Research Paper

Natural resource management practices utilized by small scale farmers for improved farm productivity in Bayelsa State, Nigeria

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The study assessed the level of natural resource management practices utilized by small scale farmers for improved farm productivity in Bayelsa State, Nigeria. To carry out the study, three specific purposes were developed and three research questions were answered by the study. Survey study design was adopted. The population for the study consisted of 2,337 registered small scale farmers in Bayelsa State. Multistate random sampling technique was used to select 80 small scale farmers that constituted the sampling frame for the study. The instrument for data collection was a 31-item structured questionnaire titled: Water and Vegetation Management Questionnaire (SWVMQ). The instrument was face-validated by three experts. Cronbach Alpha reliability method was used to determine the internal consistency of the instrument which yielded a coefficient of 0.73. From the data collected and analysed, it was found that the level at which soil, water and vegetation management practices are being utilized by farmers for improving farm productivity in Bayelsa State is still relatively low. Hence, the study among others recommended that: there should be more proactive awareness creation among the farmers by government functionaries in the state on the danger of continued neglect of soil, water and vegetation management by the farmers on food security in the area, and that the farmers should be empowered by relevant government agencies and concerned non-governmental organizations (NGOs) to imbibe the culture of management practices in soil, water and vegetation management in their farm lands.

Key words: Soil, water, vegetation, small scale farmers, productivity, SWVMQ

INTRODUCTION

The Nigerian agricultural sector is dominated by small scale farmers who produce the bulk of food requirements of the country with their associated low productivity. In order to ensure that the laudable objective of self-sufficiency in food production is achieved, the natural resources based of the nation must be properly managed (Phillip *et al.*, 2009; Odebode, 2005). These resources according to World Bank, (2003) include: soil, water and vegetation which constitute an ecosystem upon which the existence and welfare of a majority of the rural poor depends.

The use of soil for agricultural production is one of the major factors affecting environmental quality in many developing countries, Nigeria inclusive. Specifically, practices such as unguided application of agrochemicals, bush burning, deforestation, grazing, continuous tillage and uncontrolled farm mechanization affect the quality of soil and vegetative cover, thereby resulting in soil degradation (Federal Government of Nigeria, 2001). Nigeria's cultivable soils are depleted at an unprecedented rate due to increasing human population

pressure and agricultural practices. According to Mbagwu (2003), decline in agricultural productivity as a result of poor soil management is evaluated in terms of inputs use such as fertilizer / manure, water management and tillage methods to boost production.

Soil and water are basic, vital and essential resources for sustainable agriculture (NAS, 1993; Ahaneku, 2010). Sustainability implies utilizing these resources in ways that ensure little or no damage whilst guaranteeing their continuous usage (Ahaneku, 2010). The quality of water required for maximizing crop production in most regions of the country is fast becoming inadequate (Ahaneku, 2010) The case of water quality for improved agricultural production in south-south Nigeria and Bayelsa State in particular is continuously threatened due to increased water pollution and toxicity (Ekubo and Abowei, 2011). Barrett et al. (2002) noted that surface water quality is deteriorating and groundwater is polluted and irreversibly damaged by the intrusion of salt water along the coast. Poor water control also contributes to erosion especially in hilly and highland regions experiencing deforestation due to logging and agricultural expansion and to soil nutrient leaching in wetter areas (Barrett et al., 2002), investment in soil and water management according to Baig et al. (2013) is key to increased cropping intensity of rain-fed system of agriculture. Water is an important constituent of the ecosystem; it is the most abundant substance on earth. It exists in a variety of forms such as sea water, snow, surface water, soil moisture, groundwater and water vapour (Peel et al., 2004). In addition, water is particularly important to life; the earliest string of life on earth started in water and even though some forms have strayed away from their natural habitat to be sustained on land, water is still considered for their survival (Ahaneku, 2010). Water is not only for sustenance of life, but is also essential for socioeconomic development. This is because, agriculture, the first step in enabling the development of societies, requires vast amount of water (United Nations Environmental Protection UNEP, 2015). Apart from the soil and water bodies, vegetation cover also play significant roles in sustainability of human environment and poverty alleviation of the masses in rural areas (De Sherbinin, 2007).

The undisturbed natural ecosystem supports varying degrees of natural vegetation of which fire wood, timber and other non-wood forest products are an important contribution of wood to the local economy (Nahayo et al., 2013). Natural wetlands and swamps forms natural ponds and the vegetative cover provide a natural shelter for fish while the water regime brings in nutrients which stimulate the rapid growth of microorganism and invertebrates, which serve in the food chain for fish (Ocheoha, 2015). Unfortunately, the present state of soil, water and vegetation management in Bayelsa State is counter-productive. This trend has considerably undermined the productivity of farmers in crops and

livestock production in the area. This is because, substantial amount of deforestation has taken place in the country over the few decades (Alkali and Shettima, 2011).

The rate of deforestation and degradation of soil in tropical countries is estimated to be about 1% per year (FAO, 2005). In addition, Ezeah (2015), a great percentage of Nigeria's vegetation cover has been removed thereby exposing the soil to various forms of degradation. For instance, UN/FAO (2005) reported that Nigeria lost 1214 km of forest cover between 1990 – 1995; resulting in severe exposure of the soil to agents of soil degradation and consequently lost of soil productivity. The report of FAO (2003), identified the consequences of poor management of natural resources to include: environmental degradation, low level of economic development and lack of good agricultural practices which directly affect the livelihood of people. Junge et al. (2009) observed that some of the farming system practices aimed managing soil, water and vegetation have wide spread acknowledgement but with low usage among farmers. Also, Junge et al. (2009) observed further that most of the projects on resource management were carried out on research farms and only a few on-farms with low the participation of farmers.

It is quite obvious that the activities of mining companies, industrialists, estate developers and poor farming techniques in Niger Delta and Bayelsa State in particular had resulted to the present environmental menace in the area. The poorly drained soil, saline and gravelly soils are not good for crop production, because such soils retard growth and development of the crop and eventually result to poor yield (Oyinlola and Jinadu, 2012; Pirker and Mosnier, 2015). The floodable condition of arable land in Bayelsa state has negatively affected farmers' agricultural productivity. Productivity is a measure of the number of unit inputs into a production process and the corresponding units of output that emerges (Kalu, 2002). In the view of Mundel (2005), productivity is a measure of the efficiency of a person, machine, factory, system etc; in converting inputs into useful output. It is also imperative to state that the farmers who depend on the degraded soil, water and vegetation should be involved in ameliorating the natural resources for sustainable livelihood in the area.

Despite the obvious poor resource management practices among farmers, no study seems to have identified natural resource management practices by farmers bearing in mind the activities of small scale farmers to conserve the soil, water and vegetation for continuous use. It is based on the background that this study was carried out to investigate the soil, water and vegetation management practices utilized by farmers for improved farm production in Bayelsa State Nigeria. It was believed that the findings of the study will guide stakeholders in agriculture and environmental protection to formulate environmental-sensitive policies that will help

in combating natural resource depletion in the Niger Delta region in general.

The objective of this study was to identify natural (water, soil and vegetation) resource management practices utilized by small scale farmers for improved farm production in Bayelsa State, Nigeria.

Research questions

In line with the three specific purposes of the study, the following three research questions were answered by the study:
(i) What are soil management practices utilized by farmers for improved farm productivity in Bayelsa State?
(ii) What are water management practices utilized by farmers for improved farm productivity in Bayelsa State?
(iii) What are vegetation management practices utilized by farmers for improved farm productivity in Bayelsa State?

METHODOLOGY

The study was carried out in Bayelsa State Nigeria. Three questions were developed and answered by the study. The study adopted descriptive survey research design. Descriptive survey according to Osuala (2005), focused on people, their vital facts, beliefs, opinions, attitudes, motivation and behaviour as well as situations currently obtained and no variables will be manipulated as done within experimental design. Similarly, Nworgu, (2006) described survey design as that in which group of people or items are studied by collecting and analyzing data from a few people. Therefore, descriptive survey design was found suitable for this study because questionnaire was used to collect data from respondents on natural resource management practices utilized by small scale farmers for improved farm productivity in Bayelsa State. The population for the study consisted of 2,337 registered small scale farmers in Bayelsa State (Bayelsa Agricultural Development Programme, 2016). Multistate random sampling technique was used to select the respondents for the study. At the first stage, four out of the existing eight Local Government Areas (LGAs) in the state were randomly selected. The second stage involved random selection of two farming communities from each of the four LGAs selected making eight farming communities (Dawes, 2008). Random sampling procedure was used to select 10 small scale farmers from each of the eight sampled communities making 80 small scale farmers that constituted the sample frame from which data for the study were collected. The instrument for data collection was a 31-item structured questionnaire titled: Water and Vegetation Management Questionnaire (SWVMQ). The instrument was face-validated by three experts. For the purpose of ascertaining the internal consistency of the instrument,

Cronbach Alpha reliability method was used which yielded a coefficient of 0.73. To ensure quality data collection, four research assistants joined the researcher in data collection from the respondents. Each of the assistants covered one LGA each. Due to effective follow up, all the 80 copies of the questionnaire administered were retrieved representing 100% rate of return. The data collected were analyzed using mean and standard deviation.

To determine the natural resource management practices utilized by farmers, mean was employed using 4-point rating Likert scale technique. The 4-point rating scale of the degree of management practices was graded as: Highly Utilized, (HU) = 4, Moderately Utilized (MU) =3, Less Utilized (LU) =2 and Not Utilized (NU) = 1 (Dawes, 2008). The mean ratings of the respondents based on the 4-point rating scale were graded using boundary limit as stated below:

Response Categories		Ordinal values	Boundary limit
Highly Utilized	(HU)	= 4	3.50 – 4.00
Moderately Utilized	(MU)	= 3	2.50 – 3.49
Less Utilized	(LU)	= 2	1.50 – 2.49
Not Utilized	(NU)	= 1	1.00 – 1.49

In taking decision on the research question, any item with mean values that range between 1.00 – 1.49 was interpreted as Not Utilized, items with mean values between 1.50 – 2.49 were regarded as Less Utilized, items with mean values between 2.50 – 3.49 were interpreted as Moderately Utilized while items with mean values that ranged between 3.50 – 4.00 were interpreted as Highly Utilized (Dawes, 2008).

RESULTS

The results for this study were obtained based on the research questions answered in (Tables 1, 2 and 3).

Research question1

What are soil management practices utilized by farmers for improved farm productivity in Bayelsa State. The data for answering research question one is presented in (Table 1).

The data presented in (Table 1) showed that the mean ratings of the respondents on inorganic manuring and multiple cropping are 3.51 and 3.50, respectively which fell within the boundary limit of 3.50–4.00 on 4-point rating scale. This indicated that inorganic manuring and multiple cropping are highly utilized soil management practices among small farmers for improved farm productivity in Bayelsa State. Table 1 revealed that intercropping (3.00), crop rotation (2.98), and minimum tillage (2.86) had mean values that fell within the boundary limit of 2.50–3.49 on 4-point rating scale implying that these identified soil management practices are moderately utilized by small farmers for improved

Table 1. Mean ratings of the farmers on soil management practices utilized for improved farm productivity in Bayelsa State.

Soil management practices	X	SD
Mulching	2.05*	0.53
Application of organic manure	2.33*	0.89
Application of inorganic manure	3.51***	0.56
Cover cropping	2.42*	0.87
Soil fallowing	2.13*	1.04
Multiple cropping	3.50***	0.65
Intercropping	3.00**	0.66
Crop rotation	2.98**	0.78
Soil liming	1.95*	1.08
Minimum tillage	2.86**	0.76
No/zero tillage	2.02*	1.03
Construction of bonds	2.43*	0.88
Construction of terraces	2.00*	1.04
Construction of water ways	2.28*	0.84
Construction of contour with stones as barrier.	2.32*	0.96

Note: **X**= mean, *** Highly Utilized; ** Moderately Utilized; * Less Utilized (LU), Source: Field Survey (2016),(N = 80).

Table 2. Mean ratings of the farmers on water management practices utilized for improved farm productivity in Bayelsa State.

Water Management Practices	X	SD
Flood irrigation	1.88*	1.03
Furrow irrigation	2.31*	0.95
Sprinkler irrigation	1.51*	1.09
Drip or trickle irrigation	1.50*	1.18
The use of watering can for watering farm land	1.25*	0.66
Management of water shed	2.48*	0.87
Drainage	2.26*	0.89
Digging of well or borehole	2.35*	0.75
Rain harvesting	2.43*	0.56

Note: **X**= mean, *** Highly Utilized; ** Moderately Utilized; * Less Utilized (LU),   (N=80) Source: Field Survey (2016).

farm productivity in Bayelsa State. Mulching (2.05), organic manuring (2.33), cover cropping (2.42), soil fallowing (2.13), soil liming (1.95), no/zero tillage (2.02), construction of bonds (2.43), construction of terraces (2.00), construction of water channels (2.28), construction of contour with stones as barrier (2.32) all had mean values that fell within the boundary limit of 1.50 – 2.49 on 4-point rating scale which indicated that the identified soil management practices are less utilized by small farmers for improved farm productivity in Bayelsa State.

Research question 2

What are water management practices utilized by farmers for improved farm productivity in Bayelsa State. The data for answering the question 2 are presented in (Table 2).

Table 2 showed that the mean ratings of the respondents on flood irrigation (1.88), furrow irrigation (2.31), sprinkler irrigation (1.51), drip or trickle irrigation (1.50), the use of watering can for watering farm land (1.25), management of water shed (2.48), drainage (2.26), digging of well or borehole (2.35) and rain harvesting (2.43) all had mean values that fell within the boundary limit of 1.50 – 2.49 on 4-point rating scale which indicated that the identified water management practices are less utilized by small farmers for improved farm productivity in Bayelsa State.

Research Question 3

What are vegetation management practices utilized by farmers for improved farm productivity in Bayelsa State. The data for answering research question-3 are presented in (Table 3).

Table 3. Mean ratings of the farmers on vegetation management practices utilized for improved farm productivity in Bayelsa State.

Vegetation Management Practices	X	SD
Reduced bush burning	1.67*	1.04
Avoid encroachment of forest reserves	1.99*	1.02
Fallowing	2.22*	0.75
Controlled logging	2.06*	0.89
Controlled hunting for balanced ecosystem	1.54*	1.06
Erosion control practices	2.09*	0.73
Agroforestry practices	1.46*	0.76

Note: **X**= mean, *** Highly Utilized; ** Moderately Utilized; * Less Utilized (LU), (N = 80). Source: Field Survey, 2016.

Table 3 revealed that the mean ratings of the respondents on reduced bush burning (1.67), avoid encroachment of forest reserves (1.99), fallowing (2.22), controlled logging (2.06), controlled hunting for balanced ecosystem (1.54), erosion control practices (2.09) and agroforestry practices (1.46) had mean values that fell within the boundary limit of 1.50 – 2.49 on 4-point rating scale which indicated that the identified vegetation management practices are less utilized by small farmers for improved farm productivity in Bayelsa State.

DISCUSSION

Based on the data collected and analyzed, the study found that inorganic manuring, multiple cropping, intercropping and crop rotation were utilized by farmers in the study area for improved farm productivity. This finding is in conformity with that of Ogbonna *et al*. (2007), on adoption of soil management and management technologies in Nsukka area of Enugu state where they found that farmers utilized manuring, mulching and improved cropping such as multiple cropping, crop rotation as soil management and management practices. The findings also revealed that soil management practices such as mulching, organic manuring, cover cropping, soil fallowing, soil liming, no/zero tillage, construction of bonds, construction of terraces, construction of water channels, construction of contour with stones as barrier, water management practices such as: flood irrigation, furrow irrigation, sprinkler irrigation, drip or trickle irrigation, the use of watering can for watering farm land, management of water shed, drainage, digging of well or borehole, rain harvesting and vegetation management practices such as: reduced bush burning, avoid encroachment of forest reserves, fallowing, controlled logging, controlled hunting for balanced ecosystem, erosion control practices and agroforestry practices are less utilized by small farmers for improved farm productivity in Bayelsa State. This finding conformed with the report of World Bank, (1999) which affirmed that soil management efforts by most farmers in Nigeria is still very low resulting in the recorded high rate of soil degradation in the country; that soil degradation affected about 50 million people in Nigeria and led to the greatest loss of the Nation's GNP (US $3000 million per year) relative to other environmental problems. The findings revealed generally poor water management practices by farmers. Igbokwe, (1996) reported that high labour intensity, time consuming, regular inspection and the large amount of construction materials required in water management are some of the problems that discourage farmers from installing or maintaining water management practices. In addition, Junge *et al*. (2009) shared that a similar report that soil and water management practices are less utilized by farmers due to some limiting factors which may include high cost of installation and maintenance of management structures.

Conclusion and recommendations

For small scale farmers in south-south Nigeria to be able to continue in production, certain level of responsibility is expected from them in natural resource management considering the increased rate of degradation in the Niger Delta. Soil, water and natural vegetation in the area are not to be properly managed by all actors in natural resource use such as miners, estate developers, industrialists and farmers. This instigated the worker to assess the level of utilization of soil, water and vegetation management practices among small scale farmers whose sustainable livelihood depends on these resources. Through a well-structured questionnaire, the opinions of small scale farmers were sought across Bayelsa State. From the data collected and analyzed, it was found that the level at which soil, water and vegetation management practices are being utilized my farmers for improving farm productivity in Bayelsa State is still relatively low. Hence, the study recommended that:
(a) There should be more proactive awareness creation among the farmers by government functionaries in the state on the danger of continued neglect of soil, water

and vegetation management by the farmers on food security in the area.

(b) The farmers should be empowered by relevant government agencies and concerned non-governmental organizations (NGO)s to imbibe the culture of management practices in soil, water and vegetation management in their farm lands.

(c) Agricultural extension agents should ensure regular visits and contacts to teach and guide the farmers on effective soil, water and vegetation management practices for improved farm productivity in the area.

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