Journal of Forestry Research and Management. Vol. 15(2).18-32; 2018, ISSN 0189-8418
www.jfrm.org.ng

HUMAN PERCEPTION ON FOREST COVER CHANGE IN ELEYELE FOREST RESERVE, IBADAN OYO STATE

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ABSTRACT

Nigeria is plagued with wanton reduction in forest cover due to uncontrolled human population, agricultural expansion and changes in socioeconomic well-being of the people. Yet forest contributes both physical and environmental needs which are indispensible and irreplaceable. It is to this end this study brings to the fore the impending danger associated with reduction in forest size and cover of Eleyele forest reserve, Ibadan. Primary data sourced through questionnaires using a multi stage sampling technique were analysed using descriptive and econometric analysis in this study. The study results showed that construction of houses and expansion in farm land are the leading causes of forest cover reduction. Furthermore, age (ß = -0.0155, $p<0.01$), male relative to female (ß=-0.4040, $p<0.01$), distance from home/work place to the forest (ß=0.0866, $p<0.01$), work experience (ß=0.8454, $p<0.01$), at least primary (ß=0.5858, $p<0.1$) or secondary (ß=1.3116, $p<0.01$) education relative to no formal education influenced respondents ability to perceive change in forest cover as harmful. Other factors that significantly affected harm detection in forest cover reduction were being married (ß=1.2714, $p<0.01$), perception score (ß=0.0712, $p<0.01$) and income (ß=-0.009, $p<0.01$) from their livelihood. The study concludes that at least primary education is helpful in detecting that reduction in forest cover is harmful to human. The study therefore recommends that primary education should at least be made compulsory to all while the aged and males should be enlightened about environmental benefits.

Keywords: Forest-Cover, Socio-economic, Enlightenment, Odd Ratio

INTRODUCTION

Forest over history is valuable to the world's human population and the value is by each day increasing as people still use forest for shelter, fuel-wood and provision of food for themselves. Forest product is used as raw material for wood processing industry while it also provides habitat for wildlife, reserves for water and soil conservation, oxygen and food chain (USAID/Nigeria, 2008). The last few decades marked massive changes in land use and land cover in forest ecosystems of Nigeria. These changes were attributed to increase in human population, agricultural expansion and changes in socioeconomic well-being of the people which have triggered unsustainable extraction of natural resources (Suleiman *et al*., 2017).

Rising human population and global climate change have been reported to be among the key factors that have contributed to vegetation cover losses (Lepers *et al*., 2005). Among nations with the highest deforestation rates, significant proportions of their forest losses have been reported on the savanna woodland forests that are poorly protected (FAO 2010; Green *et al*, 2013). In Nigeria, according to Usman and Adefalu (2010), forest reserve occupies about 10% of the total land area. The total forest cover is made up of about 445 protected areas, distributed over the five main ecological zones of fresh water/ mangrove, the lowland rainforest, the derived savanna, and the Sahel/Sudan savanna (Usman and Adefalu, 2010). However, most of these forest reserves have been degraded with some not having any forest left (USAID/Nigeria 2008).

This is because most of the protected areas lack adequate protection and management, therefore faced with the problems of illegal logging, encroachment by farmers, overgrazing by livestock, and excessive fuel wood collection among other factors. For instance, widespread poaching and encroachment by local people have been reported in the Kainji Lake National park, the Yankari Game Reserve, and the Old Oyo National Park (Oseni, 2007). The problem of inadequate governance and lack of political will to safeguard these forest reserves have negatively impacted on the once flourishing and ecologically diverse forest ecosystem of Oyo state (Meduna *et al*, 2009).

The pursuit of economic opportunity has made many Nigerians to move from rural to urban areas. As a result, the proportion of Nigerians living in cities has risen from 19 percent in 1975 to 46 percent in 2013, leading to a rapid physical expansion of urban areas (UN, 2015). The case is not different in Ibadan: the former seat of government of the old Western region and now the capital of Oyo State. The rapid sprawl has eaten into forested areas, savanna, farmland, fallow lands, and river flood plains. Forests and wetlands have been degraded.

In the Eleyele forested wetland; a modified natural riverine wetland in the northwest quarter of Ibadan, an estimated 66 percent of the wetland riparian forests were lost between 1984 and 2014 due to the urban expansion (Tijani *et al.*, 2012). Further, the study highlighted that waste effluent discharge from the city also contributed to deterioration in water quality. With an increasing population and pressure on natural and man-made forest resources, there is a greater demand for up-to-date and accurate assessment of changes in forest covers. Therefore, this paper investigated the extent to which residents around Eleyele forest detect changes in its forest cover and thus offer pragmatic recommendations in abating further decrease in the forest size. To this end, perception and factors that influence perception of changes in forest size as well as constraints inhibiting the activities of forest managers were examined in this study.

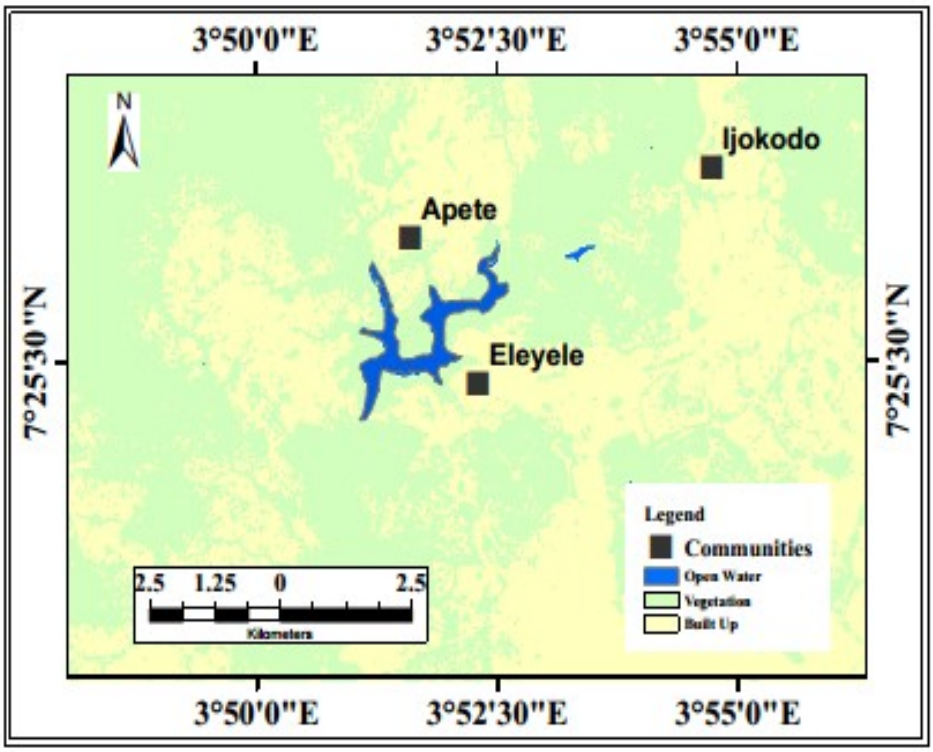

Figure 1: The map showing the study site

Materials and Methods

The study was carried out in the Eleyele forest reserve located in Ibadan the capital of Oyo State. Ibadan is located between latitude 7°20'N – 7°25'N and longitude 3°51'E – 3°56'E. Ibadan is one of the large cities in West Africa with land size covering an area of 240 $km^{2.}$ The forest reserve covers Eleyele river basin (Tijani *et al*, 2012). Multi stage sampling technique was used in this study. Stage one involved the purposive selection of communities around Eleyele river basin. The second stage involved the purposive selection of three (3) communities namely Apete, Ijokodo and Eleyele along Eleyele river basin while in the third stage a total of one hundred (100) respondents were randomly selected from surrounding houses and work places in each communities (Eleyele (40 respondents), Apete (30 respondents) and Ijokodo (30 respondents).

The primary data for this research was collected through the use of questionnaires. The data collected was analyzed using descriptive statistics and logit regression analysis.

Logistic regression was used to determine the influence of socio-economic characteristics on respondents' ability to perceive reduction in size of forest cover as being harmful. The parameters of the model were estimated with the maximum likelihood estimation technique. A binary response to "is the reduction in forest cover harmful?" modeled as yes or no was specified and estimated logistically. The logit specification is suited to models where the dependent variable is dichotomous and also provides a model for observing the probability of factors that influenced the awareness of change in forest cover or not. Following Gujarati (1988), the model is specified as follows:

$$P(Y_{i=m}) = \frac{1}{1+e^{-z}} \quad \text{.....(1)}$$

$$\frac{P}{1-P} = e^{z} \quad \text{.....(2)}$$

$$1 - P = 1 - \frac{1}{1+e^{-z}} \quad \text{.....(3)}$$

Given that $\Omega = e^{z}$ .....(4)

$$\Omega = \frac{P}{1-P} \quad \text{.....(5)}$$

$P =$ Probability of occurrence of the dependent variable

$Y_i =$ Dependent variable corresponding to certain value, m

$z =$ Predictor variable (linear combination of the conversion factors)

$e =$ Base of natural logarithm and

$\Omega =$ Odd of the evaluative factors occurring for each explanatory variable

Assuming Z is a linear function of a set of predictor variable, then,

$$Z = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} \quad \text{.....(6)}$$

If equation (6) holds then;

$$\Omega = e^{\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki}} \quad \text{.....(7)}$$

In this study, Y_{i-m} is the probability of agreeing that reduction in forest cover is harmful. The logistic regression model is given as:

$$\Omega = e^{\beta_0+\beta_1 X_{1i}+\beta_2 X_{2i}+\cdots+\beta_k X_{ki}} \quad \ldots\ldots(8)$$

The dependent and explanatory variables used are

Y_i = Reduction in forest cover harmful (1 if Yes, 0 is otherwise),

β_i = Unknown parameters to be estimated, e =error term while

x_i = ranges from 1-9.

x_1 = Age (years)

x_2 = Gender (1 if male, 0 if female)

x_3 = Household size (number of household members)

x_4 = Distance from house to forest (km)

x_5 = Work experience (years)

x_{6j} = A set of dummy variables for educational levels (j=0, 1, ., .,k for none formally, primary, secondary and tertiary). It takes a value of 1 if respondent belong to the jth category, and 0 if otherwise.) The dummy variable none formally (j=0) was dropped in the estimation.

x_{7j} = A set of dummy variables for marital status (j=0, 1, ..., k for single, married and widowed). It takes a value of 1 if respondent belong to the jth category, and 0 if otherwise.) The dummy variable single (j=0) was dropped in the estimation.

x_8 = Perception score

x_9 = Income (₦)

Marginal Effects after Logistic Regression

Marginal effects measure the expected instantaneous change in the dependent variables as a function of a change in a certain explanatory variable while holding other co-variates constant (SAS, 2011). It is thus a means of interpreting the effects of the predictor variables on the dependent variable. For a logistic regression model, the marginal effect of a change in the

$P\ (Y = 1)$ changes when X increases by 1 unit. As such, the marginal effect of a change in the explanatory variable on the ability to detect harm in reduction of forest cover is given as:

$$\delta_{jk} = \frac{\delta P_j}{\delta x_K} = P_j\ (\beta_j - \sum P_j \beta_j)$$

$P_j =$ probability of detecting mean harm in reduction of forest cover

$\delta_{jk} =$ impact of a variation in the predictor variable on the probability of occurrence

Odds Ratio

The odds ratio is a statistical measure defined as the ratio of the odds of an event occurring in one group to an event occurring in another group; for instance a dichotomous classification. It is a summary measure of the relationship between two variables or dichotomous classification and it tells us how better the odds are for the occurrence of a certain event. The odds ratios are particularly useful when dealing with dummy variables to answer some policy questions such as how likely will age, gender or income of respondents affect the detection of harm associated with reduction in forest cover. Assume the

$odds\ for\ group\ 1 = odds1 = {}^{p}/_{1-p}$ and the

$odds\ for\ group\ 2 = odds2 = {}^{q}/_{1-q}$; where p and q are probabilities for group 1 and 2, respectively.

$odds\ ratio = {}^{odds1}/_{odds2}$, but considering that

$In\ \left(\frac{p}{1-p}\right) = logit\ (p) and$

$In\ \left(\frac{q}{1-q}\right) = logit\ (q)$, it follows that the $\log odds\ ratio = logit\ (p) - logit\ (q)$.

Therefore, the odds ratio may be taken as the $antilogarithm\ of\ [logit\ (p) - logit\ (q)]$ or alternatively as the antilogarithm of the slope of the logit regression, one unit apart of two different values of the predictor (Mukherjee *et al.*, 1998).

RESULTS AND DISCUSSIONS

The results of socio-economic characteristics of the respondents are shown on Table 1. The tables revealed that majority (32.6%) of the respondents were less or equal to 30 years of age. More than half of the respondents were males (66.0) with secondary school education as the highest educational attainment. Also, more than half (66.0%) of the respondents are married with household size of less than 5 individuals. Furthermore, not less than one third of the sampled population (34.4%) earns ₦20, 000 or less monthly in the study area. The major occupation among the respondents is trading (30.9%) followed by artisanship/craft (26.8%). The scenario above indicates an averagely educated populace with low income and yet more mouths to feed.

Table 1: Socio-economic characteristics of the respondents

Socio-economic characteristics	Percent
Age Group (years)	
= 30	32.6
31 – 40	27.4
41 – 50	14.7
=60	9.5
Gender	
Male	66.0
Female	34.0
Level of Education	
No – formal	7.2
Primary	27.8
Secondary	46.4
Tertiary	18.6
Marital Status	
Single	25.8
Married	66.0
Widow	8.2
House hold size	
1 – 4	71.1
5 – 8	25.8
9 – 12	3.1
Income Group (₦)	
= 20000	34.4
21000 – 40000	6.3
41000 – 60000	17.7

61000 – 80000	3.1
81000 – 100000	9.4
>100000	29.2
Livelihood Activities	
Arable Crop Farming	3.1
Tree Crop Farming	8.2
Livestock	3.1
Lumbering	3.1
Non – Timber Forest Products (NTFPs)	3.1
Artisanship/Craft	26.8
Trading	30.9
Salary Job	10.3
Student/Others	11.3

Majority (66.0%) of the forest fringe communities agree that there had been change in physical state of the forest estate (Table 2). About half of them (42.3%) representing a larger division agree that the change has been a bad one. This altogether indicated that the people appreciate forest and its benefits.

Table 1: Assessment of forest change by residents of 1-5 years

Period under review	Change in forest state	Very great (%)	Great (%)	Not noticeable (%)
2010-2015	Good	37.5	30.0	71.4
	Bad	62.5	70.0	28.6

Table 3 reveals that respondents are aware that construction of houses and other buildings (61.1%) contributes to the reduction in forest size of Eleyele reserve. They therefore attest to the fact that uncontrolled urbanization/housing mainly contributed to decrease in forest cover. The case also holds for expansion in farm land where 26.4% and 27.6% are highly and moderately aware respectively that it is also contributing to reduction in forest cover. However, one of every three respondents claimed they are not aware that law and order are not enforced by the government. It therefore implies that the government has laws that are not being enforced in protecting the forest reserve. The populace was also willing to support forest management as majority (52.2%) indicated that they don’t know of forest residents who don’t want to support forest management. Meanwhile, they were moderately aware that non-availability of articulated policy to manage the forest and other reasons contributes to the reduction in forest size.

Table 3: Factors contributing to the reduction in the forest size

Factors	Highly aware	Moderately aware	Lowly aware	Not aware
Construction of houses and other buildings	40.0	21.1	16.7	22.2
Expansion in farm land	26.4	27.6	13.8	32.2
Non-enforcement of law and order by the government	14.3	24.2	25.3	36.3
Non-availability of articulated policy to manage the forest	21.6	28.4	23.9	26.1
Unwillingness of the populace to support forest management	21.6	26.1	22.7	29.5
Other (specify)	8.3	41.7	20.8	29.2

Table 4 showed that respondents have no medium of forest enlightenment. This could be one of the major reasons for the reduction in forest size. Therefore, extension agents should take note and intensify efforts in public enlightenment. The Table also revealed that the main forest management practices carried out by the government was reforestation (36.8%) and prevention of fire outbreak (33.3%).

Table 4: Medium of enlightenment and management practices carried out by Government

Enlightenment and Management Practices	Percent
Medium of forest enlightenment	
None	49.8
Print media	5.3
Electronic media	8.7
Outreach	16.0
Public education programs	19.1
Others	1.1
Forest management practices	
Reforestation	36.8
Prevention of fire outbreak	33.3
Cutting of roads and pathways through the forest	11.1
Others	5.6
None	13.3

Respondents suggestions on major ways through which activities of forest users can be regulated are presented on Table 5. The result showed that the major way by which the activities of forest users can be regulated is through restriction order/rules (35%). Other ways includes entry time regulation (17%) and issuance of permit (14.9%).

Table 5: Suggested Means of Regulating Forest Activities

Regulations	Percent
Restriction order/ rules	35.0
Entry time regulation	17.0
Issuance of permit	14.9
No idea	12.8
Increase awareness and enlightenment about forestry	5.3
Employ more guards	2.1
Using local scare crow (voodoo)	1.1

The result of the Logistic analysis used to understand the influences of socio economic factors on respondents' ability to detect harm in reduction of forest cover is presented in Table 6. The likelihood ratio of -37.7589 is significant at 1% indicating the overall significance and goodness of fit of the model. The model at hand thus provides the right prediction 99 out of 100 times. Also, seven out of the nine variables used were significant in explaining ability of respondents to detect harm associated with reduction in forest cover. The marginal effect and the odd ratios of the variables were also presented in Table 5 so as to further unravel the magnitude of effect the explanatory had on the dependent variable.

The results show that age, gender, distance from home/work place to the forest, work experience, education attainment, being married, perception score and income from their livelihood were significant and therefore are factors that bear influence on respondents' ability to perceive reduction in forest cover as being harmful. The results show that age was negatively significant. This implies that an increase in age will lead to a decrease in the likelihood of perceiving harm in reduction of forest cover. This may occur because younger people are more likely to perceive

greater numbers of forest values than older people. Another possible explanation was attributed to the fact that the younger inhabitants have had more opportunities to leave the community and gain more in-depth environmental education or have more frequent contact with the outside world through various media sources (Yang *et al*., 2015).

Table 6: Factors influencing Ability of Respondents' to detect Harm in Forest Cover Reduction

Variables	Coefficient	Marginal effect	Odds ratio
Age	-0.0155***	-0.0020***	0.9846***
Sex	-0.4040***	-0.0511***	0.6677***
Household size	0.0315	0.0040	1.0320
Distance	0.0866***	0.0110***	1.0905***
Work Experience	0.8454***	0.1070***	2. 3289***
Education dummy			
Primary School	0.5858*	0.0742*	1.7965*
Secondary School	1.3116***	0.1660***	3.7120***
Tertiary	0.5110	0.0647	1.6670
Marital Status dummy			
Married	1.2714***	0.1620***	3.5659***
Widow	-0.5326	-0.0674	0.5871
Perception score	0.0712***	0.0090***	1.0738***
Income	-0.0009***	-0.0392***	0.9999***
Constant	-4.1477**		
Log likelihood	-37.7589		
LR Chi-square	42.11		
Pseudo R-Square	0.3580		

Note; *P < 0.10, **P < 0.05 and ***P < 0.01 = Significant at 10%, 5% and 1% probability level respectively

Also, female respondents are more likely to perceive that the reduction in forest cover is harmful when compared with the male respondents. The distance from the forest to homes or work places is positive and significant. Therefore, an increase in the distance increases the respondents' ability to detect that reduction in forest cover is harmful. This may be occasioned by the increasing harm that can be felt in such places such as rising temperature, exposure to wind or flooding and other factors as distance from the forest increases. Also, work experience around the forest which is used in place of exposure to the forest environment was significant and positive. This shows that those that have stayed for long around the forest believes that the

reduction in forest cover is non beneficial but rather harmful. Both primary and secondary school education positively influences the likelihood of detecting harm in reduction of forest cover better than non-formal education. This indicated that the people with a higher level of education placed more importance on forest values and is thus averse to its reduction. This may occur because the better educated people have learned more about the diverse ecosystem services provided by forests and economic values of forests from school and various media sources. If education levels increase in the future, then these results suggest that the forest will become more important to local people not only as their source of livelihood but also for various aspects, such as the effects of forest on climate, ecotourism, and water and soil protection (Yang *et al*., 2015).

The result further show that being married when compared with being single was also positive and significant in influencing the danger in reducing forest cover. Moreover, respondents' perception score was also found to be significant and positive. Therefore, the better the respondents appreciate forest benefits the better they understand the harms associated with reduction in forest cover. Furthermore, the result showed that income is a significant factor that influences respondents' perception of forest change but negatively; implying the higher the income, the less the respondents are likely to detect harm in reduction of forest cover.

The positive and significant odd ratio indicate that age, gender (being male rather than female), distance from forest homes/work place, work experience, being educated and married, perception score and income significantly increased the log odds of perceiving harm associated with change in forest state by 0.9846, 0.6677, 1.0905, 2.3289, 1.7965, 3.7120, 3.5659, 1.0738 and 0.9999 respectively. Results of the marginal effects show that the likelihood of a male respondent detecting harm associated with reduction in forest cover decreases by 0.0511 or 5.11%. With respect to age and income, a negative and significant relationship was also observed. Therefore, a unit increase in age and income will decrease the likelihood of detecting harm associated with reduction in forest cover by 0.0020 or 0.2% and 0.9999 or 99.99% respectively. Further, a positive and significant odd ratio of distance from homes or work places to the forest, number of farming years and perception score implies that a unit increase in the these variables increase respondents' ability to detect harm associated with reduction in forest cover by 1.1%, 10.7% and

0.9% respectively. Results of the marginal effects also show that those respondents having primary school education when compared with those without formal education and married compared to singles, are 7.42% and 1.62% better in perceiving as harmful the change in forest state respectively.

Table 7 revealed that lack of cooperation; inadequate funding, personnel, awareness and poor implementation of policies were perceived as inhibiting the activities of the forest managers within the study area.

Table 7: Constraints inhibiting the activities of the forest managers in the area

Constraints	Not at all	Low	High	Very high
Lack of cooperation	18.7	27.5	45.1	8.8
Lack of enough funding	11.0	20.9	45.1	23.1
Inadequate number of personnel	20.7	19.6	40.2	19.6
Inadequate awareness	15.1	16.1	39.8	29.0
Poor implementation of policies	15.6	8.9	44.4	31.1
Others (specify)	23.8	-	33.3	42.9

CONCLUSION AND RECOMMENDATION

This study therefore concludes that a minimum of primary education is helpful in detecting that reduction in forest cover is harmful to human. The study recommends that primary education should at least be made compulsory to all while the aged and males should be enlightened about environmental benefits of the forests and forest cover.

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