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Prediction of Soil Loss using SLEMSA and USLE Erosion Models for an Agricultural Field in Makurdi, Benue State, Nigeria

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ABSTRACT
A field experiment was conducted at the Teaching and Research Farm of the College of Agronomy, University of Agriculture, Makurdi (Latitude 7°46' – 7°50'N and Longitude 8°36' – 8°40'E) during the 2015 and 2016 cropping seasons. Soil erosion plots (runoff plots) were set up under a slope gradient of 2.5 % to estimate soil loss using Soil Loss Estimation Model for Southern Africa (SLEMSA) and Universal Soil Loss Equation (USLE) erosion models under rainfed condition. Soil management practices namely, bare fallow (control), 4 and 8 t/ha mulched maize, maize + cowpea and unmulched maize were replicated three times. The data collected on soil loss was analyzed using analysis of variance test based on randomized complete block design (RCBD). Under direct measurement, higher soil loss was observed under the bare fallow plots followed by unmulched maize treated plots compared to the cover management treated plots, while lower values of soil loss were noticed under 8 t/ha mulched maize management. The values of soil loss ranged from 0 – 31.8 t/ha/yr during the two cropping seasons. The moderate to higher soil loss values (13.9 – 31.8 t/ha/yr) obtained under the bare fallow plots were beyond the tolerable limit of 12.5 t/ha/yr. Soil loss estimated using SLEMSA and USLE models indicated very low (tolerable) ratings under cover management practices. Correlation analysis between the soil loss values estimated by the SLEMSA and USLE showed high positive significant correlation ($r = 0.982$) and ($r = 0.99$) in 2015 and 2016 respectively.
Keywords: Erosion models, soil loss, erosion, cover management, tolerable limit

INTRODUCTION

Benue State lies within the Southern Guinea Savanna agro-ecological zone of Nigeria where soil erosion is very acute because of high intensity rainfall and the erodibility of the soils during rainy seasons. There is therefore the need to document the extent of soil erosion using models so as to propose an acceptable land use plan for agricultural development.

Soil loss estimation model for southern Africa (SLEMSA) was initially developed for Zimbabwean conditions by Elwell, (1978) to predict long term average annual soil losses by sheet and rill erosion from small scale farming areas for specific combination of physical and management conditions (Schulze, 1979). It has been tested in some other areas of Africa (Elwell and Stocking, 1982; Igwe *et al*., 1999). It appears to be useful model in differentiating areas of high and low erosion potential (Morgan, 1995).

The Universal Soil Loss Equation (USLE) of Wischmeier and Smith, (1965, 1978) is the most widely known and used empirical soil loss model all over the world (Morgan, 1995; Igwe *et al*., 1999; Stone and Hilborn, 2012; Smith, 2013). The USLE computes sheet and rill erosion using values representing the four major factors affecting erosion, namely climate erosivity R, soil erodibility K, topography LS, and land use and management CP (Kenneth *et al*., 1991)

Soil loss quantification appeared to have been simplified with the development of the Universal Soil Loss Equation of Wischmeier and Smith, (1978) and Soil Loss Estimation Model for Southern Africa (Elwell, 1978), and in particular with the development that enabled the prediction from some field observations and the results of some laboratory tests (Obi, 1982; Morgan, 1995; Igwe *et al*., 1999; Strohbach, 2012; Stone and Hilborn 2012; Mutowo and Chikodzi, 2013; Smith, 2013).

In this study, it has been envisaged that SLEMSA and USLE could be used to the conditions of Makurdi, Benue State since the equation employed represents the major factors affecting erosion, and it only requires determination of values for the different factors. Therefore, the study was aimed to estimate extent of soil loss at various management practices using SLEMSA and USLE models so that planning of management techniques can be suggested in order to reduce further degradation.

MATERIALS AND METHODS

Study Area

The experimental plots were set up at the Teaching and Research Farm of the College of Agronomy, University of Agriculture, Makurdi, during the 2015 and 2016 cropping seasons.

The area is located at latitude $7^o46' - 7^o50'$N and longitude $8^o36' - 8^o40'$E (Fig. 1) and characterized by tropical climate with wet and dry seasons. The rainfall pattern is bimodal with annual rainfall varied between 900 and 1200mm. The wet season usually begins in April and ends in October/November. Temperature ranges between $21 - 35^oC$. Vegetation is guinea savannah type. The major crops cultivated in the area are maize, cowpea, yam, cassava, rice, sorghum and millet.

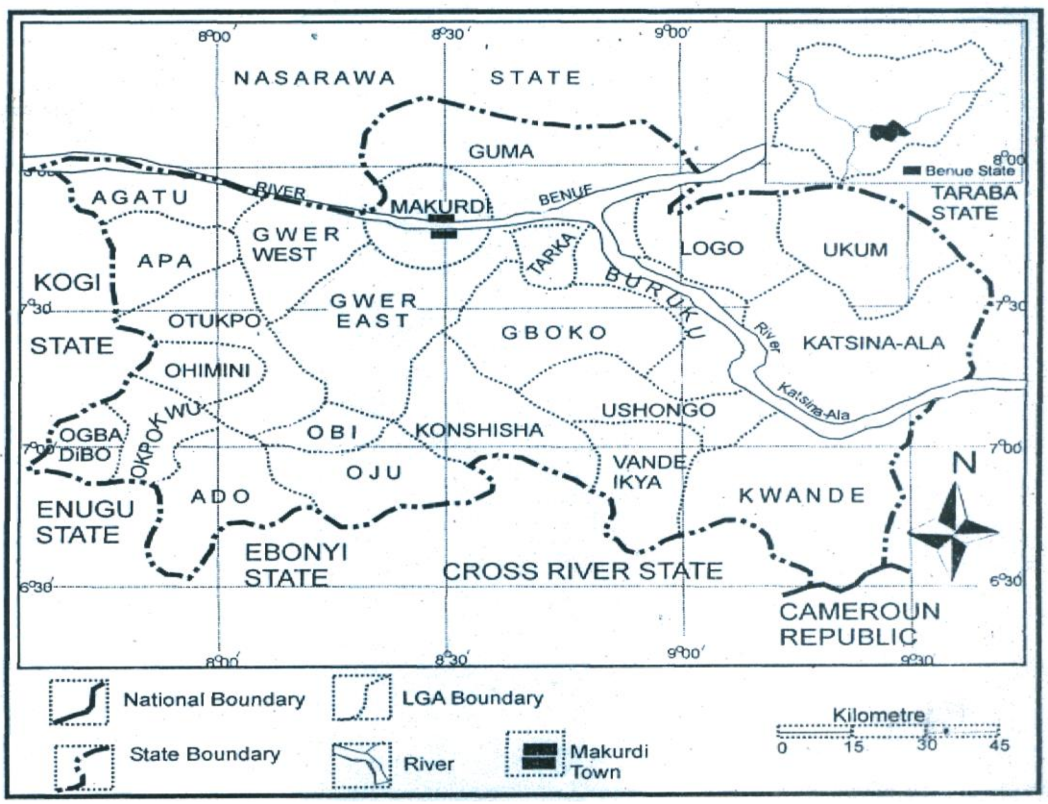


Figure 1: Map of Benue State showing Makurdi
Source: Ministry of Land and Survey, Makurdi

Direct Measurement of Soil Loss using Erosion Plots

The erosion (runoff) plots were laid out on cultivated lands under a slope gradient of about 2.5% before the onset of the rainfall season. Fifteen (15) runoff plots measuring 20m x 3m (plus $1.5m^2$ triangular downslope end) (i.e $61.5m^2$) each were bordered by corrugated iron sheets which were inserted into the soil to a depth of 20cm leaving 25cm above the soil surface to prevent lateral flows from the plots to the adjacent area.

Soil management practices were as follows: (T1) bare fallow; (T2) 4 t ha^{-1} surface mulch + maize; (T3) 8 t ha^{-1} surface mulch + maize; (T4) maize + cowpea; (T5) maize. The experiment was laid out in randomized complete block design (RCBD) of five (5) treatments and replicated three (3) times.

The rainfall data of the study site was collected in 2015 and 2016 at University of Agriculture, Makurdi; College of Agronomy Meteorological Station (UAM-CAMS) located 41 meters away from the site.

Runoff and sediments were collected in barrels at the lower outlet of the plots and measured after each rainfall event. The sediment yield (amount of soil washed by runoff from the plots) was determined after oven-drying an aliquot sample of the runoff and weighing the sediments.

Indirect Soil Loss Estimation using Soil Erosion Models

Input data for SLEMSA models

The major erosion control variables that have been identified and expressed numerical (Elwell, 1978) in the SLEMSA model include: rainfall kinetic energy (E), percent effective vegetal cover (i), soil erodibility index (F), percent slope steepness (S) and slope length (L). These variables were combined into three factor namely, a factor that describes soil loss from bare plot (i.e t ha^{-1} yr^{-1} from a field plot of $61.5m^2$ under a weed free bare fallow) (K), a canopy cover factor (C), and a topographic factor (X).

The above three factors were combined into the general SLEMSA model as indicated in equation 1 (Hilborn 2012; Mutowo and Chikodzi, 2013; Smith, 2013).

$$Z = K X C \quad \text{………….. (1)}$$

(i) Estimation of K (Mean annual soil loss index):

The value of the K factor was determined by relating mean annual soil loss to mean annual rainfall energy (E) (Jm^{-2}) using the exponential relationships in equation 2, 3, 4 and 5 (Morgan, 1995; Igwe *et al*., 1999; Mutowo and Chikodzi, 2013; Smith, 2013):

$$\text{In } K = b \text{ In } E + a \text{---------------} (2)$$

Where; $a = 2.884 – 8.2109F$ ---------------------- (3)

$$b = 0.4681 + 0.7663F \text{ ----------------------} (4)$$

$$E = 18.84 P \text{ …………………………} (5)$$

By substituting equations (3) and (4) into equation (2) above, we get equation 6.

Where, P = mean annual rainfall (mm) (2500 mm in 2015 and 636.5 mm in 2016).

F = soil erodibility (F_b) rating (F = 4) of Stocking et al. (1988) was adopted and K was calculated using the relationship in equation 6.

$K = \exp [(0.4681 + 0.7663F) \text{ In } E + 2.884 – 8.1209F]$ ………. (6)

(ii) Estimation of X (Topographic Factor):

The topographical factor for SLEMSA model was adapted and used as indicated in equation 7 (Wischmeier and Smith, 1965, 1978; Morgan, 1995; Igwe *et al*., 1999; Mutowo and Chikodzi, 2013; Smith, 2013).

$$X = L \sqrt{(0.76 + 0.53S + 0.076S^2)} / 25.65 \text{ …………………} (7)$$

Where; L = slope length (21m), S = slope percentage (2.5%).

(iii) Estimation of C (Crop cover/mgt factor):

Crop management factor was obtained by choosing 0.4 (grain corn) for Crop Type Factor and 1.0 (fallow), 0.6 (mulch) and 0.9 (spring) for Tillage Method Factor as described by Stone and Hilborn, (2012). These two factors were multiplied together to obtain the C-factor at various soil management practices.

(iv) Tabulation of Z (Estimated mean annual soil loss)

The values for the factors involved in the SLEMSA model and the predicted soil loss for the study site using this model were calculated in t ha^{-1} yr^{-1}.

Input data for USLE models

The Universal Soil Loss Equation (USLE) of Wischmeier and Smith, (1965, 1978) computes sheet and rill erosion using values representing the four major factors affecting erosion, namely climate erosivity R, soil erodibility K, topography LS, and land use and management CP (Kenneth *et al*., 1991). The USLE is indicated in equation 8.

$$A = R \times K \times L\,S \times C \times P \;\ldots\ldots\ldots\ldots\ldots.. (8)$$

(i) Estimation of R (Rainfall erosivity index)

The mean annual rainfall use in this model is the same as that used for SLEMSA. According to Wischmeier and Smith, (1978), erosivity is calculated from the kinetic energy of rainfall which in turn is estimated from the mean annual rainfall and 30 minute rainfall intensity value (Morgan, 1995). However, rainfall kinetic energy and intensity data were not available. Therefore, the erosivity factor R that was adapted by Roose, 1975 as cited by Morgan, (1995) was used as indicated in equation 9.

$$R = P \times 0.5 \;\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (9)$$

Where, R= erosivity of rainfall (J/m^{-2}), P= mean annual rainfall (mm) (2500 mm in 2015 and 636.5 mm in 2016).

(ii) Estimation of K (Erodibility factor):

Soil texture, organic matter content, soil structure and permeability were the main soil properties used to estimate the soil erodibility factor and were obtained using the erodibility nomograph developed by Wischmeier *et al*. (1978) as indicated in equation 10 (Wishmeier and Smith, 1978; Igwe *et al*., 1999; Stone and Hilborn 2012).

$$K = 0.01317\,[0.00021\,(12 - OM\%)M^{1.14} + 3.25\,(Ss - 2) + 2.5\,(Ps - 3)] \;\ldots\ldots.(10)$$

Where, OM% = % organic matter, Ss = structure code, Ps = permeability code,
M = particle size fraction i.e [SS%(SS% + Sa%)], SS% = % silt plus fine sand
(0.002 - 0.1mm size fraction), Sa = % sand (0.1- 2mm size fraction)

(iii) Estimation of LS (slope factor).

Topographic factor was estimated from the slope length (L) and slope steepness (S) of the study site as indicated in equation 11 (Morgan, 1995; Torri, 1996)

$$LS = 22.13\,(0.065 + \left(\frac{L}{0.045S}\right)^n + 0.0065\,S^2) \;\ldots\ldots\ldots\ldots (11)$$

Where, n = an exponent for: n = 0.5 if $S \geq 5\%$; n = 0.4 if $S \leq 3\%$ and < 5%, n = 0.3 if $S \leq 1\%$ and 3%, n = 0.2 if $S < 1\%$

(iv) Estimation of C (crop management factor)

Crop management factor was obtained as stated in SLEMSA above.

(v) Estimation of P (erosion control practice)

Input variables for P were adapted as described by Morgan (1995) and Stone and Hilborn (2012) (Table 1).

(vi) Tabulation of A (predicted soil loss)

The values for the factors involved in the USLE model and the predicted soil loss for the study site using this model were calculated in t ha^{-1} yr^{-1}.

Table 1. Erosion Control Practice (P-factor) Values for the USLE

Management	P – value
Ploughing up and down (Bare fallow)	1.0
Strip cropping / cross slope	0.8
Applying mulch <2 t/ha	0.6
Applying mulch at 4 – 5 t/ha	0.1
Applying mulch at 6 – 8 t/ha	0.01
Intercropping	0.8
Dense intercropping	0.5

Source: Morgan (1995); Stone and Hilborn (2012)

Statistical Data Analysis

The estimated data were analyzed using the IBM SPSS version 20. Correlation analyses were performed to test the relationship between the soil loss values estimated by the two models. The SLEMSA and USLE models were compared in the study to have a general comparative overview of the erosion hazard indices in the study site. Soil erosion hazard values were categorized using Soil Loss Tolerance Classes and rated in t ha^{-1} yr^{-1} as follows: very low (tolerable) (<6.7), low (6.7 – 11.2), moderate (11.2 – 22.4), high (22.4 – 33.6) and severe (>33.6) (Stone and Hilborn, 2012).

RESULTS AND DISCUSSION

Soil Loss Estimation using SLEMSA Model

The estimated soil losses for the study site using soil loss estimator model for Southern Africa (SLEMSA) is shown in Table 2. The estimated soil losses were higher under the bare fallow plots compared to the plots treated with cover management practices. These high soil loss values for the bare fallow plots are attributed to the combined effects of the various factors affecting erosion at the study site. A single factor may have an overwhelming effect than others leading to differences in the estimated soil loss as also reported by Igwe *et al*. (1999). The highest soil loss estimated under the bare fallow in 2015 is mainly due to its highest C-value (Crop cover factor), while the values obtained under the bare fallow and other treatments in 2016 are mainly due to the changes in E and K factors, which are the function of rainfall erosivity and soil erodibility factors. Schulze (1979) working in the key area of the Drakensberg (South Africa), also indicated that SLEMSA is highly sensitive to its inputs variable especially to rainfall erosivity and soil erodibility. This is again mainly associated with its mean annual rainfall (2500 mm in 2015 and 636.5 mm in 2016). Treatments (4 and 8 t/ha mulched maize and maize + cowpea managements) where relatively lower soil loss estimates were recorded, no single factor seemed more important than any other factors in affecting the estimated soil loss values. The relatively high estimated soil loss under unmulched maize was largely due to the high value of crop cover C-factor than the K-factor. In general, treatments have more or less similar values for the crop cover factor with the bare fallow where relatively high soil losses were estimated. However, their values of the K and X factors are very low. The low (2.5 % slope) topographic factor of the study site might have been responsible for low soil loss observed. Although one or two factors may be responsible for the high or low soil loss in a given area, the combined effect of the values of all three factors namely K, X and C is most important.

Table 2. Estimated Input Variables of SLEMSA Model and Calculated Soil Loss (t/ha/yr) for Makurdi in 2015 and 2016 Cropping Seasons

Treatment	F	A	b	E	K	X	C	Z (t/ha/yr)
2015								
(T1) Bare fallow	4	-29.59	3.53	3924.94	45.31	0.46	1.00	20.84
(T2) 4t/ha mulch + m	4	-29.59	3.53	3924.94	45.31	0.46	0.24	5.00
(T3) 8t/ha mulch + m	4	-29.59	3.53	3924.94	45.31	0.46	0.24	5.00
(T4) Maize + Cowpea	4	-29.59	3.53	3924.94	45.31	0.46	0.18	3.75
(T5) Maize	4	-29.59	3.53	3924.94	45.31	0.46	0.36	7.50
2016								
(T1) Bare fallow	4	-29.59	3.53	999.27	36.05	0.46	1.00	16.49
(T2) 4t/ha mulch + m	4	-29.59	3.53	999.27	36.05	0.46	0.24	3.96
(T3) 8t/ha mulch + m	4	-29.59	3.53	999.27	36.05	0.46	0.24	3.96
(T4) Maize + Cowpea	4	-29.59	3.53	999.27	36.05	0.46	0.18	2.97
(T5) Maize	4	-29.59	3.53	999.27	36.05	0.46	0.36	5.94

m = maize, F = erodibility factor (F_b), a = b= functions of F, E = rainfall energy, K = mean annual soil loss, X = topographic factor, C = crop management factor, Z = estimated soil loss

Soil Loss Estimation using USLE Model

The estimated values of the various soil loss factors and the amount of soil loss in t/ha/yr are shown in Table 3. All the estimated soil loss values under the various soil management practices were less than 7 t/ha/yr. This site is characterized by low slope gradient (2.5 %) resulting in low values of LS (topographic factor) factors and consequently lower soil loss. In general, all the treated plots had estimated soil losses of less than 7 t/ha/yr which is below the tolerable limits given by Stone and Hilborn (2012) and Smith (2013) for most soils. The results indicated that all soil erosion factors are important in determining the amount of soil loss. Higher soil loss values were observed under bare fallow for both 2015 and 2016 cropping seasons. This may be characterized by no crop cover (C) and erosion control practice (P) factors as well as high rainfall erosivity and erodibility resulting to high soil loss.

In 2015, the values of R, K and LS remained constant while C and P varied with changes in soil loss estimation under various soil management practices. In 2016 the values of R and LS remained constant while K, C and P varied with changes in soil loss estimation under various soil management practices. The lowest estimated soil loss was obtained under 8 t/ha mulched maize management. In general, the estimated soil loss values under cover management practices were rated very low and therefore, fall within the range of soil loss tolerable limit of 12.5 t/ha/yr as set by Smith (2013).

Table 3. Estimated Values of Erosion Factors and Soil Loss Estimated by using USLE for Makurdi in 2015 and 2016 Cropping Seasons

Treatment	R	K	LS	C	P	A (t/ha/yr)
2015						
(T1) Bare fallow	1250	0.07	0.21	1.0	1.0	18.38
(T2) 4t/ha mulch + m	1250	0.08	0.21	0.24	0.1	0.50
(T3) 8t/ha mulch + m	1250	0.05	0.21	0.24	0.01	0.03
(T4) Maize + Cowpea	1250	0.08	0.21	0.18	0.5	1.89
(T5) Maize	1250	0.07	0.21	0.36	0.8	5.29
2016						
(T1) Bare fallow	318.25	0.09	0.21	1.0	1.0	6.015
(T2) 4t/ha mulch + m	318.25	0.06	0.21	0.24	0.1	0.096
(T3) 8t/ha mulch + m	318.25	0.06	0.21	0.24	0.01	0.009
(T4) Maize + Cowpea	318.25	0.08	0.21	0.18	0.5	0.481
(T5) Maize	318.25	0.09	0.21	0.36	0.8	1.732

m = maize, R = Rainfall erosivity factor, K = Erodibility factor, L = Slope length, S = Slope gradient, C = Crop management, P = Erosion control practices, A = predicted soil loss (t ha^{-1} yr^{-1})

Comparison of Soil Loss Estimated by SLEMSA and USLE

Trends of soil loss values estimated by SLEMSA and USLE are presented in Figs. 2 and 3 for 2015 and 2016 cropping seasons. The results indicate that soil loss estimated by SLEMSA is greater than that estimated by USLE for the study site. USLE underestimated the soil loss for the various management practices as compared to the SLEMSA values. The SLEMSA values were closer to the measured value in the field and higher than the field values in 2016. The differences between some of the values of soil losses estimated by the two methods can be attributed to the differences in the sensitivity of the two models to their input factors. Under bare fallow, for instance K, X and C-value (Crop Cover factor) for SLEMSA is 1.0 indicating no cover management and the R, C and P factors of USLE for the study site are relatively high. Hence, as the SLEMSA is highly sensitive to the C and P factors and USLE to the E (rainfall Kinetic energy/rainfall intensity), K, X and C factors, the lower R, C and P factors of USLE and higher E, K, X and C factors for SLEMSA resulted in higher soil loss values for SLEMSA than the USLE model. However, as the reasons for the differences in the soil losses estimated by the two methods mainly resulted from combinations of the effects of all factors involved in both models, no single factor is usually considered accountable for the variations.

Therefore, depending on the relative ease of determination of the input variables and the level of accuracy required, either of the two methods can be used to access the degree of severity of soil erosion under the prevailing conditions of Makurdi, Benue State.

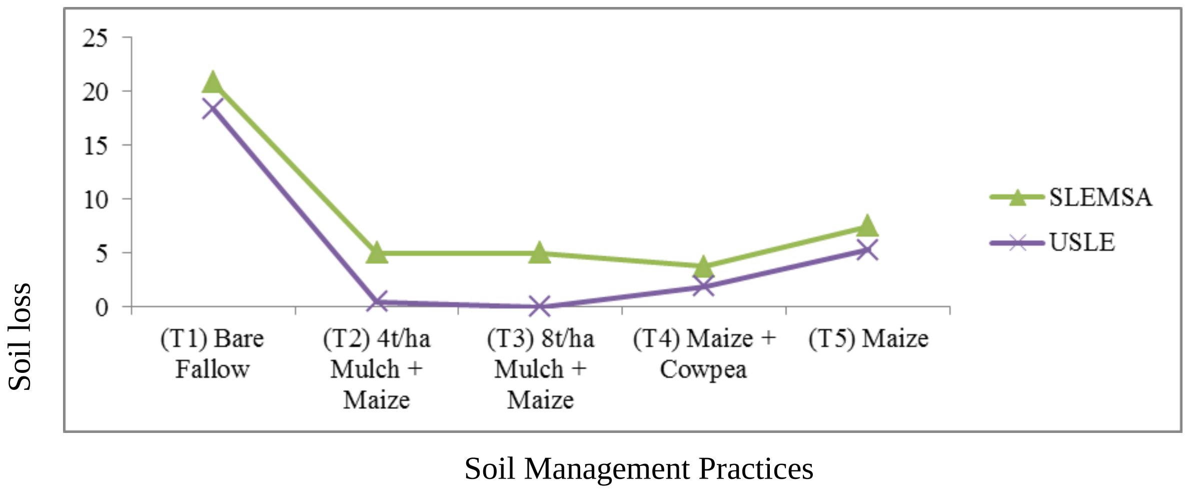
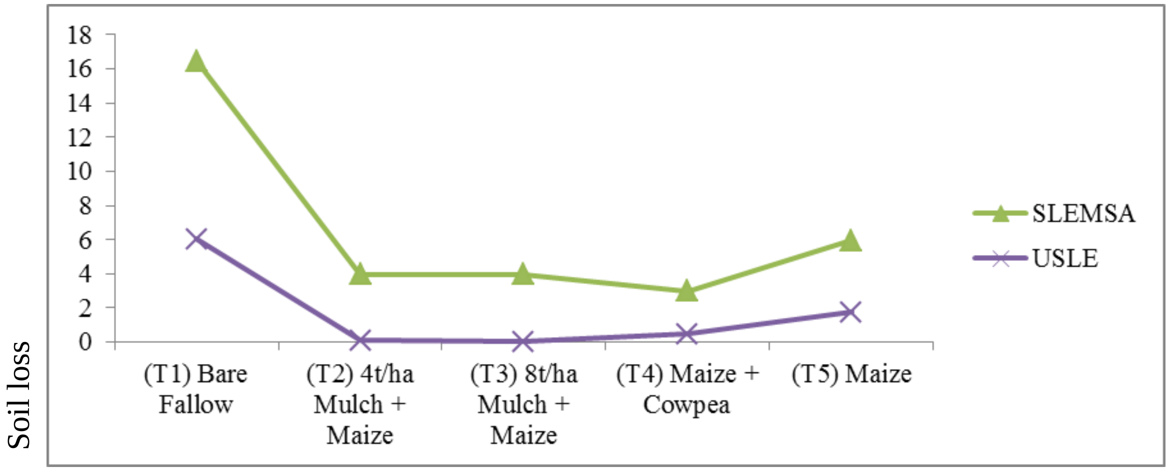


Figure 2. Soil Loss (t/ha/yr) Estimated by SLEMSA and USLE for Makurdi during the 2015 Cropping Season



Soil Management Practices

Figure 3. Soil Loss (t/ha/yr) Estimated by SLEMSA and USLE for Makurdi During the 2016 Cropping Seasons

Qualitative Comparison of Soil Loss Measured in the Field and Soil Loss Estimated using the SLEMSA and USLE Models.

Comparison of soil loss values from field and that estimated using the USLE and SLEMSA models with soil loss tolerance rates is shown in Table 4. The results indicated that the estimated soil loss for SLEMSA and USLE had very low rating indicating "tolerable" under 4, 8 t/ha mulched maize and cowpea + maize treatments. Under field trials, high, moderate and low ratings were obtained under the bare fallow and unmulched maize management in 2015, while moderate rating was obtained under bare fallow in 2016. The high soil loss (31.8 t/ha/yr) and moderate soil loss (13.9 t/ha/yr) in the bare fallow plots under field trials in 2015 and 2016, respectively, are beyond the soil loss tolerance limit of 12.5 t/ha/yr as reported by Smith (2013).

Tolerable soil loss is defined as the maximum acceptable rate of soil erosion (Morgan, 1995; Stone and Hilborn, 2012; Smith, 2013). The soil loss estimated using SLEMSA and USLE models do not normally represent the actual field conditions. Comparing such soil loss values with the measured field soil loss values without careful considerations to the limitations may therefore lead to wrong conclusions. Here, the measured soil losses in the field were higher than the estimated soil losses by SLEMSA and USLE under the bare fallow plots in 2015 cropping season.

Soil loss estimation using erosion models on the other hand takes these factors into consideration. Therefore, quantitative comparison of soil loss values obtained in the field with those estimated using erosion models may be impractical. However, to evaluate the effect of the inherent soil erodibility of the actual soil loss and assuming that all the other field specific factors are similar for the various study treatments, some qualitative comparison has been made among the soils of the various study treatments.

Some discrepancies between the estimated and measured soil loss values were also observed on soils where field soil erodibility ranged from very low to high as opposed to the very low estimated soil loss values. This could mean good field management. All these soils losses occurred on a low slope gradient (2.5 %). Besides, the study site has moderate rainfall erosivity. Therefore, these soils are potentially erodible as evidenced from the bare fallow plots results, the field topography, moderate natural rainfall erosivity of the area and cover management practices are mainly responsible for the very low soil erosion hazards. This can be used in convincing farmers to adopt improved conservation practices.

Table 4. Comparism of Soil Loss Values from Field Trials and those Estimated using the SLEMSA and USLE Models with Soil Loss Tolerance Rating in Makurdi

Treatment	**Estimated Soil Loss**				**Measured Soil Loss**		**Remark**
	SLEMSA		**USLE**		**Field Data**		
	Value	**Rating**	**Value**	**Rating**	**Value**	**Rating**	
2015							
(T1)	20.84	M	18.38	L	31.80	H	Not tolerable
(T2)	5.00	VL	0.50	VL	4.25	VL	Tolerable
(T3)	5.00	VL	0.03	VL	2.62	VL	Tolerable
(T4)	3.75	VL	1.89	VL	4.60	VL	Tolerable
(T5)	7.50	L	5.29	VL	9.19	L	Not tolerable
2016							
(T1)	16.49	M	6.015	VL	13.90	M	Not tolerable
(T2)	3.96	VL	0.096	VL	0.12	VL	Tolerable
(T3)	3.96	VL	0.009	VL	0.00	VL	Tolerable
(T4)	2.97	VL	0.481	VL	0.49	VL	Tolerable
(T5)	5.94	VL	1.732	VL	1.83	VL	Tolerable

H = High; L= Low; M=Moderate; VL = Very Low. (T1) bare fallow; (T2) 4 t ha^{-1} surface mulch + maize; (T3) 8 t ha^{-1} surface mulch + maize; (T4) maize + cowpea; (T5) maize.

Correlation Analysis between SLEMSA and USLE

Correlation analysis between the soil loss values estimated by the SLEMSA and USLE in 2015 and 2016 cropping seasons is shown in Table 5. The result showed high positive significant correlation (r = 0.982) and (r = 0.992) in 2015 and 2016 respectively between the soil loss values estimated by the SLEMSA and USLE.

Table 5. Correlation Coefficient (r) and p-values between SLEMSA and USLE

Relationships	**Corr. Coeff. (r)**	**p-value**
2015		
SLEMSA vs USLE	0.982**	0.003
2016		
SLEMSA vs USLE	0.992**	0.001

CONCLUSION

In an attempt to validate the soil loss estimated by the USLE and SLEMSA models for different treatments, their values were compared to that collected in the field under rainfed conditions. Under field trials, high and low rating were obtained under the bare fallow and unmulched maize management respectively in 2015, while moderate rating was obtained under bare fallow in 2016. The moderate to high soil losses (13.9 – 31.8 t/ha/yr) under the bare fallow plots in 2015 and 2016 are beyond the soil loss tolerance limit of 12.5 t/ha/yr.

Soil loss estimated using SLEMSA and USLE models had very low (tolerable) ratings under cover management practices. The two models provided realistic estimates that are closer to the measured values. Therefore, either of the two models can be used to access the degree of severity of soil erosion under the prevailing conditions of Makurdi, Benue State. The available results also suggest that, the SLEMSA and USLE are appropriate for this experiment as a result of its sensitive to input factors to predict soil loss under different soil management practices in Makurdi. Cover management practices is encouraged in order to reduce further degradation in the area.

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