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# Push and Pull Factors Promoting Agroforestry Tree Crop Uncontrolled Extraction on Rural Households in Delta State, Nigeria

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**Abstract**

The purpose of this study was to determine the push and pull factors promoting agroforestry tree crop depletion on rural household in Delta State. A multistage sampling technique was used. The sample size for the study was 120 farmers. The instrument for data collection was questionnaire. The data collected were analyzed with descriptive statistics such as chart, means derived from 5-point likert scale and inferential statistics such as logistic regression model and multiple regression model. The results of the chart on the socioeconomic characteristics of the farmers showed that majority (62%) of the farmers were between the ages of 31-40 years. High proportion (79%) of the respondents were female. Majority (77%) of the respondents were married. Most (75%) of the respondents were formally educated. The modal class of respondents farming experience was 16-20 years. The logistic result revealed that age, household size and farm size were positively significant at 5% and 10% probability level while farm income, land tenure and level of education were negatively significant at 5% probability level respectively. The Cobb-Douglas function was chosen because it had the best fit. The coefficient of multiple determinations ($R^2$) was 0.625.The multiple regression result showed that the variables firewood collection and tree logging were positive while bushfire and farm erosion were negative and significant at 1%, 5% and 10% probability level. The activities of deforestation should be discouraged through stringent environmental laws for sustainable agricultural production.

**Keywords**: Agroforestry, Depletion, Household, Socioeconomic, Tree Crop

## 1. Introduction

Nigeria was once covered by extensive vegetation varying from humid tropical forest in the south to savannah grassland in the north. This extensive vegetation has over the years reduced as a result of the various human activities. Forest resources contribute greatly to the livelihood of the rural people. Apart from the provision offuelwood and food materials, they also stores crop and animal biodiversity. The loss of these benefits implies deforestation. The continued loss of forestland to deforestation and the consequent degradation of the environment have become a source of concern to the government especially when human needs are considered. The loss of tree crops which constitutes tree crop depletion from an existing agroforestry system is occurring at a gradual rate and it is a consequence of human activities. Deforestation is used in a broad sense to mean the removal of forest and grassland vegetation (NESDA, 2000). Deforestation is the conversion of forest to an alternative permanent non-forested land use such as agriculture, grazing or urban development (van Kooten and Bulte, 2000). According to Eboh (1995) deforestation is the loss of forestland to arable agriculture or decline in the quality of forest vegetation cover through unguarded exploitation. The evidence of increased deforestation is emerging where forest sourced products like fuelwood and building materials are becoming scarce. This scarcity is reflected in increased prices of these forest products and a growing trade in forest related items. Forest degradation occurs when the ecosystem functions of the forest are degraded (Anon., 2010).

A major component of the forest that is being depleted is the tree. It is the tree that provides the requisite cover in the forest that helps protect the biodiversity. The loss of tree translates to deforestation occasioned by reduction in the tree cover. Trees and forest are essential aspects of the rural livelihood. They are a live support system not only for humans but also for wild and domesticated plants and animals (PIREP, 2006). Trees and forests protect the land from erosion as well as protecting the home and the farm by the provision of windbreaks. Other benefits include; improvement of soil fertility and provision of habitat and food for animals. Trees are integral part of the forest, hence the need to protect and manage it. Most farm level tree management is primarily to meet household needs of fruit, fuel, fodder and building materials (Arnold and Dewees, 1998).The depletion of forest resources and rising demand for forest products particularly of the rural people who rely on forests for survival means have widened the gap between the demand and supply of forest products in Nigeria. The deforestation are caused by different activities carried out by, loggers, firewood collectors, people who are cutting down the forests, burn farmers, commercial farmers, ranchers and infrastructure developers .An increased population brings about a declining fallow period and increased intensification of land use (Eboh, 1995). Consequent upon this, there is gradual and progressive decline of soil fertility and crop yield (Nwafor, 2006). This brings about a declining productivity and extension of cultivation to fragile and most often marginal agricultural land. This leads to felling of trees in search of more productive land and forest products, thus the environment is apparently being degraded. Agroforestry programmes have severally been advocated to help in ameliorating this problem but the capacity to do this is not entirely being realized. In the face of increasing population with a consequent environmental degradation and deforestation that follows it, the government as a matter of policy emphasizes management and use of forest resources, environmental protection and promotion of private participation in forestry in the recent past. These demonstrate the height to which the government places agroforestry practices as a veritable solution to deforestation. Agroforestry practices can be classified into two major types namely; farm –based and forest-based. The farm-based practices include planting trees on and around agriculture fields, home gardens, tree wood lots and profit-making crop under shade trees or agriculture crops inter-cropped with profit-making trees. The forest-based practices comprise of agricultural practices related with forests where farmers collect food, fruits and gums. In this study agroforestry is referred to as farm-based practice. These problems of tree crop loss and low productivity might not have persisted if there were adequate knowledge of the effects of tree crop depletion apart from benefits in the study area. Hence, this research was carried out to find out the effects of agroforestry tree crop depletion on rural households. The objectives of the study were to determine the influence of socio-economic variables of household heads on agroforestry tree crop depletion, examine the economic effects of tree crop depletion on the household income and describe the perception of farmers on the importance of tree crop to the households.

## 2. Materials and methods

The study was conducted in Delta state, Nigeria. Delta state lies between latitude 50and 60 451E and longitude 50 and 60 301N. It has a total land area of 16, 842km$^2$ with an estimated population of 4,098,291(Federal Republic of Nigeria Gazette, 2007). Two local government areas were randomly selected from Delta North, Delta Central and Delta South Agricultural Zones. This gave a total of six LGA's that were studied. In each of the LGA's, two autonomous communities were selected and finally twenty farming household heads were chosen randomly. This gave a total of 120 farming household heads that were studied. Primary data were collected from the farmers through structured interview schedule and questionnaire. Data were analyzed using descriptive statistics such as chart, inferential statistics such as logistic regression, multiple regression and means derived from5-point likert scale.

Analytical Techniques

Logistic Regression Model

The implicit form of the model is specified as follows;

Y = f (x1, x2……..xn)

The explicit form of the model is;

In $^{y}/_{1-y}$= odds in favour of getting 1 for tree crop non-conservation, otherwise, 0

$b_1$-$b_n$ = coefficient of independent variables

$x_1$-$x_n$= socio-economic variables of household

e =error term

The socio-economic variables considered include:

$x_1$ = age of household head (years), $x_2$ = gender of respondents (male =1, otherwise= 0), $x_3$ =household size (number of persons in the household), $x_4$ =farm income (N), $x_5$ = farm size (hectares), $x_6$ = farming experience (years), $x_7$ = land

tenure (private = 1, otherwise = 0), $x_8$ = level of education( years spent in school).

Multiple Regression Analysis

Multiple regression analysis function is represented as,

$Hy = b_0 + b_1fwc + b_2bf + b_3tlg + b_4fer + b_5fdtm + e$

where

Hy = household farm income

$b_1$-$b_n$ = coefficient of tree crop depletion variables

fwc = firewood collection (frequency day/year), bf = bushfire (frequency number/year), tlg = tree logging (number logged/year), fer = soil erosion (prevalent in a year = 1, otherwise = 0), fdm = farm distance to the market (km), e = error term.

## 3. Results and discussion

**Socioeconomic characteristics of farmers**

The result shows the socioeconomic characteristics of farmers in the study area. The result show that 62% of the farmers fell within the age bracket of 31-40years, 18% of the respondents range between 41-50years. About 12% of the respondents were 30years and below. The respondents between 51-60years were 8%. The age distribution skewed towards 31-40years indicating that there were relatively high proportions of middle age people involved in farming, implying that the respondents were still within the economically active age. This is in tandem with Ayanwuyi, et al (2013) those majorities (77.7%) of the respondents were between 31 to 50 years. The result shows that 79% of the interviewed farmers were female while 21% were male involved in farming activities. This implies that more female are involved in the deforestation activities. This could be as a result of the type of economic activities going on in the study area. This disagrees with the argument of Oladele (2011) that male farmers dominate agricultural activities. The result reveals that majority (77%) of the respondents were married while 13% were single. The remainder (3%) of the farmers was divorced while 7% were widowed. The married status of household is usually used to determine the stability of a household. It is normally believed that those married farmers tend to be more involved in aggressive farming activities resulting to tree crop depletion to cater for the family. The high percentage of married respondents may imply that the business of tree crop depletion could be a viable avenue to generate enough income to sustain family. This result is in accordance with Gordon and Craig (2001) who noted that rural household was dominated by married couples.

The result indicates that 58%, 12% and 5% of the farmers had primary, secondary and tertiary education respectively while 25% of the farmers had no formal education. This implies that the majority of the farmers were literate. This is evident that most of them can read and write to know the policies governing the forest resources but deliberately encroached and exposed the environment into threat to generate income for survival. Even if they were educated, they did not have access to the information because of the remote village they are staying. Oni et al (2005) stated that literate farmers are susceptible to acceptance of new policies to protect the environment.

The findings show that 63% of the respondents had farming experience of 16-20 years in the study area. About 17% and 5% had 11-15 years and 21-25years experience in farming. 26-30 years and above 30 years farming experience was 3% each respectively and while 9% had 10 years and below experience in farming. This implies that the modal class of respondents farming experience was 16-20 years.

**Socio-Economic Determinants of Agroforestry Tree Crop Uncontrolled Extraction**

The result in Table 1 shows that the coefficient of age 0.6614 was positively significant at 10% probability level implying that a unit increase in age would result to increase in tree crop depletion activities. This is contrary to a priori expectation because the younger ones are not planting trees to protect the environment. The result indicates that coefficient of household size 0.8821 is positive and statistically significant at 5% level of probability. This indicates that as the household size increases, the probability that a farmer would be actively involved in deforestation activities to earn more money for survival would increase. The finding agrees with Ironkwe et al (2009) that most farm families in Nigeria have large household size of 6 to 10 persons. The coefficient of farm income -0.8024 reveals that it is negatively significant at 5%. The negative and significant variable means that a unit decrease in the household income will increase tree crop depletion activities. According to Barbier and Cox (2004) wage increase can also stimulate deforestation .Table 1 shows that the coefficient of farm size 0.6973 is positive and statistically significant at 5% probability level. This implies a one unit increase in farm size will lead to a corresponding rise in tree crop depletion activities by households. This conforms to a priori expectation. The result further indicates that the coefficient of land tenure -0.8502 is negatively significant at 5% level of probability. The negative coefficient shows that a unit decrease in land space available for farming would increase the probability of tree crop depletion by farmers. This confirms the research done by Enwelu,

et al (2013) that land tenure system hinder increase of land for further production. In a similar view, poorly defined tenure is generally bad for people and forests (Chomitzet al., 2007). The result reveals that the coefficient of level of education -0.6404 is negatively significant at 5% probability level. The negative sign means that a unit decrease in the households' level of education will increase tree crop depletion activities carried out by farmers probably because of having no knowledge of the consequences of uncontrolled extraction of tree crop.

**Effect of Tree Crop Depletion on Household Income**

The result in Table 2 reveals that Cobb-Douglas function had the best fit and therefore chosen as the lead equation. The coefficient of multiple determinations (R2) of the function was found to be 0.625 which implies that the estimated variables included in the model explained 62.5% of variation in the margins of respondents. The overall regression result was significant with F-statistic value of 14.768 which was significant at 1% probability level. The coefficient of firewood collection is positive and significant at 1% level of probability, which is in agreement with a priori expectation. The implication is that an increase in firewood collection will lead to a corresponding increase in household income. The result is in agreement with Kayode et al (2010) that 89% of respondents used firewood daily for cooking of food thrice, twice or once, therefore, the rate of cooking by household determines the frequency of use of firewood. The coefficient of bush fire was negative and significant at 5% probability level. This implies that an increase in bush fire will lead to a corresponding decrease in household income. The findings are in agreement with a study conducted inBrazil by Carvalhoet al (2001). The coefficient of tree logging was positive and significant at 5% level of probability. This implies that an increase in the activities of tree logging will lead to a corresponding increase in the income of household heads. This is in agreement with Aderounmu et al (2002) but disagreed with (Chomitzet al., 2007) that logging catalyzes deforestation. The coefficient of soil erosion was negatively significant at 5% level of probability which conforms to a priori expectation. The implication is that increase in farm erosion will lead to decrease in the farm income of the respondents in the study area.

Table 1. Logistic Estimate of Socioeconomic Determinants of Agroforestry Tree Crop Depletion

| Variable | Coefficient | Standard error | Odd ratio | Significant level |
|---|---|---|---|---|
| Age | 0.6614 | 0.3725 | 0. 460 | 0.0758* |
| Sex | 0.5785 | 0.4127 | 1.781 | 0.1602 |
| Household size | 0.8821 | 0.3765 | 0.446 | 0.0163** |
| Farm income | -0.8024 | 0.4210 | 2.247 | 0.0534** |
| Farm size | 0.6973 | 0.3623 | 2.033 | 0.0541** |
| Farming experience | 0.4710 | 0.4014 | 1.591 | 0.2406 |
| Land tenure | -0.8502 | 0.4260 | 0.392 | 0.0425** |
| Level of education | -0.6404 | 0.3174 | 1.873 | 0.0431** |
| Constant | 0.5580 | 0.3712 | 1.752 | 0.1250 |
| Log likelihood = 54.26 | | | | |
| Pseudo $R^2$ = 0.674 | | | | |
| LR $Chi^2$ = 65.43 | | | | |

Source: Field Report 2018. (*) = 10.0% level of significance; (**) = 5.0% level of significance; (***) = 1.0% level of significance

Table 2. Effect of Tree Crop Depletion on Household Income

| Variable | Coefficients | Standard error | T- value |
|---|---|---|---|
| Firewood collection | 2. 321 | 0.667 | 3.480*** |
| Bushfire | -0. 379 | 0.193 | -1.964* |
| Tree logging | 0.084 | 0.032 | 2.625** |
| soil erosion | -0.123 | 0.056 | -2.196** |
| Farm distance to market | 0.006 | 0.043 | 0.140 |
| Constant | 5.603 | 1.273 | 4.401*** |
| $R^2$ | 0.625 | | |
| F-Ratio | 14.768*** | | |

Source: Field Report 2018. (*) = 10.0% level of significance; (**) = 5.0% level of significance; (***) = 1.0% level of significance

Table3. Perception of Farmers on the Importance of Tree Crop to Households

| Importance | Strongly agree | Agree | Undecided | Disagree | Strongly disagree | Total | Mean | Decision |
|---|---|---|---|---|---|---|---|---|
| Income of farm increased | 12 (10) | 89(74.2) | 11(9.2) | 5(4.2) | 3(2.5) | 462 | 3.85 | Agreed |
| Chances of complete crop failure reduced | 40 (33.3) | 68(56.7) | 12(10) | - | - | 508 | 4.23 | Agreed |
| Soil fertility increased | 27(22.5) | 64(53.3) | 23(19.2) | 6(5) | - | 472 | 3.93 | Agreed |
| Conservation of soil | 84(70) | 36(30) | - | - | - | 564 | 4.70 | Agreed |
| Easy collection of firewood from the forest | 92(76.7) | 28(23.3) | - | - | - | 572 | 4.77 | Agreed |

Figure in parenthesis are percentage

**Perception of Farmers on the Importance of Tree Crop to Households**

The result in Table 3 reveals that all the respondents agreed that an agro-forestry practice makes it easy for firewood collection from the forest. It also helps in the conservation of the soil as agreed by the respondents in the study area. The respondents agreed that complete eradication of crop and failure is reduced by planting of trees. Higher proportion (75.8%) of the respondents agreed that tree crop had the capacity to increase the fertility of the soil. Finally, 84.2% of the respondents agreed that that tree crop increased their farm income.

## 4. Conclusion and recommendations

The study has shown that as deforestation increased, the income of household tend to increase. Firewood collection, bushfire, tree logging and farm erosion are serious menace in our contemporary society of climate change. The land tenure system adopted does not encourage large farming hence to expand production the farm size must increase. The level of farmers income was a factor that supports tree crop depletion been ignorance of the side effect of tree removal without replacement. It is recommended that the government should enact policies to discourage indiscriminate felling of trees.

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