

# THE INFLUENCE OF FOOD SECURITY ON SUSTAINABLE LAND MANAGEMENT TECHNOLOGIES OF FARMING HOUSEHOLDS IN KWARA STATE, NIGERIA

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**Abstract.** Poor land management practices are degrading soils and undermining food security. Despite this, there is scant information regarding the effect of food security on a household decision to adopt SLM technologies. This paper, therefore, measured the food security status and assessed the effect of food security on SLM technologies. A structured interview schedule was used to gather data for this study. A three-stage sampling procedure was employed for this study. Two out of four agricultural development project (ADP) zones were randomly selected in the first stage. This was followed by a proportionate selection of 30 villages from the two selected zones. Lastly, ten farming households were picked randomly from each selected village to make up a sample consisting of 300 farming households. The result revealed that the calculated mean per capita food expenditure (MPCFE) was NGN 4,218.587 and the proportion of food-secure and food-insecure households were 37.7% and 62.3% respectively. The findings further affirmed that there are ample opportunities for increasing the use of SLM technologies among the food insecure-households when compared with their food-secure counterparts. The  $R^2$  value of 29.8% suggests that the explanatory variables explained about 30% of the variation in the explained variable. Furthermore, the factors influencing SLM technologies of households include food security status, family size, age of the household head and plot size. This study provides a useful insight into policies and actions taken by farmers and the government to mitigate the effects of suboptimal use of SLM technologies for improved production and food security. Policies favouring an increase in plot size should be vigorously pursued.

**Keywords:** farming households, food security, regression analysis, SLM technologies and Shriar index

## INTRODUCTION

Land is that part of the earth crust on which plants grow. It is important for residential, recreational, transport, commercial and agricultural purposes. According to Gabathuler et al. (2009), about 2.6 billion people depend directly on agriculture for their living and 52% of the land used for agricultural purposes is either slightly or severely disturbed by soil degradation. Land degradation by human activities has been a significant development challenge of the 21st century (Utuk and Daniel, 2015). The causes of land degradation are complex and vary from place to place. The major causes are generally classified into two categories: proximate and underlying causes (Pingali et al., 2014). The proximate causes are mainly natural factors, whereas the underlying factors are mostly anthropogenic and include population growth, land tenure, and other socio-economic and policy-related factors (Belay et al., 2015).

Land degradation affects agricultural production and productivity, irrigation and water development projects; it can also cause a severe health threat to the public since it can damage drainage and other sanitation facilities, which in turn affects the development of human capital. In Nigeria, there are limited cultivable land and high population growth rates, fallow periods are no longer enough to allow soil fertility to be regained. Consequently, crop yields have fallen drastically. In response to this, farmers have been pushed either to bring increasingly

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marginal lands into use or to migrate into forest areas, enhancing the challenges of land degradation and deforestation (FAO, 2011). Therefore, to reduce the effects of land degradation, increase agricultural production and productivity, the sustained management of land becomes a critical issue. Increased investments in land to promote agricultural growth and poverty reduction are one of the key objectives of the World Bank's (2007) rural strategy: Reaching the Rural Poor. Sustainable land management (SLM) requires a better understanding of the ecological, social, cultural, political and economic dimensions by all stakeholders from local to national and international levels.

The SLM practice helps to combine land, water, biodiversity, and environmental management to meet increasing food and fibre needs while maintaining the ecosystem services and sustenance. It involves the use of land to meet changing human needs while ensuring long-term socio-economic and ecological functions of the land. It is important to meeting the requirements of a growing population. Improper land management can lead to land degradation and a significant reduction in land productivity (World Bank, 2006). SLM is a requirement for sustainable agricultural development, and it is a key element of the AGENDA 21 goal of sustainable development. SLM technologies can make farmers less vulnerable to climatic risks, improve soil texture and enhance the activities of soil micro-organisms.

The adoption of SLM technologies to a greater extent determines whether a farmer will be food secure or not. Knowing the best technologies and practices to achieve this goal is germane (Branca et al., 2013). In Nigeria, poor adoption of sustainable land management practices is mainly influenced by food insecurity of households. Food insecurity is still a critical issue among farming households in Nigeria (Salau et al., 2019). Food security exists when all members of a household, at all times, have enough physical, civic and financial means to secure and consume food that satisfies their dietary needs and food choices for an energetic and beneficial life, otherwise a household is said to be food insecure (FAO, 2005).

A number of studies (de Graaff et al., 2008; Miheretu and Yimer, 2017) have addressed important factors explaining the adoption SLM technologies among households. However, none of these studies have addressed the influence of households' food security on SLM technologies. Also, the majority of previous studies modelled the adoption of SLM practices as a binary

function. Such modelling would make it difficult to assess the preference of households concerning various SLM practices, given that the farmers are more likely to use a combination of SLM practices. This study uses a multivariate approach instead of a bivariate one. Thus, this study examined SLM technologies, measured food security status, and assessed the effect of a household's food security on the adoption of SLM technologies in the studied area.

## MATERIAL AND METHODS

### Studied area

This study was carried out in Kwara State. It is located on latitude (8° and 10° N) and longitude (3° and 6°). The state has a land area of 35,705 sq. km and a population of 193,392,500 (NPC, 2016). The Niger State and the Republic of Benin are to the north and west of Kwara State respectively. It also shares a border with Osun, Kogi and Oyo States to the south-east, east and south-west respectively (Fig. 1).

The climate is composed of wet and dry seasons, each lasting for about six months. The wet season commences in April and lasts till October, while the dry season commences in November and ends in March. Temperatures range between 33°C and 34°C, with the total annual rainfall of about 1,318 mm. The predominant occupation of residents is agriculture. The common crops grown are cassava, millet, maize, okra, sorghum, beniseed, cowpea, yam, sweet potato, and palm tree. The state has about 1,258 rural communities and the



**Fig. 1.** Map of Kwara State, Nigeria  
Source: adapted from Ibiremo et al., 2010.

rural dwellers are the majority. Due to ecological features, cultural practices and management convenience, the state is divided into four zones by the Kwara State Agricultural Development Project (KWADP, 2010). These are Zone A: Baruteen and Kaima Local Government Areas (LGAs); Zone B: Edu and Patigi LGAs; Zone C: Asa, Ilorin East, Ilorin South, Ilorin West and Moro LGAs and Zone D: Ekiti, Ifelodun, Irepodun, Offa, Oyun, Isin and Oke-Ero LGAs (KWADP, 2010).

### Method of data collection and sampling

A structured interview schedule was used to collect primary data for this study. A three-stage sampling procedure was employed to select a total of 300 farming households. Two out of four ADP zones were randomly selected in the first stage. This was followed by a proportionate selection of 30 villages from the two selected zones. Lastly, ten farming households were picked randomly from each of the selected villages as shown in Table 1.

**Table 1.** Village distribution in the zones

Zones	Village distribution	Sampled villages	Sampled households
Zone B	237	10	100
Zone C	483	20	200
Total	720	30	300

Source: Muhammad-Lawal, 2008.

### Analytical techniques

The tools of analysis included descriptive statistics, SLM index, food security index and multiple regression analysis. The socio-economic features of the respondents were explained using descriptive statistics.

A Shriar index (2005) was used to estimate the SLM technologies scores (Table 2).

For all the activities, the maximum number of points is 46.

The SLM index is given as:

$$SLM = \sum_{i=1}^{10} S_i W_i \quad i = 1, \dots, N \quad (1)$$

where:

SLM – sustainable land management technology index for the  $i^{\text{th}}$  household

**Table 2.** SLM technologies, the scale ranges and their associated weights

SLM technologies	Scale range	Weight	Max. points
Agronomy			
Cover crops	0–3	3.5	10.5
Inter cropping	0–3	3.0	9
Organic fertiliser			
Compost	0–1	3.0	3
Animal and green manure	0–1	3.0	3
Min soil disturbance			
Minimum tillage	0–3	2.5	7.5
Mulching	0–1	3.0	3
Water management			
Terraces	0–1	3.0	3
Water harvesting	0–1	3.0	3
Agroforestry			
Trees on crop land	0–1	2.0	2
Fallowing	0–1	2.0	2
Total			46

Source: adapted from Salau et al., 2019.

S – scale range for the activities adopted by the  $i^{\text{th}}$  household

W – weight of the activities adopted by the  $i^{\text{th}}$  household.

If a household is involved in any activity it gets 1 point and 0 if it is not. The scale range of 0–3 indicates that the household is involved in an activity. It gets 1, 2 and 3 points for low, medium and high activities respectively. This classification was built on the proportion of the total area cultivated on which a particular strategy is applied. Legumes are more endurable and so attracted the highest weighting of 3.5 (Salau et al., 2019). Inter-cropping with other crops besides legumes takes the value of 0, 1, 2 and 3 for no, low, medium and high levels of activity respectively. The scale range of organic fertiliser application, water management, agroforestry and mulching is 0–1. Zero, for no activity and 1 if it applied. The scale of minimum tillage takes the value of 0 for

no activity, and 1, 2 and 3 for the use of tractor, animal traction and hoes/cutlass respectively.

Using a food security index, the respondents were further classified into food-secure and food-insecure households. The index is given as:

$$M_i = \frac{\text{per capita food expenditure for the } i^{\text{th}} \text{ household}}{\frac{2}{3} \text{ mean per capita food expenditure (MPCFE) of all households}} \quad (2)$$

where:

$M_i$  – food security index

when:

$M_i > 1$  – household is food secure

$M_i < 1$  – household is food insecure.

If the per capita monthly food expenditure (PCMFE) of a household is larger or equal to two-thirds of the MPCFE, the household is food secure. A food-insecure household exists when the PCMFE is less than two-thirds of the MPCFE (Omonona et al., 2007).

To determine factors affecting SLM technologies at different levels of food security, a multiple regression model was employed.

The model is stated as:

$$Q = n_o + n_1X_1 + n_2X_2 + n_3X_3 + n_4X_4 + n_5X_5 + u$$

where:

$Q$  – SLM technologies score of  $i^{\text{th}}$  household

$n_o$  – constant

$n_1, n_2, \dots, n_k$  – coefficients

$X$  – explanatory variables

$K$  – number of explanatory factors

$u$  – error term.

The explanatory variables are:

$X_1$  – food security status of the  $i^{\text{th}}$  household

$X_2$  – family size (adult equivalent)

$X_3$  – age of the respondents (years)

$X_4$  – gender of the household head (1 if male and 0 if otherwise)

$X_5$  – plot size (hectares).

## RESULTS AND DISCUSSION

### Socio-economic characteristics of respondents

Table 3 shows that the majority (70.3%) of respondents were males. Following the culture and tradition of the

**Table 3.** Socio-economic characteristics of the respondents

Variable	Frequency	Percentage	Mean
<b>Age</b>			
1–30	35	11.7	50.5
31–60	180	60.0	
61–90	85	28.3	
<b>Gender</b>			
Male	211	70.3	
Female	89	29.7	
<b>Level of education</b>			
No formal education	45	15.0	
Primary	75	25.0	
Secondary	141	47.0	
Tertiary	29	9.7	
Post-graduate	10	3.3	
<b>Marital status</b>			
Single	27	9.0	
Married	231	77.0	
Divorce	24	8.0	
Separated	18	6.0	
<b>Household size</b>			
1–5	85	28.3	7.36
6–10	179	59.7	
11–15	25	8.3	
16–20	11	3.7	
<b>Main source of income</b>			
Agriculture	162	54.0	
Salary	85	28.3	
Trading	53	17.7	
<b>Access to Remittance</b>			
Yes	183	61.0	
No	117	39.0	
<b>Monthly income (USD)</b>			
100–500	169	69.7	518.3
600–1000	131	26.7	
<b>Plot size (ha)</b>			
1–5	225	75.0	
6–10	54	18.0	4.6
11–15	21	7.0	

Note: 1.00 US dollar (USD) = 370.00 Nigerian nairas (NGN).  
Source: field survey, 2019.

people, the male respondents usually have more access to farmland through inheritance when compared with their female counterparts. The mean age of the respondents was 50.5 years. This suggests that most of the respondents were still in their active age. Age is an important variable which can affect the ability and agility with which the household head caters to the food requirements of the household. An aged household head is more likely to have a bigger family size and may lack the energy required to work for the maintenance of the family.

Sixty-one percent of the household heads had access to remittances. Access to remittances may affect the type of food consumed and expenses of households. A large (85%) proportion of the household heads are literate. Hence, they are expected to be able to make good decisions with respect to SLM technologies adoption. The respondents operate at a subsistence level with a mean plot size of 4.6 hectares. The size of farmland cultivated may affect the choice and adoption of SLM technologies. Furthermore, the study revealed that the mean monthly income was USD 518.30 from agricultural and non-agricultural related jobs. The average household size is 7. Their polygamous nature probably accounts for the large family size documented in the area. Their availability eliminates labour shortages faced during the rainy season.

#### Food security status of farming households

Table 4 indicates that the calculated MPCFE was NGN 4,218.587 (USD 11.40). Households whose per capita food expenditure falls above and below NGN 4,218.587 were designated as food-secure and food-insecure households respectively. Hence, 37.7% and 62.3% of the farming household are food secure and food insecure respectively.

**Table 4.** Households' food security status

	Food secure	Food insecure	All
$\frac{2}{3}$ mean per capita food expenditure was NGN 4,218.587.			
Proportion of households	37.7	62.3	100
Number of households	113	187	300

Source: field survey, 2019.

#### SLM technologies ranges of food-secure households

The frequency distribution of SLM technologies score of food secure households is presented in Table 5. Individual SLM technologies score ranges between 17% and 83% with a mean of 50.6%. About 49.4% SLM technologies score gap from the optimum (100%) was yet to be attained by all the food secure households. The level of SLM technologies score obtained in this study suggest that opportunities still exist for increasing productivity and income through increased adoption of SLM technologies in the studied area.

**Table 5.** SLM technologies ranges of food secure households

SLM technologies class index	Frequency	Percentage
0.11–0.20	2	1.80
0.21–0.30	14	12.9
0.31–0.40	16	14.2
0.41–0.50	26	23.0
0.51–0.60	16	14.2
0.61–0.70	27	23.9
0.71–0.80	11	9.70
0.81–0.90	1	0.90
Mean	0.506	
Standard deviation	0.158	
Minimum value	0.172	
Maximum value	0.832	

Source: field survey, 2019.

The frequency distribution of SLM technologies score of food-insecure households is indicated in Table 6. SLM technologies score of food-insecure households' ranges between 17% and 77% with an average of 45.3% scores. About 54.7% SLM technologies score gap from the optimum (100%) was yet to be attained by all the food insecure households. The findings further affirm that there are ample opportunities for increasing productivity and income through increased adoption of SLM technologies among the food-insecure households when compared with their food-secure counterparts.

**Table 6.** SLM technologies ranges of food-insecure households

SLM technologies class index	Frequency	Percentage
0.11–0.20	11	5.90
0.21–0.30	25	13.7
0.31–0.40	44	23.5
0.41–0.50	39	20.9
0.51–0.60	20	10.7
0.61–0.70	44	23.5
0.71–0.80	4	2.10
Mean	0.453	
Standard deviation	0.155	
Minimum value	0.170	
Maximum value	0.770	

Source: field survey, 2019.

### Factors influencing SLM technologies of households

The  $R^2$  value of 29.4% suggests that the explanatory variables explained about 30% of the variation in the explained variable. The factors influencing SLM technologies of households are food security status, family size, estimated monthly income and plot size (Table 7).

**Table 7.** Determinants of SLM technologies

Variable	Coefficient	Standard error	t- value
Food security status ( $X_1$ )	0.066	0.021	3.152*
Household size ( $X_2$ )	0.013	0.003	4.345*
Age ( $X_3$ )	0.002	0.001	1.854**
Gender ( $X_4$ )	0.024	0.016	1.475
Plot size ( $X_5$ )	0.009	0.002	5.199*
Constant	0.201	0.038	5.153*

\*, \*\*Significant at 1% and 10% levels respectively.

Source: field survey, 2019.

The coefficient of food security was positive and significant at 1% level of probability. This suggests that the more the household is food secure, the higher

the adoption of SLM technologies among households. The coefficient of household size is positive and significant at 1% level of probability. This indicates that the larger the family size, the more the availability of labour. The availability of labour force was found to have a significant positive influence on farmers' decision to continuously use SLM technologies. As the labour force increases by one person (adult equivalent), the odds ratio of the probability of a household to continually conserve its plots also increases by a factor of 0.013. Age of respondents was found to have a positive and important influence at the 10% level. This indicates that aged respondents were more likely to adopt SLM practices when compared with the young ones. An old household head was more likely to have larger household size to provide the labour needed to work on the farm. The effect of plot size owned by a household on the decision to conserve and use SLM technologies was statistically significant at 1% level. Surprisingly, gender of the household head was not among the factors influencing the adoption of SLM technologies among households in the studied area.

### CONCLUSIONS AND RECOMMENDATIONS

This study assessed the effect of food security on SLM technologies among farming households in Kwara State, Nigeria. The result revealed that 37.7% and 62.3% of the farming household are food secure and food insecure respectively. The findings further affirmed that there are ample opportunities for increasing the use of SLM technologies among the food-insecure households when compared with their food-secure counterparts. SLM practices are complementary to one another, and employing two or more SLM practices in a given plot is found to be highly associated with a higher value of crop production. The result revealed that the food security status, family size, estimated monthly income and plot size represent important factors influencing SLM technologies adoption by households. Farmers must expand their knowledge of SLM technologies and adopt improved technologies. The government should create an enabling environment through policy interventions so that food is readily available, accessible and properly utilised. Additionally, policies and programmes that favour increased plot size should be vigorously pursued.

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