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Rainfall Erosivity and Soil Erodibility as Related to Water Erosion in Burundi

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SOIL EROSION is a serious problem in Burundi due to the high erosivity of rainfall and runoff water. Rainfall erosivity and soil erodibility are important factors that govern soil erosion. Therefore, this study aims to evaluate several individual storm erosivity parameters that have been developed under tropical climatic conditions using soil loss data collected from runoff-erosion plots that were set up at the farm of ISA in Burundi. Data of rainstorm characteristics, soil and runoff losses were obtained on a storm basis from 92 runoff events recorded during the period from March 1986 to February 1987. Eleven erosivity factors were evaluated and fitted to the soil loss data for fallow plots. Results revealed that runoff (R0) and the erosivity index (EI_{15}) are considered the best erosivity factors that may fit soil loss under Burundi conditions. Also, 18 erosive rainstorm events accounted for 75% of the total soil loss. Erosive rainfall events were distributed in March, April, November, December, and January as 2, 4, 4, 2, and 6 events, respectively. They accounted for a percentage of soil loss as 76, 83,69,70, and 96%, respectively.

Significant relationships were obtained when runoff initiation time (t_0) was related to soil saturation deficit (8_s-8_i) reflecting the importance of soil moisture in predicting the runoff initiation time. Soil erodibility factor for Burundi Oxisol soils was estimated as 0.01 $t.hr.MJ^{-1}.\ mm^{-1}$. Erodibility factor values ranged from 0.003 for storms producing soil losses less than 0.5 $t.ha^{-1}$ to 0.024 for storms producing soil losses greater than 5 $t.ha^{-1}$.

Rainfall erosivity and soil erodibility are essential information required prior to conservation measures in tropical Africa. It has been anticipated that erosion erosivity in Burundi is a function of high rainfall erosivity (1100 mm. yr^{-1}) and runoff rather than the inherent soil erodibility .

Much effort has been devoted to the development of an erosivity index that beat correlates with soil loss estimation . Several rainfall erosivity indicies were proposed such as total storm kinetic energy "E" (Wischmeier and Smith , 1958) 30 min energy intensity factor "EI_{30}" (Wischmeier , 1959), rainfall index "p^2 /p" , where p is the mean rainfall for the wettest month and p is the mean annual rainfall (Fournier , 1960) , rainfall amount "A" (Roose , 1973), 15 and 30-minute rainfall intensity " I_{15}" , " I_{30}" , and " AI_{30}" , storm kinetic energy " KE > 25 " (Hudson, 1971 and Lal, 1976), and runoff " R " (Foster *et al* , 1982). In most cases, significant amounts of runoff and soil losses were recorded when rainfall intensity exceeded 20 $mm.hr^{-1}$ and rainfall amount exceeded 45 mm (Temple,1962 and Othieno,1975). This study aimed to evaluate several individual storm erosivity factors that have been developed under tropical climatic conditions of Burundi as related to soil erodibility using soil loss data collected from constructed runoff - erosion plots .

Material and Methods

Four fallow runoff-erosion plots were set up at ISA farm, Gitega, Burundi. Runoff from 92 rainfall events was caught, measured , and sampled from March 1986 to February 1987. Rainfall amount, duration,and 15 and 30-minute intensities were obtained from recording rain guage at ISA meteorological station. Eleven erosivity factors were selected and evaluated as follows: rainfall amount "A", total energy"E", maximum 30-minute rainfall intensity "I_{15}", runoff "RO", EI_{30} ,EI_{15} , EA , AI_{30} ,AI_{15} , and I_{30} , $\sqrt{\overline{ARO}}$. Runoff initiation time "t_o", in relation to soil moisture content (8_s-8_i) , and storm intensity "I" , was studied using eight fallow and vegetated plots. Runoff initiation time was monitored when the gutter began to recieve runoff from plots .

Soil erodibility factor "K" was estimated using two approaches : the direct measurement of soil loss collected with runoff from the established plots applying USLE, and the second approach was the derivation from the nomograph of Wischmeier *et al.* (1971). The impact of rainfall energy on aggregate size distribution, soil detachment and aggregate stability was investigated using the wet sieving analysis. Stability index was calculated according to Alderfer and Merkle (1941).

Results and Discussion

Erosivity factors

Effective rainfall events recorded during the period of the study are presented in Table 1. Conceptually, it would have been ideal to fit the eleven erosivity factors to the soil loss data using simple regression analysis (Table 2). Results revealed that runoff ($r^2 = 0.84$), followed by EI_{15}- ($r^2 = 0.77$) and EI_{30}- ($r^2 = 0.73$) were preferred to the other tested erosivity parameters and can represent "R" factor in USLE under Burundi environmental conditions . Although runoff proved to be a good parameter in calculating "R" factor, however, rainfall measurement is easier to estimate than runoff. Therefore, EI_{15} may be more convenient to fit the soil loss data in USLE under Burundi tropical conditions . Analysis of 92 rainfall events revealed that the total rainfall energy was 220 $MJ.ha^{-1}$ with the highest value obtained in April (85 $MJ.ha^{-1}$). Total storm erosivity for EI_{15} and EI_{30} were 8122 and 4700 MJ. mm. ha^{-1} hr^{-1} , respectively, (Table 3) .

Vegetation cover plays an important role in intercepting and dissipating rainfall kinetic energy. The average percentage of total storms caused soil loss was 91% in fallow plots , 80% in maize - soybean cultivated soils , 75% in eragrostis grass and 74% in Pinus, Acacia and Eucalyptus forest soils (Table 3). The corespondent soil losses measured from the same soils were 76, 26,10 and 9 $t.ha^{-1}$. yr^{-1},respectively. Thus, forest and grass covers possessed remarkable effect in dissipating rainfall energy and reducing soil detachment .It is worthwhile noting that 18 rainstorm events accounted for 75% of the total soil loss from fallow plots. These erosive events were distributed as 2,4,4,2, and 6 in March,April,November,December and January . They accounted for soil loss percentages of 76,83,69, 50 and 96% for the mentioned months , and accelerated the detrimental impact of splashing raindrops. The relationships between soil loss and EI_{15} index are depicted in Fig. 1. Kinetic energy associated with EI_{15} significantly detached more soil particles from bare- fallow plots than from the protected grass and forest - covered plots .

The threshold rainfall amount necessary to initiate runoff is an important parameter from the soil erosin view point. It is generated by the interaction of soil surface condition, antecedent soil moisture, and rainfall pattern. Multiple

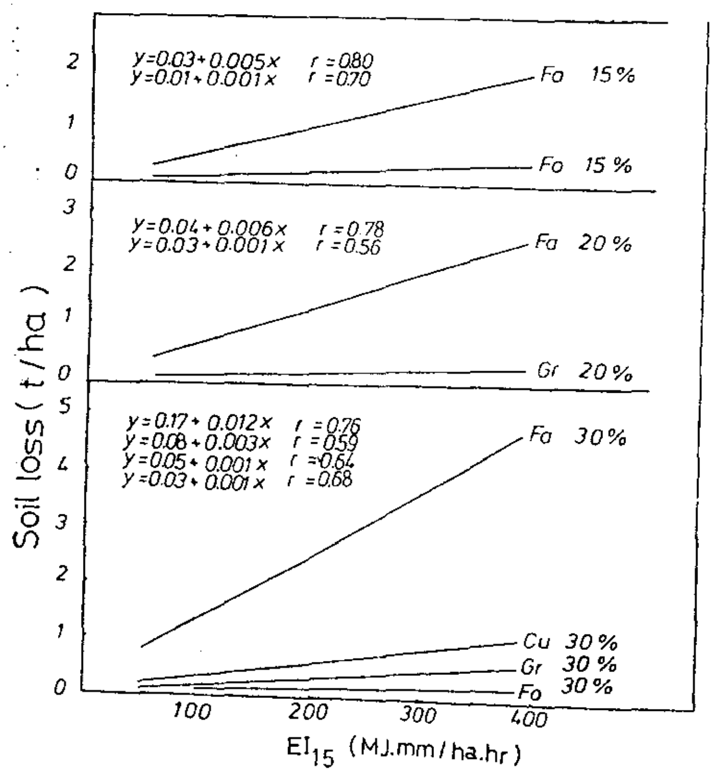

Fig . 1. EI_{15} and soil loss under different vegetation cover and land slope .

regression was used to analyze the influence of both soil saturation deficit (θ_s-θ_i) and rainfall intensity (I) on the observed runoff initiation time (t_o) as shown in Table 4. Significant correlation coefficients were obtained between (t_o) and both (θ_s-θ_i) and (I) . The strength of the individual relationships among these parameters was investigated using simple regression analysis . Runoff initiation time (t_o) revealed significant correlation only with (θ_s-θ_i), while it was insignificant with (I). This indicates that no apparent relation exists between runoff initiation time and rainfall intensity,and the antecedent soil important than

TABLE 1. Rainfall, runoff, and soil loss for the plots .

Date	Storm characteristics					Average soil loss (SL) and runoff (RO)							
	Rainfall mm	Duration min.	Kinetic energy MJ/ha	I_{30} mm/hr	I_{15} mm/hr	Fallow		Cultivated		Grasses		Forest	
						SL Kg/ha	RO mm	SL Kg/ha	RO -mm	SL Kg/ha	RO mm	SL Kg/ha	RO mm
March 4	10.2	155	1.74	7.0	10.0	128.0	2.00	59.6	1.29	29.8	0.90	24.7	0.84
1986 5	7.0	160	1.09	6.4	12.4	98.8	1.47	44.7	1.01	20.7	0.63	17.0	0.64
7	27.2	90	6.22	29.0	32.0	1315.8	5.13	374.1	3.18	133.2	2.33	141.7	2.42
9	10.2	36	2.31	19.8	30.0	466.3	3.61	115.9	2.14	54.5	1.58	53.3	1.75
11	12.2	110	2.33	10.0	14.0	178.7	2.41	75.5	1.55	38.4	1.11	36.9	1.00
27	15.2	285	2.48	16.0	24.8	387.2	3.58	88.9	2.43	27.9	1.43	42.1	1.70
April 8	30.5	95	7.05	30.0	35.0	1464.7	5.42	320.7	2.98	148.3	2.71	165.5	2.76
9	9.0	190	0.43	6.0	6.8	103.7	1.56	37.1	0.97	19.8	0.59	20.3	0.68
15	19.8	120	4.07	18.0	20.0	440.9	4.03	100.2	2.55	46.7	1.96	49.6	2.15
15	15.5	210	2.72	7.0	10.8	150.8	2.36	57.4	1.41	35.8	1.19	32.3	1.13
18	18.3	155	3.53	19.8	18.0	408.5	3.86	89.6	2.32	42.0	1.83	46.1	1.93
19	46.0	140	9.33	65.0	82.0	5610.7	22.55	1596.8	8.10	534.0	6.73	589.6	8.17
22	36.7	85	8.89	54.0	62.0	4631.4	20.38	1234.2	7.05	426.4	5.58	455.3	7.22
23	33.5	215	6.82	46.0	100.0	4002.5	17.73	944.6	6.11	377.4	5.11	395.8	6.20
25	8.5	110	1.50	8.0	13.5	131.5	1.88	54.4	1.14	26.3	0.82	22.8	0.80
30	15.0	45	3.49	25.4	42.0	709.7	4.40	137.2	2.23	78.3	1.97	71.5	1.84
May 10	7.3	105	1.26	10.4	15.2	188.2	2.01	66.8	1.13	47.5	1.02	35.6	0.86
11	12.2	45	2.74	23.2	36.8	446.4	4.04	213.1	2.63	74.8	2.01	66.6	1.95
16	10.1	35	2.29	20.0	30.0	393.6	3.80	174.1	2.39	67.1	1.91	53.3	1.79
Sept.22	14.5	30	3.57	29.0	44.0	364.1	1.77	95.3	0.45	50.1	0.61	37.8	0.53
Oct. 8	15.8	160	2.94	23.0	40.0	338.9	2.01	70.8	0.77	62.0	0.76	35.2	0.66
18	18.4	50	4.35	34.4	56.0	773.3	3.42	343.0	1.62	121.5	1.83	90.2	1.68
31	15.3	60	3.40	24.0	30.0	475.7	3.05	273.5	1.39	105.9	1.52	72.0	1.41
Nov. 1	27.3	200	5.42	27.0	32.8	1173.9	6.14	527.5	3.65	271.4	3.44	156.0	2.77
5	7.1	190	1.06	5.0	,.0	107.9	1.25	39.9	0.55	26.0	0.64	18.4	0.53
12	11.9	170	2.06	9.6	12.0	183.7	1.78	74.7	0.74	40.5	0.84	27.8	0.68
17	6.7	155	1.04	9.0	14.8	127.8	1.58	62.0	0.86	33.1	0.58	22.4	0.60
18	12.0	42	2.52	23.0	42.0	1034.9	4.91	345.7	2.32	117.7	1.89	127.9	1.91
19	6.1	120	0.98	5.0	12.4	92.9	1.55	56.4	0.91	19.4	0.49	17.3	0.45

TABLE 1. (continued).

	22	27.3	400	4.70	24.8	36.8	1852.6	8.14	752.8	3.99	301.5	3.72	238.5	3.49
	29	12.7	100	2.49	26.6	32.8	562.7	4.06	348.4	2.26	129.8	1.95	109.1	1.72
	30	13.7	250	2.25	6.4	12.4	208.8	3.06	143.1	1.68	81.8	1.39	61.4	1.13
Dec.	5	7.5	120	1.27	15.0	18.0	177.2	1.77	60.4	0.83	55.9	0.80	39.9	0.74
1987	7	17.1	40	4.14	33.6	60.0	3114.1	7.45	1096.1	4.28	419.9	3.76	285.3	3.28
	9	7.6	225	1.11	7.6	8.8	118.4	1.43	41.5	0.80	37.1	0.68	26.8	0.64
	14	21.3	240	3.88	13.0	20.0	1014.9	6.67	682.8	3.56	195.2	3.41	158.8	2.87
	18	10.1	125	1.81	16.4	22.0	413.1	2.26	137.8	1.43	97.6	1.21	61.1	1.15
	28	8.0	35	1.75	14.2	20.0	305.6	2.20	100.4	1.40	80.2	1.09	55.9	1.03
Jan.	1	36.5	110	8.48	32.0	46.8	4707.9	10.32	1832.1	6.65	571.2	6.10	506.9	5.79
	5	16.9	55	3.88	30.0	52.0	4049.2	9.22	1709.2	5.80	592.7	5.28	505.6	5.09
	9	16.5	35	4.05	32.4	50.0	5124.5	11.07	1948.9	6.51	730.4	6.04	704.6	6.20
	14	13.6	40	3.17	25.0	36.0	1932.5	6.36	799.6	4.03	273.6	3.80	248.2	3.55
	19	13.0	180	2.27	15.0	24.0	300.3	3.10	165.5	1.74	85.1	1.37	69.1	1.13
	23	11.0	255	1.70	5.8	10.4	157.0	2.21	80.2	1.16	47.6	0.88	37.7	0.78
	27	21.8	45	5.38	36.2	60.0	3484.8	7.59	1205.5	4.26	380.2	3.65	293.4	3.37
	30	8.5	150	1.40	10.0	18.8	324.8	1.91	96.0	1.09	49.5	0.88	41.7	0.88
Feb.	5	18.7	125	3.78	27.4	34.0	2244.2	5.56	529.0	2.95	239.9	2.50	189.9	2.36
	10	18.8	160	3.63	21.0	26.0	1645.0	4.77	281.2	2.31	127.4	1.82	111.4	1.94
	14	8.4	35	1.85	16.2	20.8	397.8	2.15	100.3	1.12	60.2	0.92	50.6	0.94
	20	12.4	50	2.74	22.0	30.0	1546.9	4.56	279.2	2.18	159.4	1.91	130.0	1.90
Total		800.9		163.56			59612.8	245.54	20063.7	125.9	7792.7	107.17	6850.9	107.03

TABLE 2 . Coeffecients of determination (r^2) between soil loss and erosivity indecies under different vegetation covers .

Vegetation covers	A	E	EA	I_{30}	I_{15}	EI_{15}	EI_{30}	AI_{15}	AI_{30}	RO	$I_{30}\sqrt{ARO}$
Fallow	0.62	0.69	0.66	0.72	0.70	0.77	0.73	0.73	0.72	0.84	0.73
Cultivated	0.55	0.62	0.58	0.64	0.63	0.64	0.61	0.62	0.61	0.84	0.68
Grasses	0.53	0.58	0.51	0.60	0.60	0.57	0.53	0.55	0.53	0.88	0.63
Forest	0.55	0.60	0.56	0.62	0.60	0.63	0.60	0.61	0.59	0.87	0.63

A = amount of rainfall
E = kinetic energy
I_{15} and I_{30} = maximum 15 and 30-minutes intensity
RO = runoff

storm intensity in predicting or estimating (t_0). Analysis of variance for fallow and vegetated plots using the two-group experimental procedure possessed a significant difference (p = 1%) in runoff initiation time, reflecting the desirable effect of forest and grass covers in delaying runoff initiation time. Soil-covered plots have a much higher absorption capacity and energy dissipation thus limiting runoff generation. The threshold of rainfall amount required to initiate runoff from fallow plots having 30% slope was 6 mm fallen in 8 min. following a cease of rain for 24 hr with soil moisture content field capacity. It was also evident that runoff and sediment losses at the begining of the rainy season, following three consecutive dry months,were generally less than losses occurred during the rainy season for similar events. Surface flowing water on bare - fallow soils resulted from early rain attacked the well defined cracks made up in the dry season,and formed rills which were graded into small gullies.

Soil erodibility

Soil erodibility factor "K" in USLE represents a quantitative measurement of soil susceptibility to water erosion . Soil erodibility "K" parameters were solved in USLE for the established plots (Table 5). "K" values derived from the Wischmeier's nomograph are presented in Table 6. Average "K" value based on the direct measurement of sediment loss and calculated from USLE was 0.009,

TABLE 3 . Monthly rainfall events account for considerable erosion under different vegetation cover and slope .

Months	Rainfall events	Rainfall amount mm	Total energy MJ/ha	EI_{15} MJ.mm/ ha.hr	EI_{30} MJ.mm/ ha.hr	Erosive rainfall events																
						*Fo.			Gr.			Cu.			Fa.				
						8%	15%	30%	8%	20%	30%	8%	12%	30%	8%	12%	15%	20%	30%
March 86	11	115.8	23.88	710.0	316.8	7	9	9	7	9	9	11	9	11	-	9	11	11	11
April	18	270.3	58.19	2768.2	1905.8	13	13	13	13	13	13	13	13	13	-	13	17	18	17
May	7	50.9	10.78	212.6	145.0	5	7	5	5	5	5	5	5	7	-	5	7	7	7
Sept.	1	20.1	4.39	165.2	108.3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Oct.	5	58.8	12.32	478.7	308.2	3	4	4	3	4	4	4	3	4	4	4	5	5	5
Nov.	20	185.0	34.51	917.9	480.9	12	12	15	12	13	15	15	13	16	17	17	20	20	20
Dec.	12	107.0	20.85	518.2	295.3	10	10	12	10	12	12	12	12	12	12	12	12	12	12
Jan. 87	12	186.0	41.09	1983.7	870.1	11	11	12	11	12	12	12	12	12	12	12	12	12	12
Feb.	6	65.6	13.61	367.4	270.1	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Total	92	1060.1	219.60	8121.9	4700.5	68	73	77	68	75	77	79	74	82		79	91	92	91
Average							72			73			78				88		
Percent							74%			75%			80%				91%		

*Fo: forest, Gr: grass, Cu: cultivation, Fa: fallow .

TABLE 4. Runoff initiation time (t_0), soil saturation deficit ($\theta_s - \theta_i$), and storm intensity (I) under different slope and vegetation cover.

Vegetation cover and slope	No. of samples	Simple correlation coefficients with		Multiple regression equations	R^2
		$(\theta_s - \theta_i)$	(I)		
Cu., 12%	15	0.78	-0.42	$Y = 28.6 + 2.8X_1 - 0.74X_2$	0.90
Fa., 12%	15	0.71	-0.26	$Y = 7.6 + 1.1X_1 - 0.05X_2$	0.91
Fo., 15%	15	0.90	-0.21	$Y = 10.1 + 1.6X_1 - 0.14X_2$	0.89
Fa., 15%	15	0.94	-0.13	$Y = 14.0 + 1.7X_1 - 0.33X_2$	0.92
Gr., 20%	15	0.92	-0.56	$Y = 9.4 + 1.5X_1 - 0.17X_2$	0.90
Fa., 20%	15	0.92	-0.50	$Y = 9.1 + 1.1X_1 - 0.14X_2$	0.89
Cu., 30%	15	0.90	-0.21	$Y = 15.1 + 1.6X_1 - 0.25X_2$	0.91
Fa., 30%	15	0.93	-0.29	$Y = 9.8 + 1.3X_1 - 0.16X_2$	0.90

Y = runoff initiation time, X_1 = soil saturation deficit, X_2 = storm intensity

TABLE 5. Erodibility factor values "K" calculated from the USLE for different slope "LS" of fallow soils .

Slope (%)	Slope length (m)	LS factor	Soil loss (ton/ha)	EI_{15} "R" (MJ.mm/ha.h)	K_{USLE} (ton.ha/MJ.mm)
8	10	0.57	47.51	4431.1	0.02
12	5	0.73	57.57	8121.9	0.01
12	10	1.04	85.54	8121.9	0.01
12	20	1.47	125.58	8121.9	0.01
15	10	1.48	44.86	8121.9	0.004
20	10	2.40	58.04	8121.9	0.003
30	10	4.89	112.58	8121.9	0.003

while that obtained from nomograph was 0.028. Differences between the two methods were statistically significant ($p = 0.05$) indicating that the nomograph method is overestimating the soil loss than the established erosion plots . The observed differences in "K" values may be attributed to land slope , natural variability or perhaps to peculiar variation in soil management history in the field sites .

TABLE 6. Erodibility factor values "K" of fallow soils calculated from Wischmeier's erodibility nomograph (1971).

Slope (%)	Texture		M factor	Numerical ratings		O.M (%)	"K"
	Si+VFS %	C %		Struc.	Perm.		
8	16+21	28	2645	4	3	2.8	0.029
12	22+25	25	3525	4	3	2.3	0.038
15	10+17	33	1809	3	4	3.1	0.020
20	12+19	30	2170	3	4	2.6	0.024
30	15+23	40	2280	4	4	4.1	0.027
Mean							0.028

An attempt has been made to study the relationship between rainfall erosivity index "R" and soil loss "A" under the standard field plot condition using USLE as A=RK . A regression equation was obtained in the form of $A = B_0 + B_1R$. The slope of this equation "B_1" or $\Delta A / \Delta R$ was found to satisfactorily represent "K" factor which was estimated as 0.013 . This "K" value was more similar to "K" obtained from USLE than from the nomograph.

Soil erodibility factor "K" varied according to rainfall erossviness and soil loss severity. Rain storms may be classified into four categories : storms producing soil loss less than 0.5, 0.5 to 2, 2 to 5, and more than 5 t. ha $^{-1}$. Erodibility factor "K" was calculated for each category using data presented in Table 1. The relationship between soil erodibility factor "K" and each storm - soil loss is illustrated in Fig .2."K" values ranged from an average of 0.003 for storms producing soil loss less than 0.5 t. ha $^{-1}$ to 0.024 for storms producing soil loss greater than 5 t. ha $^{-1}$. The mean "K" value for all storms was 0.01.

The impact of rainfall erosive energy on soil detachment was investigated through studying aggregate size distribution and its stability. Twelve rainstorm events with different EI_{15} were used to examine the relationship between EI_{15} and each of the following : 2mm, 0.25mm, 0.08 mm-aggregates, total aggregation and aggregate stability index. Negative and significant correlations were obtained with 2 mm- and 0.25 mm aggregates, total aggregation and stability index (Fig.3) . The fine aggregates (0.08 mm) showed insignificant

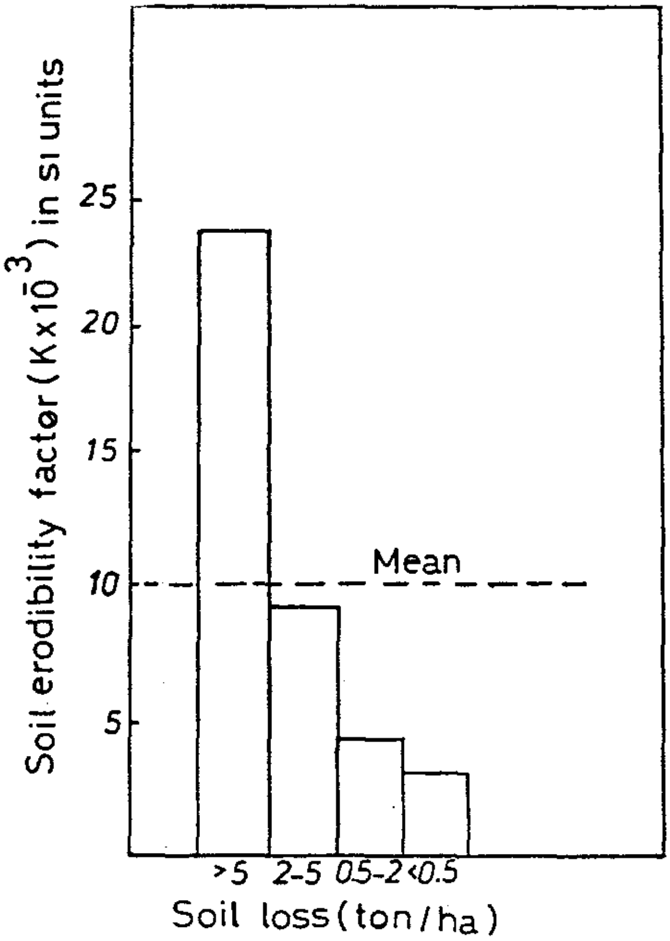

Fig. 2. The relationship between soil erodibility and soil loss.

correlation. This behaviour clearly explains the detrimental impact of splashing raindrops on the detachment of the large and medium-sized aggregates which undergo brreakdown as rain- fall energy increases. Small aggregates were less susceptible to detachment. The continuous desintigration of large and medium -sized aggregates resulted in remarkable decrease in total aggregation.

Conclusion

Under Burundi environmental conditions, EI_{15} may be considered a convenient erosivity parameter and may satisfactorily represent "R" factor in

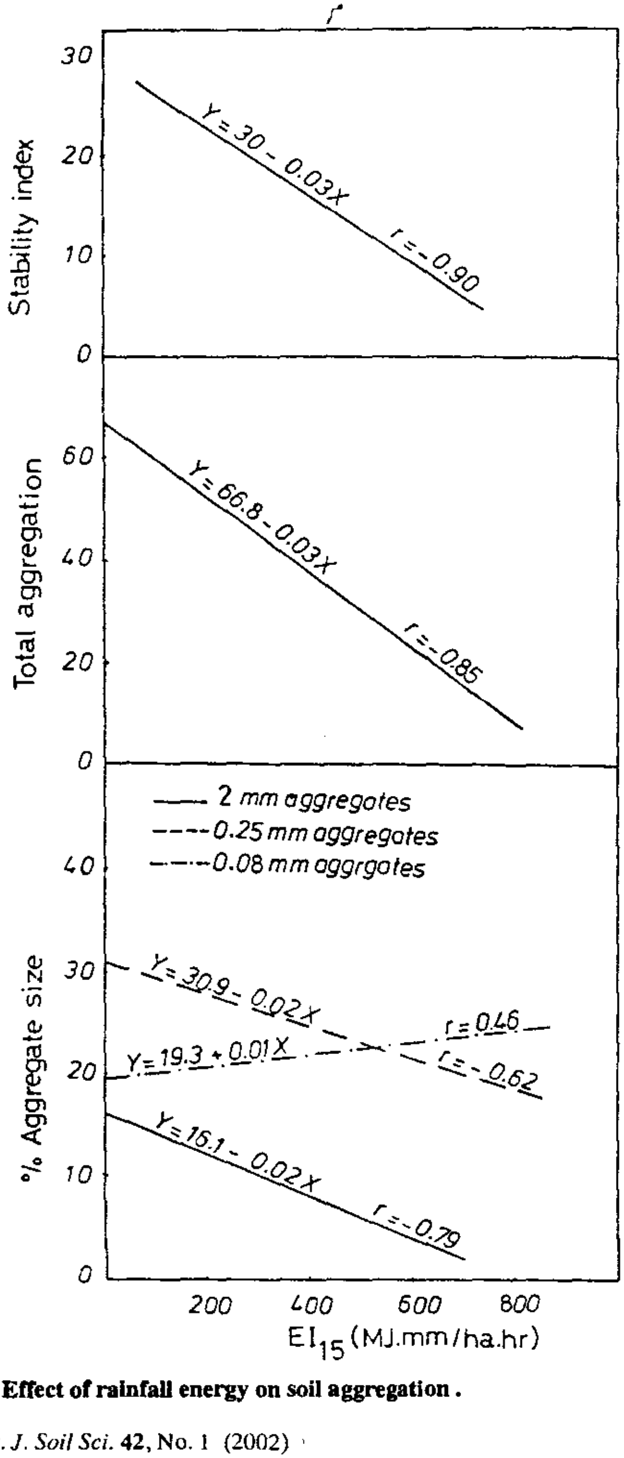

Fig . 3. Effect of rainfall energy on soil aggregation .

USLE. Rainfall intensity showed no significant impact on runoff initiation time which was more relared to the antecedent soil moisture. Early rainfall events following dry season contributed to severe surface-flowing water that formed rills and small gullies. Runoff initiation time was appreciably delayed in forest and grass-covered soils compared with cultivated and fallow soils .

Soil erodibility factor "K" was estimated as 0.01 $t.ha^{-1}.MJ^{-1}$ and considerably varied according to the magnitude of soil loss. "K" factor ranged from 0.003 for storms producing soil loss below 0.5 $t.ha^{-1}$ and 0.02 for storms over 5 $t.ha^{-1}$. Wischmeier's nomograph is overestimating "K" factor compared with the direct measurement in the field. Detachment of the large and medium -sized aggregates was proportionl to rainfall erosivity index. Fine soil aggregates underwent less breakdown and detachment .

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انجراف التربة فى بوروندى وعلاقته بطاقة المطر وقابلية التربة للانجراف

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ظاهرة انجراف التربة فى بوروندى مشكلة خطيرة مرتبطة بالطاقة العالية للمطر والماء الجارى وقابلية التربة للانجراف . ولذلك فإن هذه الدراسة تهدف الى تقييم العديد من عوامل طاقة المطر للرخات الفردية تحت ظروف المناخ المداري باستخدام بيانات فقد التربة الحادث من شرائح أرضية صممت لهذا الغرض بمزرعة المعهد العالى الزراعى ببوروندي .

وقد تم تحليل بيانات ٩٢ رخة مطر خلال فترة الدراسة من مارس ١٩٨٦ الى فبراير ١٩٨٧.
تم خلالها تقييم احدى عشر معامل لطاقة المطر وعلاقتها بفقد التربة فى الشرائح الخالية من الغطاء النباتى .

أظهرت النتائج وجود ارتباط قوى بين فقد التربة وكل من معاملى الجريان السطحي وطاقة قطرات المطر مضروبة فى كثافة المطر الساقط فى ١٥ دقيقة .
وجد أيضا أن ٧٥ ٪ من فقد التربة الكلى نتج من ١٨ رخة من بين الـ ٩٢ رخة الكلية وكانت موزعة على الاشهر كالتالى ٢ . ٤ . ٤ . ٢ . ٦ فى مارس وابريل ونوفمبر وديسمبر ويناير على الترتيب بنسبة فقد قدرها ٧٦، ٨٣، ٦٩، ٧٠، ٩٦ ٪ .

أظهرت النتائج وجود علاقة معنوية بين الوقت اللازم لبداية حدوث الجريان السطحي ومحتوى التربة من الرطوبة . تم تقدير معامل قابلية التربة للانجراف والذى تراوحت قيمته بين ٢٠٠ر. للرخات التى تعطى فقد فى التربة مقداره أقل من ٥رطن / هكتار الى ٢٤.ر. للرخات التى تعطى فقد فى التربة أكثر من ٥ طن / هكتار بمتوسط قدره ١.ر طن ساعة / ميجاجول . مم لتربة الهستوسول المنتشرة فى بوروندى .