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Impacts of Abandoned Gebu Forest Escarpment Reserve in Kogi State of Nigeria on Climate Change: Need for Forest Institutional Measures

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ABSTRACT

The study examines abandoned Gebu Forest Escarpment Reserve (GFER) in Kogi State, Nigeria with a view to recommending forest institutional measures for climate change mitigation. The method used for the study was socio-economic survey to gather data through digital mapping, observations, administration of questionnaire and the use of secondary data. The results indicated that the built-up area; mosaic of farmlands/settlements; riparian forest; and wooded savanna within the forest reserve occupy 7.13%, 25.07%, 44.17% and 23.63% respectively. A total of estimated 5,413,216 kg of CO_2 is lost to the atmosphere per year in GFER as a result illegal occupation of the community people within the forest reserve. The forest reserve has a composition of trees that are predominantly of savanna species. The respondents (76.67%) were aware of the GFER and majority of the respondents affirmed their livelihood dependency on Gebu forest reserve for farming, grazing, hunting, sales of forest products and collection of fuelwood for energy. The causes of anthropogenic activities of the communities within and around the GFER include absence of forest management by the State Forestry Department; high population growth and unsustainable agricultural practices while the effects of these activities include increase in environmental temperature, flooding, dryness of watershed and droughts. The binary logistic model for institutional measures for climate change mitigation of GFER in Kogi State indicated overall significant fit to the data judging from the chi square value (df, 7) =143.62 that is significant at $p<0.05$. The final loss of the model indicated a value of 7.58. It is recommended that a New Forest Management Plan should be produced for a good tenet of Gebu Forest Escarpment Reserve Management; the Government of Kogi State should enunciate robust forest policy and be complimented with an enactment of forestry act; and secondary forest road should be constructed within and near the forest reserve for easy accessibility, policing, motoring and evaluation of the forest reserve.

Keywords: climate change, mitigation, forest management, institution, deforestation

INTRODUCTION

Cumulative effects of human activities are changing the world's climate. According to Intergovernmental Panel on Climate Change (2001), climate is now warming rapidly that the effects are perceptible within a single human lifetime or within the history of a people. With this new change, an alteration in biodiversity is already facing multiple threats. However, the Intergovernmental Panel on Climate Change (IPCC, 2007) concluded that warming of the climate system is unequivocal and most likely due to observed increase in anthropogenic greenhouse gas concentrations in the atmosphere. In addition to the rise in average global temperatures, discernable changes have been observed in the day, night and seasonal temperatures in frequency, duration and intensities of heat waves, droughts, floods, winds and storm patterns, snow, frost, ice cover, and in global sea levels.

Forests are a significant part of the global carbon cycle. Plants use sunlight to convert CO_2, water, and nutrients into sugars and carbohydrates, which accumulate in leaves, twigs, stems, and roots. Plants also respire, releasing CO_2. Plants eventually die, releasing their stored carbon to the atmosphere quickly or to the soil where it decomposes slowly and increases soil carbon levels.

http://www.forestry.gov.uk/website/forestry.nsf/byunique/infd-7m8mnm29/08/2010 reported that deforestation alone is responsible for nearly 20 per cent of global carbon emissions that is more than the emissions from every car, every plane, every boat, every train and more than the whole of the transport sector put together.

The estimated forest area for Africa in 2005 was 635 million hectares accounting for 16 percent of global forest area. Net annual forest loss is about 4 million hectares for the period 2000 to 2005 (FAO, 2007). This amounts to almost 55 percent of the global reduction in forest area. However, the reported forest cover is distributed unevenly among the different sub regions and countries. The forest resources in West African countries have dwindled. The area change of the total forest cover in West Africa between 1990 and 2000 was -1,351,000 ha/year (FAO, 2001). Nigeria has a total forest of 13, 517, 000 ha (14.8%) whose ha/capita is 0.1. The total area change between 1990 and 2000 was -398,000ha/year (-2.6%). The state-led forest management in West Africa has failed to enhance sustainable forest management. The failure resulted from non-inclusion of local communities in forest management. The local communities constitute a readily available labour force that can be used to protect forest resources easier than State Forestry Department. Communities are vital components and have important role to play in collaborative forest management.

In many parts of the world, achieving a transition from deforestation to forest conservation and management will be a challenge. Forests will have to be managed using sustainable forestry practices. If forest programmes are to be successful, they will need to be part of wider, integrated land use and natural resource management programmes.

Nigerian forest and woody vegetation resources include the high forests, woodland, bushlands, plantations, and trees on farms (Federal Ministry of Environment Abuja, 2006). Each of these resources variously contributes to production, protection and conservation functions. Literature is replete with overwhelming evidence of the significance of tree species to human existence (Eckmuller *et al*. 1984; Oguntala, 1993; Diouf, 1997; Agbeja and Adesoye, 2003). In all the various forms of vegetation, trees tend to be the most sophisticated and strongest in influencing landscape protection. This assertion was corroborated by Oguntala (1993) with a remark that without trees, cities are hotter and drier, the air pollution is worse, the wind stronger, the flood danger and erosion more serious, the dust more damaging and people less comfortable and less healthy.

Studies show that forest reserves in Nigeria occupy about 96,043 km^2 or about 10 million hectares, which represents almost 10 per cent of Nigeria's land area of 923,767 km^2. However, the total forest estate cover is far below the 25% of forest estate recommended for reservation policy for every country of the world. The Forest estate is in about 445 gazetted Forest Reserves, distributed over the five main ecological zones namely the Freshwater/Mangrove, the Lowland Rainforest, the Derived Savanna, the Guinea Savanna and the Sudan/Sahel zones. The reserved forests are made up of 20,746km^2 of high forest, 3,208 km^2 of derived savanna and 72,089 km^2 of savanna. The forest estate in Nigeria is the legacy inherited from the Colonial Forest Administration. Forest reservation in most part of Nigeria reached its peak in the mid 1950's particularly in the Northern States where approximately 42,000 km^2 were reserved. Between 1960 and 1972, an area of over 12,900 km^2 was proposed for reservation in the Northern States. In the south, forest reservation has been at a standstill and the prospect of creating more reserves in the future is in doubt. The situation now is that most of the forest reserves are being subjected to dereservation as a result of increase in population and economic expansion in other sectors of the economy.

The former Gubbo-Adagaki Native Administration Forest Reserve (now Gebu Forest Escarpment reserve) located in Koton Karfe, Kogi Local Government Area, Kogi State, Nigeria was constituted and gazetted on 24 July 1931. The forest reserve is of the Guinea Savanna vegetation whose original size was 194.72 km^2 (19,472 hectares). This constitutes 0.20 percent of the total forest reserves in Nigeria and 0.27 percent of forest reserves in Savanna ecological zone of Nigeria. However, Gebu Forest reserve has since been abandoned by the State Department of Forestry, Kogi State. The whole forest reserve is facing accelerated deforestation, de-reservation and a good tenet of forest management is completely discarded.

One of the emerging issues in the whole world these days is climate change or global warming. Deforestation alone however, is responsible for nearly 20 per cent of global carbon emissions. Gebu Forest Escarpment Reserve is a repository of myriad of tree species that could serve as carbon sink among other forest reserves in Nigeria. It is very expedient that the destruction of Gebu Forest reserve is halted and a good management plan should be produced to attain sustainable forest management under an auspices of holistic forest policy and forestry act of Kogi State. Against this background, abandoned Gebu Forest Reserve in Kogi State, Nigeria was assessed and the general objective of the study was to provide information on the status of Gebu Forest Reserve with

a view to recommending institutional measures for sustainable management of the forest which in turn would mitigate climate change impacts. The specific objectives were to determine the current extent of Gebu Forest Reserve based on up-to-date digital map of the reserve on GIS platform; identify tree species endowment in the reserve; determine the level of dependence of the fringe communities on the forest reserve for livelihood and the impacts of their activities on the health and integrity of the forest ecosystems; identify causes and effects of anthropogenic activities on climate change; and investigate forest institutional measures for climate change mitigation.

MATERIALS AND METHODS

Study Area

Gebu Escarpment Forest Reserve is located in Koton Karfe, Kogi Local Government Area of Kogi State, Nigeria. The original size of the reserve was 194.72km^2. The Forest lies within Latitude $7^0 49^1 59.89^{11}$N and $8^0 14^1 59.88^{11}$N and Longitude $6^0 39^1 59.90^{11}$E and $6^0 54^1 59.90^{11}$. The forest extends from Okpareke village towards Adingere village along Koton Karfe- Adingere road. The forest is of the Guinea Savanna vegetation type.

Data Collection

Sample frame for the project involved field survey which entails detailed appraisal of the objectives of study. These objectives were carried out through the use existing forest boundary map and satellite imagery obtained from Google Earth Map Server which is secondary data. The second type of data used is the primary data which were obtained using the Global Positioning System (GPS) device. The GPS was used to collect coordinates of forest boundary. The GPS was calibrated to track the road network coordinate every second in WGS84 coordinate format. The coordinates obtained through the tracking were downloaded into ArcGIS software where they were subsequently plotted as arcs. The botanical name of every living tree encountered in each field plot was recorded. In cases where a tree's botanical name was not known immediately, such a tree was identified by its commercial/common/local name. Such commercial or local names were translated to correct botanical names using Gbile (1984) and Keay (1989). Each tree was recorded individually in the field forms. Structured questionnaire was used to obtain information on livelihood dependency on Gebu forest reserve from respondents who were farmers, traders, artisans and civil servants.

Data Analysis

The data were analyzed using descriptive and inferential statistical tools. Descriptively, percentages and tables were used while Logit Regression was employed for inferential statistics.

Logit Regression

Logit Regression was used to investigate forest institutional measures that will positively mitigate climate change in the study area.

Logistic Models

The binary logistic models are very useful in situations where the dependent or response variable is binary in nature. This implies that they can have only two possible values. The models therefore, describe the relationship between one or more continuous independent variable(s) to the binary dependent variable. The two common binary models are the logit and probit. The logistic model is particularly preferred because of the unique information it provides. Distinct information provided by logit is the odds ratio. It is defined as the ratio of the odds of an event occurring in the group to the odds ratio of it occurring in another group (Deeks, 1996; Bland and Altman, 2000). Logit also provides information on the consequences of one variable on the other. The model clearly indicates the variable(s) that mostly would mitigate climate change as institutional measures in Gebu Forest Escarpment Reserve, Kogi State, Nigeria. The logit of a response p between 0 and 1 is given as:

Logit (p) = log (p/1-p) = log (p) –log (1-p)
The simplest form of logit model is expressed as:
Logit (pi) = a + bxi……...……Model 1

Where,
xi = vector of predictor or independent variables

pi = probability of an effect of forest institutional measures that will positively mitigate climate change in Gebu Forest Reserve, Kogi State.
a and b = regression parameters.

In binary models, the two possible results are assigned values of 1 or 0. Therefore, in this study, respondent that says 'yes' to a factor that will mitigate climate change is assigned a value of 1 and respondent that says 'no' to a factor that will mitigate climate change is assigned a value of 0. The parameter estimation for this study was done using Quasi-Newton method under logistic regression (logit) option of STATISTICA version 5 Software. Models tested were obtained by fitting all the independent variables together and backward elimination was done to obtain the best subset model. Emphasis was placed on keeping the model as simple as possible and selecting combinations of independent variables which make practical sense.

RESULTS AND DISCUSSION

Current Extent of Gebu Escarpment Forest Reserve

The current area of Gebu Forest Escarpment Reserve is 194.72 km^2 (19,472 hectares) following the plotting of all the coordinates obtained during the field survey, and their subsequent correction with the Google Earth image. The map was at a scale of 1:90,000. Four distinct habitats were identified within the forest reserve area and these were built-up area; farmlands/ settlements; riparian forest; and wooded savanna. However, as a result of the relative closeness of the farmlands to settlements particularly those small settlements, it was difficult to separate the signature of farmlands from that of the settlements. Therefore, settlements and farmlands were combined in some areas as a mosaic of farmlands and settlements. Although, this is still acceptable because in most of the settlements visited, farmlands (subsistence farming) surround the settlements. The problem could also have been compounded by the resolution of the satellite image used (28.5m) in the landuse/landcover analysis. The coordinates used in the interpretation of these different landuses/landcovers were obtained during the reconnaissance survey of the forest area. Table 1 shows the area coverage of each of the mapped habitat within Gebu Forest Escarpment Reserve while Figure 1 shows the landuse/landcover map of Gebu Forest Escarpment Reserve.

Gebu forest escarpment reserve has been de-reserved by mosaic of farmlands/ settlements and built-up area that accounted for 32.2 percentage of the whole forest reserve. This constitutes illegal occupancy because the forest reserve was constituted and gazetted in 1931; under no circumstance should it be encroached by communities. However, the insensitivity of government through abandonment of the reserve paved way for illegal activities in the forest reserve.

According to http://www.articlesbase.com/environment-articles/how-much-carbon-does-a-tropical-tree-sequester-2824934.html,
Science Daily shows that natural African tropical forests absorb about 600 kg (1,323 lbs) of carbon per hectare per year. Therefore, an estimated total of 11,683,200kg of Carbon Dioxide is expected to be sequestered every year for the whole Gebu Forest Reserve with the original size of 19,472 hectares. However, only an estimated 6,269, 984kg of Carbon Dioxide is sequestered per annum based on the new digital map where only 67.8 percent constitutes riparian forest and wooded savanna. The remaining 32.2 percent constitutes built-up area and mosaic of farmland/settlements. This indicates that a total of 5,413,216kg of carbon is released into the atmosphere instead of being sequestered (carbon sink) in the forest reserve every year. This usually increases the temperature of the surrounding communities and other weather vagaries like rainfall, wind, humidity, etc. are verifiable indicators of climate change. The implication is that a total of 19,320 kg of carbon dioxide (CO_2) is emitted into the atmosphere per hectare of Gebu Forest Escarpment Reserve per year.

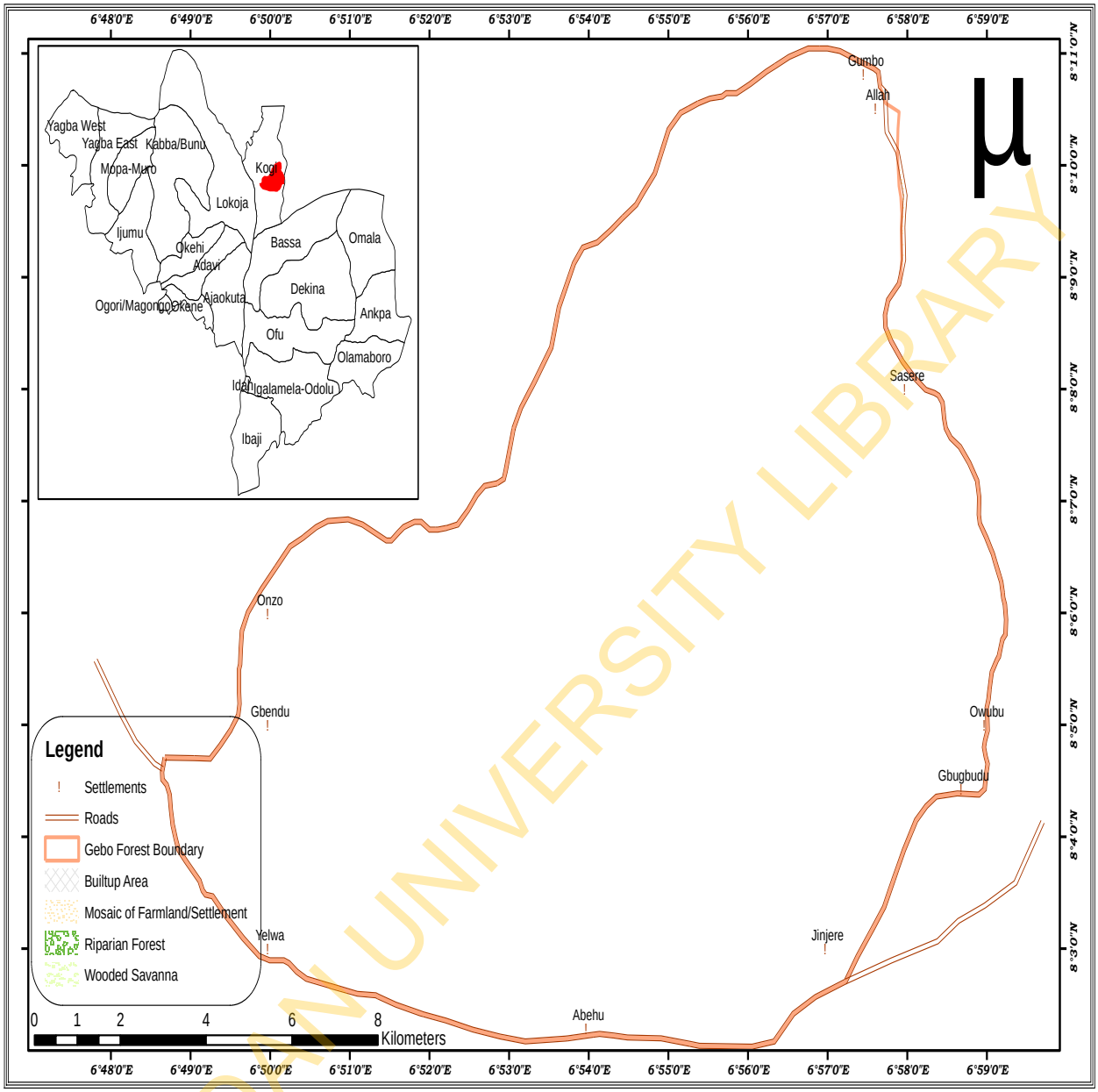

Figure 1: Land Use/Land Cover Map of Gebu Forest Escarpment Reserve, Kogi State, Nigeria

Table 1: Landuse/Landcover Area Extent within Gebu Forest Escarpment Reserve

S/N	Landuse/Landcover	Area (km^2)	Hectares	Percentage of Land use (%)
1	Built-up Area	13.88	1388	7.13
2	Mosaic of farmland and Settlement	48.83	4883	25.07
3	Riparian Forest	86.00	8600	44.17
4	Wooded Savanna	46.01	4601	23.63
Total		194.72	19,472	100

Identification of Tree Species in Gebu Forest Reserve

Gebu Forest Escarpment Reserve is predominantly characterized by a lot of Savanna tree species. A total of thirty one major species were identified during the field survey (Table 2). However, these tree species will face extinction in the immediate future if the forest reserve remains abandoned by the State Forestry Service without any stringent forest management procedures and this could constitute a factor that will accelerate adverse climate change in Kogi state in particular and Nigeria in general.

Table 2: Tree Species Composition and Family Sourced within Gebu Forest Escarpment Reserve in Kogi State, Nigeria

S/N	Species	Family/Subfamily
1	*Acacia spp*	Caesalpinoidae
2	*Adansonia digitata*	Bombacaceae
3	*Anogeissus leiocarpus*	Combretaceae
4	*Berlinia occidentalis*	Caesalpinoidae
5	*Ceiba pentandra*	Bombacaceae
6	*Cola hispidia*	Sterculiaceae
7	*Danielia oliveri*	Caesalpinoidae
8	*Detarium microcarpum*	Caesalpinoidae
9	*Ficus thonningii*	Moraceae
10	*Funtumia elastica*	Apocynaceae
11	*Hymenocardia acida*	Euphorbiaceae
12	*Isoberlinia doka*	Caesalpinoidae
13	*Khaya senegalensis*	Meliaceae
14	*Lophira lanceolata*	Ochnaceae
15	*Malacantha spp*	Sapotaceae
16	*Markhamia tomentosa*	Bignionaceae
17	*Milletia thonningii*	Papilionoidae
18	*Nauclea latifolia*	Rubiaceae
19	*Parkia biglobosa*	Mimisoidae
20	*Piliostigma thonningii*	Papilionoidae
21	*Pterocarpus erinaceus*	Caesalpinoidae
22	*Ricinodendron spp*	Euphorbiaceae
23	*Sterculia setigera*	Sterculiaceae
24	*Strychnos spinosa*	Loganiaceae
25	*Terminalia avicennoides*	Combretaceae
26	*Terminalia glaucescens*	Combretaceae
27	*Trema nitens*	Ulmaceae
28	*Trema orientalis*	Ulmaceae
29	*Vitellaria paradoxa*	Sapotaceae
30	*Vitex doniana*	Verbenaceae
31	*Ziziphus mucronata*	Rhammaceae

Source: Field Survey, 2008

Dependence of the Fringe Communities on Gebu Forest Escarpment Reserve for Livelihood

Socio-Economic characteristic of Respondents

The result in Table 3 reveals that out of 120 respondents, males constituted the highest proportion of the total number (69.17%) while females constituted the remaining 30.83%. More than two-thirds of the respondents were married (75.83%) while 11.67% of them were single. The age distribution of the respondents shows that more than half of the respondents (51.67%) were in the age brackets of 21-40 years while 23.33% represent 41-60 age brackets. The remainders were those in the age brackets of 60 and above; and 20 and below with 14.17% and 10.83% respectively. This result was satisfactory for responses in the study locations because most of the respondents were old enough to discuss on issues concerning the Gebu Forest Escarpment Reserve.

The level of education of the respondents shows that more than half of the respondents had no formal education (51.67%) while more than one-fifth had only primary education (23.33%). Only 1.67% of the respondents had tertiary education. The remaining respondents had quranic education (10.83%). This result indicated a low level of literacy. Almost two-third of the respondents were farmers

(70.83 %%). The respondents that were traders constituted 19.17% while artisans and civil servants were 4.17% and 5.83 respectively. In agreement with the main occupation of the respondents, their main sources of income were from farming (73.33%) and trading (16.67%). Salary (5.83%) and artisan (4.17%) represent small proportions of income.

With respects to the ethnic group of the respondents, 67.50% were Hausa, 14.17% Fulani while the remaining smaller proportions are Yoruba (5%) and Ibo (6.67%). However, remaining 6.67% respondents were made up of other ethnic groups like Ebira, Nupe, Gwari.

Awareness and Utilization of Gebu Forest Products among Respondents in Okpareke, Ibehu and Adingere Communities

Table 4 shows that more than two-thirds of the respondents from three communities namely Okpareke, Ibehu and Adingere (76.67%) were aware of the existence of Gebu Forest Escarpment Reserve while the remaining 23.33.0% denied awareness. Majority also affirmed that from time to time they obtain their livelihoods from the forest. Some of the ways by which the respondents obtain their livelihoods include the use of forest land for farming, grazing cattle, hunting, and sale of forest products as well as other income sources not explicitly mentioned by the respondents. Virtually, all the respondents agreed that some of the forest products derived from Gebu Forest were used for construction, furniture, sheds, fuel wood without permission from Kogi State Forestry Department to enter the forest. The objectives of illegal entry into the forest reserve by the three communities include deforestation, conversion of forest to built-up area, illegal farming and wildlife poaching. This was as a result of abandonment of the Forest Reserve by the Kogi State Forestry Service and the roads within and around the beat was in a very deplorable condition for monitoring and evaluation of status and trend of forest encroachment.

Table 3: Socio-Economic Characteristics of Respondents

Demographic Characteristics		Frequency	Percentage (%)
Sex	Male	83	69.7
	Female	37	30.83
Marital Status	Single	14	11.67
	Married	91	75.83
	Others	15	12.50
Age	20 and below	13	10.83
	21-40	62	51.67
	41-60	28	23.33
	60 and above	17	14.17
Level of Education	No formal education	62	51.67
	Primary	28	23.33
	Secondary	15	12.50
	Tertiary	02	1.67
	Quranic	13	10.83
Ethnic Group	Hausa	81	67.50
	Ibo	08	6.67
	Yoruba	06	5.00
	Fulani	17	14.17
	Others	08	6.67
Occupation	Farming	85	70.83
	Trading	23	19.17
	Artisan	05	4.17
	Civil Service	07	5.83
Main Source of Income	Farming	88	73.33
	Trading	20	16.67
	Salary (Civil Service)	07	5.83
	Artisan	05	4.17

Source: Field Survey, 2008

Table 4: Awareness of Gebu Forest Reserve and Utilization of Forest Products

Awareness	Frequency	Percentage (%)
Yes	92	76.67
No	28	23.33
Total	**120**	**100.00**

Source: Field Survey, 2008

Identification of Factors and Effects of Anthropogenic Activities in Gebu Forest Reserve on climate change

The factors that were identified as inducing anthropogenic activities of residents in Okpareke, Ibehu and Adingere

communities include high demand for forest land for farming, absence of management by Department of Forestry, multi-stakeholders and their diverse interests, high population growth and unsustainable agricultural practices. The effects of these factors on climate change as attested by virtually all respondents include increase in temperature, flooding, dryness of watershed and drought.

Logit Models for Climate Mitigation in Gebu Forest Reserve and its Fringe Communities

In this study, the binary logistic regression analysis was used to investigate forest institutional measures that will mitigate climate change within and around Gebu Forest Reserve. The institutional measures investigated were Forest Management Plan (FMP); Forest Policy and Forestry Act (FPFA); Governance of Forest Reserve (GFR); Provision of Funding (PF); Provision of Infrastructure (PI); Provision of Forest Manpower (PFM); Joint Forest Management (JFM). Preliminary investigation involved fitting all these measures together and then backward elimination was done to obtain the best subset models. The resulting models were evaluated using chi square goodness-of-fit statistics (Bruhn *et al*., 1991). The Final Loss on accuracy was computed using maximum likehood estimation and odds ratio (Deeks, 1996; Davies *et al*, 1998). The models obtained for the study are presented as follows:

CCMWAGFR = -32.22 + 26 FMP -1.97 FPFA +10.90 GFR + 0.60 PF -3.67 PI -0.23 PFM -38.03JFM….Model 2

Final Loss = 7.58; Chi square (df,7)=143.62; p = 0.00000
Odds ratio unit change: Constant (0.00); PMP (162943E6); FPFA (0.14); GFR (54091.37); PF (1.82); PI (.03); PFM (.79); JFM (-)

Where
CCMWAGFR = Climate Change Mitigation Within and Around Gebu Forest Reserve (Presence =1; Absence =0)
FMP = Forest Management Plan
(Presence =1; Absence =0)
FPFA = Forest Policy and Forestry Act
(Presence =1; Absence =0)
GFR = Governance of Forest Reserve
(Presence =1; Absence =0)
PF = Provision of Funding (Presence =1; Absence =0)
PI = Provision of Infrastructure
(Presence =1; Absence =0)
PFM = Provision of Forest Manpower
(Presence =1; Absence =0)
JFM = Joint Forest Management
(Presence =1; Absence =0)

Model 2 presented above for climate change mitigation within and around Gebu Forest Escarpment Reserve in Kogi State, Nigeria gave overall significant fit judging from the chi square value that is significant at $p<0.05$. There is sufficient evidence that estimated coefficients are not zero for independent variables. This implies that the regression parameters in the model are statistically significant. Climate change mitigation within and around Gebu Forest Reserve will be influenced most positively by FMP with the highest odds ratio of 162943E6.This is followed by GFR and PF with odds ratio of 54091.37 and 1.82 respectively. The higher the odds ratio, the more influential the institutional measures will be on Climate Change Mitigation within and around Gebu Forest Reserve (Table 5).

Table 5: Logistic Binary Nature of Factors influencing Climate Change Mitigation within and around Gebu Forest Reserve

Dependent Variable (CCMWAGFR): Climate Change Mitigation Within and Around Gebu Forest Reserve (Presence	
Independent Variables	**Odds ratio**
Whether there is Forest Management Plan (FMP)	*16294E6
Whether there is Forest Policy and Forestry Act (FPFA)	0.14
Whether there is Governance of Forest Reserve (GFR)	*54091.37
Whether there is Provision of Funding (PF)	*1.82
Whether there is Provision of Infrastructure (PI)	0.03
Whether there is Provision of Forest Manpower (PFM)	0.79
Whether there is Joint Forest Management (JFM)	-
Model X^2 (df ,7) =143.62	

P<0.05

CONCLUSION

The study has shown that institutional measures are needed for climate change mitigation within and around Gebu Forest Reserve, Kogi State. The specific models depend on the locations where the data were collected, and therefore should not be applied to areas outside the range of the data. However, the modelling approach is of general applicability and can be used to predict the institutional measures that will influence climate change in the Savanna ecological zones of Nigeria.

Recommendations

The following are recommnended to effectively and sustainably manage abandoned Gebu Forest Reserve Escarpment in Kogi State of Nigeria:

- New Forest Management Plan should be produced for a good tenet of Gebu Forest Escarpment reserve management.
- Kogi State Government should provide fund for the management of Gebu Forest Escarpment Reserve
- The Government of Kogi State should enunciate holistic forest policy and should be backed up with enactment of forestry act.
- Secondary forest road should be constructed within and around the forest reserve for accessibility, policing, motoring and evaluation of the Gebu Forest Escarpment Reserve.
- Manpower requirement for forestry sector in Kogi state should be strengthened in quality and quantity for the management of Gebu Forest Reserve.

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