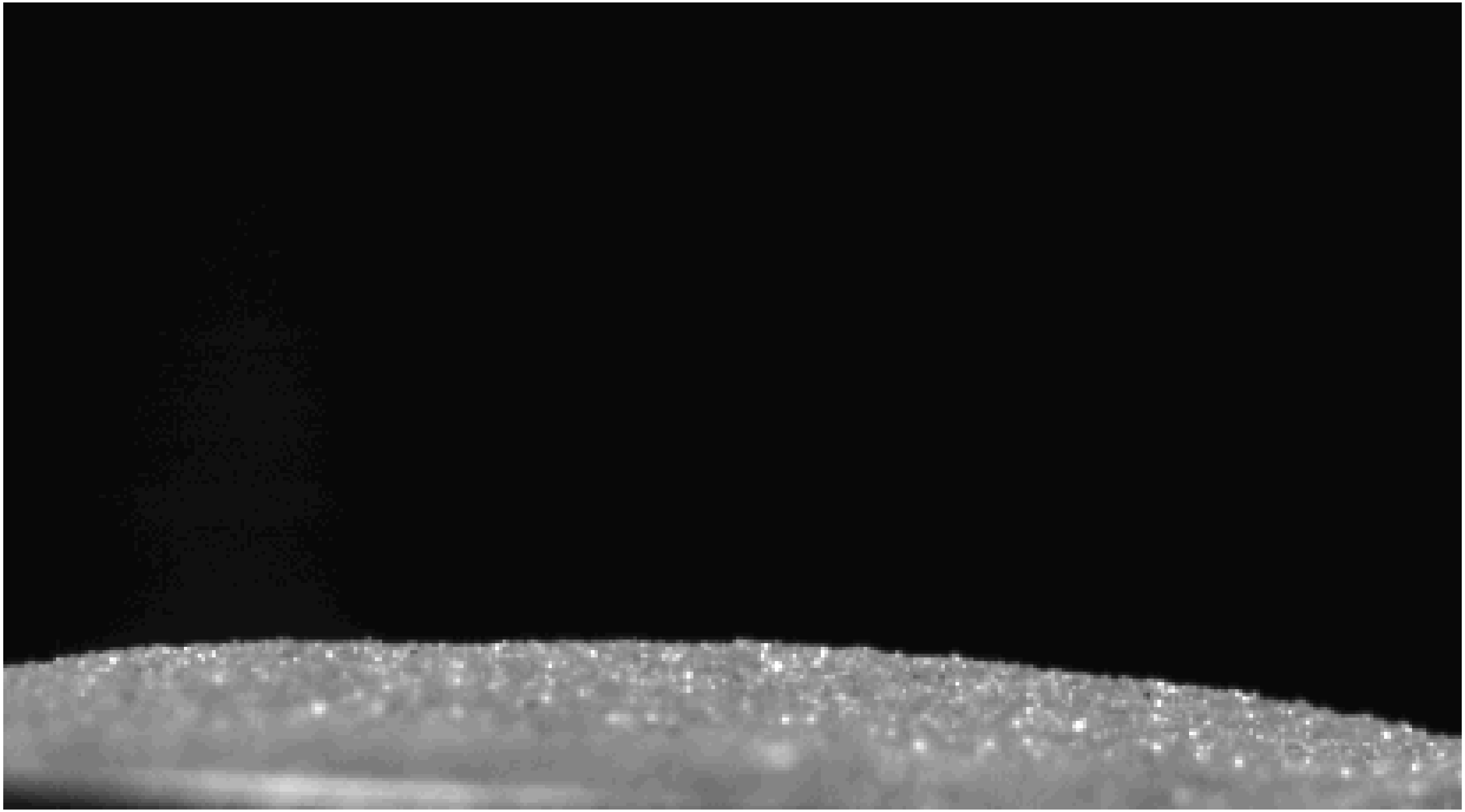


Coastal deposition: South Shore Moloka‘i

http://cramp.wcc.hawaii.edu/Watershed_Files/Molokai/WS_Molokai_molokai_SouthMolokai.htm

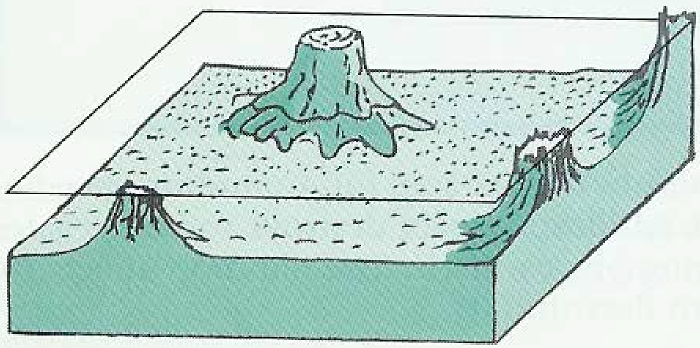
Water Erosion

Soils: A renewable resource.

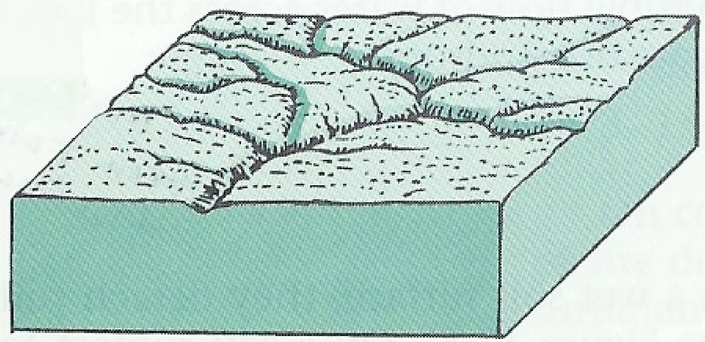


http://serc.carleton.edu/NAGTWorkshops/visualization/collections/soil_erosion.html

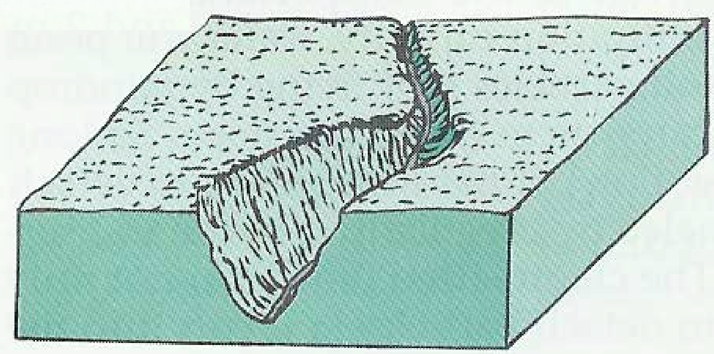
Soils: A renewable resource.



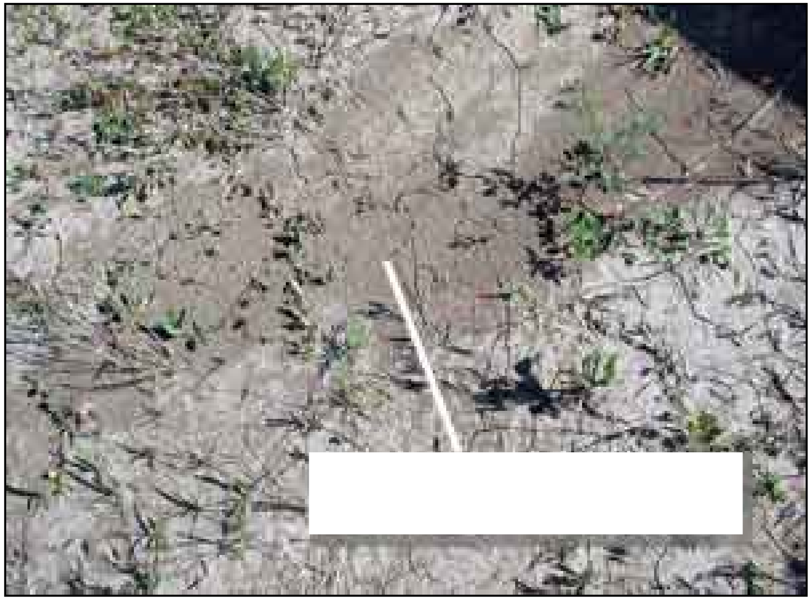
(*a*) Sheet erosion



(*b*) Rill erosion



(c) Gully erosion

Universal Soil Loss Equation
or
USLE

$$A = R \times K \times LS \times C \times P$$

Where:

A = Estimated Avg. Annual Soil Loss (ton/ac•yr)

R = Rainfall Erosivity (ft-ton/ac•yr)

K = Soil Erodibility (ton•ac/ac•ft-ton

LS = Slope Length & Steepness

C = Cover-Management

P = Supporting-Practice

Rainfall Erosivity Factor (R)

$A = R \times K \times LS \times C \times P$

(Troeh et al. 2004)

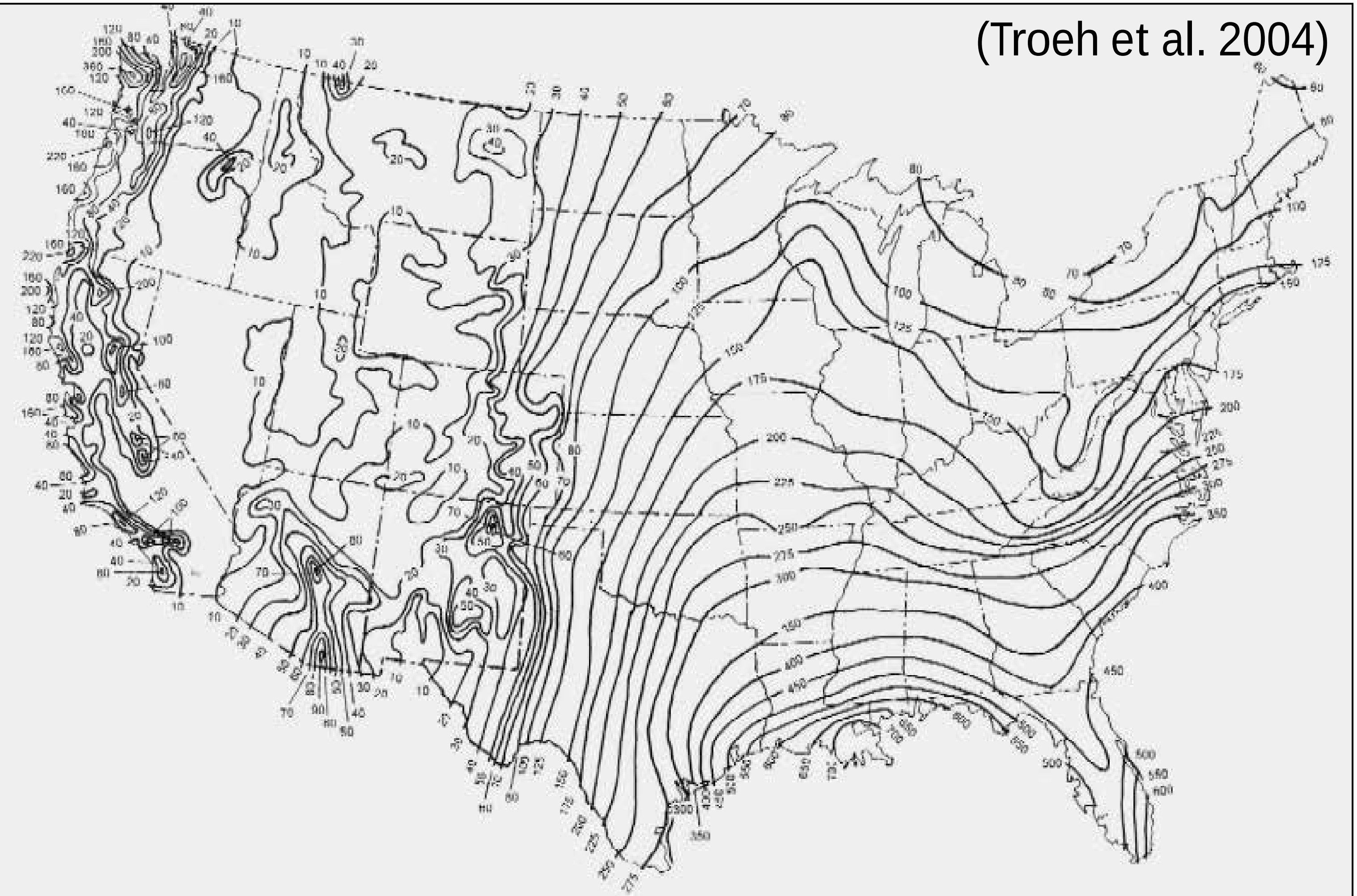


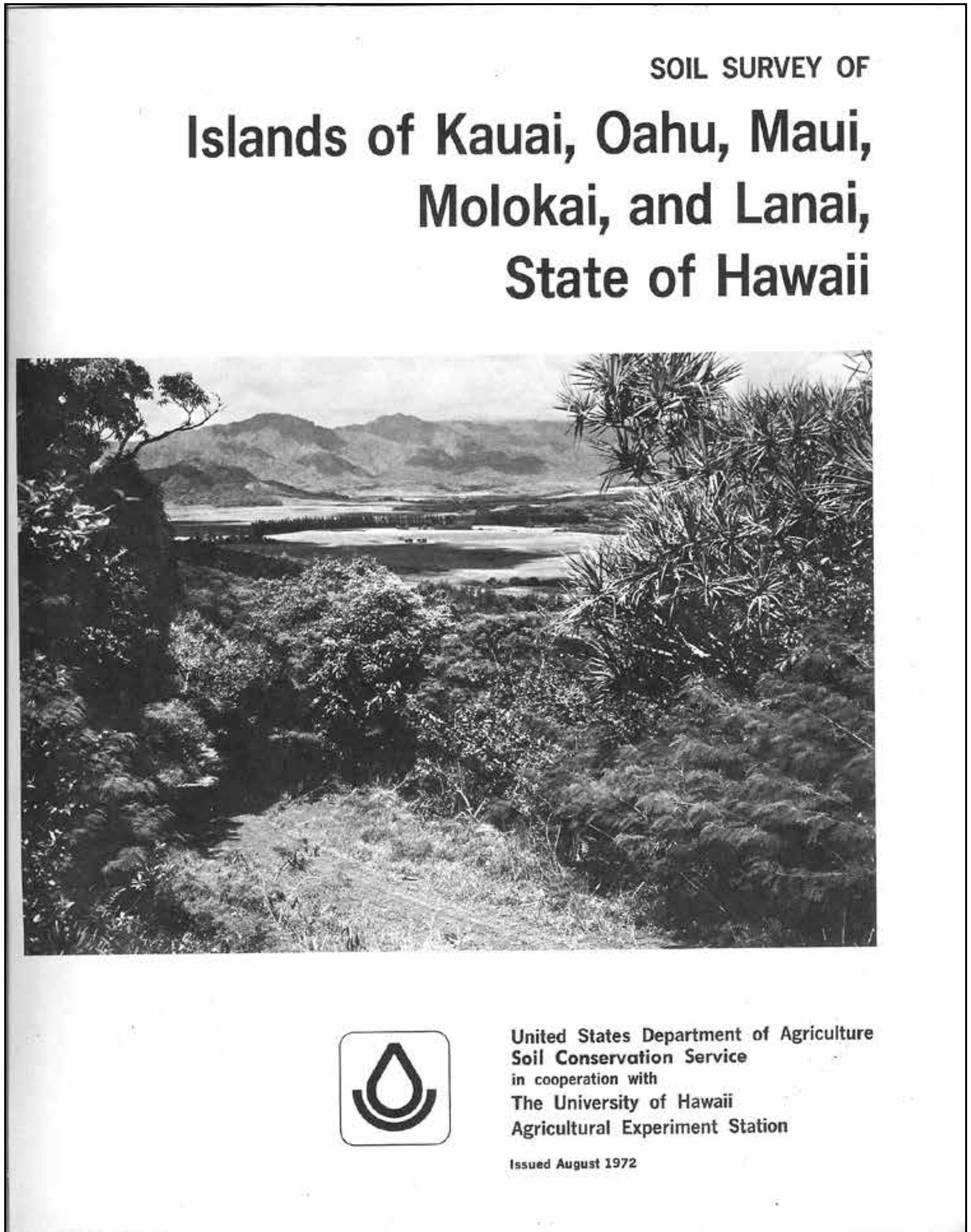
Figure 6–2 Isoerodent map (*R* values) in units of 100 ft-ton/ac-yr for the conterminous United States. (Modified from Renard et al., 1997.)

Soil Erodibility Factor (K)

A = R x **K** x **LS** x **C** x **P**

- Inherent soil erodibility
- Rate of soil loss on a standard plot (72.6 ft long on a 9% slope)

Soil Erodibility Factor (K)


SOIL SURVEY OF

Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii

United States Department of Agriculture
Soil Conservation Service
in cooperation with
The University of Hawaii
Agricultural Experiment Station

Issued August 1972

K factors are tabulated for each soil map unit in County Soil Surveys, also available on Web Soil Survey

Soil Erodibility Factor (K)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm³	In/hr	In/in	pH	Mmhos/cm					Pct
48-------------	0-24	<2	1.35-1.55	6.0-20	0.02-0.05	3.6-6.5	<2	Low--------	0.10	5	2	<2
Myakka	24-30	1-8	1.45-1.60	0.6-6.0	0.10-0.20	3.6-6.5	<2	Low--------	0.15			
	30-82	<2	1.48-1.70	6.0-20	0.02-0.10	3.6-6.5	<2	Low--------	0.10			
49A-------------	0-34	2-12	1.35-1.65	2.0-20	0.05-0.20	4.5-5.5	<2	Low--------	0.10	5	2	1-4
Lochloosa	34-44	13-20	1.55-1.70	0.6-6.0	0.10-0.15	4.5-5.5	<2	Low--------	0.24			
	44-57	15-35	1.55-1.70	0.6-0.2	0.12-0.15	4.5-5.5	<2	Low--------	0.28			
	57-80	20-45	1.60-1.70	0.06-0.2	0.13-0.18	4.5-5.5	<2	Low--------	0.28			
50-------------	0-8	1-5	1.20-1.50	6.0->20	0.08-0.12	3.6-6.5	<2	Low--------	0.10	5	2	<3
Sparr	8-48	1-5	1.45-1.70	6.0->20	0.05-0.08	3.6-6.5	<2	Low--------	0.10			
	48-56	15-32	1.55-1.80	0.6-2.0	0.10-0.15	3.6-6.5	<2	Low--------	0.20			
	56-84	15-30	1.55-1.70	0.06-0.6	0.10-0.15	3.6-6.5	<2	Low--------	0.24			
51-------------	0-42	1-7	1.35-1.65	2.0-20.0	0.03-0.20	3.6-5.5	<2	Low--------	0.10	5	2	1-3
Plummer	42-81	15-30	1.50-1.70	0.6-2.0	0.07-0.15	3.6-5.5	<2	Low--------	0.15			
52-------------	0-9	---	0.12-0.35	>6.0	0.25-0.40	3.6-4.4	<2	Low--------	----	---	2	30-90
Lodwith	9-15	5-18	1.10-1.25	0.6-6.0	0.10-0.18	4.5-5.5	<2	Low--------	0.20			
	15-17	1-10	1.10-1.65	0.6-20.0	0.10-0.15	4.5-5.5	<2	Low--------	0.17			
	17-44	35-55	1.20-1.65	<0.2	0.04-0.15	5.1-7.3	<2	High-------	0.24			
	44-93	35-55	1.20-1.65	<0.2	0.04-0.15	6.1-8.4	<2	High-------	0.24			
53-------------	0-21	---	0.10-0.40	>6.0	0.25-0.40	3.6-4.4	<2	Low--------	----	---	2	>20
Shenks	21-28	29-50	0.85-1.30	0.06-0.6	0.18-0.30	5.1-6.5	<2	Moderate	0.32			
	28-82	38-65	1.10-1.35	<0.06	0.10-0.20	5.6-7.8	<2	High-------	0.28			
54-------------	0-10	6-12	0.70-1.50	6.0-20	0.15-0.20	3.6-6.0	<2	Low--------	0.15	5	2	3-10
Emeralda	10-18	4-12	1.40-1.70	6.0-20	0.05-0.10	3.6-6.0	<2	Low--------	0.15			
	18-56	38-60	1.60-1.85	<0.2	0.10-0.20	4.5-6.5	<2	High-------	0.24			
	56-80	38-60	1.60-1.85	<0.2	0.10-0.20	4.5-7.3	<2	High-------	0.24			
55B-------------	0-82	1-3	1.45-1.65	>6.0	0.03-0.08	4.5-5.5	<2	Low--------	0.10	5	2	.5-1
Lake												
56-------------	0-9	1-12	1.05-1.55	>6.0	0.05-0.15	4.5-6.5	<2	Low--------	0.15	5	2	1-4
Wauberg	9-24	1-10	1.30-1.60	>6.0	0.03-0.10	4.5-6.5	<2	Low--------	0.15			
	24-40	24-35	1.50-1.70	<0.2	0.07-0.13	5.1-7.3	<2	Moderate	0.28			
	40-63	18-35	1.50-1.90	<0.2	0.05-0.13	5.1-7.3	<2	Low--------	0.24			
	63-81	36-50	1.60-1.70	<0.2	0.08-0.15	5.1-7.3	<2	High-------	0.24			
57D-------------	0-6	3-12	1.50-1.65	6.0-20	0.05-0.10	3.6-6.0	<2	Low--------	0.15	5	2	1-5
Micanopy	6-12	20-38	1.50-1.65	0.6-2.0	0.10-0.15	3.6-6.0	<2	Moderate	0.32			
	12-55	40-60	1.55-1.70	<0.0-0.2	0.10-0.18	3.6-6.0	<2	High-------	0.28			
	55-85	25-38	1.55-1.70	<0.0-0.2	0.10-0.15	3.6-6.0	<2	High-------	0.32			
58B-------------	0-82	1-3	1.45-1.65	>6.0	0.03-0.08	4.5-5.5	<2	Low--------	0.10	5	2	.5-1

Soil Erodibility Factor (K)

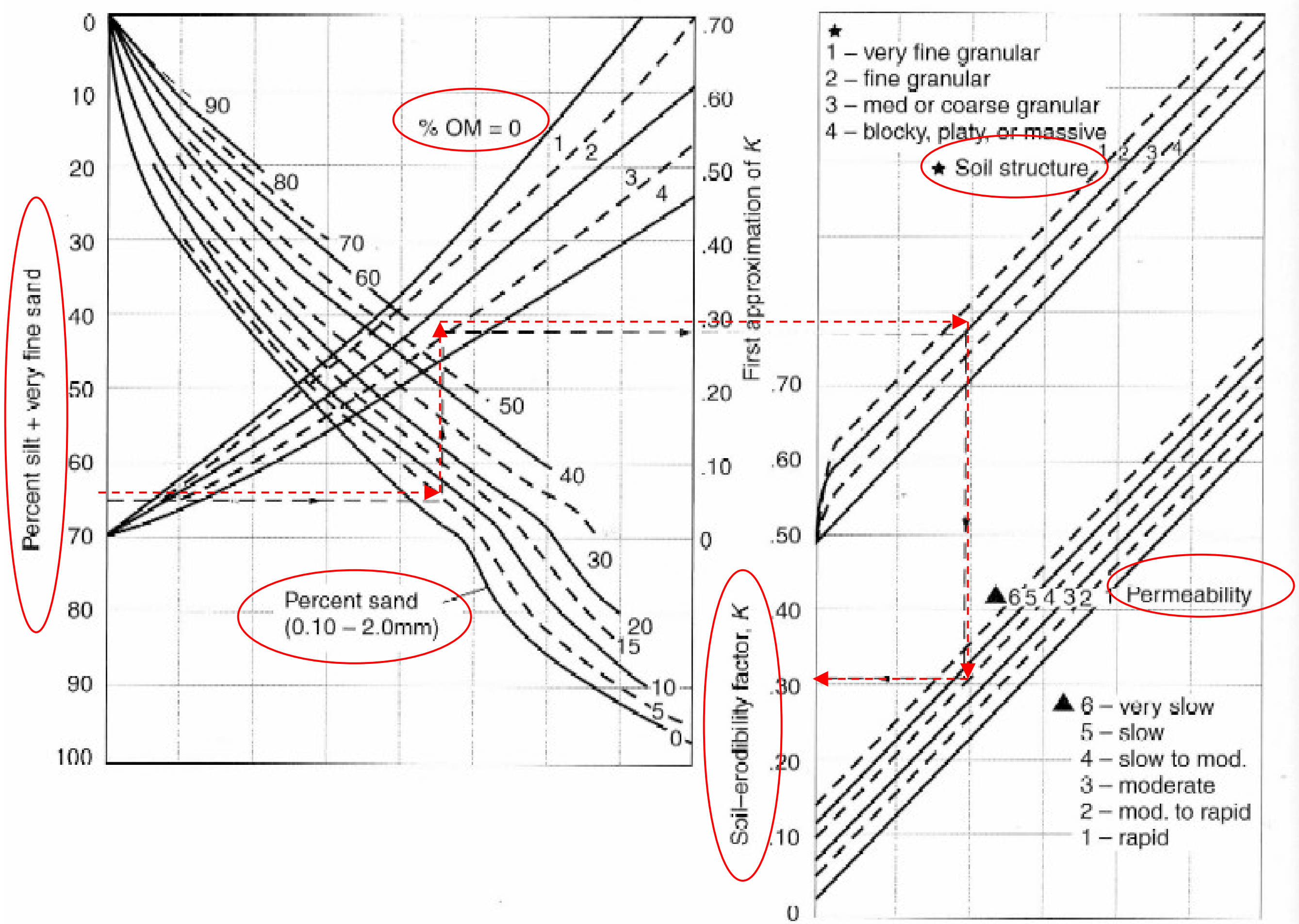


Figure 6–1 A nomograph to determine the soil-erodibility factor, *K*, from percent silt plus very fine sand (0.002 to 0.1 mm), percent sand (0.1 to 2.0 mm), percent organic matter, soil structure, and soil permeability. The dashed line shows how the nomograph is used to obtain a *K* value of 0.31 for a soil having 65% silt + very fine sand, 5% sand, 2.8% organic matter, fine granular structure, and slow-to-moderate permeability. This same sequence of properties must always be used to obtain *K* values from the nomograph. (From the *Journal of Soil and Water Conservation*, Volume 26, p. 189–193, 1971 [Wischmeier et al.]).

K factor nomograph:

K = ¦ (5 soil properties)

(Troeh et al. 2004)

Slope Length & Steepness Factor (LS)

A = R x **K** x **LS** x **C** x **P**

LS is the ratio of expected soil loss per unit area of a particular field segment compared to what would be lost from a 9%, 72.6-ft-long slope with no cover.

Slope Length & Steepness Factor (LS)

LS Lookup Tables

Example: Determine LS for ag field w/ slope of 5% & length of 400 ft.

Table 4-2.
Values for topographic factor, LS, for moderate ratio of rill to interrill erosion.[1]

Slope (%)	Horizontal slope length (ft)																
	3	6	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

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

Cover Management Factor (C)

A = R x **K** x **LS** x **C** x **P**

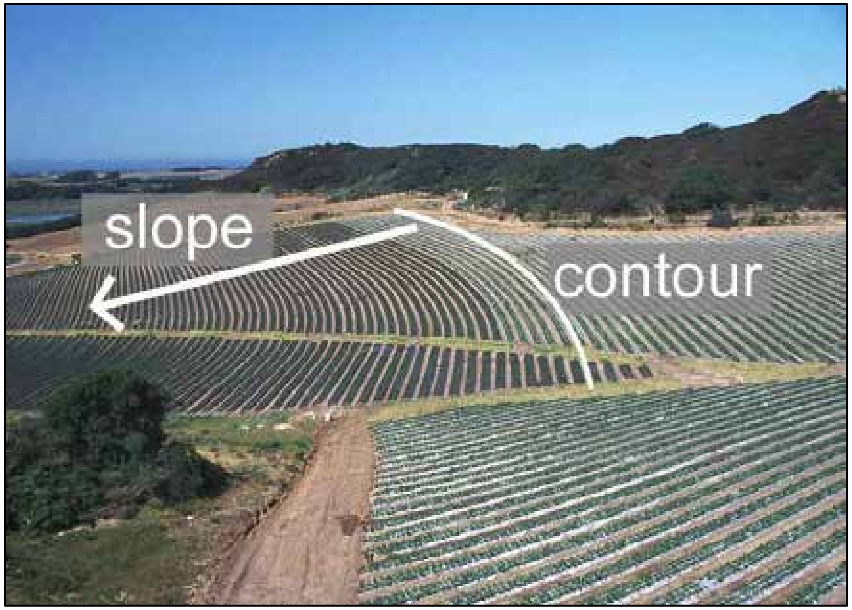
C = ¦ (5 subfactors)

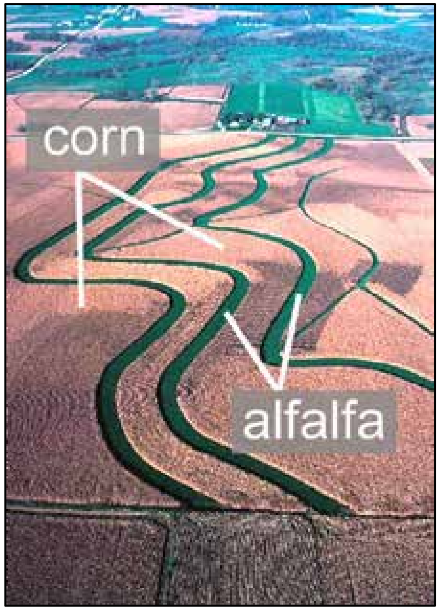
C = PLU*CC*SC*SR*SM

Supporting-Practice Factor (P)

A = R x **K** x **LS** x **C** x **P**

The fractional amount of erosion that occurs when "special practices," e.g., contour cultivation, contoured strip cropping, & terracing, are used compared with erosion that would occur without them.





http://passel.unl.edu/Image/siteImages/Stripcropping-LG.jpg

With conventional tillage:

A= 170 x 0.26 x 1.62 x 0.20 x 1.0 = 14.3 t/a/y

With conservation tillage:

A = 170 x 0.26 x 1.62 x 0.11 x 1.0 = 7.9 t/a/y

With contour cultivation:

A= 170 x 0.26 x 1.62 x 0.20 x 0.61 = 8.6 t/a/y

With cons. tillage & contour cult.:

A = 170 x 0.26 x 1.62 x 0.11 x 0.61 = 4.8 t/a/y

Soils: A sustainable resource.

Table 1. USLE Assessment at 3 Sites in the Kaiaka Bay Watershed (A = R * K * LS * C * P)									
Site	HCG			TCB			PES		
R	250[4]	250	250	280[4]	280	280	400[4]	400	400
K	0.17	0.17	0.17	0.17	0.17	0.17	0.15	0.15	0.15
LS	0.091	0.091	0.091	2.95	2.95	2.95	1.19	1.19	1.19
Bare	0.45			0.45			0.45		
40 % Cover		0.15			0.15			0.15	
95 % Cover			0.011			0.011			0.011
P	1	1	1	1	1	1	1	1	1
July '05[5]	1.74			63.2			32.1		
Jan '06[5]		0.58			21.1			10.7	
July '06[5]			0.04			1.54			0.78

[1]HCA = Haleiwa Community Gardens site; [2]TCB = Thompson Corner Bridge site; [3]PES = Poamoho Experiment Station site
[4]July 2005 calculation; [5]Tons per acre per year

Wind Erosion