An Assessment of the Impact of Round Wood Collection on Deforestation in Benue State, Nigeria

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Abstract

Purpose: The high cost of alternative sources of household energy and steel in Nigeria is aggravating the dependence on forest frontiers in search of forest wood for construction, charcoal production, and fuel wood gathering for heating. This necessitates the study to access the impact of Round Wood Collection (proxies as Tree Logging, Charcoal Production, and Fuel Wood Collection) on Deforestation in Benue State, Nigeria.

Methodology: A survey design research was used for the study with the instrument of a structured questionnaire administered to 400 respondents determined by Taro Yamane’s (1967) sampling formula and selected through two-stage sampling techniques across nine (9) Local Government Areas (LGAs) in Benue State. The data elicited from the field was analyzed through descriptive statistics and a regression with the aid of Statistical Package for Social Science (SPSS) 23.

Findings: The result showed a significant positive relationship between Round Wood Collection (RWC) and Deforestation (DEF) in Benue State, implying that DEF in Benue State will increase significantly by 24.4%, 44.7%, and 28.4% as a result of a percent change in the rate of Tree Logging, Charcoal Production, and Fuel Wood Collection respectively in the state.

Conclusion: The study concludes that RWC impacts negatively on the forests and vegetation cover in Benue State which has a negative ripple effect on biodiversity, the ozone layer, ecosystem functioning, and livelihoods of forest fringe communities.

Recommendation: The study recommends that the Benue State government should increase funding to the State Department of Forestry and employ adequate forest personnel to enhance forest management and revenue yields from the forests.

Keywords: Deforestation, round wood collection, irreversible model of land-use change, benue state.
INTRODUCTION

The global certified forest area between mid-2019 and mid-2020 was estimated at 435.5 million hectares (FAO/UNECE, 2021) of which 25.3 million hectares of tree cover was degraded in 2021 (Global Forest Watch, ND). The forest sector has contributed immensely to the Gross National Income (GNI) of national economies around the globe, with a gross value added of an estimated US$ 468 billion in 2006 and export trade from forest products reaching US$ 330 billion in 2007 (Food and Agricultural Organization of United Nation [FAO], 2008). The global consumption of furniture in 2020 was estimated at US$ 400 billion (FAO/UNECE, 2022). In the European Union (EU), forestry and logging accounted for 0.2 percent of the GDP with 517,000 forest fringe employments in 2019 (Euro Stat, ND) while in the United Kingdom (UK), total wood product export amounted to €2.0 billion in 2021 (Forestry Research, 2022). In Africa, timber production accounts for 6 percent of the GDP of Ghana with an estimated 12 percent foreign exchange earnings between 1990 to 2000 (Lebedys, 2004 cited in Idumah & Awe, 2017) while in Gabon, timber production accounted for 0.3 percent of the GDP in 2011 (African Economy Outlook, 2012 cited in Idumah & Awe, 2017). An estimated two-thirds of Africa’s population relies on the forest as a source of livelihood and food with over 90 percent relying on the forest to harvest fuel wood and charcoal as energy providers (Ojo et al., 2018).

The forestry sector generated about 2.5 percent of Nigeria’s GDP in 1979 with wood and wood products accounting for about one percent of total foreign exchange earnings (Okorie, 1981 cited in Akpa, 2022). Log exports in the 1960s were peak at 773,000 cubic meters in 1964 amounting to about US$ 18 million (FAO, 2001) in Nigeria. The percentage contribution from forestry stood at 0.26 percent with a value-added of ₦52.02 billion in 2021 in the country (Uzuegbu, 2022). On a less monetary front, Barnes (1990) cited in Akpa (2022) showed an estimated 90 percent of households in sub-Saharan Africa use fuel wood as a stable source for domestic heating while a report by Olajide (1999) showed 80 percent of the Nigerian population depends on fuel wood and its product (charcoal) as a source of energy. This shows the enormous benefits of the forest to national economies and household energy needs which call for a paradigm shift to sustainable use of the forest frontiers to enhance the environment and livelihood of forest fringe communities.

While revenue yield from the forestry sector is on a downward swing owing to poor data collection and lack of accountability, forest fringe communities have relied continuously on the forest as means of livelihood and subsistence in Nigeria. In line with the aforementioned, an empirical study by Ekhuemelo, Tembe and Abah (2019) showed weekly earnings of ₦22,000 and ₦11,000 to ₦15,000 from charcoal production in Makurdi and Guma LGAs respectively in Benue State. The study revealed further that charcoal production significantly enhanced the socio-economic well-being of charcoal producers as revenue accruing from charcoal production is used to finance household expenditures and other needs such as payment of school fees and purchase of vehicles.

Despite the forgoing benefits of the forests to national economies and means of livelihood of forest fringe communities in Benue State, Nigeria, the adequate hybrid processes of traditional forest conservation frameworks and modern forest management principles have not been implemented in the state (Tee, Agbiye & Ogwuuche, 2018) to enhance a sustainable means of livelihoods from the forest sector. The forests (52 forest reserves and 77 communal forests) and vegetation in Benue State are depleting at an alarming rate owing to anthropogenic activities of man in the various forests. An empirical study by Adia et al. (2018) showed a decline in Yandev forest plantation in...
the state from the original size of an estimated 331 hectares in the year 1935 to 36 hectares in 2016 as captured by satellite imagery with the Google Earth Map. The study revealed further that “from initial stock density of 1,111 per ha, the average number of stand with diameter at breast height (dbh) > 20 cm in the four compartments have declined considerably to 77 for Cassia spp, 152 for Arzadirachta indica, 208 and 206 for Tectona grandis and Gmelina arborea respectively.” An empirical study by (Dagba, Sambe & Adia, 2017) showed logging, fuel wood gathering, and other anthropogenic activities to have accounted for the depletion of the Okokoro forest in Otukpo LGA of Benue State. In Apa LGA of the state, an investigation by Ikyagba, Jande and Eche (2020) showed a decline of 175.40 km² of forest cover spanning 20 years period (1988-2008) with a 49.99 percent rate of the total decline in the forests within the period, while an inquiry by Ekhuemelo, Tembe and Abah (2019) revealed that as much as 132 trees and 109 trees were harvested for charcoal production on weekly basis in Makurdi and Guma LGAs of Benue State respectively.

Observation in the study area shows Round Wood Collection (RWC) to be the leading factor accounting for the deteriorating spate of forest decline in the state. RWC is the felling and harvesting of forest wood through tree logging and lumbering, charcoal production, and fuel wood collection for construction and export, heating, and as important energy providers. Benue State has 129 forests (52 forest reserves and 77 communal forests) with inadequate forest personnel (Benue State Gazette, 2010) to man the various forests. This provides the necessary conditions for indiscriminate tree harvesting and spiral forest degradation which has threatened forest trees such as Milicia excelsa, Khaya senegalensis, Daniellia oliveri, Prosopis Africana, among others with extinction in the state (Tee, Agbiye & Ogwuche, 2018). Surveys in the major sawmills and wood depots in Otukpo, Makurdi, Gboko towns, and smaller wood depots along the Otukpo-Oweto highway showed a rising scarcity of forest trees in the state owing to indiscriminate tree felling and inadequate afforestation programs to regenerate and replenish the dwindling forest frontiers in the state.

Tree-logging deforestation nexus has mixed assertions in empirical studies around the world. Putz et al. (2001) cited in Chakravarty et al. (2012) sees logging as a less proximate factor in forest decline but serves as a major source of forests degradation. Tree logging and lumbering alters the natural formation of primary forests and thus create the channel for deforestation to take place through access roads for proximate anthropogenic activities such as crop farming, urbanization, and mining, among others. Empirical studies (Capistrano 1990, Von Amsberg, 1994 and Deacon, 1995) see logging to be a proximate factor influencing the rate of forest decline which impact negatively on ecosystem functioning, biodiversity, climate change, and resource-induced conflict such as sedentary farmer-pastoralist conflict. A study by Mfon et al. (2014) showed the depletion and transformation of Ekinta forest reserve (104km²) in Cross River State from tropical high forests into grassland as a result of unsustainable logging which led to eco-system dis-functioning and loss of biodiversity in the state. A study by Palmer (2011) showed illegal logging to be the most direct threat to Indonesia’s remaining tropical forest.

The process of charcoal production involves the felling and harvesting of tree trunks and branches to convert into charcoal (through a burning process) before being used as a source of energy in households, bakeries, and restaurants. An estimate by FAO (2020) showed the global production of wood charcoal in 2018 amounted to 53.2 million tons with Africa accounting for about 64% (34.2 million tons) of the total production. The increasing trend in global decline in tropical forests in 2009 owing to charcoal production resulted in Greenhouse Gasses emissions of an estimated

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71.2 million t for carbon dioxide and 1.3 million t for methane (Chidumayo & Gumbo, 2013). El Salvador is one of the countries around the globe that is worst hit by deforestation with only 2.5% of the country remaining forested (Hecht et al., 2006) as a result of anthropogenic activities in the forests with charcoal production accounting largely for the deteriorating spate of forests decline in the country (Repetto, 1990). In Africa, an inquiry by Onekon and Kipchirchir (2016) revealed that Kenya would lose about 65.6 percent of its forest cover to charcoal production and usage by 2030.

A report by World Bank (2000) showed 45% of Nigerians live below the poverty line. The poverty rate is higher in rural communities as households in rural communities have fewer alternative sources of livelihood. To ameliorate the increasing rate of poverty and increase in the cost of alternative sources of energy, forest fringe communities and house households in Benue State, Nigeria encroach further into forest frontiers to harvest wood for heating and energy use. A report by FAO (2014) revealed that more than 2.4 billion people globally rely on the use of fuel wood and charcoal for cooking with small enterprises also relying on the use of fuel wood and charcoal as important energy providers. Empirical inquiries by (Adia et al., 2018; Tee, Agbidye & Ogwuche, 2014; Abah, Hembafan & Esheya, 2020; Ikaagba, Jande & Eche, 2020;) have been carried to assess the effects of deforestation on livelihoods and land use change across LGAs in Benue State and on conservation pattern with tree species in the state, however, empirical inquiry on the impact of RWC on deforestation in the state is relatively absent. This provides the basis for the study to fill the gap in empirical works of literature.

Policy measures such as the Reducing Emission from Deforestation and forest Degradation (REDD) have been initiated by United Nations (UN), the Montreal Process Criteria and Indicators in Santiago in 1995 were also introduced to curtail the impact of deforestation while in Nigeria, measures such as the ban on logging (1975), Annual Afforestation (AP) (1988), National Forest Action Plan (NFAP) (2005), educating farmers about the dangers of environmental degradation, providing farmers with high yielding varieties of crop and irrigation equipment (Ibrahim, Iheanacho & Bila, 2015) were introduced to check the rate of deforestation. Measures such as Hammering fees, the Annual Tree Planting Campaign (2000), and tree Ornamental Seedling (2004) have been introduced by the Benue State government (Benue State Gazette, 2010) to check the rate of forest decline, yet forests cover continues to dwindle each year. The increasing rate of forest decline despite the aforementioned measures provides the basis for the study to assess the following research questions.

1.1 Research Questions

The main research question is, what is the impact of Round Wood Collection on deforestation in Benue State? while the specific research questions are;

i. What is the impact of Tree Logging on Deforestation in Benue State?
ii. What is the impact of Charcoal Production on Deforestation in Benue State?
iii. What is the impact of Fuel Wood Collection on Deforestation in Benue State?

1.2 Research Hypotheses

H₀₁: There is no significant impact of Tree Logging on Deforestation in Benue State
H₀₂: There is no significant impact of Charcoal Production on Deforestation in Benue State
H₀₃: There is no significant impact of Fuel Wood Collection on Deforestation in Benue State
2.0 THEORETICAL FRAMEWORK

2.1 The Model of Irreversible Land-Use Change

The model in Kerr, Pfaff and Sanchez (2002) and Vance and Geoghengan (2002) depict land users’ decision to convert woodlots to alternative agricultural use in consonance with changing economic environment given time and location factors which affects the return on land cover (Purnamasari, 2010). The model is however modified to examine forest fringe communities, loggers, charcoal producers, and round wood collectors’ decision to convert forest frontiers in Benue State to round wood revenue generating ventures in woodlots than allowing land cover for aesthetic uses and biosphere functioning given the prevailing economic environment, time, and location. The theory was built on the assumption of an irreversibility of forests to their original state (primary forest) after anthropogenic activities of man such as RWC, agriculture, and urbanization, among others in the forest which are determined by time, location, and prospective returns on forested lands. The model is evident in the study area and is relevant to the study as forest fringe communities, loggers, fuel wood collectors, farmers, and charcoal producers encroach further into forest frontiers in the state to enhance revenue yield from the forests.

3.0 METHODOLOGY

A survey research design was used for the study to acquire detailed knowledge and observation of RWC in the forests in Benue State. To have an unbiased representation of the study population, multi-stage sampling techniques were employed to select the sample size of 400 respondents determined through Taro Yamane’s (1967) sampling formula. The purposive sampling technique was used to select three (3) LGAs each from the three senatorial zones in the state owing to the prevalence of and presence of wood harvesting and wood depots respectively in the LGAs. Simple random sampling was employed to select the respondents from communities with significant round wood activities. An instrument of structured questionnaire divided into two sections (section one contained information on the demographic and socio-economic characteristics of the respondents while section two contained information on the impact of Round Wood Collection on Deforestation in Benue State). The five-point Liker-Scale of Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A), and Strongly Agree (SA) was used to elicit relevant information for the study. Descriptive statistics of tables and percentage indexes were applied to the demographic and social-economic characteristics of the respondents while the inferential statistics of Regression Analysis with the aid of SPSS 23 was used to examine the impact of RWC on DEF in the state. P-value was used to test the stated hypotheses at a 5 percent level of significance while Durbin Watson test and Variance Inflation Factor (VIF) were employed to test for autocorrelation and multicollinearity among the residuals of the model and among the predictor variables respectively. Cronbach’s alpha coefficient was used to test the reliability of the instrument from which the result showed an index of 0.9 which Kothari (2011) suggested that a construct with a coefficient of 0.7 or above is desirable and captures adequately the necessary information for the study.

3.1 Study Area, Population, and Sample Size Determination

Benue State has a total land mass of 30,955 km² with a projected population of 6,141,300 million people (City Population, ND). It lies at Latitudes 7.3369°N and longitudes 8.7404°E and on the derived savannah belt between the tropical rainforest of southern Nigeria and the open grassland savannah vegetation of northern Nigeria (Benue State Diary, 2012). The State is bordered to the

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east by Taraba State, to the west by Kogi State, to the North by Nasarawa State, to the South by Cross-River State, and to the southwest by Enugu State. The State is dominated by tree species such as; *Khaya senegalensis, Detarium microcarpum, Parkia biglobosa, Daniellia oliveri, Afzelia africana, Vitellaria paradoxa, Vitex doniana, Nauclea diderichii, Prosopis africana, Terminalia schimperiana,* among others (Benue State Diary, 2012). The sample size for the study was determined through the Taro Yamane’s (1967) sampling formula from the study population of 3,008,000 people (Vandeikya-338,700; Katsina-Ala-325,500; Ukum-313,300; Makurdi-433,700; Guma-280,300; Gboko-521,700; Agatu-166,900; Otukpo-384,600; Oju-243,300) based on city population (ND) figure. Thus;

\[ n = \frac{N}{1 + N(e)^2} \]

Where:
- \( n \) = sample size
- \( N \) = population of the study area
- \( e \) = Level of significance (0.05)
- \( 1 \) = Unity (a constant)

This formula was substituted thus;

\[ n = \frac{3,008,000}{1 + 3,008,000(0.05)^2} \]

\[ n = 400 \]

### 3.2 Model Specification

The study developed a univariate model to assess the impact of Tree Logging (TLG), Charcoal Production (CCP), and Fuel Wood Collection (FWC) on Deforestation (DEF) in Benue State. Thus;

DEF = \( f \) (TLG, CCP, FWC) \-------- (1)

DEF = \( a + \beta_1\)TLG + \( \beta_2\)CCP + \( \beta_3\)FWC + £ \------ (2)

Where
- DEF = Deforestation
- TLG = Tree Logging
- CCP = Charcoal Production
- FWC = Fuel Wood Collection
- \( a \) = Constant
- \( \beta_1, \beta_2, \beta_3 \) = are the coefficients of parameter estimate.
- £ = Error term

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4.0 FINDINGS

Three hundred and sixty-nine (369) questionnaires were returned for analysis and are presented in the frequency table (Table 1) and percentage indexes on socio-economic and demographic characteristics of the respondents while responses on the impact of RWC on DEF in Benue State, Nigeria are regressed with SPSS 23 and presented in table 3.2.

Table 1: Socio-economic and demographic characteristics of respondents in the study

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-40</td>
<td>243</td>
<td>65.9</td>
</tr>
<tr>
<td>41-70</td>
<td>82</td>
<td>22.2</td>
</tr>
<tr>
<td>Above 70</td>
<td>44</td>
<td>11.9</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>249</td>
<td>67.5</td>
</tr>
<tr>
<td>Female</td>
<td>120</td>
<td>32.5</td>
</tr>
<tr>
<td><strong>Household size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 5</td>
<td>101</td>
<td>27.4</td>
</tr>
<tr>
<td>6-10</td>
<td>115</td>
<td>31.2</td>
</tr>
<tr>
<td>Above 10</td>
<td>153</td>
<td>41.5</td>
</tr>
<tr>
<td><strong>Household income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below ₦20,000</td>
<td>145</td>
<td>39.3</td>
</tr>
<tr>
<td>₦20,000 – ₦50,000</td>
<td>111</td>
<td>30.1</td>
</tr>
<tr>
<td>₦51,000–₦100,000</td>
<td>63</td>
<td>17.1</td>
</tr>
<tr>
<td>Above ₦100,000</td>
<td>50</td>
<td>13.6</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil servant</td>
<td>71</td>
<td>19.2</td>
</tr>
<tr>
<td>Round wood collector</td>
<td>111</td>
<td>30.1</td>
</tr>
<tr>
<td>Farmer</td>
<td>163</td>
<td>44.2</td>
</tr>
<tr>
<td>Others</td>
<td>24</td>
<td>6.5</td>
</tr>
<tr>
<td><strong>Household energy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>29</td>
<td>7.9</td>
</tr>
<tr>
<td>Wood/charcoal</td>
<td>273</td>
<td>74.0</td>
</tr>
<tr>
<td>Gas/kerosene</td>
<td>67</td>
<td>18.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>369</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: SPSS 23 (Field work, 2022)

Responses presented in table 1 shows that 65.9% of the respondents with 243 frequencies are between the ages 18-40 years, 22.2% fall between 41-70 years, while the remaining 11.9% with 44 frequencies are above 70 years. The responses on gender show 67.5% of the respondents are males while the remaining 32.5% are females. This depicts that age and gender play a significant role in forest decline in Benue State as a large portion of the respondents falls in the active ages of 18-40 years with a significant portion (67.5%) being males.

Responses on household size show 41.5% of the respondents have a household size of more than ten persons, 31.2 percent have a household size of 6-10 people, and the remaining 27.4% are
households with less than five persons. A large portion of the respondents (39.3%) earn a monthly income of less than ₦20,000, 30.1% earn an average monthly income of ₦20,000 to ₦50,000, 17.1 earns an average monthly income of ₦51,000 to ₦100,000, while the remaining 13.6% earns an average monthly income greater than ₦100,000. This shows that a large portion of the respondents has a household size of above 10 persons with a large portion of the population earning an average monthly income that is less than ₦20,000. The low average monthly income with large family size incentives forests fringe communities in Benue State, Nigeria to encroach further into forest frontiers to enhance a sustainable means of livelihood and household energy source. Contrary to the finding, a report by Purnamasari (2010) showed an inverted U-shaped relationship between poverty and deforestation in Kalimantan, Sumatra, and Sulawesi in Indonesia, signifying that poor people lack adequate resources to convert forest frontiers to alternative sources of livelihood.

Responses on occupation show 44.2% of the respondents are farmers, 30.1% are Round Wood Collectors, 19.2% are civil servants, while the remaining 6.5% of the respondents engage in other forms of occupation not mentioned in the study. On household sources of energy, 74.0% of the respondents make use of fuel wood and charcoal as household sources of energy, 18.2% use gas and kerosene as household sources of energy, while the remaining 7.9% use electricity as household sources of energy. This shows that large portions of the respondents being farmers and Round Wood Collectors relies heavily (74.0%) on the forest for household energy source which impacts negatively on the forests (Capistrano, 1990; Von Amsberg, 1994; Ojo et al., 2018).

**Table 2:** Responses on impact of TLG, CCP, and FWC on DEF in Benue State, Nigeria

<table>
<thead>
<tr>
<th></th>
<th>Responses</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA</td>
<td>A</td>
</tr>
<tr>
<td>TLG</td>
<td>185</td>
<td>87</td>
</tr>
<tr>
<td>CCP</td>
<td>218</td>
<td>101</td>
</tr>
<tr>
<td>FWC</td>
<td>195</td>
<td>82</td>
</tr>
</tbody>
</table>

*Source: SPSS 23 (Field Work, 2022)*

The frequency of responses of the impact of Tree logging, Charcoal production, and Fuel wood collection as depicted in table 2 showed 272 (185+87) of the responses agreeing to TLG as the leading factor influencing deforestation in Benue State, 15 responses were undecided, while 82 (37+45) disagreed with TLG as the proximate factor influencing deforestation in Benue State. Responses on charcoal production showed 319 (218+101) frequencies in favor of charcoal production as a proximate factor in forest cover decline in Benue State, 7 responses are neutral, while the remaining 43 (15+28) responses disagree with CCP as the proximate factor influencing the alarming rate of forests decline in the state. On FWC, 277 (195+82) responses agrees with fuel wood collection as the leading factor influencing the rate of forest decline in Benue State, 43 responses were undecided, while the remaining frequency of 49 (31+18) disagreed with fuel wood collection as the leading factor in forest frontiers decline in Benue State. The responses are further transformed, computed, and subjected to a regression analysis against the computed responses of the common dependent variable (DEF) to infer the rate of variation in forest frontiers decline resulting from RWC (proxies as TLG, CCP, and FWC) in Benue State, Nigeria.
Table 3: Regression analysis depicting the impact of RWC on DEF in Benue State, Nigeria

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Standard Error</th>
<th>Standardized Coefficient (Beta)</th>
<th>t-statistics</th>
<th>P-value</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLG</td>
<td>0.054</td>
<td>0.244</td>
<td>5.248</td>
<td>0.000**</td>
<td>8.242</td>
</tr>
<tr>
<td>CCP</td>
<td>0.056</td>
<td>0.447</td>
<td>9.206</td>
<td>0.000**</td>
<td>8.975</td>
</tr>
<tr>
<td>FWC</td>
<td>0.059</td>
<td>0.284</td>
<td>6.023</td>
<td>0.000**</td>
<td>8.473</td>
</tr>
</tbody>
</table>

R = .951     Adj R² = .903     DW = 1.255

Legend: ** Significant @ 5% Level.

Source: SPSS 23 (Field work, 2022)

Table 3 depicts the model summary which shows the relationship between the observed variable and the predictor variables. The R-value of 95.1% shows a significant relationship between the dependent and independent variables in the study while the adjusted R-squared value of 90.3% shows that a 90.3% variation and forest decline in Benue State is accounted for by Tree Logging, Charcoal Production, and Fuel Wood Collection. The remaining 9.7% of changes in the forest frontiers in Benue State are accounted for by other variables not captured in the model. To test for autocorrelation and multicollinearity in the model, the Durbin-Watson test and VIF were employed from which the results in table 3.3 show no autocorrelation among the residuals of the model (DW=1.225) and no multicollinearity among the predictor variables (given that the VIF values are less than 10) (Jingyu, 2003).

The p-value of TLG (0.000 < 0.05) shows a significant impact of TLG on DEF in Benue State, Nigeria. The result indicates that a percentage increase in TLG will lead to a significant 24.4% increase in DEF in Benue State. This is in line with previous studies (Abah, Hembafan & Esheya, 2020; Von Amsberg, 1994) of a significant impact of TLG on DEF which impact negatively on the environment and biodiversity. CCP also has a significant impact on DEF in Benue State (p-value of 0.000<0.05) which posit that a percent increase in CCP will lead to a significant 44.7% increase in deforestation in the State that is in line with empirical studies by (Onekon & Kipchirchir, 2016; Repetto, 1990). In addition, FWC (p-value 0.000<0.05) has a significant impact on DEF in Benue State. This shows that a percentage increase in FWC will lead to a significant 28% increase in deforestation in Benue State which is in line with previous empirical studies (Abah, Hembafan & Esheya, 2020; Ojo et al., 2018).

5.0 CONCLUSION

The study concludes based on the findings that RWC impacts negatively on the forests and vegetation cover in Benue State which has a negative ripple effect on biodiversity, the ozone layer, ecosystem functioning, and livelihoods of forest fringe communities.

5.1 Contribution to Knowledge and Suggestion for Further Studies.

The study has enhanced the growing body of knowledge on deforestation by highlighting the impact of indiscriminate tree felling, illegal fuel wood collection, and uncontrolled charcoal production on forest transition and changes in vegetation cover in Benue State, Nigeria. It is noteworthy that the continuous depletion of economic trees such as Locust bean (Parkia biglobosa) and Mahogany (Khaya ivorensis) and undue reliance on the forests is largely a result of inadequate funding and forest research to enhance sustainable forest management principles,

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low income and poverty, inadequate forests personnel, and high cost of alternative sources of heating and household energy. Further inquiries should be carried out on the impact of bush burning on deforestation and forest degradation in Benue State which is an annual ritual that is practiced by hunters, farmers, and pastoralists to hunt game, control weeds, and have fresh shoots for animals respectively.

6.0 RECOMMENDATIONS.

The following recommendations are advanced based on the finding to enhance net forest gain and socio-economic well-being which is a win-win situation.

i. The Benue State government should increase funding to the State Department of Forestry and employ adequate forest personnel to enhance forest management and revenue yields from the forest. Efforts such as logging and transportation permits should be strengthened in synergy with existing forestry policies such as the hammering fees, Annual Tree Planting Campaign (2000), and tree Ornamental Seedling (2004) while forestry research in collaboration with the College of Forestry and Fisheries, Joseph Sarwuan Tarka University, Makurdi, Benue State should be strengthened to enhance best global forest management practices.

ii. The Federal Government should provide the enabling environment for private investment in green energy to assuage overdependence on the forests for household energy. There is a need to revamp Ajeokuta and other steel companies in the country to optimum capacity to mitigate tree logging in the various forest frontiers in the country.

iii. Non-Governmental Organizations (NGOs) and advocacy groups should enhance advocacies on the relevance of the forest to ecosystem functioning, biodiversity, and climate change mitigations in line with the REDD framework.

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