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ASSESSMENT OF SOIL EROSION AND SOIL CONSERVATION PRACTICES ON FARMLAND IN AKOKO REGION OF ONDO STATE

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ABSTRACT

The study was conducted to assess soil erosion and soil conservation practices by farmers in Akoko Region. The study was based on the data obtained from 200 sample households. The data were analyzed using simple descriptive statistics. The finding of the study shows that almost all farmers of the study area had good knowledge about the causes, indicators and consequences of soil erosion. The main causes of soil erosion were climate change, wind, heavy rain, deforestation, nature of the soil and slope/gradient of the land. The major soil conservation methods implemented by the farmers were traditional ditches, soil bunds, contour plowing and crop rotation. This research finding also concludes that the main constraints to apply soil conservation in Akoko Region were mainly socio-economic and biophysical factors.

Keywords: Soil Erosion, Soil conservation, conservation measure.

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INTRODUCTION

Agriculture is a back bone of the economy of Akoko Region and a way of life for which agricultural land is an indispensable resource on which the welfare of the society is built on. The livelihood of the vast majority of the population depends directly or indirectly on this sector.

Soil erosion is a common phenomenon in Akoko Region, where it causes widespread soil degradation. The pressure on arable land in the area is growing and this forces people of the region to convert more marginal, available forest and grazing lands to arable lands. Hence, forest resources are very few and continuously decreasing both in quantity and quality. Soil erosion triggered and become a principal obstacle for sustained and integrated socio-economic development of the nation. According to Ojo and Johnson (2010) soil erosion is a dynamic geomorphic event operating on the landscape. Further, Jones (2007) defined soil erosion as "the wearing away of the land surface by physical forces such as rainfall, runoff water, wind, ice, temperature change, gravity or other natural or anthropogenic agents that abrade, detach and remove soil or geological material from one point on the earth's surface to be deposited elsewhere". About 40-75% of the world's agricultural land's productivity is reduced due to soil erosion (Baylis et al., 2012; UNCCD, 2013). Soil erosion has negative consequences on agriculture (Olsson et al., 2005).

Such unsustainable and exploitative land use practices due to an increasing demand for food, fiber and fodder by growing human and livestock populations are responsible for accelerated soil erosion in many parts of Akoko Region. The use of soil conservation practices may be conceptualized as a decision-making model with four components. First, physical characteristics of the land (include degree of slope, slope length, and soil erodibility) that define the potential for soil erosion.

Second are the personal attributes of the farmer which may translate into a disposition to recognize and control erosion. Important attributes may include age, education, profitability orientation, risk aversion, etc. The third component can be described as the economic profile of the farm enterprise. This profile may serve to facilitate action stemming from one's disposition to control erosion or may produce constraints to actual implementation. Finally, the decision to adopt may be influence by public institutions which may intervene to alter a farmer's disposition toward soil erosion control and/or to offset economic or technical management constraints to practice use (Christine, 2012).

A review of the relevant literature points to the fact that a number of empirical studies have been undertaken on assessment of soil erosion and soil conservation on farmlands, the existing soil conservation practices adopted by farmers on their farmland and the socio-economic and bio-physical factors influencing farmers' implementation of different soil conservation practiced. However, nearly all of them have been addressing issues of adoption in relation to improved production technologies. Available evidence shows that studies on the determinants of adoption of soil conservation measures are few and far between. Therefore, this study was conducted in view of bridging this gap. The objectives of this study were to assess soil erosion and the causes that trigger soil erosion problems, identify the existing soil conservation practices adopted by the farmers on their farm and examine the socio-economic and bio-physical factors related constraints influencing farmers' decision to implement different soil conservation practices.

MATERIALS AND METHODS

Description of the Study Area

Akoko Region is located North-East of Ondo State and South-West of Nigeria. The region lies within Latitude $7^0$28'N and longitude $5^0$44'E. The region covers an areal extent of about 2465.6km2. The area is situated at an altitude between 270m and 2750m above sea level. Most parts of the region have undulating terrain, which in many cases are almost completely encircled by high rugged rock outcrops, rising to a height of over 2750m in some places.

Geologically, the area is a physiograhic region characterized by two major

crystalline basement rocks of the main African Precambrian shield. These are magmatite and granite gnesis, with quartz and pegmatite veins. These rocks belong to the migmatitegnesis sub-classification of the basement complex of Nigeria. AkokoRegion is located within the humid tropical climate of the forest region, which experiences two climatic seasons namely the rainy season (April-October) and the dry season (November-March).

Sampling Techniques

In order to obtain data on the assessment of soil erosion and soil conservation practice and related problems, the sampling procedure was random sampling technique. Akoko region is made up of four Local Government Areas: Akoko North-East, Akoko North-West, Akoko South-East and Akoko South-West. Five communities were selected from each local government areas. In order to generate the required sample units, the determination of sampling method is essential in order to determine and calculate sample sizes. The sample size needed for level of credibility was a total of 200 copies of questionnaire. In each local government area, 50 copies of questionnaire was administered.

Data Analysis

On the basis of the data collected through both primary and secondary sources, the researcher analyzed and interpreted in accordance with the nature of the data and response of respondents. In analyzing the raw data acquired from each respondents, the researcher, adopted both qualitative and quantitative methods of descriptive statistical techniques provided by the Statistical Package for Social Sciences (SPSS) version 16.0. this software was used for analysis and interpretation of data collected. The findings of the study were presented in tables, figures and charts.

RESULTS AND DISCUSSION

RESPONDENT CHARACTERISTICS

Household characteristics of farmers examined in the study area were age, education level, household head gender, occupation and household size. The aim of choosing these parameters was to obtain the general overview of the characteristics of respondents, how they perceive soil erosion and how could these influence the adoption of soil conservation measures and their sustainability.

Age of Respondents

The study found age distribution of farmers varying from below 20 to above 50 years. Majority of the farmers (39%) were in the age group of 31-40 while 21% were in the age group of 41-50 years. 20% were in the age group of 20 to 30 years, 14% were those with age group below 20 years where 6% were above 50 years Table 1). this implies that most of the farmers were in the economically productive age group and therefore, there is large labour force in the study area. According to

Mandara (1998) household members are considered economically productive from the age of 20 to 50 years. The age group below 20 years are children who are attending schools and others are too young to participate in farming activities. The age group above 50 years is considered less economically active because the members are not energetic enough to participate in labour intensive production activities.

Table 1: Age of the Respondents

Age	Frequency	Percentage
Below 20 years	28	14
20-30 years	40	20
31-40 years	78	39
41-50 years	42	21
Above 50 years	12	6
Total	200	100

Source: Field Survey, 2017

Education Level of Respondents

The education levels of the respondents are as shown in Table 2 below. Majority (40%) had primary education, 20% no education, 26% secondary education and 14% tertiary education. However, generally except for the few 20% who had no formal education, most of the respondents were educated. the introduction of various soil conservation measures in the study area are likely to be adopted because majority could not only be trained by soil conservation experts but also, are able to read from books, leaflets, brochures and other sources of information.

Table 2: Education Levels of Respondents

Education Level	Frequency	Percentage
No formal education	40	20
Primary education	80	40
Secondary	52	26
Tertiary	28	14
Total	200	100

Source: Field Survey, 2017

Household Gender of Respondents

Table 3 shows gender of the household in the study area. Out of 200 household, the highest (62%) were male while 38% were female. Female had smaller percent presentation regardless of the fact that, they are key players in most of the household's farm activities. Probably the reason behind is that, the study aimed at the heads of the household as responsible main decision makers about household affairs. Therefore, except for the few household which were headed by female which were either widow, divorced and separated, the majority were male. Sometimes, females had to respond on behalf of their husbands if absent, combining some household which were headed by male and others by female, all the interviewed farmers were heads of household. This implies that most useful information regarding the topic in question was obtained because the heads of the household provided it.

Table 3 Household Gender of Respondents

Gender	Frequency	Percentage
Male	124	62
Female	76	38
Total	200	100

Source: Field Survey, 2017

Household Size

According to the study result (Table 4), the average number of household members for the study was 5-9 which 60% was. A large number of members in the household mean more people to feed and share the household budget (Mhinte, 2000). Furthermore, family size is also important factor in determining the extent to which labour is available in any economic activity and it reflects household's ability to access enough food, health services and other basic needs.

Table 4 Household Size

Household Size	Frequency	Percentage
0-4	32	16
5-9	120	60
10-13	36	18
14 and above	12	6
Total	200	100

Source: Field Survey, 2017

Occupation

Table 5 shows the major occupation of the respondent. 48% were involved in farming only while 20% were involved in trading; 11% were civil servant, 8% artisan, 10% student and 3% involved in other jobs.

Table 5 Occupation

Occupation	Frequency	Percentage
Farming	96	48
Trading	40	20

Civil Servant	22	11
Artisan	16	8
Students	20	10
Others	6	3
Total	200	100

Source: Field Survey, 2017

INDICATORS, CAUSES, EXTENTS AND CONSEQUENCES OF SOIL EROSION

As recognized from group discussions, farmers acquaint with soil erosion from observations of their surroundings and accumulated experiences. Environment lends them with traditional knowledge that could be experienced through the passage of time and shared with each other that could either strength or weakness of farmer's practices.

Farmers in the study area mentioned that indicators for existence of severe soil erosion varies. Those farmers who choose the severity level as high understood and related the existence of soil erosion on their plots to development of gullies in their farms as well as the truncated topsoil. 33.5% and 27% of the farmers suggested that, respectively, gully development and absence of fertile topsoil to be a major indicators of the existence of moderate to severe soil erosion problem on their cultivated fields. About 25.5% of farmers verify that poor crop and grass growth as indicators for soil erosion. Others describe the existence of severe soil erosion problem by observing the stoniness of soil (14%) (Table 6)

Table 6 Indicators of Soil Erosion

Indicators	Frequency	Percentage
Gully development	67	33.5
Absence of fertile topsoil	54	27
Poor crop and grass growth	51	25.5
Stoniness of soil	28	14
Total	200	100

Source: Field Survey, 2017

Farmers described existence of soil erosion on their farm as severe, moderate, minor and no erosion risk (Table 7)

Table 7 Farmers' Expression of Soil Erosion by Degree of Severity

Soil Erosion Severity Level	Frequency	Percentage
Severe	63	31.5
Moderate	54	27
Minor	50	25
No Erosion Risk	33	16.5
Total	200	100

Source: Field Survey, 2017

Table 7 above shows that 31.5% of the farmers indicated that erosion on their farm is severe while 27% indicated that erosion on their farm moderate. 25% indicated that erosion on their farm is minor while 16.5% indicated that there is no erosion problem on their farms.

Identification of the causes of soil erosion is important for knowing the main factors contributing to the loss of the resource in return influencing the sustainability of the life and helps to take appropriate measurement to halt it.

Table 8 indicates the main causes of soil erosion in the study area. 34% of the farmers considered the high intensity of rainfall (erosivity) as one of the causes of soil erosion in their land while 16% indicated that nature of the soil is the cause of soil erosion in their lands. Deforestation and slope/gradient of the land were also mentioned as causes of soil erosion by 14% and 14.5% of the farmers of the study area. 11% indicated that climate change was the cause of soil erosion in their farms while 10.5% indicated that wind was the cause of erosion in their farms. Pimental (2006), suggested that soil erosion results from actions that expose the soil to rainfall or wind. As observed from the table, deforestation has created favourable condition for heavy rain fall to do its activity of removing soil particles from one locality to another.

Table 8: Causes of Soil Erosion

Causes of erosion	Frequency	Percentage
Climate Change	22	11
Wind	21	10.5
Heavy Rain	68	34
Deforestation	28	14
Nature of the soil	32	16
Slope/gradient of the land	29	14.5
Total	200	100

Source: Field Survey, 2017

Consequences of Soil Erosion

Table 9 below shows the response from farmers on the consequences of soil erosion. Loss of crop production was indicated by 49% of the respondents whereas 9.3% and 1.3% indicated that the gully formation and land dissection are also consequences of soil erosion. 39.7% and 0.7% responded that soil erosion led to loss of soil fertility and damage infrastructure. The overall impact of soil erosion means a loss of crop production with reduced income will directly affects the livelihoods of the rural population.

The level of crop loss in an area is a reflection of food security or insecurity especially for rural areas. Nutrient deficient soils which is one main impact of soil erosion, produce 15 to 30% lower crop yields than an un-eroded soil (Pimentel, 2006). According to the findings of this study indicated on Table 9, majority of the population of farmers confirmed that they lose well above 21% of crops every year due to erosion. This is a high reflection of food insecurity in the study area because the level of crop loses is positively related to food security of an area. In support of this, Odendo, et al. (2010) emphasize that soil fertility degradation on farmers is reported as the primary biophysical root cause of food insecurity and poverty in Akoko Region where most people living in the area obtain their livelihoods from farming.

Table 9: Consequences of Soil Erosion

Consequences of soil erosion	Frequency	Percentage
Loss of crop production	98	49
Land dissection	2.6	1.3
Gully formation	18.6	9.3
Loss of soil fertility	79.4	39.7

Damage of infrastructure	1.4	0.7
Total	200	100

Source: Field Survey, 2017.

MAJOR SOIL CONSERVATION PRACTICE IMPLEMENTED BY FARMERS IN THE STUDY AREA

Almost all of the farmers reported that soil conservation measures were very helpful for erosion control and better crop production. In the study area, different types of traditional conservation measures are old age practices developed through gradual but dynamic processes across generations. Traditional ditches were indigenous practices widely used by 52% of the surveyed farmers for erosion control (Table10). These are micro-channels constructed on cultivated fields to drive out excess water from cultivated fields. The dimension and orientation of ditches are different from normal plow furrow and their construction is performed in every cropping season.

Most farmlands have traditional ditches and farmers believed that these ditches are used to conserve soils, seeds and fertilizers by decreasing the dimensions of rills until the cover became string enough to resist such erosion features. These ditches had advantages to decrease the lengths of rills and widths and depths or rills by decreasing the concentration of runoff. Farmers reported that the ditches were effective especially for one cropping season to conserve soil and chemical fertilizer from high runoff. They also emphasized that ditches demand less labor and low cost andshort time to construct compared to other newly introduced conservation measures. However, they underlined that for sustainability of the land, ditches have little importance compared to other conservation structures.

This shows that though farmers have awareness for conservation structures to sustain land productivity, they are still using conservation measures which are important for short span of time. This suggests that efforts of educating and training farmers towards the newly introduced soil conservation technologies are very important.

Soil bunds were reported as the other means of conserve soil practiced by 23% of the surveyed farmers. Soil bund is an embarkment or ridge built across a slope along the contour. However, from field observation soil bunds were rarely constructed and poorly maintained. Farmers indicated the inappropriateness of the soil bunds on steep slopes where runoff is high. Contour plowing was widely used un the study area by 16% of the respondents. As soil conservation measure, it is an efficient technique for reducing runoff mainly in moderately and gently sloping areas. On steep slopes, as farmers noted, contour plowing only may not be effective, it needs other techniques like bunds to do with effectively control erosion. Crop rotation (9%) was reported as one of the important mechanism to reduce soil erosion impacts. Crop rotation is used by the farmers for different reasons including soil moisture and soil fertility, thus improved crop yield.

Table 10: Farmers' Conservation Practices in Akoko Region

Conservation practice	Frequency	Percentage
Traditional Ditches	104	52
Soil bunds	46	23
Contour plowing	32	16
Crop rotation	18	9
Total	200	100

Source: Field Survey, 2017

FACTORS THAT AFFECT FARMERS TO APPLY SOIL CONSERVATION METHODS IN THE STUDY AREA

SOCIO-ECONOMIC FACTORS

Based on the research finding, the socio-economic constraints affecting farmers to apply soil conservation in the study area were human labor force, lack of economy to sustain their life and farm size of farmers land. According to research findings these factors affect farmers both positively and negatively to apply soil conservation practices. The size of family members can be seen from different angles: in the first place, if the household size is larger with many mouths toeat rather than to work, will have negative effect on practices of soil conservation measures in general. But when the majority of family members are capable of working, structural soil conservation measures tend to positively correlate with large family sizes. Farm size and practice of structural soil conservation measures have strong positive relationship. The small farm size holders have negative attitudes towards soil conservation measures.

Bio-Physical factor

Other factor that affect farmers in the study area to apply soil conservation practice is related to bio-physical factors such as topographic condition of the land, distance between home area and farmland, high intensity of rainfall. Most of the focus group participants thought that farmers who had more farmland did not use soil conservation structure because most of their farmlands are located at different places and the distance between the farmland is far away from their home. As a result, they do not have a chance to observe their farmland daily or even for weeks. Hence, the ignored farmland could be eroded by sudden runoff if the cut of drain

or other soil conservation practices were destroyed by runoff at the time of high intensity of rainfall.

CONCLUSIONAND RECOMMENDATIONDS

Soil erosion is a threat to the economic development of Akoko Region. As farmers are dependent on the agricultural sector for their livelihood, assessing soil erosion and conservation practices has become very important.

Based on the above findings, households were familiar with the indicators of soil erosion on their farmland. 33.5% of the farmers reported the presence of gullies as a major indicator on their farmland while 27% and 25.5% of the farmers reported that absence of fertile topsoil and poor crops and grass growth were the indicators of soil erosion respectively. The study identified that farmers of the study area applied the soil conservation practices on their farm. The major soil conservation practices which have been applied by farmers were traditional ditches, soil bunds, contour plowing and crop rotation. As stated by the farmers, the main determinant factors for farmers' decision to apply soil conservation methods on their farmland were related with socio-economic and bio-physical factors.

To realize the goal of achieving sustainable use of the land and the soil resource in the study area, any concerned body or organization should disseminate education to the whole farmers about the introduced or newly and traditional soil conservation methods to promote the awareness of the farmers about the effect of soil erosion which enables the farmers to adapt and implement soil conservation practices effectively.

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