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# Farmers' Perception of Erosion Risk and Its Implication on the Adoption of Soil and Water Conservation Practices

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**Abstract** Farmers' perception of the erosion risk relates with their decision to adopt its mitigation measures. Little has been done to escalate this idea as a basis for effective watershed management. This paper assesses farmers' perception of erosion risk; and examines the underlying factors guiding the decision for the choice of SWC practices. Interviews were conducted on 390 farmers in Nabajuzi watershed of the Lake Victoria Basin of Uganda. Data analysis was performed using a *Probit* regression model. The hypotheses tested were: (a) farmers' perception of the erosion risk does not correspond with their decision to adopt SWC practices; (b) the adoption level of soil and water conservation (SWC) practices is a reflection of both their technical performance and the degree of acceptability by local farmers. The perceived risk ranged sequentially from high to very high on geomorphic units of back slope, shoulder and summit; contradicting the USLE output whose range was moderate to very high. Farmers believed that management of these slopes should combine agronomic and structural measures. On the toe and valley, sheet wash was perceived to be a weak indicator of erosion risk; and if this form occurred, mulching was sufficient to contain it. The significant ($P<0.05$) factors in this watershed influencing farmers' adoption decision for SWC practices were: age, formal education level, on-farm income, family size, distance of farm from homestead, and access to agricultural extension service and training. It was concluded that though inconsistent with USLE, farmers' perception of the erosion risk was pivotal in adoption and implementation of SWC measures.

**Keywords** *Erosion Management, GIS, Lake Victoria Basin of Uganda*

## 1. Introduction

Mitigating the risk of erosion is a challenge to soil and water conservation (SWC) in smallholder farmer communities [27] particularly in Sub-Saharan Africa (SSA). For effective rehabilitation of the erosion affected landscapes, available pathways either emphasize landuse change; or adoption of appropriate SWC technologies. The latter is feasible since farmers are considered in the quest for SWC [34; 28]. Its adoption success, however, is a function of farmers' awareness and perception of the erosion risk [46]; which is said to vary over time and in space. Little information is available for bench-marking farmers' awareness and perception of the erosion risk in order to craft options for its containment [5]. In Uganda, the choice of appropriate land management technologies is rather difficult since land policies are not clearly defined [41]. As a result, most farmers in the rural setting are faced with insecure tenancy on the land; a factor that renders adoption of SWC technologies unattractive and unattainable [20].

At household level, success in erosion risk management attained if anchored on the degree of intensity of a farmer's prior knowledge of erosion risk on his/her agricultural land. This is the first stage in mitigating soil erosion [29]. The other stages following in tandem, being their interest in the decision to adopt, and their decision to determine the level of soil conservation practices to execute pertaining from previous perceived erosion risk.

However, there is no consensus on how perception of erosion risk is related to farmers' adoption of SWC practices. Additionally, conceptualization of the farmers' perception and erosion risk management is also a question of debate [16], for example, contended that this was a structural issue, encompassing socio-economic factors. Whereas this might be true, scanty information is available for heterogeneous landscapes about how on-farm profits derived from use of SWC technologies for reducing erosion risk could perpetuate additional usage of the said management practices. Some authors believe that this relationship between anticipated profits on-site and adoption of SWC practices is positive; while others that it is negative [30]. Mismatches are also identified in the factors that determine adoption of SWC practices in different spatial locations; of which [17] identified land ownership, tenure system and property rights on the land by farmers as the most critical ones.

Whereas [26] identified three critical issues in this debate such as perception of the risk itself, perception of the management strategies to avert the risk, and the socio-economic characteristics of the farmer, predicting these theoretical constructs based on empirical adoption models alone is an illusion [19]. Studies have therefore underscored the Theory of Planned Behaviour (TPB) or Reasoned Action Approach (RAA) for this purpose [35]. This is perhaps a more rational approach for erosion risk management at a wider scale [18]; a concept which requires further investigations. Assessing farmers' perception of the erosion risk is advantageous in SWC; it offers a balanced yard stick to judge the local farmers against scientific views in a bid to mitigate the erosion risk [46].

This study was, therefore, conceived based on TPB/RAA as shown in Figure 1, with the objective of assessing farmers' perception of erosion risk and examining farmers' decision for choosing erosion risk management practices at watershed level. We hypothesized that: (a) farmers' perception of erosion risk does not correspond with their decisions to adopt erosion management practices; (b) the adoption level of SWC practices is a reflection of both their technical performance and degree of acceptability by local farmers to increase agricultural production.

## 2. Materials and Methods

### 2.1. Site Description

The study was conducted in Nabajuzi watershed of the Lake Victoria Basin (LVB) of Uganda; located at latitude 0˚ 00′ 01″ N and 0˚ 20′ 01″ S, and longitude 31˚ 39′ 00″ and 31˚ 50′ 00″ E (Figure 2). This site is characterized by a high population density of 123 persons per $Km^2$ [45]; and high magnitudes of soil loss ranging from (25-140) t $ha^{-1}yr^{-1}$ [24].

Due to population pressure, inappropriate cultivation practices, deforestation and excessive grazing intensities, the soil of this watershed has been severely degraded, leading to a huge volume of pollutants into the basin [11]. Erratic and un-predictable rainfall regimes associated with high intensities [4] are received, a condition which is presumed to aggravate soil erosion risk in the watershed.

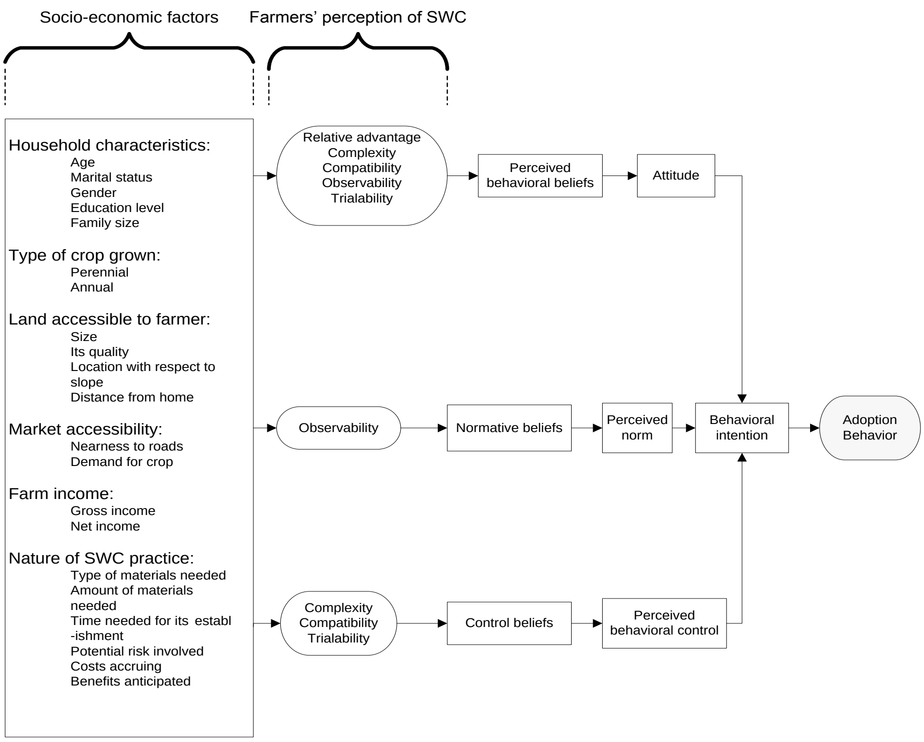


***Figure 1:*** *Conceptualizing Farmers' Adoption of SWC Practices Based on the Perceived Risk of Erosion*
**Source:** Modified from Reimer *et al*., 2012

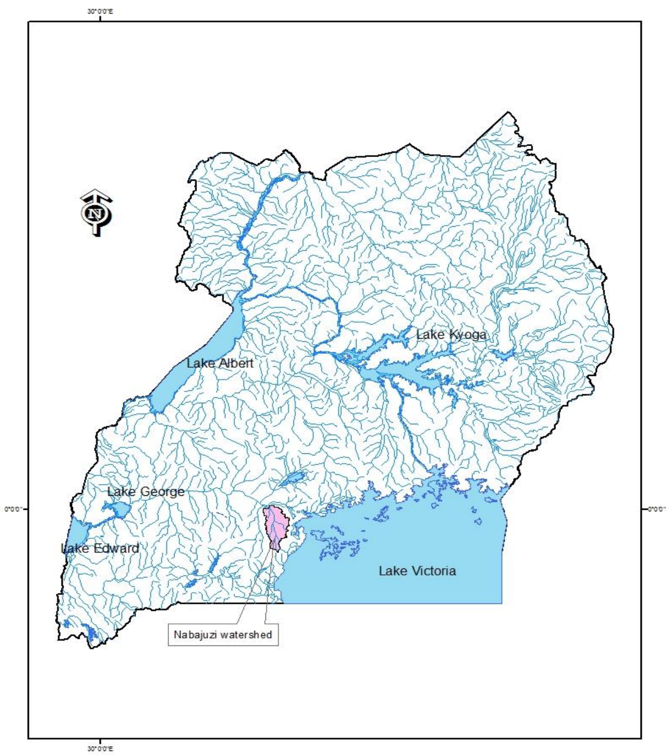


***Figure 2:*** *Map of Uganda Showing the Location of Nabajuzi Watershed of the Lake Victoria Basin of Uganda*

## 2.2. Research Design and Survey Instrument

The study was conducted following a longitudinal design focusing on a particular farmer category in the watershed in order to obtain causal explanations about the erosion risk. A semi-structured questionnaire method was pre-tested and then used in a socio-economic survey.

## 2.3. Sample Size and Selection Procedure

The target population was the lowest income peasant farmers at household level who are most severed by the erosion effects. This target was achieved following poverty indicators generated by the Uganda Bureau of Standards [45]. There were 66 administrative parishes the watershed (Figure 3), and which were then overlaid with a household poverty shape file (to select number of households below the poverty line). A total of 24,000 households was obtained and this was regarded as population size ($N$ = 24,000).

Sample size selection was based on the following procedure [3]:

$$n = \frac{pqN}{(SE)^2 N + pq} \text{..........................................(Equation 1)}$$

Where $n$ = sample size,

$N$ = population,

$p$ = proportion of population possessing the major attribute (expressed as a decimal),

$q$ = 1- $p$, and

$SE$ = standard error of the proportion

Taking the confidence interval at +5% and confidence level at 95%, we derived the standard error of proportion as:

$$SE = \frac{5\%}{1.96} = 0.025 \text{ .......................................(Equation 2)}$$

Therefore, our sample size ($n$) was determined as follows:

$$n = \frac{0.5 \ X \ 0.5 \ X \ 24000}{(0.025)^2 \ X \ 24000 + 0.5 \ X \ 0.5}$$ = 390 households, and these were interviewed during the survey.

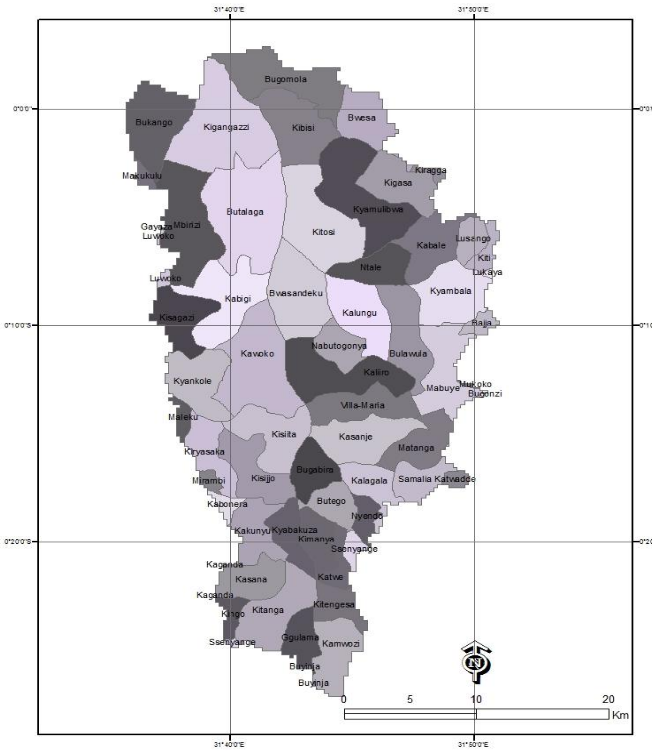


***Figure 3:*** *Population (N) as Derived From Administrative Parishes in Nabajuzi Watershed in LVB of Uganda*

## 2.4. Variable Selection and Context

The independent variables were selected based on economic theories on adoption of SWC practices as established by [38]. On the other hand, the dependent variable was quantified based on a consultative meeting with twenty farmers, selecting four purposively from the five erosion risk classes (very low to very high) as in Figure 4.

The key informants were then involved in identifying what farmers considered as the most pertinent issue(s) with regard to erosion risk in Nabajuzi watershed. Using a binary indicator, farmers' awareness of the erosion risk was quantified. 80% of the key informants were aware of the occurrence soil erosion risk on their land parcels; while 20% were not. Hence, 16 farmers who were aware of the erosion risk were further engaged in selecting the dependent variable, which was quantified by an index. The magnitude of soil erosion risk and its possible causes in the entire watershed were then rated. A score of 3 was assigned for very much erosion risk; 2 for much erosion risk; 1 for moderate erosion risk; and 0 for low or negligible erosion risk. All these attributes carried the same weighting, to enhance quantification of farmers' perception of erosion risk. An arithmetic mean of the scores obtained from each indicator as shown in Table 1, with the highest mean being the most important variable.

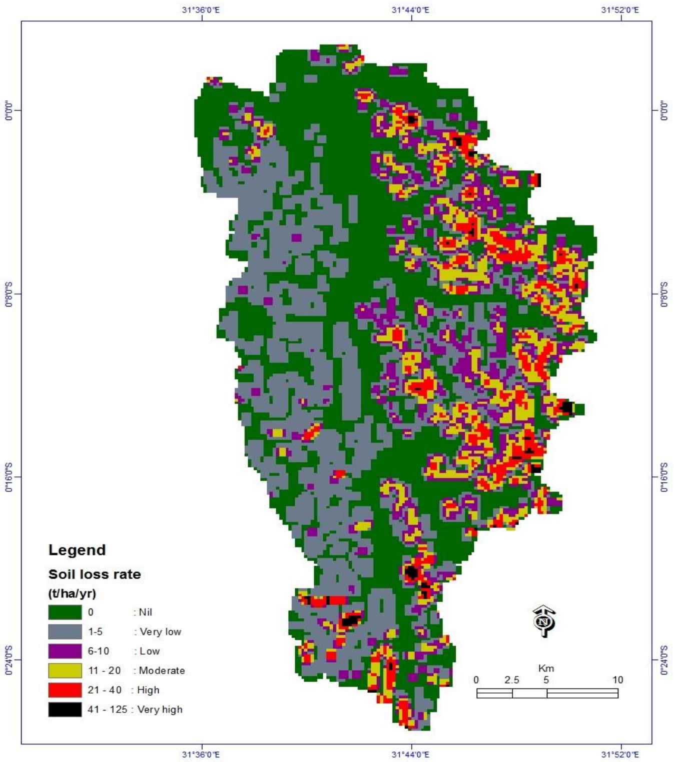


***Figure 4:*** *Erosion Risk Potential for Nabajuzi Watershed of Uganda based on GIS-USLE modeling*

***Table 1:*** *Scoring Farmers' Perception of the Erosion Problem in Nabajuzi Watershed in LVB of Uganda*

| S/n | Indices | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 | F11 | F12 | F13 | F14 | F15 | F16 | $\bar{X}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Scores | | | | | | | | | | | | | | | | |
| 1. | Erosion is very much in nearly all parts of watershed | 3 | 2 | 3 | 1 | 0 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 3 | 2.125 |
| 2. | Erosion is much in some parts of watershed | 2 | 3 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 2 | 0 | 2 | 3 | 2 | 2 | 2.000 |
| 3. | Erosion is moderate in all watershed area | 1 | 1 | 1 | 2 | 3 | 1 | 0 | 1 | 0 | 1 | 1 | 3 | 3 | 2 | 1 | 1 | 1.375 |
| 4. | Erosion is low or negligible in all watershed area | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0.5 |

F1…..16 = Farmer identification number as used in the scoring process; $\bar{X}$ = Arithmetic mean of the scores

Table 2 shows a summary of the selected variables, their definition, and measurement scale and how they affect farmers' adoption of SWC practices to reduce the erosion risk.

***Table 2:*** *The Selected Variables and their Expected Effect on Adoption of SWC Practices*

| Variable Name | Definition | Measurement | Unit | Expected Sign |
|---|---|---|---|---|
| **(a) Dependent variable** | | | | |
| Farmers' awareness and perception of occurrence of the risk of erosion on their agricultural lands | Target all peasants in Nabajuzi watershed of the LVB of Uganda | scale | persons | |
| **(b) Independent variables** | | | | |
| House-hold characteristics: | | | | |
| - age of house head | chronological | scale | year | + |
| - marital status of house | yes or no | ordinal | | + |
| head | male or female | ordinal | sex | + |
| - gender of house head | formal education | scale | year | + |
| - education of house head | persons one roof | scale | persons | + |
| - size of family under house | cohorts (child/adult) | scale | persons | +/- |
| head | | | | |
| - age of family members | | | | |
| Crop type: | | | | |
| - perennial | crop value (food/cash) | categorical | | +/- |
| - annual | | categorical | | +/- |
| Land accessible to a farmer: | | | | |
| - size | quantity | scale | acre | - |
| - quality | productivity potential | categorical | | +/- |
| - farm location | farm location versus slope | | | |
| - farm distance | position | categorical | | - |
| | average distance from home | scale | metre | - |
| Market access | nearness of farm to roads and footpaths | scale | metre | + |
| | | categorical | | |
| | available market demand for the crop | | | +/- |
| On-farm income | proxy indicator for farmers' ability to invest in SWC practices | scale | shilling | +/- |
| Nature of SWC practice | | | | |
| - type and amount of materials | quantity | scale | acre | +/- |
| | anticipated | categorical | | +/- |
| - risks and benefits of the SWC practice | | | | |

## 2.5. Farmers' Assessment of Erosion Risk

The method termed as '*Assessment of the Current Erosion Damage (ACED)*' was used to determine farmers' rating of the erosion risk. In this method, two activities were involved. The first was to conduct a transect walk with the previously selected key farmers. While, the second activity was to select and quantify with farmers the erosion risk of indicators on different slope positions.

During field excursion, erosion indicators were observed from plots of 30 m by 30 m; a dimension that was considered sufficient enough for rills to develop [23]. These plots were purposively selected and mapped with a hand-held Global Positioning System (GPS) receiver on to the erosion risk map, previously generated using GIS-based USLE model for the site (Figure 4). Farmers' perception of soil erosion risk was matched with the erosion classes identified in Nabajuzi watershed. This formed a platform for validating the results and quantifying the erosion risk indicators, since they form a foundation for proper SWC formulation [29].

Whereas their classification is usually based on current and past erosion features, this study focused on erosion processes; soil- and crop-related features to determine farmers' rating of the erosion risk. The considered alternatives for each criterion were its severity; most critically affected landuse; slope angle and topographic location within the watershed (Figure 5).

The strength ($P_{ij} \geq 0.7$) and weakness ($P_{ij} \leq 0.7$) of these indicators were then statistically established [46] as presented in Equation 3.

$$P_{ij} = 1 - \frac{\sum_{0}^{j-1} n_{ij}}{n_i} \quad \text{(Equation 3)}$$

Where: $Pij$ is the probability that an indicator, $i$ occurred in an erosion class equal or greater than $j$;
$n_{ij}$ is the number of presence of an indicator, $i$ appearing in an erosion class $j$; and
$n_i$ is the total number of presences observed for indicator $i$.

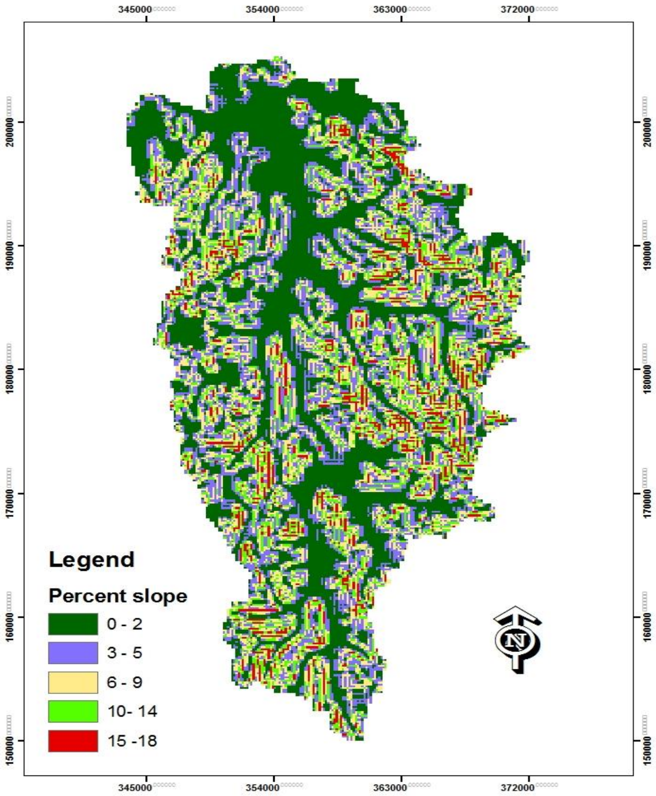


***Figure 5:*** *Percent Slope Categorization to Quantify Farmers' Perception of Erosion Risk in Nabajuzi Watershed*

### 2.6. Farmers' Adoption Level of SWC Practices

Literature highlights methodological constructs relating the level of adoption for soil conservation practices [13; 34]. A critical concern is that there is no consensus among these constructs. This study embraced the idea of estimating the farmland area under conservation practice as an indicator of farmers' adoption level [15]. Therefore, the field plots (30 m by 30 m) already established during transect walk were used for this purpose. The plots were divided into equal quadrants (15 m by 15 m) such that the proportion of the area under SWC was estimated by direct observation; and the dominant practices were recorded. Individual farmers' perception and awareness for soil erosion risk was assumed to have binary outcomes. The *Probit* regression model was used to quantitatively identify factors that influence the adoption of SWC practices. The general form and identified variables for this regression model are presented in Equation (4).

$Y = \beta + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_{12} X_{12} + e$ ……………………(Equation 4)

Where: $\beta_1 \ldots\ldots \beta_{12}$ = coefficients to be estimated by the regression model;

$e$ = random error term;
$Y$ = farmers' perception and awareness of the erosion problem;
$X_1$ = age of house head (*in years*);
$X_2$ = family size (*excluding* extended family members);
$X_3$ = education level of house head (*in years of schooling*);
$X_4$ = marital status of house head;
$X_5$ = distance to the garden from home (*in metres*);
$X_6$ = land size (*in acres*);
$X_7$ = total spending in SWC as a proxy for income of house head;
$X_8$ = land quality of the parcel;
$X_9$ = length of time for accessing the land parcel (*in years*);
$X_{10}$ = farmers' access to agricultural training and extension services;
$X_{11}$ = land tenure and ownership system operating in the watershed;
$X_{12}$ = crop type grown.

### 2.7. Statistical Analysis

The data were entered in Statistical Package for Social Sciences (SPSS) version 16 and transferred to STATA for easy analysis. The outliers, normality (distribution) and symmetry (skewness and kurtosis) were all checked using explanatory data analytical procedure. The identified outliers were discarded; and since the data were found to be normally distributed with no skewness or kurtosis, further analysis was guaranteed. Multi-collinearity was also tested using Variance Inflation Factors (VIFs) and a covariance matrix. The covariance matrix showed no Multi-collinearity in the data. Similarly, all variables showed VIF values which were less than 10, a condition which proved that the degree of linear relationship among variables was fine. Therefore, all the selected variables were used in the running of the *Probit* regression model (Equation 4).

## 3. Results and Discussion

### 3.1. Farmers' Perception of Erosion Risk *versus* GIS-Based USLE Prediction

Results showing a comparative assessment of farmers' perception the erosion risk with the USLE prediction output are presented in Table 3. A variation was evident between farmers' belief about soil erosion risk and what is predicted by USLE. Mismatches were recognized in processes, rates and magnitude in relation to topographic positions which are known to farmers, as opposed to what the model predicts. Sometimes farmers' perceived erosion risk indicators were not actually important in this watershed ($P<0.7$). For instance, whereas farmers recognized sheet wash as a low erosion risk indicator, it was also a weak one. The area they associated with such a risk, was potentially low-lying (valley & toe slope); hence, susceptible to deposition processes rather than to erosion processes. But within the same area, the USLE predicted erosion risk to 0-10 t $ha^{-1}yr^{-1}$. This is a substantial quantity of soil loss which calls for mitigation attention since it is above the tolerance level of 5 t $ha^{-1}yr^{-1}$ [43]. Most farmers perceived soil stoniness to bear a high erosion risk, an observation which was in line with USLE prediction (21-40 t $ha^{-1}yr^{-1}$). Unfortunately, soil stoniness in this analysis was regarded as a weak erosion risk indicator, a condition which could be attributed to thin and/or young soil profile. Finally, farmers perceived poor seed germination and poor crop development as a moderate risk of soil erosion, which was now in line with what the USLE predicts. But all these indicators were weak, since such conditions could be associated with either low soil fertility or pest and diseases damage rather than to soil erosion risk.

By and large, the strong erosion risk indicators (*P>0.7*) identified in the survey were interrills, rills, gully development, presence of some bare patches of rocks, absence of top soil layer, presence of pedestals, exposure of crop roots, washing and bending of crops. Distinguishing the indicators as discussed above, was a plausible means of harmonizing farmers' perception of erosion risk with scientific knowledge to provide a rational strategy for adopting SWC practices at a watershed scale.

***Table 3:*** *Farmers Assessment of the Erosion Risk in Nabajuzi Watershed of the LVB of Uganda*

| Identification Criteria | The most observable erosion indicator(s) in the estimated plots | Strength/weakness of the erosion indicator (s) in the plots using (Equation 3) | Farmers' erosion risk perception | Farmers' estimation of the most affected crop cover | Geomorphic slope description along the transect line | Slope gradient (%) | Erosion risk according to a GIS-based USLE model (t ha$^{-1}$yr$^{-1}$) |
|---|---|---|---|---|---|---|---|
| Process | Sheet wash | 0.4 | Low | Horticulture | Valley and toe | 0-5 | 0-10 |
| | Interrills | 0.8 | High | Horticulture | Back slope | 6-9 | 11-20 |
| | Rills | 0.7 | High | Banana | Shoulder | 10-14 | 21-40 |
| | Gully development | 0.7 | Very high | Banana | Shoulder | 10-14 | 21-40 |
| Soil Features | Soil stoniness | 0.6 | High | Banana | Shoulder | 10-14 | 21-40 |
| | Presence of some patches of bare rocks | 0.7 | High | Banana-coffee | Summit | 15-18 | 41-125 |
| | Absence of top soil layer | 0.8 | Very high | Banana-coffee | Summit | 15-18 | 41-125 |
| | Presence of pedestals | 0.7 | Moderate | Horticulture | Back slope | 6-9 | 11-20 |
| Crop Features | Exposure of roots | 0.7 | Very high | Coffee | Back slope | 6-9 | 11-20 |
| | Poor seed germination | 0.4 | Moderate | Cereal crops | Back slope | 6-9 | 11-20 |
| | Washing of crops | 0.8 | High | Cereal crops | Back slope | 6-9 | 11-20 |
| | Bending of crops | 0.7 | Very high | Banana | Back slope | 6-9 | 11-20 |
| | Poor crop development | 0.4 | High | Banana | Back slope | 6-9 | 11-20 |

## 3.2. Empirical Analysis and Variables

Table 4 presents results obtained from the *Probit* regression analysis. The most significant factors influencing farmers' decisions to adopt SWC practices to mitigate the erosion risk are consequently discussed in the subsequent sections.

Number of observations = 390
LR chi$^2$ (10) = 78.76
Prob > chi$^2$ = 0.0000
Log likelihood = -100.11821
Pseudo R$^2$ = 0.2823

***Table 4:*** *Results of the Probit Regression Analysis*

| Awareness_percep | Coef. | Std. Err | z | P>\|z\| | [95% Conf. interval] | |
|---|---|---|---|---|---|---|
| Age | -.645777 | .3072047 | -2.10 | 0.036** | -1.247887 | -.0436669 |
| Farmer income | .6800275 | .280724 | 2.42 | 0.015** | .1298185 | 1.230236 |
| Family size | .2707459 | .0793255 | 3.41 | 0.001*** | .1152707 | .426221 |
| Farm distance | .5960017 | .2119934 | 2.81 | 0.005** | .1805024 | 1.011501 |
| Education | .1772243 | .0388721 | 4.56 | 0.001*** | .1010363 | .2534123 |
| Farmer training | .0238471 | .0140307 | 1.70 | 0.089* | -.0036526 | .0513468 |
| _cons | -2.854128 | .7734741 | -3.69 | 0.000 | -4.37011 | -1.338147 |

* Significant at P ≤ 0.1; ** Significant at P ≤ 0.05; *** Significant at P ≤ 0.01

Where: Coef. stands for a coeffient determining the change in independent variables on the dependent one; Std. Err for standard error; z for Z-score; P for Probability; Conf. for confidence interval; and cons for constants which would equal to the dependent variable if all the independent ones were equal to zero.

### 3.2.1. Age of Household Heads

The age of household head was negatively related with adoption of SWC practices (r = -0.646, Table 4); implying that the younger the household head the more likely that s/he adopts SWC practices. The underlying reason is that young farmers may still have a long span of time to plan for their lives than the old ones who may be highly vulnerable to life threatening risks. Besides, young household heads are usually more educated, physically fit and highly adaptive to new innovations with regard to SWC technologies. Empirical studies [15; 38] also had a similar observation, showing that the age of the farmer was negatively correlated with adoption of SWC practices. As farmers become older, they become weaker; and implementing SWC practices is rather challenging even when they are aware of the erosion risk [22]. In the study site, we recognized that farm labour was provided by household members whose physical strength would easily be compromised by old age. This argument is supported by [6] on the basis of a Multinomial *Probit* regression analysis and differential calculus; observing that the maximum age of a farmer to adopt SWC practices would approximately be 51 years. In the study site, the average age of the respondents was 43 years, an age below the calculated age-limit for adoption potential. This age (43 years) suggests that the farmers in this watershed would adopt new SWC technologies to reduce the risk of soil erosion.

### 3.2.2. Economic Significance/Profitability

The relationship between farm income and adoption of SWC practices in this site was positive (r = 0.68, Table 4). This was in line with an earlier study by [1]. The SWC technologies that are usually perceived to be profitable are usually adopted by farmers [10]. Therefore, the result obtained on this relationship was indicative that the more the farmers realized high potential income from such management practices, the more they would adopt them. The long term implication of SWC is contrary to this. As SWC practices become more and more beneficial strategies for land management, farmers tend to disregard them since they will have already acquired enough income to start other business enterprises [25]. Premised on this, studies have shown that off-farm income plays an unattractive role in influencing farmers' decision to adopt SWC practices [21]. Whereas [38] found a negative relationship caused by off-farm income on adoption of SWC practices, [37] recognized a positive one. Off-farm income activities tend to reduce the economic significance of the erosion problem because of the less time, less labour and less interest that farmers will have for installing new and maintaining the existing SWC practices [39]. Thus, farm income of great significance to adoption of SWC practices is on-farm [2]. Off-farm income was out of scope in this study; but further economic investigation is needed to establish quantitatively the equilibrium level for farm-income to impact farmers' adoption for SWC practices.

### 3.2.3. Education Level

The level of education attained by a farmer was a positive significant factor (r = 0.177, Table 4). This supports what was previously noted by empirical studies on the same variable [12]. Education influences the level of awareness; hence farmers perceive the occurrence of soil erosion risk on their land parcels. Whereas this is true, the effect of education on the adoption of SWC practices is ambiguous. For instance, some studies show that increasing the education level increases the farmers' likelihood to adopt SWC practices; which consequently reduce soil loss [33]. On the other hand, increasing the education level increases the opportunity cost of the labour; which negatively affects the adoption of labour-intensive SWC practices.

### 3.2.4. Family Size

This study revealed rather controversial results relating to family size in Nabajuzi watershed (Table 4). A positive coefficient was noted implying that the larger the family size, the more likely that the members would adopt SWC practices. This can be attributed to the fact majority of the farmers in this watershed (75%) had no off-farm income generating activities. Thus, to ensure continued food supply to sustain their livelihoods in the area, the only option was to rudimentarily adopt some SWC practices. This was in line with an earlier view which was advocated for by [40] in Kenya. Secondly, a large family was advantageous in establishing physical structures for erosion management since much of the labour force in this watershed was easily provided by family members. This variable has been variously reported by some empirical studies [38; 8] to have a negative effect on farmers' adoption behavior for SWC practices. This situation implies that the larger the family size, the less the member would be interested in investing in SWC practices. Earlier studies suggest that as large families face food shortages due to drought, they tend to maximize short-term seasonal benefits rather than paying attention to SWC practices which benefit them in long-run. Perceived risk of erosion missing

### 3.2.5. Household Location

In Nabajuzi watershed, the commercially-oriented crops whose benefits were realized in short-run, generally received maximum attention and supervision regardless of the distance between a farmer's home and the farm (Table 4). Such crops included tomatoes, onions and cabbages that were grown on well-managed plots located on the toe slopes and valleys far away from farmers' homes. But for other crops such as banana and coffee, the observation was quite different from the one above. Banana plantations that were within a radius of less than 100 m around the homesteads were intensively managed as opposed to coffee. Priority to banana was attributed to its being a staple food while coffee which was traditional cash whose benefits to the farmers were not immediately achieved. Descriptive statistics showed that the average distance of the farms from homesteads was a 430 m. This condition resulted into contradictory findings than those in literature; and indicated a positive relationship with respect to adoption of SWC practices in this watershed. This implies that the longer the distance from home the farm was, the more the farmers would adopt SWC practices. This unusual observation was attributed to the ambiguous impacts of commodity prices on adoption of SWC practices which were earlier noted by [32]. For instance, the higher the commodity price, the more incentives would land users obtain, hence; adopting SWC practices for continued profitability of the landuse. Unfortunately, high commodity prices could also trigger encroachment into the fragile and marginal lands in a bid to increase agricultural production, hence; leading to further soil erosion risk. Such linkages require further investigation particularly at a watershed scale. Previously, studies indicated that longer distances discourage investments in SWC practices due to additional costs accruing from transport [14]. Thus, farms located near homes are believed to receive maximum attention and supervision [7].

### 3.2.6. Level of Training

Farmers who received better agricultural training and other extension services were more likely to adopt SWC practices in Nabajuzi watershed (Table 4); and the reverse was also true as shown by the positive correlation coefficient value obtained for this factor. Most importantly, was the fact that access to such services was easily attained by large families as opposed to smaller ones; and this increases their exposure to better agricultural innovations [43]. This in turn, influences their adoption behaviour for SWC practices to reduce the risk of soil erosion [7].

## 3.3. Adoption Intensity of SWC Practices

Results indicating farmers' adoption intensity for SWC practices are presented in the Figure 6. The SWC practices commonly used in this watershed were agronomic with contour bunds, mulches and trash lines being the most dominant ones.

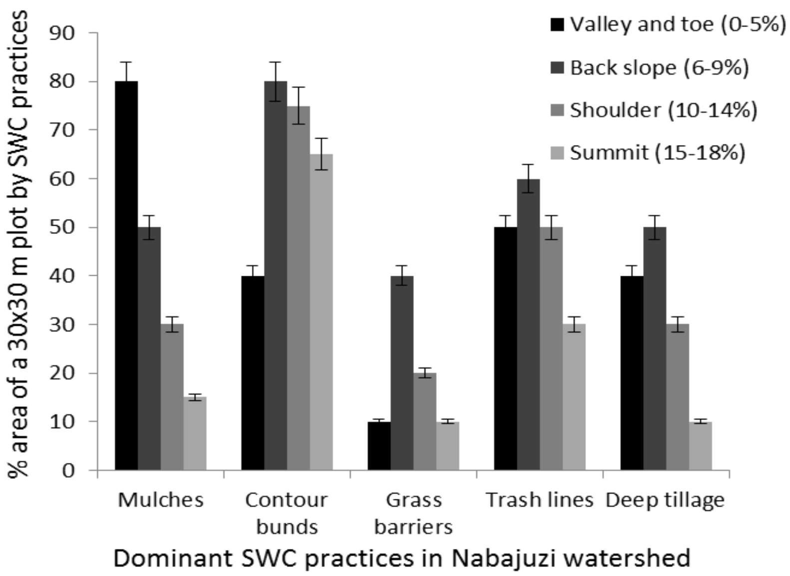


***Figure 6:*** *Intensity of Farmers' Adoption for SWC Practices in Nabajuzi Watershed in LVB of Uganda*

The adoption intensity of these SWC practices was in resonance with the perceived severity of the erosion risk. Farmers constructed contour bunds in a *fanya-chini* design mainly to improve runoff retention and reduce soil losses across slope gradients of the perceived geomorphic units with a severe risk of erosion. Since the efficiency of contour bunds depends on infiltration capacity of the soil [42], farmers adopted other SWC practices such as grass barrier strips, trash lines and deep tillage to supplement the bunds for this purpose. On the other hand, mulching was emphasized based on it known potential for reducing surface sealing, improving water holding capacity as well as micro-organisms' activities in the soil. Therefore farmers believed that these conditions could help in reducing soil erosion risk particularly on level to gently undulating slopes (0-9) %. However, for steeper slopes, farmers held the view that structural erosion risk management measures were important for supplementing the agronomic and vegetative practices in reducing runoff and soil losses from agricultural land.

## 4. Conclusion

The risk of soil erosion was perceived to be severe on back slope, shoulder and summit; hence, in a farmer's view such risk could be reduced by integrating agronomic and structural measures at such geomorphic units as deduced from the level of willingness to adopt such SWC practices. Further perception of the farmers was that mulches could be applied in sheet wash areas in the watershed. Lastly, the level of adoption for SWC practices was influenced by age of farmer, education level, on-farm income, family size, distance of farm from homestead, and access to agricultural training and other extension services. Therefore, the strategy of coupling of farmers' perceived risk of erosion with USLE model outputs is one of the most viable ventures for proper erosion management and rehabilitation of the degraded agricultural watersheds. This increases the farmers' willingness to accept and sustain new SWC technologies targeting such agricultural lands.

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