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# Perception of Rural Farmers on Impact of Economic Tree Crops on Environmental Sustainability in Delta State, Nigeria

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## ABSTRACT

**The Government of Nigeria has engaged in tree planting campaign at both community and national scale due to its environmental benefits and mitigation of climate change hazards. The perception of indigenous people on the environmental benefits could influence their actions. It is important to clarify the existing body of knowledge on the perception of indigenous people on the environmental benefits of economic tree crops. This study empirically investigated the perception of rural farmers with respect to the impact of economic tree crops on environmental sustainability. Primary data collected from randomly selected 150 farmers, were analyzed using descriptive statistical tools (i.e. mean, percentage, frequency distribution table) and inferential statistics (logistic regression and chi-square).The test of hypothesis indicated no significant difference in the perception of respondents with respect to the impact of economic tree crops on environmental sustainability (i.e. farming households expressed homogenous opinion on the environmental impact of economic trees. We have sufficient evidence to conclude that indigenous people positively perceived tree crops as important panacea for environmental sustainability and would continue to plant and keep trees in the environment. It was recommended that climate mitigation policies target of Nigeria, should be based on the perception of farmers towards trees planting in order to achieve the set goal of environmental sustainability.**

**Keywords:** perception, rural farmers, impact, tree crops, environmental sustainability

## INTRODUCTION

Economic trees are permanent crops that are capable of being exploited for up to 25-35 years. They are normal features of communities in Delta State, Nigeria. Natural rubber tree provides employment and source of income for a good number of rural populations and is very relevant in poverty reduction (Achoja, 2013). Oil palm also serves as a source of livelihood, income and

food for many rural families and processor (Oladipo, 2008). Domestically, the others have commanded increased demand and supply from consumers and producers respectively. The bulk of the tree fruits hawked by fruit sellers in the markets are from the rural areas, indicating widespread awareness of the economic potentials of tree crops among rural people (Chukwuji, et al 2001) in Nigeria. Economic trees possess dual importance of contributing to rural cash economy and environmental sustainability.

The reality of changing climate has become an important drive for tree planting campaign by local and national governments in Nigeria. Tree planting to mitigate the effect of climate change is an important national objective in Nigeria that deserves collective efforts.

Economic tree refers to group of permanent crops of perennial nature that are capable of being exploited for up to 25-35 years. (Ogunwusi et al 2016, Neuwinger, 2006; Ji-rovetz, et al 2003; Annabelle, et al 2004.

Nigeria was in 20$^{th}$ position among world's major producing countries. By 2005, there was an increase in production to 209,000MT. In 2006, Nigeria moved to 19$^{th}$ position in the worlds in the world with a production value of 225,000MT. In 2007, it rose to 225,500MT. In 2008, Nigeria's production value increased further to 234,000MT (FAOSTAT 2010). In Africa, Tanzania is the highest producer followed by Ghana, Mozambique and Nigeria. They are widely grown in the tropical and sub-tropical regions for their sweet fruit sap (Olife, et al 2015). Nigeria produced 3% of the total world citrus output between 2000 and 2004. This ranked the country 9$^{th}$ among the major citrus producing countries (UNCTAD 2007). The production of citrus in Nigeria is mainly for local consumption. Olife, et al (2015) further recommended that in order for Nigeria to fully harness the potentials of tree crops there should be adequate funding of its research and development. Majority of the tree crops are mostly fund in the rural environment and provide sustainable income, employment and livelihood for individual who own them.

Environmentally these tree crops have ecological benefits. United States Department of Agriculture – Forest Service (2005) stated that 100 trees removed 53 tons or carbon dioxide and 430 pounds of other air pollutants per year and one hundred matured tree catch about 1390,000 gallons of rain water per year. It further stated that strategic management of tree crops can save up to 56% of an annual air conditioning cost.

There is now overwhelming body of scientific evidence that human activity is responsible for this change through release of green house gases.

Climate change therefore, remains an issue of serious concern globally. Its negative effect particularly on rural households in developing countries is alarming. Evidence from summits, conferences, literatures and seminars in local and international fora show among other factors that decreasing tree population is a contributing factor to climate change. Rise in sea level, floods, wild fires, melting ice, changing rainfall patterns, increasing atmospheric temperature are all linked to negative environmental impact of climate change. Over the last century, atmospheric concentration of carbon dioxide increased from 278ppmto 385ppm in 2008 and average global temperature rose by 0.74 degrees Celsius (Global leadership for climate Actions,

2009). According to scientist this is the largest and fastest warming trend ever discerned in earth's history. The global economy took steps to address climate in 1992 (United Nations Framework Convention on Climate Change - UNFCCC) and in 1997 (Kyoto protocol).

The above trend has raised increased concerns about the rising threat of climate change to current income and consumption patterns of rural households and individuals who make a living from agricultural related activities (Foresight, 2011 and IPCC, 2012). Adaptation and mitigation have been suggested by appropriate authorities to address climate change. Tree planting as an aspect of mitigation has been adopted but not widely practiced. Evidence of adoption is seen from the One Man One Tree campaign launched in Ghana, One Man One Tree campaign launched in Lagos, Nigeria, establishment of forest Company by Shubhendu Sharma whose mission is to bring back lost forests by creating them and Plants for the Planet; Billion Tree campaign launched in Nairobi Kenya (Government of Ghana 2017, Vanguard Newspaper July 13 2010, The Forest 2015 blog and UN and Climate Change, 2014) . Within his background, it is important to investigate the ownership of economic tree crops in relation to poverty alleviation and climate change mitigation in Delta State, Nigeria.

It has been emphasized severally that climate change is one of humanities greatest problem. Environmental hazards are man-made due to over production and consumption practices which undermine the environment. Tree planting involves giving back to the environment the energy it requires to mitigate climate change. Mbow, *et al, (2014*) stressed the importance of trees in an ecosystem, especially, as it relates to climate change adaptation and mitigation. Considering the National campaign for tree planting, it is important to investigate the perception of rural farmers on economic trees with respect to environmental sustainability.

Achoja and Obodaya (2019) reported that backyard orchard ownership has positive effects on rural poverty alleviation and food security. They added that tree fruits marketing contributed 24% of the household income of those that are engaged in it. This is the economic implications of compound trees.

In most part of Delta State, the wild tree crops have become exhausted and can no longer support the societal demand. Research work on ownership of compound trees is in its infancy stage. Work is yet to be done on the perceived environmental benefits of tree crops ownership among indigenous people. The need for concerted research efforts for finding out the distribution and perceived sustainable environmental impact of tree crops is overdue. The indication is crystal clear. As it stands, there exists a considerable body of knowledge on the use of backyard orchards as a panacea for food security and poverty alleviation (Achoja and Obodaya, 2020, Chukwuji, et. al, 2001) but further research emphasis needs to be placed on the environmental benefits of tree crop ownership in the ever-changing global climate. In this regard, research attention needs to be directed at the increasing cases of extreme climate events (i.e. extreme temperature and flooding). More research investments are needed for the development of completely organic approaches to climate change mitigation. The dwindling tropical forest abounds with many tree species that have been reported to possess environmental and economic/commercial values.

The main thrust of this study was to examine the perceived impact of economic tree crops on environmental sustainability in Delta State, Nigeria**.** The specific objectives of the study are to:

1. ascertain the distribution of economic tree crops owned by farmers in Delta State, Nigeria,
2. examine the factors that exert marginal effects on tree crop ownership among farmers and
3. evaluate the perception of households on environmental impact of economic tree crops in Delta State, Nigeria.

**Hypothesis of the study**

**Ho1:** There is no significant difference in the perception of rural farmers with respect to the impact of tree planting on environmental sustainability (climate change mitigation).

**Ho2**: The selected socioeconomic factors do not have significant marginal effects on economic tree ownership decision in the study area.

## MATERIALS AND METHODS

### Area of Study, Sampling Procedure and Sample Size

The research was carried out in Delta State, Nigeria. This area was chosen because of the presence of the tree crops. It is located in the evergreen tropical rain forest zero in the southern region of Nigeria with swamp forest in adjoining low-lying areas that is seasonally water logged. It has two distinct seasons, a long-wet season lasting from March to October and a shorter dry season from November to February. The area is agriculturally advantageous for the production of crops and livestock.

The sample for the study was composed through a multi stage sampling procedure involving 3 stages as follows:

- **Stage 1: Selection of Local Governments (LGAs)**
  Fifteen (15) Local Government Areas were randomly selected from the 25 LGAs in the State.
- **Stage 2: Selection of Communities**
  One (1) community was randomly selected from each of the selected LGAs in Delta State. This gave a total of 10 communities that were sampled for the study.
- **Stage 3: Selection of Respondents.**
  Ten (10) economic tree owners were selected from each of the 15 communities. This gave a total of 150 that were selected and studied. The distribution of sampled respondent is shown in Table 1.

**Table 1: Distribution of sampled respondents.**

| S/NO | LGAs | No. of Communities | No. of Respondents |
|---|---|---|---|
| 1 | ANIOCHA SOUTH | 1 | 10 |
| 2 | ANIOCHA NORTH | 1 | 10 |
| 3 | BOMADI | 1 | 10 |
| 4 | BURUTU | 1 | 10 |
| 5 | ETHIOPE EAST | 1 | 10 |
| 6 | ETHIOPE WEST | 1 | 10 |
| 7 | IKA NORTH | 1 | 10 |
| 8 | IKA SOUTH | 1 | 10 |
| 9 | ISOKO NORTH | 1 | 10 |
| 10 | ISOKO SOUTH | 1 | 10 |
| 11 | NDOKWA EAST | 1 | 10 |
| 12 | NDOKWA WEST | 1 | 10 |
| 13 | OKPE | 1 | 10 |
| 14 | OSHIMILI NORTH | 1 | 10 |
| 15 | UGHELLI NORTH | 1 | 10 |
| TOTAL | | **15** | **150** |

## Data Collection Techniques

Both quantitative and qualitative data were used for this investigation. The data were elicited from primary sources. Data collection was achieved with the aid of questionnaire and interview schedule. The questionnaire was structured to harmonize with the specific objectives of the study. The instrument was made to pass through validity and reliability tests procedure. The questionnaire was administered to and retrieved from the respondents with the aid of trained enumerators.

## Methods of Data Analysis

Both descriptive statistical tools (mean, percentage, frequency distribution table) and inferential statistics T-test and multiple regression model were used to analyze collected data.

## Model Specification for Simpson Diversity Index Determination

$$Simpson\ Index\ (D) = \frac{\sum n(n-1)}{N(N-1)} \ldots\ldots\ldots\ Equation\ 1$$

Where;
n = Number of trees of a particular specie
N = Total number of all tree species in the population

## Decision Rule

The closer the SDI value to 1 the higher the impact it creates on environmental sustainability.

Marginal effect of the factors that influence economic tree crops ownership was achieved using Logit Multiple regression model**.**

## Model Specification for Ownership Decision

$$\ln (Pij/C\text{-}Pij) = \beta_0 + \beta_1 ELO + \beta_2 AVMKT + \beta_3 EINC + \beta_4 FOL + \beta_5 ENSHT + \beta_6 PFSC + \beta_7 POP + \beta_8 LGP + \beta_9 AIGN + \beta_{10} AES + \beta_{11} TDI + \beta_{12} AST + \beta_{13} BDE + \mathcal{e}i \ldots (Equation\ 2)$$

The perceived implication of economic tree planting on climate change and environmental sustainability as specified in objective 3 was obtained using a 4-point type Likert scale and achieved using chi-square. This is shown in the following model Chi-Square Model specification on perceived implication

$$\chi^2 = \Sigma \frac{(Fo - Fe)^2}{fe} \ldots\ldots\ldots (Equation\ 3)$$

Where;
Fo = Observed frequency from owners and non-owners' economic tree
Fe = Expected frequency calculated

$$Fe = \frac{RT \times GT}{GT} \ldots\ldots\ldots Equation\ 3$$

Where;
RT = Row Total
CT = Column Total
GT = Grand Total

## RESULTS AND DISCUSSION

### Distribution of Identified Tree Crops Ownership Among Surveyed Households

**Table 2.: Distribution of economic tree ownership among respondents**

| S/N | Economic trees | Frequency (n= 150) | Percentage (%) |
|---|---|---|---|
| 1 | Pear | 31 | 21 |
| 2 | Mango | 80 | 53.3 |
| 3 | Coconut | 84 | 56 |
| 4 | Orange | 57 | 38 |
| 5 | Ogbono | 79 | 53 |
| 6 | Cocoa | 11 | 0.7 |
| 7 | Pepper fruit | 27 | 18 |

*Note: Multiple responses were recorded.

Table 2 shows the distribution of the 7 identified economic trees that are commonly planted by households in Delta State, Nigeria. The result is reported in the order of frequency (prevalence). Coconut is most common with 56%, Mango (53.3%), Ogbono, (53%), Orange (38%), Pear (21%), Pepper fruit tree (18%) and Cocoa (0.7). The possible reasons for this distribution can be adduced to the dual economic and environmental benefits derivable. This finding shows that diverse economic trees were planted and owned by households Simpson Diversity Index (SDI) as a measure which shows that the more the economic trees owned by a household, the more the economic and environmental benefits derivable.

**Factors That Determine the Ownership Decision of Economic Trees**

Table 3 Logistic Regression Result showing the factors that determine the ownership decision of economic trees.

**Hypothesis Testing**

**$Ho_2$**: The selected socioeconomic factors do not have significant marginal effects economic tree ownership decision in the study area.

The result in Table 3 shows that the selected socio-economic factors significantly determine economic tree ownership decision thus the null hypothesis is rejected and the alternate accepted that the selected socio-economic factors significantly determine economic tree ownership decision.

**Table 3: Marginal Effects after logistic regression**

| Variables(x) | dy / dx (Coeff.) | Standard error | t.cal` | P.val |
|---|---|---|---|---|
| ELO | 0.26 | 0.1442 | 1.78 | 0.074 |
| AVMKT | 0.09 | 0.0684 | 1.46 | 0.145 |
| EINC | 0.09 | 0.1816 | 0.52 | 0.606 |
| FOL | 0.22 | 0.1043 | 2.11* | 0.035 |
| ENSHT | -0.11 | 0.1781 | 2.45 * | 0.047 |
| PFSC | 0.49 | 0.1677 | 2.93** | 0.003 |
| POP | 0.37 | 0.1636 | 2.25* | 0.025 |
| LGP | -0.01 | 0.1796 | -0.07 | 0.948 |
| AIGN | 0.14 | 0.1692 | 0.85 | 0.394 |
| AES | 0.49 | 0.1677 | 2.94** | 0.005 |
| TDI | 0.59 | 0.3192 | 3.19** | 0.002 |
| AST | -0.14 | 0.2143 | -0.66 | 0.511 |
| BDE | 0.42 | 0.1626 | 2.60 ** | 0.009 |

Y= Prob. (tree ownership)
= 0.80
*= sig. @ 5%
** = sig. @ 1%

The marginal effect of the independent variables in the binary logistic regression analysis is represented in Table 3 above. The marginal effect explains by how many units the decision to own economic tree changes if the explanatory variables selected changes by one unit. On the response scale, it was observed that;

- **Marginal Effect for Fertility of Land (FOL)** has a positive relationship with economic tree ownership decision. This implies that if fertility of land increases by one unit, the decision to own economic trees increases by 0.2572485 units this is significant with a Z value of 2.11.
- **Marginal Effect for Enterprise Shift (ENSHT)** was negative and significant with a T-value of -2.45 implying that if enterprise shift increases by one unit, the decision to own economic trees increases by -0.11 units.

- **Marginal Effects for Perceived as a Food Security Crop (PFSC)** was positive and significant with a z value of 2.93 implying that if perceived as a food security crop increases by one unit, the decision to own economic tree increases by 0.49 unit.
- **For price of products (POP) the marginal effect** was positive and significant with a z value of 2.25 implying that an increase by one unit implies a 0.37 unit increase in economic tree ownership decision.
- **For access to extension services (AES) the marginal effect** was also positive and significant with a z value of 2.94 and implies that an increase by one unit implies a 0.49 unit increase in economic tree ownership decision.
- **Marginal effect for Tree diversity index (TDI)** was likewise positive and significant with a coefficient of 0.59 implying that a one unit increase TDI will cause a 0.59-unit increase in economic tree ownership decision.
- **Finally, marginal effect for boundary demarcation (BDE)** was observed to be positive and significant with a T- value of 2.60 implying that an increase by one-unit results in an increase in economic tree ownership decision by 0.42 units.

## Perceived Implication of Economic Tree Planting on Climate Change Mitigation

**Table 4: Distribution of perception of respondents on environmental implications of economic tree planting**

| S/N | Perceptions | Chi-cal | Chi-tab | Remark |
|---|---|---|---|---|
| 1 | Economic tree crop can reduce the hotness of the environment | 0.45 | 3.84 | Not significant |
| 2 | It provides good shade and wind break | 0.12 | 3.84 | Not significant |
| 3 | It provides fresh air | 0.55 | 3.84 | Not significant |
| 4 | It purifies the air we breathe | 7.08 | 3.84** | Significant |
| 5 | Economic tree crop can mitigate the impact of climate change on the environment | 0.75 | 3.84 | Not significant |

df = 1
**=5% α level

In Table 4 the result of the response of both owners and non owners of economic tree on perceived implication of economic tree planting on climate change mitigation was presented. The result shows that the surveyed rural farmers are homogenous in their knowledge on environmental implication of trees. This result could be attributed to the awareness of indigenous rural farmers on the capacity of economic trees to reduce the hotness (temperature) of their environment; provide shade and wind brakes to protect their environment, particularly buildings. Awareness of rural farmers on the environmental benefit of economic tree could influence their decision to positively respond to the tree planting campaign and own a tree. This conforms with the earlier finding of Odafivwotu (2015) who investigated public perception on climate change in Yenagoa, Bayelsa State Nigeria, which showed that a significant portion of the respondents saw that tree planting and stoppage of deforestation among other measures as critical in mitigating climate change.

### Hypothesis Testing

**Ho2**: There is no significant difference in the perception of surveyed households with respect to economic tree planting and climate change mitigation. The null hypothesis is generally accepted that there is no significant difference in the perception of households that economic tree planting can mitigate climate change hazards. The surveyed households expressed homogenous perception on the potential of trees for environmental sustainability in Delta State, Nigeria.

## CONCLUSION

The study investigated the impact of selected economic tree ownership on rural household income and environmental sustainability in Delta State, Nigeria and found out that economic tree owners were food secure while non owners were food insecure, it was also discovered that income level of economic tree owners was higher than that of non owners and that economic trees have a multiplier effect of 28% on the overall income level and significant impact on the climate of the study area. Conclusively, the study has pointed out the economic and environmental potentials of economic tree and it is expected that if the dual concept behind this study is adopted, the global goal of poverty alleviation and climate change mitigation will be adequately attained.

## RECOMMENDATIONS

1. That tree planting campaigns of governmental and nongovernmental organizations targeted at climate mitigation should adopt the use of economic trees while targeting people of all ages so as to attain the objective and simultaneously providing sustainable income thereof.
2. That international organizations such as World Bank, United Nations etc with climate mitigating objectives targeted at developing countries should key into the twin potentials of economic trees in order to achieve their goals.
3. That community heads and leaders should advocate economic tree planting as a means of ensuring adequate food security and income level for rural households.

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