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FACTORS AFFECTING SOIL WATER EROSION IN NORTH WESTERN COAST OF EGYPT

BY

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ABSTRACT

The current study aims at estimating and assessing soil erosion by water in Bahig area, in the North Western Coast of Egypt. Eighteen soil profiles were dug in two watersheds, in two locations, the first is a virgin soil, the second is a recently cultivated soil Soil samples were taken at various depths. Soil losses by water were estimated using the Universal Soil Loss Equation (USLE).

Results showed rainfall erosivity factor "R" of 22.42 J/ha for both soils, soil erodibility factor "K" of 0 73 for virgin soil and 0.57 for recently cultivated soil Soil slope length-steepness factor "LS" was 0.4 for both soils. Crop management factor "C" = 1 0 for virgin soil and 0.05 for recently cultivated soil. Conservation practice factor "P" was estimated as unity (1) for both soils. The predicted annual soil losses by water is estimated at 6.55 t/ha/yr for virgin soil and 0.26 ton/ha/yr for recently cultivated soil. Soil erosion could be reduced by using soil conservation practices in order to protect soils, crops, air and roads from severe erosion.

INTRODUCTION

Soil water erosion encompasses detachment, transport and deposition of soil particles by the erosive forces of raindrops and surface flow of water. The detachment of soil particles is initiated by beating action of falling raindrops which splash soil particles, break down soil aggregates and seal soil surface. The water from rainfall infiltrates into the soil and when the rainfall rate exceeds the infiltration rate of the soil, the runoff occur and the soil particles are detached and dispersed by the impact of raindrops go into suspension and transported by the surface runoff, either as sheet flow or rill and gully flow. When the kinetic energy of the raindrop splashes or runoff is spent or where vegetation or mechanical obstruction resist the erosive forces the moving particles come to rest and the deposition is occurred, it is the end of the erosion process (Ben, 1955: Tripathi and Singh, 1993 and Nearing, 1997)

The Universal Soil Loss Equation (USLE) is currently the soil loss model and most commonly used to predict soil loss rates from the landscape The equation uses empirically determined multiplicative factors to account for the effect on erosion of rainfall energy "R", surface condition "CP", soil erodibility "K", and for the combined effect of slope and slope-length "LS". Arroug, (1995); Mostafa, (1998) and El-Falah, (2003) stated that applying USLE formula is recommended to be used for the prediction of soil loss due to water erosion under North Western coast conditions.

MATERIALS AND METHODS

Bahig area, in the North-Western Coast of Egypt, (Map 1), was chosen to carry out this study. This area lies between the third and fourth ridges in an arid zone. It lies with the El-Hammam region. It has an elevation of 55-65 m above sea level and is located at 60 km west of Alexandria and 9 km south of the beach. It is located between longitudes 29° 29' to 29° 31' E, and latitudes 30° 49' to 30° 51' N. Annual rainfall is 172 mm (average for the past 10 years) mostly with few violent storms in winter.

Eighteen soil profiles were dug in two watersheds, a virgin one and a recently cultivated one. Each watershed has a slope gradient of 4 % south to north and 2 % west to east. Three soil profiles were selected from three rows at fixed distances along and across the 4 % slope (upper, middle and lower slope positions).

Disturbed and undisturbed soil samples were taken from three depths of the representative profiles, i.e., 0-15, 15-30 and 30-45 cm. The disturbed soil samples were air-dried, crushed and passed through 2-mm sieve and used for soil chemical analysis. The undisturbed samples were used in determining some soil physical properties.

Soil loss by water was estimated by applying the Universal Soil Loss Equation (USLE) proposed by Wischmeier and Smith (1965) as follows:

$A = R. K. LS. C. P.$ where,

A = estimated average annual soil loss, t/ha,

R = rainfall factor, which equals the mean annual erosivity value divided by 100 [the mean annual erosivity = "EI_{30} / 100"; where: E: kinetic energy "Jules"; I_{30}: maximum 30-minute intensity of rain " mm " .

K = soil erodibility index, which is expressed as soil loss per unit of rainfall erosivity index from bare and fallow soils of a 9 % slope and 22.1 m long, m/J

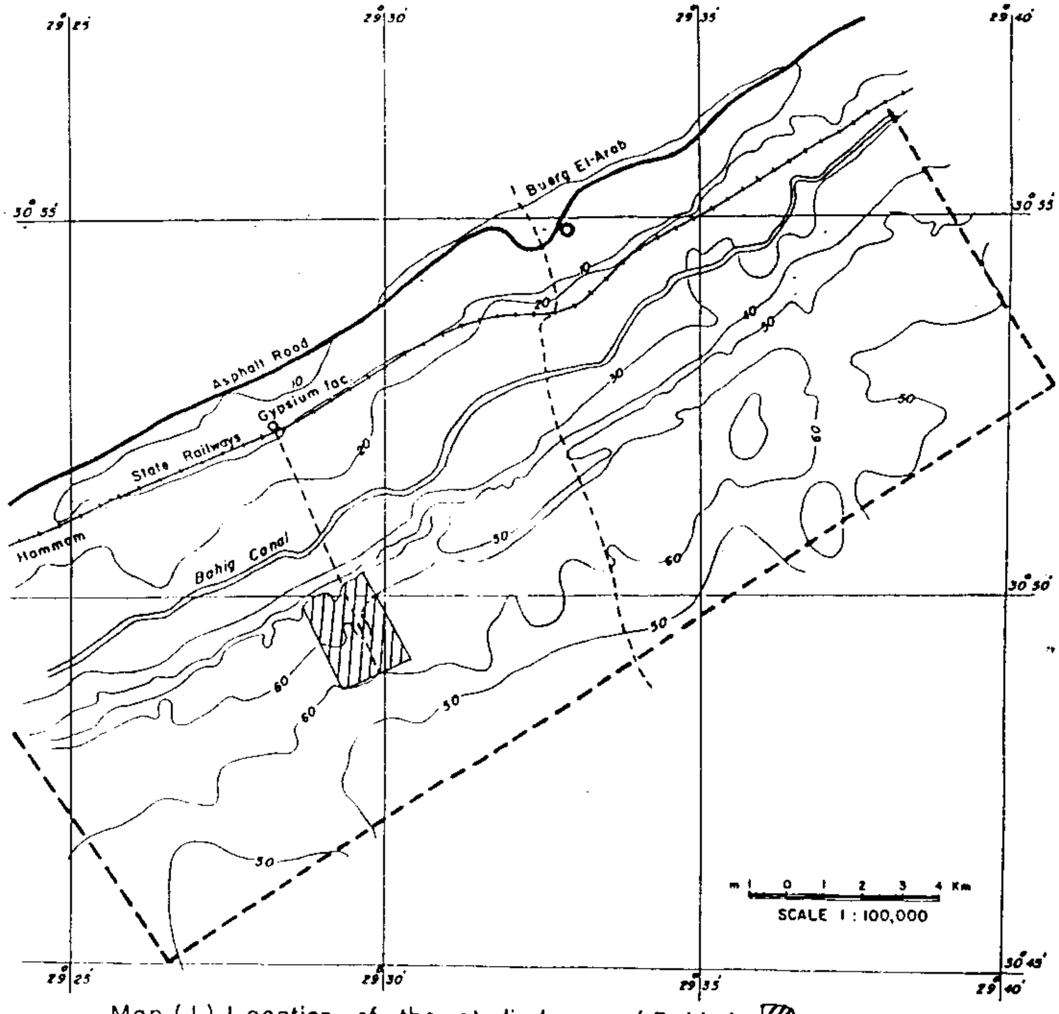
LS = slope length-steepness factor, dimensionless, where,

L is in meter and S is in percent,

C = cropping-management factor, dimensionless; it represents the ratio between soil loss under a given plant cover and that from bare soil,

P = conservation practice factor, dimensionless; it represents the ratio of soil loss under a specific conservation practice to that with no conservation measures.

Meteorological data from 1994 to 2003 years were obtained and calculated from Burg El-Arab meteorological station.



Map.(1) Location of the studied area (Bahig)

Determination of soil properties:

Structure of soil profiles was examined in the field. Particle size distribution was determined. Seven soil particle sizes were separated, i.e., very coarse sand, coarse sand, medium sand, fine sand, very fine sand, silt and clay using sieves and the pipette method (Piper, 1950). Hydraulic conductivity was determined according to the Darcy's low:

$Q/At = K\Delta H/L$ where,

Q = volume of water passing through the soil column (cm^3) at time t,
A = cross-sectional area of the soil column (cm^2)
K = hydraulic conductivity at t °C.
$\Delta H/L$ = hydraulic gradient (klute, 1986).

Organic matter content was determined according to Walkley and Black's method (Jackson, 1958).

RESULTS AND DISCUSSION

The USLE (A = R. K. LS. C. P) was used to predict the amount of soil loss by water erosion.

Rainfall erosivity factor "R":

The factor "R" is a definition of the erosivity of rainfall events and is defined as the product of two rainstorm characteristics: the kinetic energy "K" of rainfall and the maximum 30-minute intensity "I_{30}". According to Wischmeier *et al.* (1958), the following equation for calculated E was applied:

$$E = 118.9 + 87.3 \log_{10} I$$

Where,
E = kinetic energy of rain in 10^3 joule/ha.
I = average rainfall intensity mm/hr

The rainfall erosivity factor "R" was calculated for the entire study area from rainfall data obtained for Burg El-Arab Meteorological Station, Table (1) and Fig. (1).

The sum of EI_{30} products for all the major storms over Bahig desert area gives "R" values (Table 2) for the period of 4 year (from 2000 to 2003).

During the four-year period from 2000 to 2003, the highest "R" value using USLE was 37.64 J/ha in 2000 and the lowest one was 13.57 J/ha in 2002. The average "R" value was 22.42 J/ha.

Soil erodibility factor "K":

Soil erodibility factor "K" represents a quantitative measurement of the susceptibility of soil to water erosion. It is related to some factors including soil texture, structure, permeability, organic matter content (Tables 3 and 4).

In this study, "K" was determined by the equation of Arroug (2005), which depends mainly on some soil properties. The equation is as follows:

Table (1): Rainfall and temperature data obtained from Burg El-Arab Meteorological Station during 10 years from (1994 – 2003).

a- Rainfall (mm)

Month / Year	Jan.	Feb.	Mar.	Abr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	Mean
1994	43.20	3.30	23.60	–	–	–	–	–	–	6.00	114.10	67.50	257.7	21.48
1995	17.90	50.50	7.00	6.00	–	–	–	–	–	0.40	28.10	8.90	118.8	9.90
1996	57.20	16.70	26.90	3.10	–	–	–	–	–	7.40	24.00	24.90	160.2	13.35
1997	41.80	36.10	17.10	7.30	0.60	–	–	–	3.60	7.20	16.80	42.30	172.8	14.40
1998	61.80	47.30	73.00	0.60	1.30	–	–	–	–	0.40	33.00	15.70	233.1	19.43
Average	44.38	30.78	29.52	3.40	0.38	–	–	–	0.72	4.28	43.20	31.86	188.52	15.71
1999	25.90	8.90	2.60	1.20	–	–	–	–	–	1.10	6.60	15.00	61.3	5.11
2000	102.50	19.00	22.50	–	3.00	–	–	–	7.00	39.50	19.00	57.50	270.0	22.50
2001	34.50	7.50	–	–	–	–	–	–	1.50	26.50	4.50	43.50	118.0	9.83
2002	87.50	18.00	5.00	6.50	8.50	–	–	–	–	5.50	5.50	11.00	147.5	12.29
2003	14.50	57.50	40.50	1.00	5.50	2.50	–	–	–	–	18.50	38.00	178.0	14.83
Average	52.98	22.18	14.12	1.74	3.40	0.50	–	–	1.70	14.52	10.82	33.00	154.96	12.91
Mean	48.68	26.48	21.82	2.57	1.89	0.25	–	–	1.21	9.40	27.01	32.43	171.74	14.31

–: none

Table (1): Cont.

b- Temperature (°C)

Month / Year	Jan.	Feb.	Mar.	Abr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
1994	15.5	14.2	15.9	20.2	22.2	24.1	26.3	26.9	26.3	24.8	18.4	14.3	20.76
1995	13.4	14.7	16.2	17.9	20.3	26.0	27.0	27.2	25.9	22.6	17.2	14.6	20.25
1996	13.5	14.5	15.8	18.0	22.1	24.7	26.3	27.0	26.4	22.3	19.9	14.3	20.40
1997	14.7	13.2	14.7	16.8	21.6	25.2	27.1	26.6	24.7	22.4	18.4	15.0	20.03
1998	14.3	14.7	14.6	19.4	21.9	25.1	26.6	28.5	26.7	23.7	19.1	15.8	20.87
Average	14.28	14.26	15.44	18.46	21.62	25.02	26.66	27.24	26.0	23.16	18.6	14.80	20.46
1999	13.9	13.7	16.7	18.7	22.3	25.4	26.7	27.5	26.1	23.4	20.2	15.8	20.87
2000	13.3	13.9	15.4	21.4	23.0	25.1	27.8	27.6	25.6	22.4	18.6	15.6	20.81
2001	14.8	14.8	17.8	19.9	23.2	24.1	27.3	26.2	26.5	23.0	19.4	14.8	20.98
2002	12.4	14.0	16.5	19.4	21.6	24.6	28.8	28.5	27.5	23.8	19.5	15.9	21.04
2003	15.6	13.5	14.7	19.5	23.6	25.6	28.1	28.1	26.3	24.2	20.3	15.6	21.26
Average	14.0	13.98	16.22	19.78	22.74	24.96	27.74	27.58	26.4	23.36	19.60	15.54	20.99
Mean	14.14	14.12	15.83	19.12	22.18	24.99	27.2	27.41	26.2	23.26	19.1	15.17	20.73

-: none

Table (2): Monthly distribution of rainfall factor "R" during 2000 – 2003 years (according to USLE).

Month	Year	Intensity (I) mm/h	Kinetic energy (E) (J/ha)	I_{30}*	EI_{30}*	$R=EI_{30}/100$
Jan.	2000	1.40	131.66	4.00	526.63	5.27
Feb.		1.27	127.96	3.50	447.87	4.48
Mar.		1.18	125.18	2.00	250.35	2.50
Abr.		–	–	–	–	–
May		1.00	118.90	0.75	89.18	0.89
Jun.		–	–	–	–	–
Jul.		–	–	–	–	–
Aug.		–	–	–	–	–
Sep.		1.75	140.12	2.00	280.23	2.80
Oct.		2.32	150.81	8.25	1244.16	12.44
Nov.		1.46	133.25	3.50	466.37	4.66
Dec.		1.31	129.14	4.25	548.84	5.49
Total						37.64
Jan.	2001	1.15	124.20	2.25	279.45	2.79
Feb.		0.83	111.84	1.50	167.75	1.68
Mar.		–	–	–	–	–
Abr.		–	–	–	–	–
May		–	–	–	–	–
Jun.		–	–	–	–	–
Jul.		–	–	–	–	–
Aug.		–	–	–	–	–
Sep.		0.5	92.62	0.25	23.16	0.23
Oct.		1.6	138.12	3.50	483.40	4.83
Nov.		0.56	96.92	0.50	48.46	0.48
Dec.		1.09	122.17	3.25	397.04	3.97
Total						13.98
Jan.	2002	1.20	125.81	3.75	471.80	4.72
Feb.		1.13	123.53	2.00	247.07	2.47
Mar.		1.00	118.90	1.00	118.90	1.19
Abr.		0.72	106.45	1.00	106.45	1.06
May		0.65	102.57	0.50	51.28	0.51
Jun.		–	–	–	–	–
Jul.		–	–	–	–	–
Aug.		–	–	–	–	–
Sep.		–	–	–	–	–
Oct.		0.61	100.16	0.50	50.08	0.50
Nov.		0.92	115.74	0.75	86.80	0.87
Dec.		0.85	112.74	2.00	225.48	2.25
Total						13.57
Jan.	2003	0.97	117.75	1.25	147.18	1.47
Feb.		1.03	120.02	3.00	360.06	3.60
Mar.		1.23	126.75	2.75	348.56	3.49
Abr.		1.00	118.90	0.50	59.45	0.59
May		0.69	104.83	1.00	104.83	1.05
Jun.		0.50	92.62	0.25	23.16	0.23
Jul.		–	–	–	–	–
Aug.		–	–	–	–	–
Sep.		–	–	–	–	–
Oct.		–	–	–	–	–
Nov.		6.17	187.89	5.50	1033.41	10.33
Dec.		1.19	125.5	2.25	282.36	2.82
Total						23.58
						89.66
Mean						22.42

I_{30}*: maximum 30-min. rainfall intensity

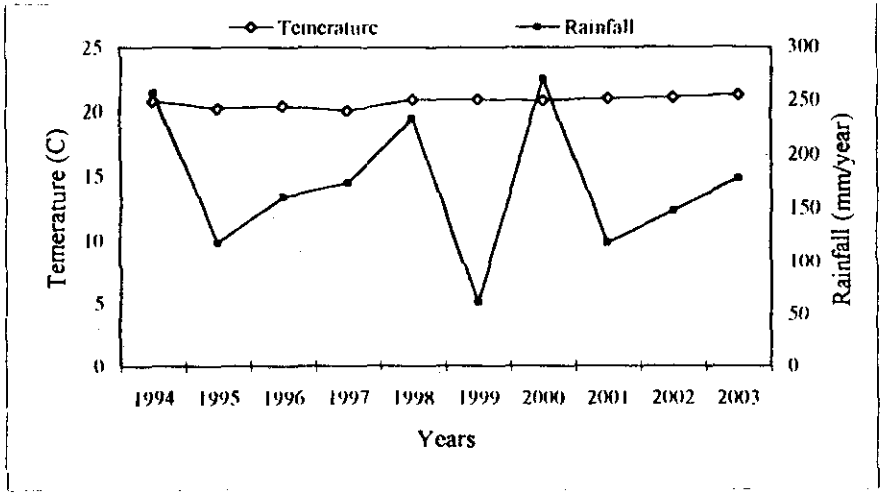


Fig. (1): Annual rainfall and mean monthly temperature distribution over the studied area from 1994 to 2003

$$K = \frac{1}{C.S + F.S} + \frac{1}{Cl + Si + O.M} + \frac{1}{P}$$

Where: CS: coarse sand (%); FS: fine sand (%); Cl: clay (%); Si: silt (%); OM: organic matter (%); P: permeability "cm/h".

The factor "K" was calculated from Tables 3 and 4. The "K" value of the virgin soil is ranges from 0.42 to 1.74; with an average of 0.73. The "K" value of the recently cultivated soil ranges from 0.33 to 1.36 with an average of 0.57.

Slope length-steepness factor "LS":

Slope length-steepness factor "LS" governs the energy and transporting capacity of flowing the water and the rate of soil loss.

From the upper to the down slope, slope length was distinguished into 18 slope length segments. Slope gradient was measured for each segment using an Abney level. Slope length-steepness factor was calculated by using the following equation of Troeh *et al.* (1980).

$$LS = (L / 22.1)^n (0.065 + 0.045\ S + 0.0065\ S^2)$$

Where, L is slope length (m), S is the slope gradient (%). The exponent of (L/22.1) i.e., the " n " value ranges between 0.2 and 0.5 according to the slope gradient.

The value of "LS" was calculated and presented in Table 5. Average "LS" from the upper to the lower slope position in both soils is a about 0.40.

Table (3): Erodibility factor "K" based on Arroug equation for "the virgin soil " of the current study.

Location: Row	Location: Slope position on (4 %)	Profile No.	Depth (cm)	CS +FS	Cl + Si + OM	Permeability (P) (cm/h)	K*
1	Upper	1	0-15	26.26	9.54	0.69	1.59
			15-30	32.56	10.55	1.28	0.91
			30-45	36.14	8.94	0.86	1.30
	Middle	4	0-15	32.65	4.02	1.04	1.24
			15-30	24.54	12.47	1.48	0.80
			30-45	27.15	11.52	1.66	0.73
	Lower	7	0-15	24.91	3.11	2.07	0.84
			15-30	34.02	5.17	0.66	1.74
			30-45	37.51	8.48	2.51	0.54
2	Upper	2	0-15	27.79	5.77	1.57	0.85
			15-30	27.95	7.55	2.76	0.53
			30-45	33.89	21.21	2.25	0.52
	Middle	5	0-15	29.58	11.65	2.06	0.61
			15-30	31.94	5.64	3.42	0.50
			30-45	34.59	11.68	1.94	0.63
	Lower	8	0-15	27.19	33.33	2.03	0.56
			15-30	30.10	6.79	3.07	0.51
			30-45	27.94	13.92	2.59	0.49
3	Upper	3	0-15	33.05	23.72	2.46	0.48
			15-30	30.66	6.83	2.54	0.57
			30-45	29.23	33.62	2.20	0.52
	Middle	6	0-15	30.61	7.30	2.94	0.51
			15-30	26.50	11.46	2.99	0.46
			30-45	31.97	3.97	3.46	0.57
	Lower	9	0-15	21.85	21.99	1.94	0.61
			15-30	22.47	30.87	2.93	0.42
			30-45	32.87	10.27	2.02	0.62
Mean							0.73

CS: coarse sand (2.0-1.0mmØ); FS: fine sand (0.25-0.1 mmØ); Cl: clay; Si: silt (0.05-0.002Ø).
$K^* = 1/(CS+FS) + 1/(Cl+Si+OM) + 1/P$ (according to Arroug 2005).

The effect of slope length on soil loss was studied for the virgin and recently cultivated soils with 2 % slope gradient and slope length of 100, 150, 300 and 500 m. Results show that soil loss increased as slope length increases. This is attributed to the high area of land surface where surface-flowing water cross and also to the transmission loss associated with the high slope length. This finding is in agreement with that of Arroug (2004). The mechanism of the increase of soil loss as the slope length increases may be due to a detachment of soil particles and transport capacity of runoff on long slopes. The influence of slope steepness on soil loss indicates that soil loss from bare fallow plots increases as the slope gradient increases.

Table (4): Erodibility factor "K" based on Arroug equation for "the recently cultivated soil" of the current study.

Location: Row	Location: Slope position on 4 %	Profile No.	Depth (cm)	CS + FS	Cl. + Si + OM	Permeability (P) (cm/h)	K*
1	Upper	10	0-15	31.59	18.79	3.35	0.38
			15-30	38.36	14.09	4.07	0.34
			30-45	33.82	4.32	4.73	0.47
	Middle	13	0-15	27.99	25.87	0.78	1.36
			15-30	31.15	24.24	1.70	0.66
			30-45	34.68	18.71	1.64	0.69
	Lower	16	0-15	28.55	8.28	1.43	0.85
			15-30	29.85	10.24	5.01	0.33
			30-45	34.72	9.12	4.06	0.38
2	Upper	11	0-15	25.41	5.69	2.94	0.56
			15-30	28.91	4.99	3.57	0.52
			30-45	29.89	5.92	3.29	0.51
	Middle	14	0-15	32.26	10.77	2.66	0.50
			15-30	33.91	12.69	2.76	0.47
			30-45	34.62	2.66	3.25	0.71
	Lower	17	0-15	33.85	12.01	1.60	0.74
			15-30	30.89	7.78	3.70	0.43
			30-45	32.35	4.39	5.13	0.45
3	Upper	12	0-15	29.98	21.40	2.10	0.56
			15-30	27.24	7.81	3.10	0.49
			30-45	26.79	4.38	5.42	0.45
	Middle	15	0-15	29.85	27.33	1.01	1.06
			15-30	22.86	23.30	3.13	0.41
			30-45	29.12	17.04	2.76	0.46
	Lower	18	0-15	28.14	28.77	1.95	0.58
			15-30	32.84	24.90	2.05	0.56
			30-45	25.85	30.27	3.33	0.37
Mean							0.57

CS: coarse sand (2.0-1.0mmØ); FS: fine sand (0.25-0.1 mmØ); Cl: clay; Si: silt (0.05-0.002Ø).
$K^* = 1/(CS+FS) + 1/(Cl+Si+OM) + 1/P$ (according to Arroug 2005).

Cropping management factor "C":

The crop management factor "C" is the ratio between the amount of soil loss under vegetation and the loss when the soil is virgin.

The Bahig area under virgin condition is characterized by a desert environment, vegetation cover is sparse, scatter and constitutes no role in protecting soil surface from splash and surface flow erosion.

With no protection on the soil surface, so "C" = 1; under recently cultivated soils, and management factor "C" reaches 0.05 (Table 6). Thus, in the virgin soil, the soil loss is approximately twenty times that in the soil under recently cultivated. These results agree with those of Arroug (2002).

Table (5): Estimation of slope steepness factor (LS).

Slope position	The virgin soils				The recently cultivated soils			
	Slope gradient (%)	Slope segment No.	Slope length (m)	LS	Slope gradient (%)	Slope segment No.	Slope length (m)	LS
Upper	4	1	300	0.99	4	10	500	1.22
	2	2	50	0.23	2	11	50	0.23
	1	3	50	0.15	1	12	50	0.15
Meddle	4	4	150	0.75	4	13	100	0.64
	2	5	50	0.23	2	14	50	0.23
	1	6	50	0.15	1	15	50	0.15
Lower	4	7	150	0.75	4	16	100	0.64
	2	8	50	0.23	2	17	50	0.23
	1	9	50	0.15	1	18	50	0.15
Total				3.63				3.64
Average				0.40				0.40
Mean	0.404							

Table (6): Cover index factor "C" construction sites.

Type of cover	Factor C
Non (bare, unprotected) Seedlings (based on a fully established stand)	1.00
Permanent grasses	0.01
Ryegrass (perennials)	0.05
Ryegrass (annuals)	0.10
Small grain	0.05
Millet or sudangrass	0.05
Field bromegrass	0.03
Grass sod	0.01
Hay (2 tons/acre)	0.02
Small grain straw (2 tons/acre)	0.02
Corn residues (4 tons/acre)	0.02
Wood chips (6 tons/acre)	0.06
Wood cellulose fiber (1.3/4 tons/acre)	0.10
Fiberglass (1000 pounds/acre)	0.05
Asphalt emulsion (1.250 gallons/acre)	0.02
Gravel, stone and fiber matting may be also be used as protective cover.	

Percent soil loss reduction as compared with fallow (from USDA Soil Conservation Service 1978)

Conservation practice factor "P":

There are no special erosion control practices in Bahig area. Therefore, soil conservation practice factor P is 1.

Estimation of the annual soil loss:

The annual soil loss due to water erosion in Bahig area can be estimated under the virgin and the recently cultivated soils using the USLE of (A = R. K. LS. C. P) could be calculated as follows:

For the virgin soil

$$A = 22.42 \times 0.73 \times 0.40 \times 1 \times 1 = 6.55 \text{ tons/ha/yr}$$

For the recently cultivated soil

$$A = 22.42 \times 0.57 \times 0.40 \times 1 \times 0.05 = 0.26 \text{ ton/ha/yr}$$

The 6.55 t/ha/yr soil loss by water of the virgin soils is high and reflects the severity of water erosion in Bahig area. The 0.26 t/ha/yr soil loss of the recently cultivated soils, reflects the conservation effect of plant cover over the soil surface. Troeh *et al.* (1980) stated minimum and maximum rates of 2 and 11 t/ha/yr; the maximum soil loss rate (11 ton/ha/yr) is for a deep, permeable, well-drained and productive soils, the minimum soil loss rate (2 ton/ha/yr) is for the shallow soils having unfavourable sub-soils and parent material that severely restricts root penetration.

This rate of soil loss of the current study Arroug (1995) suggested this rate reduced between one-third to one-half by making the "P" or "C" value equals one-third to one-half. The "C" value depends on intensifying plant cover that can be made through dryland farming (rained farming) to cover the soil surface. The "P" value can be reduced by adopting a conservation tillage practice, which is the most reasonable management practice that can be utilized in the area. Other mechanical conservation practices such as terracing may be inconvenient due to the sandy nature of the soil in Bahig area. Strip cropping and contour cultivation are practical conservation measures that can efficiently reduce water erosion.

REFERENCES

Arroug, S.M. (1995). Relation of some soil properties to its erodibility. Ph.D. Thesis, Fac. Agric., Ain Shams Univ., Egypt.

Arroug, S.M. (2002). Impact of erosion on soil properties under different cultivation systems. I. Physical properties. 6th Con of Egypt. Soil Sci. Soc., 29-30 October 2002.

Arroug, S.M. (2004). A mathematical approach for estimating the slope-length factor in the equation of soil loss by water. Egypt. J. Applied Sci., 19(11): 414-420.

Arroug, S.M. (2005). Predicting soil erodibility index by water erosion as a guide for conservation planning in Egyptian soils. Egypt. J. Applied Sci., 20(2B): 680-692.

Ben, O. (1955). How rainfall and runoff erode soil. USDA, Washington, D.C.

El-Falah, A. H. (2003). Quantitative study on soil loss by erosion and its relation to productivity in El-Qasr area of north western coast of Egypt. Ph.D. Thesis, Fac. Agric., Suez Canal Univ., Egypt.

Jackson, M.L. (1958). Soil chemical analysis. Prentice-Hall Inc., Englewood Cliffs., New Jersey, USA.

Klute, A . (1986) . Methods of soil analysis . Part 12nd Ed . American Socity of Agronomy,Madison, Wisconsin

Mostafa, A.A. (1998). Water erosion and properties of the eroded materials under different management systems. Ph.D. Thesis, Fac. Agric., Suez Canal Univ., Egypt.

Nearing, M.A. (1997). The mechanics of soil detachment by raindrops and runoff. Eurasian Soil Sci., 30(5): 552-556.

Piper, C.S. (1950). Soil and plant analysis. Interscience Publishers Inc., New York, USA.

Tripathi, R.P. and Singh, H.P. (1993). Soil erosion and conservation. Wiley Eastern Limited, New Delhi.

Troeh, F. R.; Hobbs, J.A. and Donahue, R.L. (1980). Soil and water conservation for productivity and environmental protection. Prentice-Hall Inc., Englewood Cliffs, New Jersey.

Wischmeier, W.H.; Smith, D.D. and Uhland, R.E. (1958). Evaluation of factors in the soil loss equation. Ag. Eng., 39: 458-462.

Wischmeier, W.H. and Smith, D.D. (1965). Predicting rainfall erosion losses from cropland east of the Rocky Mountains. Agric. Handbook No. 282, USDA, Washington, D.C.

العوامل المؤثرة على انجراف التربة بالمياه فى منطقة الساحل الشمالى الغربى بمصر

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يهدف هذا البحث إلى تقدير انجراف التربة كنموذج لإظهار خطورة السيول على فقد التربة والمشاكل البيئية المصاحبة لها فى منطقة بهيج بالساحل الشمالى الغربى بمصر، ولهذا تم حفر ثمانية عشر قطاعا (٩ قطاعات من أراضى بكر وأخرى مزروعة) وقدرت بعض خصائص التربة حقليا ومعمليا وتم ربطها بالمعادلة العامه (USLE) لتقدير فقد التربة بالماء.

أظهرت نتائج الانجراف المائى للتربة أن معامل الانجراف بالمطر " R "= ٢٢,٤٢ جول/هكتار، عامل انجراف التربة "K" = ٠,٧٣ ، ٠,٥٧ طن/جول لكل من الأرض البكر والمزروعة على التوالى، عامل درجة وطول انحدار التربة "LS" = ٠,٤لكل من الأرضيين، عامل إدارة الغطاء النباتى "C" = ١,٠ ، ٠,٠٥ على التوالى، أما عامل صيانة التربة "P" فكانت تساوى الوحدة لكل من الأرضيين. وبتطبيق المعادلة العامه للانجراف المائى (USLE) وجد أن كمية التربة المفقودة بالماء تقدر سنويا بنحو ٦,٥٥ ، ٠,٢٦ طن/هكتار لكل من الأراضى البكر والمزروعة على التوالى.

وبذلك تكون كمية التربة المفقودة بالماء من الأرض البكر أعلى من الحد الادنى من المعدل العالمى المسموح به (٢ – ١١ طن/هكتار/سنة)، ولهذا يوصى بضرورة اتباع وسائل صيانة التربة اللازمة ضد الانجراف المائى لتقليل فقد التربة وتدهورها وما يتبع ذلك من مخاطر بيئية على المحاصيل الحقلية والطرق ..... الخ.