SOIL EROSION PREVENTION AND CONTROL PRACTICES: USE, EXTENT AND CONSTRAINT ANALYSIS FROM FARMER-PERSPECTIVE

M. Nnenwa[1*], C.A. Eneh[1] and N. A. Onyekuru[1]

[1]*Department of Agricultural economics, University of Nigeria*

[*] *Corresponding Author*, Email: nnenwawm@gmail.com

Abstract

The importance of soil conservation analysis cannot be over-emphasized. Avoiding unsustainable land use practices by farmers can reduce soil erosion. This study aimed to ascertain the effectiveness of erosion prevention and control practices based on crop farmer perception. Logit regression analysis was used. Result showed that socio-economic factors affect farmer use of erosion prevention and control practices in the study area. Similarly, construction of bond, multiple cropping, cover cropping, and construction of water ways, minimum tillage and avoidance of bush burning were identified as effective in erosion prevention and control. No assistance from the government (3.69), poor access to prevention and control information (3.33), lack of capital (3.55) and lack of access to credit/input (3.03) were identified as serious constraints to the use of erosion prevention and control practices in the study area. Thus, the study recommends that; government should establish erosion prevention and control agency, extension programs and funds to assist farmers on erosion prevention and control. There should be cooperation involving policy makers, land owners and tenants that will lead to better land use.

Keywords: Land degradation; Sustainable land use; Soil erosion prevention; Erosion control

Introduction

The implication of soil erosion extends beyond the removal of valuable topsoil. In fact, crop emergence, growth and yield are directly affected through the loss of natural nutrients. Soil erosion is the most important environmental degradation problem in the developing world (Ananda and Herath, 2003), especially the tropics (Hanyona, 2001). United Nations (UN) Convention to Combat Land Degradation (CCD) opines that soil erosion automatically results in reduction or loss of the biological and economic productivity and complexity of terrestrial ecosystems, including soil nutrients, vegetation, other biota, and the ecological processes that operate therein (Claassen, 2004).

Scherr and Yadav (1996) argued that by the year 2020, soil erosion may pose a serious threat to food production and rural (as well urban) livelihoods particularly in poor and densely populated areas of the developing world. They further advocate for policies that would encourage soil retention strategies, land improving investments and better land management if developing countries are to sustainably meet the food needs of their populations, preserve nonrenewable natural resources and hand over their soils to future generations. Significant in this is that when soil gives away its fertility, human beings lose their fundamental living source they rely on.

Redistribution of soil by erosion and deposition is the result of perturbation and a natural landscape-forming process. However, it has been greatly accelerated by human activities in recent decades as the traditional shifting cultivation system has been replaced by more intensive but generally unstable cropping systems (Lal, 2001). The main reason for the land use intensification was and still is the increase in food production required to feed the rapidly growing population. For example, the Nigerian population has increased from 115 million in 1991 to 140 million in 2006 (Federal Republic of Nigeria, 2007).

In developing countries, over 70% of the nations' land surface has been damaged due to varying levels and types of soil erosion (Le Roux,

Newby, & Sumner, 2007). Similarly, Food and Agriculture Organization (FAO) (1999) indicates that without any conservative measures, the total area of rain-fed cropland in developing countries in Africa, Asia and Latin America would in the long-term get smaller because of soil erosion and degradation (FAO, 1999). On a global scale, FAO estimates that the loss of productive land through soil erosion globally is about 5-7 million ha/year (Kumar and Ramachandra, 2003). The main on-site impact of soil erosion is the reduction of soil quality which results from the loss of the nutrient-rich upper layers of the soil and the reduced water-holding capacity of many eroded soils (Bathrellos et al., 2010). This unveils the danger of soil erosion activities and the need for appropriate soil management practices, as well as a concerted effort in the fight against its effects.

There are more than 700 erosion sites in Anambra state alone (Ofomata, 1984; Oranye, 2013). The worst hit sites are found in Agulu, Nanka, Alor, Nnewi, Ideani Oraukwu, Oko-Nkpor, Alo, Uke, Ojokoto/Oba and Ukehe in Anambra State. Other catastrophic gullies occur at Ekwulobia/Oko and Umuchiani in Ikwulobia in the same Anambra State.

Thus, if future losses to soil erosion are well considered, development that produces short term satisfaction would either be disallowed or subjected to severe public opposition (Okin, 2002; Classeen 2004). To sensitize residents on the threat of soil erosion, annual workshops have been held on the need to protect the environment, construct embankments around some communities and fill pits with sands. But these measures have not had the desired impact because while government is tackling major gullies, other smaller ones emerge. Excavation continues in new sites daily (Nnenwa, 2018).

Though, some works has been done on farm erosion control where many advocated for the use of simple methods of erosion control such as mulching, and cover cropping (Utazi, 2002); Okoye (2001), Eze and Mbah (2013) identified that integrated land use has been practiced by Nigeria farmers. Abegunde et al. (2006) carried out an assessment of the

socioeconomic impacts of soil erosion in south eastern Nigeria and advocated for plant and residue cover to protect the soil from raindrops impact and splash which tends to slow down the movement of surface runoff. Amusa et al. (2015) also carried out research on famers' willingness to pay for Agronomic Soil Conservation practice among crop-based farmers in Ekiti State where many adopted Agronomic soil conservation. Ighodaro et al. (2013) further carried out research on the impacts of soil erosion on Agricultural potential and performance where they identified farming practices that accelerates soil erosion. Onyekuru and Uzuegbu (2011) also conducted a research on the effects of erosion on the profitability of cassava production in Osumenyi, Nnewi South Local Government Area of Anambra state and came up with the findings that erosion affects the annual profits of the farmers. Eze (2012) conducted an economic study of farmland erosion control practices in Enugu state, where he identified from farmer's perspective the possible causes of farmland erosion and control measures adopted.

But all of these studies focused mainly on erosion control practices without identifying from the farmer's perspective the practices adopted in preventing erosion on their farmland. This study closed on that gap amidst examining the constraints to farmers' use of the identified practices for erosion prevention and control. Also, in addition to its research quality and uniqueness to previous studies, this study utilizes one least-explored location for the study. Therefore, the study identified practices adopted by farmers in preventing and controlling erosion on their farmland in Anambra state.

This research provides information on measures aimed at preventing and controlling farmland erosion which will at a large extent increase crop productivity and food security. The analysis of soil conservation practices for erosion prevention and control will help the government and policy makers for future planning of erosion prevention and control measures. Information's from this research will be of enormous important to Environmental

Protection Agency, in formulating appropriate environmental related policies in order to ensure environmental sustainability.

Methodology

The study area is Anambra State. The state has 21 Local Government Areas (LGAs), 177 autonomous communities and four agricultural zones which are: Aguata, Anambra, Awka and Onitsha agricultural zones. The state is located in the humid tropical rain forest zone between latitude $6^{o}45^{l}$ and $5^{o}44^{l}$N and longitude $6^{o}36^{l}$ and $7^{o}29^{l}$E. Anambra Sate has the following neighboring states: Enugu, Imo, Delta and Kogi. It has an estimated population of 4,182,032 comprising of 50.9% men and 49.1% women (NPC, 2006).

Purposive and random sampling techniques were employed for selection of the respondents. Three out of the four agricultural zones namely, Awka, Aguata and Anambra were purposively selected for the study. This is because of the intensity of agricultural production as well as being prone to erosion (Eze and Mba, 2013). Two local government areas were purposively selected from each of the zones.

Aniocha and Njikoka were selected from Awka, Orumba north and Orumba south were selected from Aguata, while Anambra east and Anambra south were selected purposively from Anambra zone respectively. From each of the selected local government areas, two communities were randomly selected. Then two villages were further selected randomly from the selected communities, while five farmers were randomly selected from each of the selected villages to give a total of one hundred and twenty farmers for the study.

The data for the study were obtained through the use of structured questionnaire and scheduled interview for the farmers. The questionnaire and interview schedule reflect issues on the specific objectives of the study.

Results and discussion

Socioeconomic characteristics of the farmers

Result on table 1 shows that majority of the respondents (30%) are within the age range of 31-40 years. This was followed by 25% of the farmers who are within the age range of 21-30 years. This implies that youths and energetic farmers are fully involved in farming in the study area. Also, 24.2% were within the age range of 41-50 years, 16.7% were within the age range of 51-60 years, 3% were within the age range of 60 and above years. Only 0.8% of the respondents were less than 20 years of age. Table 1 reveals that 55% of the farmers were male while 45% were females. Majority of the farmers (66.7%) were married, 22.5% were single while 10.8% were widows. This implies that most of the respondents are married and within the active working age. The result agrees with the findings of Aklilu and Jan (2004); Ighodaro, Lategan, & Mupindu (2016) who both reported that male and married farmers due to the need to feed their families and farm as a major source of income amid erosion-controlled farming more than their female and single counterparts.

Also, from the results in table 1, 10.8% had post primary education, 9.2% were university graduates, 1.7% were postgraduates while 0.8% had formal primary education. This agrees with Amusa et al. (2015) who reported that level of education determines the level of willingness to adopt soil conservation practices. About 37.5% of the farmers earn between 50001-230000 naira, 26.7% earn between 230001-410000 naira annually. 9.2% earn between 410001-590000 naira, 8.3% earn between 590001-770000 naira, 4.2% earn between 7700001-950000 naira. 5.8% earn between 950001-1130000, 3.3% earn 1130001-1310000, 1.6% earn between 1310001-1670000, 1.7% earn above 1670000 while 1.7% earn 50000 on the average.

Table 1: Socioeconomic characteristics of the respondents.

Variables	Percent
Age	
<= 20	0.8
21-30	25.0

31-40	30.0
41-50	24.2
51-60	16.7
60+	3.3
Total	**100.0**
Gender	
Male	55.0
Female	45.0
Total	**100.0**
Marital Status	
Single	22.5
Married	66.7
Widow	10.8
Total	**100.0**
Major occupation	
Farming	73.3
Trading	19.2
Civil service	7.5
Total	**100.0**
Years spent in school	
<= 5	0.8
6-10	10.8
11-15	77.5
16-20	9.2
21-25	1.7
Total	**100.0**
Household size	
<= 1	19.2
2-3	6.7

4-5	35.0
6-7	31.7
8-9	7.5
Total	**100.0**
Annual income	
<= 50000	1.7
50001-230000	37.5
230001-410000	26.7
410001-590000	9.2
590001-770000	8.3
770001-950000	4.2
950001-1130000	5.8
1130001-1310000	3.3
1310001-1490000	0.8
1490001-1670000	0.8
1670000+	1.7
Total	**100.0**

Source: Field survey, 2018

Erosion prevention and control practices applied by farmers in the study area

Soil conservation measures such as construction of bond, grassing of water ways, multiple cropping, ridging across the slope, cover cropping, construction of water ways, minimum tillage, mulching and avoiding bush burning constitute the major soil conservation methods in the study area. Covering the soil with growing plants and construction of contour bands has proven to provide soil with erosion protection and control edge especially on sloping land (Floor, 2000; Glover, 2005). Figure 1-9 are percentage pic-

charts of erosion prevention and control practices adopted and utilized by the farmers in the study area.

Cover cropping: Cover cropping is an agricultural practice and an erosion prevention/control measures in which crops with good canopy formation are planted with other crops so that their canopy formation can shield the soil from the effect of soil erosion causing agents (Akamigbo, 1998). This was highly used by the farmers (67.5%) in the study area as a means of preventing erosion on their farmland whilst 25.8% of the farmers used it (cover cropping) as a means of controlling erosion on their farmland. Again, 6.7% of the farmers were neither utilizing cover cropping practice either for erosion control or erosion prevention.

These results agree with the findings of Chude (2005) who reported that canopy of some crops such as cowpea, groundnut, melon prevents rain drops from detaching soil particles achieving thus a cover crop erosion prevention and control advantage. Akamigbo (1998) corroborated this by stating that crops with good canopy formation are planted with other crops so that the canopy formation can protect the soil from the effect of the direct rainfall.

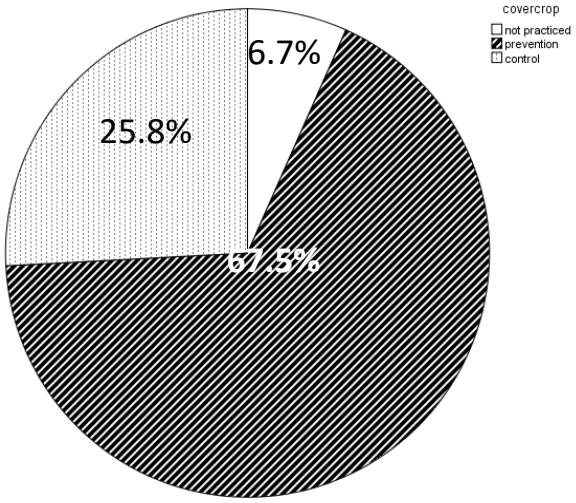

Figure 1: Cover cropping

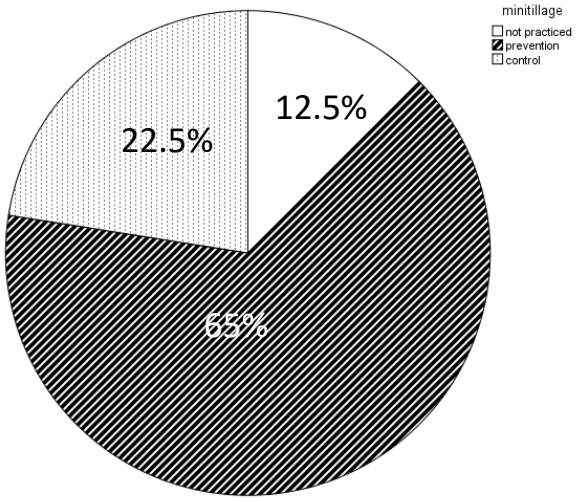

Figure 2: Minimum tillage

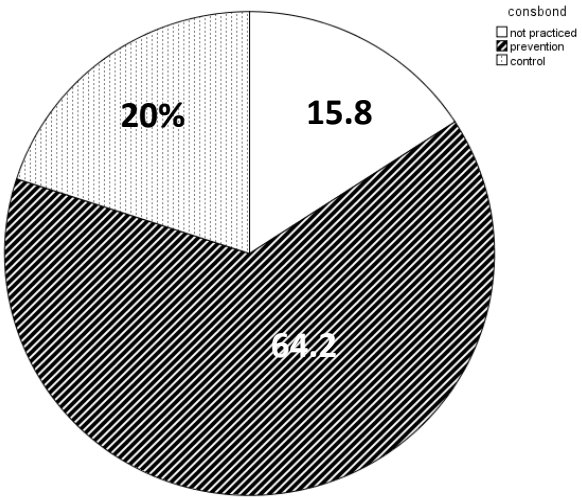

Figure 3: Construction of bond

Minimum tillage: Minimum tillage leaves at least 30% of crop residue on the soil surface, or at least small grain residue on the surface of the soil which slows water movement and, reduces the amount of soil erosion. Additionally, conservation tillage has been found to benefit predatory arthropods that can enhance pest control (Tamburini et al., 2016). As presented in figure 2, 65% of the farmers practice minimum tillage as a means of preventing erosion on their farmland while 22.5% utilize minimum tillage as a means of controlling erosion on their farmland. 12.5% of the respondents neither utilize minimum tillage for soil erosion prevention or soil erosion control. This may due in lieu as posited by Morgan (1995) and Tamburini et al. (2016) of the presence of residue mulch on the farmland orchestrated by minimum tillage which at a significant rate helps to reduce the intensity of rainfall on the farmland.

Construction of bonds: According to the respondents (farmers), construction of bonds is a veritable method of preventing erosion by making crossing bonds in between the ridges and mounds then, planting crops on the

bonds. The aim is to avoid runoff in the farm thereby, conserving the soil. This reflects the high percentages of the farmers (64.2%) who utilize it as a means of preventing erosion on their farmland. The high percentage entails that construction of bonds is very effective in erosion prevention. This agrees with the findings of Couper (1995) and Eze (2012) who reported that construction of bonds is one of the best measures in preventing gully erosion on the farmland. Further, about 24% of the farmers stated that construction of bonds is the best in erosion control as against prevention, while 15.8% neither utilize construction of bond for either prevention or control. The latter percentage of those not practicing construction of bonds could be attributed to the high financial requirement involved in the constructing the bonds (Eze, 2012).

Avoiding bush burning: Anthropogenic activities such as bush burning exposes the soil to direct effect of rainfall when the farmland is set ablaze. The burning fire inherent in bush burning destroys soil micro-nutrients that help to hold the soil against erosion (Chude, 2005). From figure 4, the greatest percentage (69.2%) of the respondents (farmers) in the study area submit that avoidance of bush burning is an effective means of protecting the soil against agents of erosion on the farmland. This was followed by 21.7% of the respondents who stated that avoidance of bush burning is better used as a means of controlling erosion on their farmland while 9.2% submitted it as neither effective in erosion prevention or control.

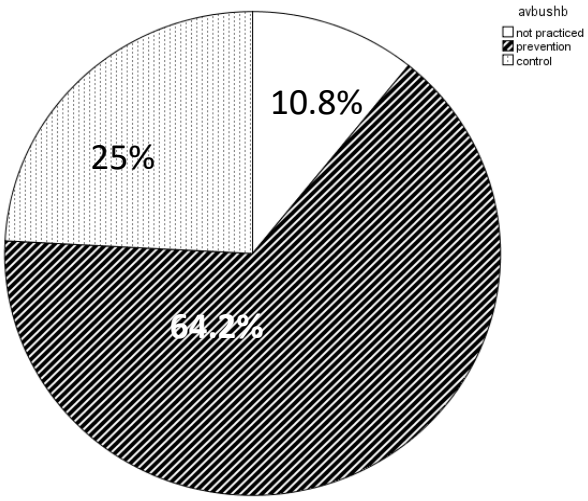

Figure 4: Avoid bush burning

Mulching: The covering of the soil with crop residues like maize stalks, palm fronds or straws helps to protect the soil surface from agents of erosion such as rainfall, runoff and wind (Odunze, 2002; Salako et al, 2006). Invariably, more than half (51.7%) of the respondents (farmers) in the study area as presented in figure 5 submit to utilizing mulching in their farmlands to protect it from erosion. Furthermore, 33.33% of the farmers use mulching as a means of controlling erosion on their farmland. This is in line with the findings of Eze (2012) on the control of farmland erosion in Enugu state Nigeria where he posited that farmers' mulch their farmland to protect it from erosion. On the other hand, 15% of the farmers neither practiced mulching for erosion prevention or control attributably probably due to the time-consuming nature of the practice.

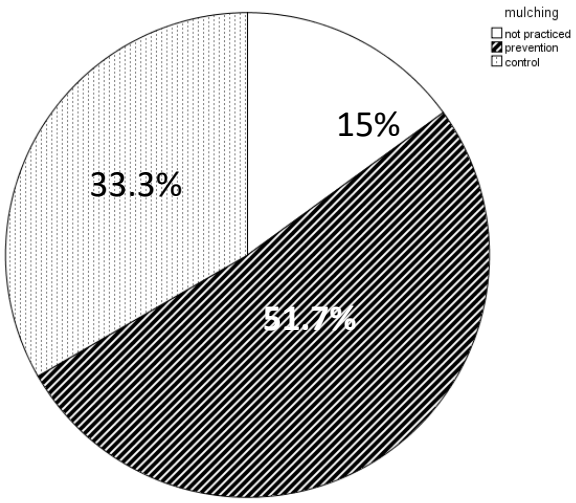

Figure 5: Mulching

Multiple cropping: Growing of two or more crops in the same piece of land in same growing season helps in soil conservation. According to Bunnet (2002), this is achieved when different kinds annual crops are planted in alternating rows. It provides better canopy cover which reduces the direct effect of rain on the soil. Results on figure 6, shows that 49.2% of the farmers uses multiple cropping as a means of preventing erosion on their farmland while 45.8% uses it to control the already existing problems of erosion on their farmland. Only 5% of the farmers are not practicing multiple cropping. The result implies that multiple cropping is widely used in the study area for erosion prevention and control. This agrees with the findings of Eze (2012) who reported that multiple cropping is widely used by farmers in Enugu state for erosion control.

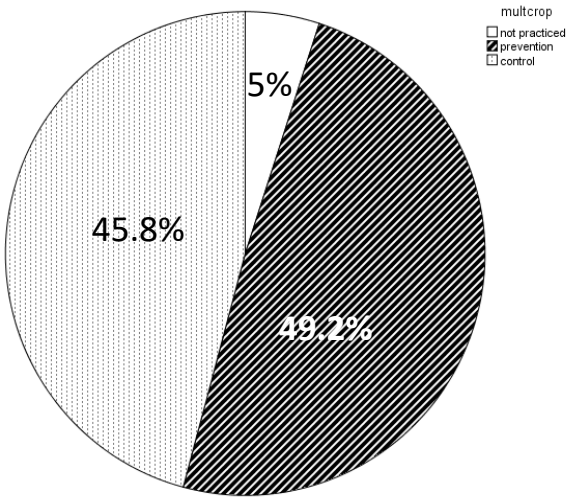

Figure 6: Multiple cropping

Construction of water ways: According to the results on figure 7, construction of water ways is greatly used by farmers in the study area for erosion prevention and control. About 48.3% of the farmers uses it to control erosion on their farmland, while 46.7% uses it as a means of preventing erosion on their farmland, 5.0% are not practicing it. The result is in line with findings of Eze and Mbah (2013) who reported that farmers in Anambra state through the help of the state Agricultural Development Program (ADP) were helped to construct diversion ditches as a means of combating the challenges of soil erosion in the study area.

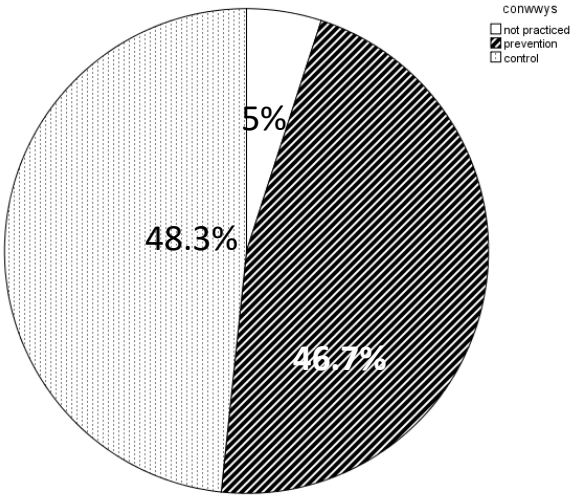

Figure 7: Construction of waterways

Ridging across the slope: From the results on figure 8, ridging across the slope is greatly used by farmers in the study area as a means of controlling erosion on their farmland. This is reflected by the high percentage of those using it for erosion control (58.33%). Similarly, 34.2% of the farmers uses construction of water ways as a means of preventing erosion on their farmland. Only about 7.5% are not using it either for prevention or control. The result agrees with the findings of Igbokwe and Okoye (2000) who reported that Nigeria farmers are knowledgeable on soil erosion control measures that is suitable to soil conservation techniques common in their area.

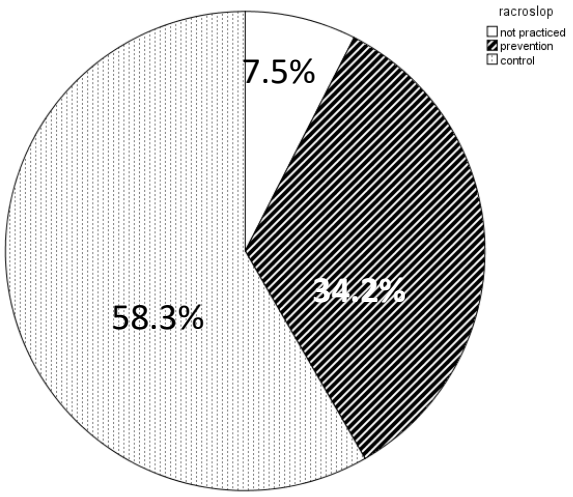

Figure 8: Ridging across the slope

Grassing of water ways: From the results on figure 9, grassing of water ways is both used as a means of preventing and controlling erosion in the study area. This is represented by 27.5% and 44.2% respectively. While a good number of the farmers 28.3% are not practicing it. This according to the farmers (those that not practicing it) is because grassing of water ways is difficult to practice and consumes a lot of time though effective if can be maintained.

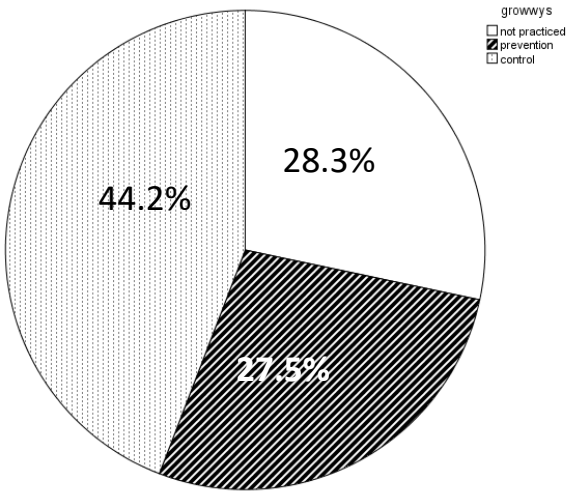

Figure 9: Grassing of waterways

Socioeconomic factors influencing use of erosion prevention and control practices

The practices for erosion prevention and control includes construction of bond, grassing of water ways, multiple cropping, ridging across the slope, cover cropping, construction of water ways, minimum tillage, mulching and avoiding bush burning. Based on the farmer's socioeconomic attributes, their likelihood of using different erosion prevention and control practices was either positive or negative.

Age of the farmers was negatively related with the use of multiple cropping, construction of bonds, grassing of waterways, avoiding bush burning, mulching, minimum tillage erosion prevention and control practices and positively related with the construction of waterways erosion prevention and control practice. The result of the marginal analysis suggests that a unit increase in age of the farmers decreases the likelihood of using multiple

cropping, construction of bonds, grassing of waterways, avoiding bush burning, mulching and minimum tillage erosion prevention and control practice at 2.1%, 6.8%, 5.8%, 1.9%, 4.4% and 2.1% respectively, while it increases the use of construction of waterways erosion prevention and control practice at 1.6%. The result suggests that as the farmers are getting older, the likelihood of them practicing multiple cropping, construction of bonds, grassing of waterways, avoiding bush burning, mulching and minimum tillage decreases, while the likelihood of using construction of waterways increases. This could be as a result of the drudgery nature of the prior-practices which makes it difficult for very old farmers to practice.

The result is in line with the findings of Amusa et al. (2015) who reported that age influences willingness to use agronomic soil conservation practices among crop farmers. The result also agrees with the findings of Eze (2012) who reported that age determines farmers' use of erosion control practices. Also, Budry et al. (2006) reported that age influences adoption of soil conservation practices. Consequently, Onyekuru et al. (2014) also reported that age affects farmer's ability to control erosion as an adaptation strategy to climate change in Nigeria forest communities.

Table 2: Logit result showing socioeconomic factors influencing use of erosion prevention and control practices

Variables	(1) **Construction of bond**	(2) **Mulching**	(3) **Grassing of waterways**	(4) **Multiple cropping**	(5) **Ridging across the slope**
Age	-3.036**	-1.880*	-2.394**	-3.504***	-0.227
	(1.193)	(1.100)	(1.121)	(1.189)	(1.109)
Gender	0.0262	-0.0354	-0.0221	-0.0183	0.0473
	(0.0383)	(0.0362)	(0.0361)	(0.0378)	(0.0371)
Marital status	-0.0506	0.0202	-0.0466	-0.0105	-0.107
	(0.0545)	(0.0498)	(0.0498)	(0.0531)	(0.0524)
Years in school	1.596*	-0.765	0.631	-0.268	0.607
	(0.821)	(0.765)	(0.775)	(0.783)	(0.763)
Major occupation	-0.0358	-0.0111	0.0742*	0.00910	-0.0856**

	(0.0436)	(0.0410)	(0.0416)	(0.0423)	(0.0414)
Household size	0.943	0.460	0.422	1.062*	-0.145
	(0.583)	(0.506)	(0.519)	(0.556)	(0.534)
Annual income	-0.0196	0.460*	0.494*	0.314	0.275
	(0.274)	(0.265)	(0.267)	(0.275)	(0.270)
Constant	6.502	2.672	0.536	8.602*	-4.276
	(4.628)	(4.335)	(4.346)	(4.567)	(4.599)
Chi^2	12.56	7.49	11.73	10.37	17.49
$Prob>Chi^2$	0.0835	0.3793	0.1097	0.1683	0.0145
Pseudo R^2	0.0802	0.0464	0.0712	0.0663	0.1053
Observations	**120**	**120**	**120**	**120**	**120**

Standard errors in parentheses
***** p<0.01, ** p<0.05, * p<0.1**

Table 3: Marginal analysis after logit

Variables	(1) **Construction of bond**	(2) **Mulching**	(3) **Grassing of waterways**	(4) **Multiple cropping**	(5) **Ridging across the slope**
Age	(-3.036)**	(-1.880)*	(-2.394)**	(-3.504)***	(-0.227)
	-0.0683	-0.04485	-0.05895	-0.07929	-0.05656
Gender	(0.0262)	(-0.0354)	(-0.0221)	(-0.04137)	(0.0473)
	0.00590	-0.008447	-0.00544	-0.00413	0.01177
Marital status	(-0.0506)	(0.0202)	(-0.0466)	(-0.0105)	(-0.107)
	-0.01139	0.00480	-0.01148	0.00236	-0.02666
Years in school	(1.596)*	(-0.765)	(0.631)	(-0.268)	(0.607)
	0.03591	-0.18237	0.15528	-0.06059	0.15128
Major occupation	(-0.0358)	(-0.0111)	(0.0742)*	(0.00910)	(-0.0856)**
	-0.008064	-0.00265	0.01825	0.00206	-0.02131
Household size	(0.943)	(0.460)	(0.422)	(1.062)*	(-0.145)
	0.212313	0.10978	0.10394	0.02401	-0.03612
Annual income	(-0.0196)	(0.460)*	(0.494)*	(0.314)	(0.275)
	-0.004411	0.01097	0.01216	0.07111	0.06840
Observations	**120**	**120**	**120**	**120**	**120**

Standard errors in parentheses

***** p<0.01, ** p<0.05, * p<0.1**

Table 4: Logit result showing socioeconomic factors influencing use of erosion prevention and control practices

	(6)	(7)	(8)	(9)
Variables	**Construction of Waterways**	**Minimum tillage**	**Cover Cropping**	**Avoid Bush burning**
Age	0.815*	-0.938*	0.630	-0.278**
	(0.455)	(0.486)	(0.479)	(0.122)
Gender	0.0166	0.00392	-0.0674	0.0728
	(0.0411)	(0.0380)	(0.0417)	(0.0444)
Marital status	-1.053	1.652	-1.071	1.516
	(1.175)	(1.131)	(1.202)	(1.269)
Years in school	0.977**	0.734*	-0.375	0.119
	(0.486)	(0.442)	(0.446)	(0.482)
Major occupation	-1.280**	0.855	-1.507**	1.424*
	(0.614)	(0.607)	(0.733)	(0.775)
Household size	0.826	-0.551	-0.232	-0.336
	(0.553)	(0.501)	(0.526)	(0.558)
Annual income	0.233	-0.150	0.537**	-0.705***
	(0.218)	(0.199)	(0.219)	(0.233)
Constant	-1.978**	2.839***	-1.441	3.434***
	(0.955)	(0.997)	(0.931)	(1.029)
Chi^2	16.56	11.10	97.30	18.69
$Prob>Chi^2$	0.0205	0.1344	0.0000	0.0092
Pseudo R^2	0.1129	0.0714	0.6262	0.1363
Observations	**120**	**120**	**120**	**120**

Standard errors in parentheses
***** p<0.01, ** p<0.05, * p<0.1**

Table 5: Marginal analysis after logit continues

	(6)	(7)	(8)	(9)
Variables	**Construction of waterways**	**Minimum tillage**	**Cover Cropping**	**Avoid bush burning**
Age	(0.815)*	(-0.938)*	(0.630)	(-0.278)**
	0.01610	-0.02082	0.13215	-0.01992
Gender	(0.0166)	(0.00392)	(-0.0674)	(0.0728)

	0.00327	0.00087	-0.01415	0.01267
Marital status	(-1.053)	(1.652)	(-1.071)	(1.516)
	-0.20809	0.36695	-0224470.	0.24645
Years in school	(0.977)**	(0.734)*	(-0.375)	(0.119)
	0.01929	-0.01630	-0.07880	0.02208
Major occupation	(-1.280)**	(0.855)	(-1.507)**	(1.424)*
	-0.02529	0.19007	-0.03163	0.02216
Household size	(0.826)	(-0.551)	(-0.232)	(-0.336)
	0.16310	-0.01225	-0.04878	-0.03838
Annual income	(0.233)	(-0.150)	(0.537)**	(-0.705)***
	0.04594	-0.033361	0.01126	-0.01237
Observations	**120**	**120**	**120**	**120**

Standard errors in parentheses
***** p<0.01, ** p<0.05, * p<0.1**

Years in school of the farmers was significant and positively related with the farmers use of construction of bonds at 10% probability level, construction of waterways at 5% probability level and minimum tillage at 1% probability level. The result suggests that more educated farmers use construction of bonds, construction of waterways and minimum tillage more than their uneducated counterparts. The result of the marginal analysis on farmer's education suggest that a unit increase in the years of education of the farmers increases the likelihood of using construction of bonds, construction of waterways and minimum tillage at 3.5%, 1.9% and 1.6% respectively.

The result agrees with the findings of Budry et al. (2006) who reported that educated farmers are aware of various available soil conservation practices. Also, Amusa et al. (2015) reported that educated farmers are more willing to pay for soil conservation practices unlike their uneducated counterparts. Onyekuru et al. (2014) further reported that more educated farmers use agroforestry and erosion control as adaptation strategy to climate change in Nigeria forest communities.

Major occupation of the farmers was significant and positively related to the farmers use of grassing of waterways, avoiding bush burning at 10% probability level each and negatively related to the use of ridging across the slope, construction of waterways and cover cropping at 5% probability level each. The result of the marginal analysis also shows that a unit increase in years of farming as major occupation increases the likelihood of the use of grassing of waterways and avoiding bush burning by 1.8% and 2.2% respectively, also decreases the use of ridging across the slope, construction of waterways and cover cropping by 2.1%, 2.5% and 3.1% respectively.

The result is in line with Amusa et al. (2015) who reported that experienced farmers are more likely to adopt practices that will conserve their farmland from degradation. Also Doss (2006) and Delville (2009) reported that more experienced farmers are more likely to identify land degradation and are more likely to face the problem once recognized.

Household size of the farmers was significant and positively related to the farmers' use of multiple cropping at 10% level of probability. The result suggests that increase in the household size would result to increase in the use of multiple cropping. This could be attributed to the fact that multiple cropping requires a lot of labour to maintain which makes it easier for larger household to practice. The result of the marginal analysis shows that a unit increase in the household size would lead to a resultant 2.4% increase in the use of multiple cropping. This agrees with the result of Amusa et al. (2015).

Annual income of the farmers was significant and positively related to the farmers use of mulching, grassing of waterways, cover cropping and negatively related with avoidance of bush burning at 10%, 10%, 5% and 1% probability levels respectively. The result suggests that increase in the farmer's income increases the likelihood of mulching their farmland as a means of soil conservation, grassing of waterways, practicing of cover cropping and also decreases avoidance of bush burning.

The result of the marginal analysis shows that a unit increase in the farmer's income would lead to increase in the use of mulching, grassing of

waterways and cover cropping by 1.0%, 1.2%, 1.1% and decrease the avoidance of bush burning by 1.2%. This implies that as income of the farmers' increases, the probability of using mulching on their farmland, grassing of waterways and cover cropping as a means of erosion prevention and control increases and decreases avoidance of bush burning.

The result agrees with the findings of Budry et al. (2006) who reported that increase in the farmers' income consequently leads to increase in the willingness to adopt soil conservation practices. Also, Onyekuru and Uzuegbu (2011) reported that there is a significant difference between the income of farmer's where there is prevalence of land degradation and where soil conservation practices are fully employed. Eze (2012) also reported that income influences farmers use of erosion control practices.

Constraints to the use of erosion prevention and control practices

The result on table 4.6.1 shows that lack of assistance from government, lack of capital, poor access to prevention and control information and lack of access to credit/inputs ranked very serious constraints to the use of erosion prevention and control practices in the study area. This was reflected by the high mean score (x) values of 3.69, 3.55, 3.33 and 3.03 respectively. Other factors such as varying topography of the farming environment, lack of cooperation from community members and land management problems also ranked serious as constraints to the use of erosion prevention and control practices. While other factors according to the farmers were not serious constraints.

Thus, the result agrees with the findings of Eze and Mba (2013) who reported that poor government land policy, lack of information on soil erosion control, land management problems and varying topography of the farming environment made it difficult to fully employ available erosion prevention and control measures. This also agrees with Eze (2012) who identified that erosion control measures require capital. Also, Onyekuru and Uzuegbu (2011), further reported that erosion affects the income of farmers

who lacks the necessary information on erosion prevention and control measures. Omar (2011) also reported that multiple cropping is capital intensive because smooth running of farming activities such as a labor requires a lot of capital.

Table 6: Constraints to the use of erosion prevention and control practices

Variables	Mean (x)	Rank	Remark
No assistance from the government	3.69	1st	very serious
Poor access to prevention and control information	3.33	3rd	very serious
Lack of capital	3.55	2nd	very serious
Lack of access to credit/input	3.03	4th	very serious
Land management problems	2.67	7th	serious
Varying topography of farming environment	2.90	5th	serious
Lack of cooperation from community members	2.74	6th	serious
Others	1.00	8th	not serious

Source: ***Field survey, 2018***

Conclusion and recommendation

This study assessed farmer's perception about the possible erosion prevention and control practices for erosion prevention and control. It determined the socioeconomic factors influencing farmers' use of the practices for erosion prevention and control and identified the constraints to the use of erosion prevention and control practices in the study area. Soil degrading processes – chemical deterioration, nutrient depletion, physical degradation, compaction and biological deterioration of natural resources, reduction of soil biodiversity; actively exposes the over three quarters of the world's man-made developments which are on soil. Yet, soil existence is the basis for the performance of most disciplines of the world. Thus, threat to soil is threat to; most of earth's natural resources directly linked to or found in the soil and particularly threat to; soil life. Thus, the study recommends that;

government should establish erosion prevention and control agency, extension programs and funds to assist farmers on erosion prevention and control. There should be cooperation involving policy makers, land owners and tenants that will lead to better land use.

References

Abegunde, A. A., Adeyinka, S. A., Olawuni, P. O., and Oluodo, O. A. (2006). An Assessment of the Socio-Economic Impacts of Soil Erosion in South-Eastern Nigeria. *TS 56 - Special Valuation Situations, Shaping the Change XXIII FIG Congress, Munich, Germany, October 8-13*

Akamigbo, F.O.R. (1998). Method of Water Erosion control on farm land for sustainable Agriculture. *An invited paper presented during the four-day Training Workshop on Soil Conservation and Sustainable Land use in the sub-Humid Agro-Ecology of Nigeria Organized by the department of Soil science, University of Agriculture Makurdi, Benue state, Held June, 23 – 26.*

Aklilu, A., and Jande, G. (2004). *Farmers' views of soil erosion problems and their conservation knowledge at Beressa watershed, central highlands of Ethiopia*. Ethiopia: Hjmng Pub

Amusa, T.A., Enete, A.A., and Okon, U.E. (2015). Willingness-to-Pay for Agronomic Soil Conservation Practices among Crop-based Farmers in Ekiti State, Nigeria. *Trends in Agricultural Economics*, 8, 1-12.

Ananda, J., and Herath, G. (2003). Soil Erosion in Developing Countries: A Social Economic Appraisal. *PubMed Ang*., 68(*4*), 343-53

Bathrellos, G. D., Skilodimou, H. D., & Chousianitis, K.G. (2010). Soil erosion assessment in southern Evia Island using USLE and GIS. *Proceedings of the 12th International Congress Patras, May, 2-5*.

Budry, B., Curtis, M. J., and Dennis, A. S. (2006). *The Adoption and Management of Soil Conservation Practices in Haiti: The Case of Rock Walls*. Haiti: Cdg Pub

Bunnett, R. B. (2002). *Interactive Geography*. USA: SNP Pan Pacific Publishing

Chude, V.O. (2005). *Soil and Water Conservation: Handbook for Extension workers*. Rome: Federal Department of Agricultural Land Resources in Collaboration with National Special Programme for food Security-F.A.O Publication.

Claassen, R. (2004). *Have conservation Compliance Incentives Reduced Soil Erosion? Amber Waves: The Economic of Food, Farming, Natural Resources and Rural America*. Accessed from: http://evs.usda.gov

Couper, D.C. (1995). *Use of graded contour banks for soil conservation*. Ibadan: International Institute of Tropical Agriculture.

Delville, P.L. (2009). Conceptions des droits fonciers, récits de politiques publiqueset controverses. Les Plans fonciersruraux en Afrique de l'Ouest. *In Les Politiques d'Enregistrement des Droits Fonciers. Du Cadre Légal Aux Pratiques Locales; Karthala: Paris, France*

Doss, C. R. (2006). Analyzing technology adoption using microstudies: limitations, challenges, and opportunities for improvement. *Agricultural Economics*, 1(*1*), 207-219. https://doi.org/10.1111/j.1574-0864.2006.00119.x

Eze S.O (2012) Economic Study of farmland erosion control practices in Enugu State, Nigeria. *An M.Sc thesis submitted to the department of Agricultural economics, University of Nigeria, Nsukka*.

Eze, S.O., & Mbah, E.N. (2013). *Challenges to Soil Erosion Control Measures among Farmers in Anambra State, Nigeria: Implications for Extension Policy*. Accessed from: https://www.semanticscholar.org/

FAO (1999). *Land, food and people*. Rome: World Commission on Environment and Development -FAO

Federal Government of Nigeria (2007). *2007 Budget*. Abuja, Nigeria: Budget Office of the Federation, Federal Government of Nigeria.

Floor, J.A. (2000). *Soil erosion and Conservation, Part I*. Accessed from: http://www.seafriends.org

Glover, E. K. (2005). Tropical dry land rehabilitation. Case study on participatory forestry management in Gedaref, Sudan. *Thesis for Award of PhD Degree at University of Helsinki. Finland*.

Hanyona, S. (2001, January 10). *Soil Erosion Threatens Farmland of Saharan Africa*. The Earth Times

Igbokwe, E. M., and Okoye, T. K. (2000). Knowledge and perception of soil and water conservation methods among practicing and potential Extension Agents; A preliminary survey; Agricultural extension and poverty Alleviation in Nigeria. *Proceedings of the Sixth Annual National Conference of the Agricultural Extension Society of Nigeria*.

Igbokwe, E.M. (1996). A soil and water conservation system under threat. A visit to Maku, Nigeria. In: E. M. Igbokwe (ed.), *Sustaining the Soil-Indigenous soil and water conservation in Africa*. Nigeria: Ped Pub

Ighodaro, I. D., Lategan, F. S., & Mupindu, W. (2016). The Impact of Soil Erosion as a Food Security and Rural Livelihoods Risk in South Africa. *Journal of Agricultural Science*, 8(8), 1-12

Ighodaro, I. D., Lategan, F. S., & Yusuf, S. F. G. (2013). The Impact of Soil Erosion on Agricultural Potential and Performance of Sheshegu Community Farmers in the Eastern Cape of South Africa. *Journal of Agricultural Science*, 5(*5*), 140-149

Kumar, R., & Ramachandra, T. V. (2003). *Water soil and sediment investigation to explore status of aquatic ecosystem*. Bangalore: Centre for Ecological Sciences, India Institute of Science.

Lal, R. (2001). Soil Degradation by Erosion. *Land Degradation and Development*, 12(*1*), 519-539.

Le Roux, J. J., Newby, T. S., & Sumner, P. D. (2007). Monitoring soil erosion in South Africa at a regional scale: review and recommendations. *South African Journal of Science*, 1(*1*), 03-24.

Morgan, R.P.C. (1995). *Soil Erosion and Soil Conservation*. Malaysia: Longman

National Population Commission (2006). *National Population Census (Anambra State)*. Abuja: NPC

Nnenwa, M. W. (2018). Analysis of soil conservation practices for erosion prevention and control among crop farmers in Anambra state, Nigeria. *Thesis, Department of Agricultural Economics, University of Nigeria, Nsukka*

Odunze, A.C. (2002). Mulching practice in a semi-arid zone of Nigeria for soil erosion control and grain yield of maize. *Journal of Sustainable Agriculture*, 20(*1*), 31-39.

Ofomata, G.E.K. (1984). Erosion in the forest zone of Nigeria. *A Paper Presented at the 27th Annual Conference of Geographical Association of Nigeria, University of Nigeria, Nssuka*

Okin, G. S. (2002). Toward a Unified View of Biophysical Land Degradation Processes in Arid and Semi-Arid Lands. In G. S., Okin (ed.), *Global Desertification: Do Humans Cause Deserts?* USA: Yhnam Pub

Okoye C.U. (2001). Modifications of the Application of Soil Erosion Control Technologies in Subsistence Agriculture. *Journal of Tropical Agriculture, food, Environment and Extension*, 2(*2*), 62 -63.

Omar, H. D. (2011). *Multiple Cropping*. Accessed from: www.newsandsociety.com

Onyekuru, A. N., Rob, M., and Murray, R. (2014). *Determinants of adaptation strategies to climate change in Nigerian forest communities*. York, UK: York Institute for Tropical Ecosystems.

Onyekuru, N.A., and Uzuegbu, G. (2011). Analysis of the Effects of Erosion in the Profitability of Cassava Production in Osumenyi, Nnewi South Local Government Area of Anambra State Nigeria. *Asian J. Exp. Biol. Sci*., 2(*3*), 2-7

Oranye, R. (2013). *Anambra and Environmental Problems Report on the Erosion Problems in Anambra State*. Accessed from: www.nationallight.com

Salako, F.K., Kirchhof, G. and Tian, G. (2006). Management of a previously eroded tropical Alfisol with herbaceous legumes: Soil loss and physical properties under mound tillage. *Soil and Tillage Research*, 89, 182-195.

Scherr, S., and Yadav, S. (1996). *Land Degradation in the Developing World: Implications for Food, Agriculture, and the Environment to 2020*. Washington, D.C, USA: International Food Policy Research Institute.

Tamburini, S., Shen, N., Wu, H.C., Clemente, J.C. (2016). The microbiome in early life: implications for health outcomes. *Nat Med*., 22(*7*), 713-22.

Utazi, C.D. (2002) An Economic Study of Farmland Erosion Control Practices in Imo State. *An MSc. dissertation submited to the Department of Agricultural Economics, UNN*.