Assessment of Land Degradation and Farm-Level Deforestation in the Niger Delta Region of Nigeria

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Abstract: Land degradation in the Niger Delta region of Nigeria has been aggravated by deforestation with resultant losses of vital biodiversity. In this paper, we provided an assessment of land degradation with drivers of deforestation in selected states in the Niger Delta. Data were collected with multi-stage sampling procedure and analyzed using descriptive and Tobit regression methods. Results show that average age of the farmers is 51.55 years with average years of education being 8 years. The farmers recognized a degraded land through the colour (20.79%), depth of the soil (4.4%) and performance of maize crop (71.73%). Deforestation is positively influenced by sex of the household heads, market distance, population per forest land, purchased land, sold land, fertile land and population density. Legislations for curtailing the pace of deforestation should be enforced with some hints on population control.

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Introduction

Land degradation is a decline in land quality caused by human activities and it is a major global issue during the 20th century and will remain high on the international agenda in the 21st century (Eswaran *et al*.2001). It is a pertinent problem confronting sustainable agricultural production in many tropical regions of the world. At least two distinct schools of thought have emerged regarding the prediction, severity, and impact of land degradation. One school believes that it is a serious global threat posing a major challenge to humans in terms of its adverse impact on biomass productivity and environmental quality (Pimentel *et al*., 1995; Dregne and Chou, 1994). Ecologists, soil scientists, and agronomists primarily support this argument. The second school, comprising primarily economists, believes that if land degradation is a severe issue, why is it that market forces have not taken care of it? Supporters argue that land managers (e.g. farmers) have vested interest in their land and will not let it degrade to the point that it is detrimental to their profits (Crosson, 1997).

The importance of land degradation among global environmental problems cannot be over-emphasized because of its impact on world food security and quality of the environment. High population density is not necessarily related to land degradation; it is what a population does to the land that determines the extent of degradation. People can be a major asset in reversing a trend towards degradation. However, they need to be healthy, politically and economically motivated to care for the land, as subsistence agriculture, poverty, and illiteracy can be important causes of land and environmental degradation (Eswaran *et al*. 2001).

Information on the economic impact of land degradation by different processes on a global scale is not available. Some information for local and regional scales is available and has been reviewed by Lal (1998). In Canada, for example, on-farm effects of land degradation were estimated to range from US$700 to US$915 million in 1984 (Girt, 1986). Land degradation can be considered in terms of the loss of actual or potential productivity or utility as a result of natural or anthropic factors; it is the decline in land quality or reduction in its productivity. In the context of productivity, land degradation results from a mismatch between land quality and land use (Beinroth *et al.,* 1994).

Niger Delta is one of the most richly endowed and yet one of the least developed regions in Nigeria. The rich flora and fauna of the area have supplied the immediate source of livelihood for the people of the region for many generations. For so long, the people lived in harmony and there was evident balance in the ecosystem. Flooding and riverbank or coastal erosion is among the major environmental hazards that the people face. However, the region is endowed with enormous natural resource. Part of a World Bank's report, following a visit to the Niger Delta in 1952 and 1953 declared that the region had great prospects to feed the entire population of the then West African sub-region and had sufficient commodities for export. Some of the produce highlighted by the report includes palm oil and cassava, which are in abundance in some parts of the area (Eswaran *et al*., 2001; Iyayi, 2004; Omofonmwan, and Odia, 2009).

Oil exploration and exploitation has over the last four decades had disastrous impacts on the physical

environment of the oil rich region. This massively threatens subsistence peasant economy, environment and the entire livelihood and basic survival of the people. It should be noted that while oil extraction has caused negative socio-economic and environmental problems in the Niger Delta, the Nigerian State has benefited immensely from petroleum since it was discovered in commercial quantities in 1956. On the other scale, when considered in respect of it's negative impact on the socio-economic life and the environment of the immediate oil bearing local communities and its inhabitants, it has left a balance sheet of ecological and socio-physical disaster (Aluko, 2004; Mathew, 2004). In the Niger Delta, the negative impact of oil exploration is visible in the life of the people.

Agriculture forms the most dominant economic activity of many communities in the area. The Federal Office of Statistics (FOS) in 1985 stated that crop farming and fishing activities account for about 90% of all forms of activities in the area. They also estimated that about 50%-68% of the active labour force is engaged in one form of agricultural activity or the other including fishing and farming. Agricultural technology has remained relatively unchanged over the years and over 90% of the farmers are subsistent farmers operating on traditional methods using basic tools.

Farming techniques still remained the use of land rotation or bush fallow system characterised by land and labour being the principal inputs of production. The organic farming technique widely used is highly susceptible to environmental changes affecting the soil, water and or deforestation because it is not technologically inspired, but rather land and labour intensive. Oil extraction and production has led to adverse environmental impact on the soil, forest and water of the Niger Delta. Various harmful and toxic organic compounds when introduced into the natural environment during oil extraction such as during seismic work, oil spill, gas flares and several other forms of pollution, changes the geo-chemical composition of the soil, river and other components of the environment. This in turn affects agriculture and leads to a drastic decline in output in both fishing and farming activities. This has ultimately affected peasant agriculture in a variety of ways, which ultimately have caused problems of environmental refugees (Aluko 2004; Uyigwe and Agho, 2007).

The peasants are very reactive to these changes because of unavailability of modern farming and fishing techniques to meet the challenges of a declining soil and marine resources. The drastic fall in output of agricultural production leads to intensive exploitation of other fertile land. The long run effect of this is land degradation and migration of peasant farmers to other rural and urban areas, where pressure is exerted on the often inadequate and dilapidated infrastructure, leading to increased poverty. Apart from degradation and loss of farms, oil spills have led to extensive deforestation with no adequate replanting practices. Mmom and Arokoyu (2009) submitted that mangrove forest deforestation is a product of the interaction of the many environmental, economic, social and political forces the Niger Delta region. As a result of deforestation, there are great concerns about rapid loss or decimation of biodiversity.

Persistent deforestation has resulted in shortened fallow periods, and use degradation and loss of soil fertility and consequently erosion of the topsoil. The slash and burn agriculture traditionally practised by shifting cultivators in the area is based on ecologically sound principles and minimises threats to the forest by leaving land fallow over periods of time long enough for regeneration. But landless peasants who have been forced from their own lands, increase the number of people pursuing such a subsistence lifestyle. This contributes to deforestation through further encroachment on forestland and reductions in fallow times (Uyigwe and Agho, 2007; World Bank, 2006).

The out-migration of displaced rural farmers in some communities as a result of environmental degradation caused by oil extraction in the region has led to a significant percentage of the local inhabitants to remain in cyclical poverty and penury. This has meant greater environmental degradation as a result of the intensive exploitation of the few remaining fertile land in the region by the residents. The oil producing communities have basically remained dependent and underdeveloped, economically marginalized and psychologically alienated. The wealth derived from oil resource exploitation and exports benefit directly only the operators of the oil industry and the bureaucrats in government and no one seems to be concerned with the low status masses in the area.

This study would provide answers to the following questions in the end: What are the features that farmers use to recognize a degraded land in Niger Delta? What are the causes of deforestation in Niger Delta? In the remaining parts of the paper, the materials and methods, results and discussions and recommendations are presented. The working hypothesis is that increasing population pressure is not significantly influencing farm-level deforestation.

Materials and Methods

The Study Area

The Nigerian Niger Delta is bordered by the Atlantic Ocean to the south and Cameroon to the east. The land surface is estimated at 112, 160 square kilometers or about 12% of the Nigeria's total land surface. The population is estimated at 35 million

housed in a state of Abia, Akwa Ibom, Bayelsa, Cross-River, Delta, Edo, Imo, Ondo and Rivers State .The region spans over 20,000 square kilometers hosting about 25% of the Nigerian population (from 2006 census, the total population of Nigeria is about 140 million people). About 2,370 square kilometers of the Niger Delta area consist of rivers, creeks and estuaries while stagnant swamp covers about 8600 square kilometers. The region falls within the tropical rain forest zone. The ecosystem of the area is highly diverse and supportive of numerous species of terrestrial and aquatic flora and fauna and human life. As opined by Iyayi (2004), it is richest wetland in the world. The region is divided into four ecological zones namely coastal inland zone, mangrove swamp zone, freshwater zone and lowland rain forest zone.

Method of Data Collection

Because the Niger Delta produces a unique homogeneity in climate and cultural values, the random sampling approach was used to select three states where data were collected. The 3 selected states were divided into local government areas (LGAs). Three local government areas were selected from each of the states. A total of 150 questionnaires were administered in each of the 3 states. At the end, due to insufficient information, only 428 were considered good to be included in the analysis. In all, 147 questionnaires were administered in Abia state, 146 in Akwa Ibom state and 135 in Rivers state. Also secondary data on population of the states were collected based on national population census of 2006. The total land area and forest land area were also collected from same publications of the National Bureau of Statistics (NBS).

Method of Data Analysis

The data collected for this study were analyzed with the aid of descriptive statistics and tobit regression analysis. Descriptive methods were employed to summarize the socioeconomic characteristics of the respondents. The analytical techniques used for descriptive analysis are frequency distribution tables, percentages. The characteristics highlighted include age, household size, sex, marital status, educational status etc.

Tobit Regression Analysis

This is the statistical tool that measures the stochastic relationship between independent variables (regressors) and dependent variables (regressand). In Tobit analysis, the regressand can assume a value of zero. For the data that were used, some farmers did not deforest any forestland, thus compelling application of Tobit regression. The importance of the regression technique is that it establishes the proportion of the variation in the dependent variable that can be explained by independent variables (Gujarati, 2007). In this study, the endogenous variable is the forestland that was cleared in the past five years. The estimated model is presented as:

$$D_i = \alpha + \sum_{j=i}^{19} \alpha_j X_j + v_i \quad .1$$

Where D_i is the deforested land areas (ha), X_j are the independent variables including population density, population per forest land, age of house heads (years), house head sex (male = 1, 0 otherwise), farming experience (years), marital status (married 1, 0 otherwise), number of people contributing to finances, education (years of education), market distance (km), inherited land (ha), purchased land (ha), borrowed land (ha), rented land (ha), community land (ha), problem getting land (yes = 1, 0 =otherwise), land conflict (yes = 1, 0 =otherwise), sold land (yes =1, 0 =otherwise), fertile land (yes = 1, 0 = otherwise and jointly owned community land (yes = 1, 0 = otherwise). v_i is the stochastic error term.

Results and Discussions

Socioeconomic characteristics of the respondents

The socioeconomic characteristics of the respondents are presented in tables 1 and 2. Table 1 shows the distribution of respondents according to sex. The table shows that 54.4% of the respondents are males, while 45.6% of the respondents are females. Proportion of females engaged in farming activities is high in the east when compared to the south-west where female farmers are engaged in processing activities. The table also shows the distribution of respondents according to marital status. This reveals that 87.1% of the farmers are married. Also according to the table, 5.8% are single, 1.4% are divorced. This implies that majority of them have reached marriageable age. According to table 4.7, 1.2% of the respondents did not respond. Also, 35.7% of the respondents have secondary education, 4.7% of respondents have university education, 17.3% of the respondents are not educated. The mean is 8.077103 while the standard deviation is 4.87801.

Table 1: Socio-economic characteristics of the farmers

Socio-economic characteristics	Frequency	%
Gender		
Male	233	54.4
Female	195	45.6
Marital status		
Single	25	5.8
Married	373	87.1
Divorced	6	1.4

Others	24	5.6
Education		
Primary	141	32.9
Secondary	153	35.7
NCE	13	3.0
OND	12	2.8
HND	10	2.3
University	20	4.7
None	74	17.3
Age		
< 30	23	5.37
30 < 40	69	16.12
40 < 50	91	21.26
50 < 60	106	24.77
60 < 70	89	20.79
≥70	50	11.68
Total	428	100.00

Source: Survey data, 2006

The table also shows the age distribution of the farmers. It reveals that only 5.37 percent of the respondents is less than 30 years old. Also, the highest proportion (24.77 percent) of the farmers belongs to age group 50<60 years. Similarly, average age for all the farmers is 51.55 years with standard deviation of 15.04. This shows that the farming households are ageing.

Indigenous knowledge for identifying degraded land

Table 2: Features that farmer used to recognize a degraded land

Land features	Frequency	%
Colour of soil	89	20.79
Depth of soil	19	4.44
Ease of tillage	38	8.88
Intensity of weed growth	71	16.59
Type of weed most common	116	27.10
Performance of maize crops	307	71.73
Performance of root and tuber crops	161	37.62
Performance of cash crops	68	15.89
Texture of the soil	42	9.81
Water drainage	99	23.13
Type of soil	165	38.55

Source : Survey data, 2006

Table 2 shows how farmers recognized a degraded land. 20.79% of the respondents recognized a degraded land through the colour of soil .4.4% of the respondents recognized a degraded land through the depth of the soil. 71.73% of the respondents recognized a degraded land through the performance of maize crops. This indicates that majority of the farmers recognized a degraded land through the performance of maize crops as a result of decrease in yield because maize does well in a fertile soil.

Determinants of deforestation

Average forest land cleared is 0.891355 ha. The kernel density graph of the deforested land is shown in figure 1. This reveals that land areas cleared by farmers are positively skewed.

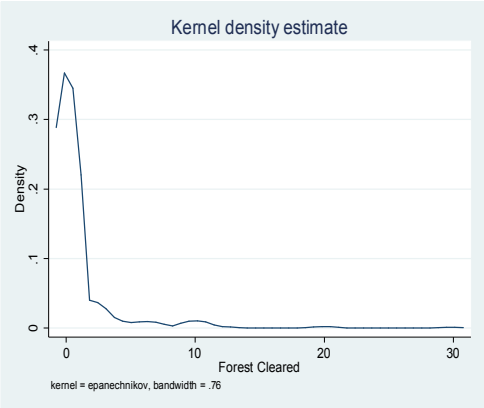

Figure 1: Kernel density estimate of deforested land

Table 3: Tobit regression results of the determinants of deforestation

Forest clear	Coefficient	Std. Err.
Population density	14.84385***	3.614335
Population per forest land	. 0103274*	.0055817
House head age	. 0189594	. 0475595
House head sex	3.148989**	1 .27783
Farming experience	. 016667	.0478119
Marital status	1.330737	1 .761825
Number of people contributing to finances	.2196888	. 3577706
Education	.2439454	. 1551384
Market distance	.0719507**	.0357592
Inherited land	.0750085	. 082371
Purchased land	.2974703*	.153391
Borrowed land	.730404	.488538
Rented land	.5273266	.4078519
Community owned land	. 1149553	. 1492038
Problem getting land	. 0948668	1. 419265
Land conflict	.3540434	1 .324347
Sold land	3.104828*	1 .777894
Fertile land	4 .232547*	2.508531
Jointly owned community land	-1. 979196	1 .31834
Constant	-103.5917	20.96902
sigma	7.316039***	.649775

Significant at 1% = ***, Significant at 5% = **, Significant at 10%=*

The sigma parameter is statistically significant ($p<0.01$). This means that the model properly fits the data. Population density is statistically significant at 1%. Variables that are statistically significant at 5% include house head sex, market distance. Other variables that are statistically significant at 10% include population per forest land, purchased land, sold land and fertile land. Population density has a positive relationship with the level of deforestation. This implies that an increase in population density will lead to an increase in the level of deforestation. Therefore, the null hypothesis should be rejected. This was also documented by Palo *et al* (1987) who identified a strong positive link between tropical deforestation and population growth for 72 tropical countries.

The coefficient of sex shows that male sex increases deforestation by 3.14898. If market distance increases by one unit, the level of deforestation will increase by 0.0719507. If population per forest land increases by one unit, deforested land will increase by 0.0103274. Purchased land has a positive relationship with deforested land. This implies that an increase in purchased land will lead to increased deforestation. If sold land increases by one unit, deforested land will increase by 3.104828. If fertile land increases by one unit, deforested land will increase by 4.232547

Conclusion

In this study, an attempt has been made to provide empirical analyses of deforestation and degradation in Niger delta. The findings will assist Nigerian policy makers to know the appropriate direction for policy formulation in order to ensure drastic reduction in the rate of deforestation and degradation in Niger delta. Land use policy in which ministry of environment and forest can take coordination role for integrating land sectoral policies in association with ministry of land is necessary. Also, policy and policy level integration in which department of environment under the ministry of environment and forest can take the lead into integrating environment and climate change issues into sectoral policies. In order to reduce the rate of deforestation and degradation in the Niger delta, policies should also encourage forest conservation bringing an end to unsustainable extraction and population contro

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