

Evaluation of Habitat Management as a Tool for Wildlife Conservation in Ode-Irele, Ondo State, Nigeria

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Abstract

Forest loss may infringe on the capacity of the forest ecosystem to carry out its numerous environmental services. This study was conducted in the forested belt of Ode-Irele, Ondo state, Nigeria. Two staged sampling technique was adopted with enumeration area being the first stage and households were the second stage. Two thousand copies of questionnaires were randomly administered to households in ten enumeration areas. Univariate analysis of variance was carried out on the respondents' level of agreement on the sensitivity of wildlife to environmental disturbance. Results showed that urban arboreta as homes for wildlife were the most sensitive. Majority (91%) of the respondents agreed that the use of chemicals kills important wild animals. All respondents agreed that forest reserves helped in protecting wild animal population, while 82% agreed that leaving forest next to another forest helps to increase total home for wild animals. Majority (91%) agreed that leaving forest on the bank of a river helped to increase total home for wild animals. Also, 82% and 85% of the respondents respectively approved of managing forest for carbon breakdown, and protection of water catchment areas. Majority (93%) approved of preservation of natural scenic beauty, particularly for tourism, as 84% approved that entrance fees should be paid for admission into private lands for collection of information. Rewards encourages involvement in sustainable forest management thus improving sustainable forest and environmental stewardship.

Keywords: Environmental Resources, Forest, Habitat, Ode-Irele, Wildlife Conservation.

Introduction

The income and means of livelihood of many rural households are hinged on forests and other environmental resources (Wunder *et al.*, 2014). This can prevent such households from falling into deeper poverty and also help to eradicate poverty levels (McSweeney, 2004; Belcher *et al.*, 2005; Wunder *et al.*, 2014). According to the recommendation of DeFries *et al.* (2010), policies on forest conservation should not only address deforestation among rural populations. The policies should also focus on reducing deforestation for industrial

and export oriented production alongside efforts to increase yields in agricultural lands in order to reduce pressure on biodiversity (Ahrends *et al.*, 2010; DeFries *et al.*, 2010). Many of the goods and services provided by forests do not directly attract monetary benefits, which have for long put pressure on forest land for some other alternative uses. Attaching economic benefits to products from the forest can thus, make people to adopt conservation and sustainable use of forest rather than its conversion (Pearce, 2001). Thus many disturbed, fragmented and secondary forests are the only remaining

habitat for many forest species, whose population viability and genetic variation are being lowered (Laurance *et al.*, 2008; Edwards *et al.*, 2011).

Protected areas are now not even sufficient to sustain global biodiversity (Margules and Pressey, 2000; Kamal *et al.*, 2015).

Surmounting this constraint requires a more holistic approach that will recognize private land and bioregional model that conserves landscapes irrespective of ownership in biodiversity conservation because all lands with conservation values cannot be set apart as protected areas (Kamal *et al.*, 2015). Loss of forestland, habitat, species, and biodiversity has been the bane of economic developments (Eneh, 2011). Conservation of forest can be promoted by using community-based conservation programmes (Brooks *et al.*, 2013). One way of encouraging people to be seriously involved in sustainable forest management and conservation is to impute economic value as rewards to the forest resources and ecosystem services in order to empower local residents (Western *et al.*, 2009; Lepetu and Garekae, 2015).

Agricultural and anthropogenic activities of humans influence the balance in the ecosystem. Conservation tools like the allocation of protected areas can be used to protect wildlife and other biodiversity in the face of human-induced activities and other processes that threaten the persistence of wildlife (Western *et al.*, 2009; Kamal *et al.*, 2015). The use of chemicals such as the pesticides, insecticides and herbicides for agricultural production goes a long way to guaranteeing food production (Schiesari *et al.*, 2013). However, without judicious use of these chemicals, tropical agroecosystems may not be able to host acceptable levels of biodiversity and ecosystem services

(Schiesari *et al.*, 2013). Furthermore, researchers have confirmed that wildlife respond to noise that are associated with a number of human activities (Patricelli and Blickley, 2006; Parris and Schneider, 2008). Human activity sometimes results in breaking contiguous habitats resulting in the reduction of wildlife habitats which influences wildlife population (Viña *et al.*, 2016).

The urban forest, as part of the ecosystem, provides wildlife with habitat and food. Management of urban trees, through using tools such as increasing tree canopy cover of most appropriate tree species, having strong pro-tree attitudes and greater environmental concerns by urbanites, and having symbolic value to urban forests, should be seen as effective tools that can provide habitats to sustain biodiversity (Jones *et al.*, 2013; Lerman *et al.* 2014; Ballinas and Barradas, 2016).

The study therefore aimed to assess the level of agreement of local residents with variables on the ecological and environmental processes that are important tools for the conservation of forest and wildlife and sustainable use of environmental resources.

Research Hypotheses

H₁: Noises of vehicles parked off road/milling engines do not significantly disturb wild animals

H₂: Use of herbicides by farmers has no significant effect on wild animals' population

H₃: Forest reserves do not significantly protect wild animal population

H₄: Leaving forest next to another forest does not significantly increase total home for wild animals

H₅: Leaving forest on the bank of a river does not significantly increase total home for wild animals

H₀: Wildlife population is not significantly reduced by patches of forest in urban areas

Material and Methods

This study was conducted in the forested belt of Ode-Irele, Ondo state, Nigeria. The study site was selected based on the prediction of Lameed and Ogunsusi, (2002) that reduction in tree cover will adversely affect the forest ecosystem which will result in decline in wildlife abundance. Ode-Irele is under Irele Local Government Area in Ondo State, Nigeria. Its headquarters is in the town of Ode-Irele. The local government has an area of 963 square kilometres and a population of 145,166 at the 2006 census (NPC, 2016). The local government is located in the Southern fringe of Ondo State between Longitudes 04° 47' E to 05° 10' E, and Latitudes 06° 16' N to 06° 40' N. The area falls within the Tropical Rainforest ecological zone.

Sample and Sampling Design

Two staged sampling technique was adopted with selection of enumeration area being the first stage and selection of households as the second stage. Ten enumeration areas out of 66 were selected based on simple random sampling technique so that each area has an equal chance of being selected. The respondents were selected within households which were the basic unit of data collection. The head of each households and any other one person above the age of 18 years were selected as respondents. A household, for the purpose of this study, was defined as a person or group of people in the same compound, answerable to the same head and sharing a common source of food and/or income (Casimir and Tobi, 2011). Ten households

were randomly selected in each of the enumeration areas. A total of 100 households were selected and identical questionnaires were administered to two persons per household, making a sum of 200 copies of questionnaires administered per enumeration area. A total number of 2,000 copies of questionnaires were administered in all the 10 enumeration areas with less than five percent returned unattended to. Assistant researchers were recruited and trained to support the administration, distribution, and interpretation of questionnaires.

Model formulation

The model for one-way analysis of variance was used to find the mean (μ_i). μ_i , was the mean yield of the i^{th} disturbance, for $i=1, \dots, r$. For each i , n_i was calculated for independent readings X_{ij} . The X_{ij} values were independent and normal, all with the same unknown variance - σ^2 :

$$X_{ij} \sim N(\mu_i, \sigma^2) \quad (j = 1, \dots, n_i, \quad i = 1 \dots r)$$

$$X_{ij} = \mu_i + \alpha_j + \varepsilon_{ij} \quad \text{Where } \varepsilon_{ij} \sim (0, \sigma^2)$$

x_{ij} = value of observation i for sample (treatment) j : $x_{ij} = \mu + \alpha_i + \varepsilon_{ij}$

$N(\mu_i, \sigma^2)$ = random variables

$N = \sum n_i$

r = total number of samples (treatments) being considered

i = index designating which sample (treatment) is being considered

n_i = number of observations available for sample (treatment) i

j = index designating which of n_i observations of sample i is being considered

α = significance level for rejecting null hypothesis

ε_{ij} = random error term

The theorem was used for the analysis of variance in the table below.

Sensitivity Analysis

The sensitivity analysis was carried out to know which of the variables contributed more to effect among the variables.

$$S_i = \frac{V_i}{V}$$

$$S_i = \frac{V - VC_i}{V}$$

$$F = 1 - \sum S$$

Where:

S = sensitivity index

S_i = first order sensitivity index

V = base value

V_i = level of agreement of variable

C_i = maximum – minimum value of variable

F = probability value

Σ = summation

Data Analysis

Quantitative data were analysed using SPSS and Minitab computer packages (version 24). Findings on disturbance of animals; impact of chemical use on wildlife; use of forest reserves in protecting wildlife; contiguity of forest and wildlife conservation; preservation of water catchment areas and wildlife conservation;

urban arboreta and wildlife conservation and; payment for environmental services were also presented using frequencies and cross tabulations. Univariate analysis of variance was carried out on the respondents' level of agreement on sensitivity of wildlife disturbance to environmental disturbance.

Results

Sensitivity of wildlife to environmental disturbance and Conservation

Table 1 shows that four of the variables measuring sensitivity of wildlife to disturbance were not significant ($P > 0.05$), therefore, the null hypotheses for these variables were accepted. The results indicate that noise from parking of vehicles off-roads did not significantly disturbs wildlife. Use of pesticides was also not recognized as a significant factor in decimating wildlife population. Forest reserves were not recognized as being significant in the protection of wild animal populations. In addition, respondents did not agree that leaving a forest next to another forest significantly enhanced the contiguity of habitat for wild animals. On the other hand, forests as urban arboreta which served as home for wild animals was significant ($P < 0.05$) and so the null hypothesis was rejected. Also, the sensitivity analysis showed that urban arboreta as homes for wildlife were seen to contribute the most to effect.

Table 1: Sensitivity of Wildlife to Environmental Disturbance

Variable	Effects	Df	Sum of Squares	Mean Square	F	Sig
Parking of vehicles off-roads/milling engine noise	Between groups	1	0.37	0.37	1.55	0.22
	Within groups	98	23.42	0.23		
	Total	99	23.79			
Use of pesticides	Between groups	1	0.22	0.22	2.71	0.10
	Within groups	98	7.96	0.08		
	Total	99	8.19			
Forest reserves and protection of wild animal populations	Between groups	1	0.41	0.41	1.85	0.07
	Within groups	98	21.65	0.22		
	Total	99	22.06			
Leaving forest next to another forest and contiguity of habitat for wild animals	Between groups	1	0.08	0.08	0.53	0.47
	Within groups	98	14.68	0.15		
	Total	99	14.76			
Leaving forest on the bank of a river helps to increase total home for wild animals	Between groups	1	0.07	0.07	0.86	0.36
	Within groups	98	8.12	0.08		
	Total	99	8.19			
Trees and patches of forests within a town as habitats for wild animals	Between groups	1	1.12	1.12	7.71	0.01
	Within groups	98	14.27	0.15		
	Total	99	15.39			

Source: Authors' field survey

Noise Disturbance and Wildlife Conservation

The Cross-tabulation procedure of disturbance against wildlife conservation shows that majority (61%) of the respondents did not agree that parking vehicles off roads and noise from milling engines disturb wild animals (Table 2). Only 32% and 35% of the respondents who approved of managing forest for carbon breakdown and protection of water catchment areas respectively also agreed that parking vehicles off roads and

noise from milling engines disturb wild animals. Ninety-three percent approved of the preservation of scenic beauty for tourism, while 95% approved of protection of biological resources for conservation, research and scientific purposes. Also, 84% approved that fees should be paid for entrance into private lands for collection of information. Some of these respondents agreed that parking vehicles off roads/noise from milling engines disturb wild animals.

Table 2: Noises from Vehicles and Other Anthropogenic Activities and Wild Animals’ disturbance

Parking vehicles off-road and noise of milling engines disturb wild animals	Approve (%)	Disapprove (%)	Total (%)
Managing forest for carbon breakdown and pollution control			
Agree (%)	32.0	7.0	39.0
Disagree (%)	50.0	11.0	61.0
Total (%)	82.0	18.0	100
Managing forests for protection of water catchment areas			
Agree (%)	35.0	4.0	39.0
Disagree (%)	50.0	11.0	61.0
Total (%)	85.0	15.0	100
Preservation of natural scenic beauty, particularly for tourism			
Agree (%)	36.0	3.0	39.0
Disagree (%)	57.0	4.0	61.0
Total (%)	93.0	7.0	100
Protection of biological resources for conservation, research and scientific purposes			
Agree (%)	37.0	2.0	39.0
Disagree (%)	58.0	3.0	61.0
Total (%)	95.0	5.0	100
Fees should be paid for entrance into private lands for collection of information			
Agree (%)	34.0	5.0	39.0
Disagree (%)	50.0	11.0	61.0
Total (%)	84.0	16.0	100

Source: Authors’ field survey

Use of Chemicals and its Impact on Wildlife Conservation

Majority (91%) of the respondents agreed that the use of these chemicals kills important wild animals (Table 3). The cross-tabulating procedure for the use of the chemicals with other forest management processes showed that 77% and 78% of the respondents respectively approved of managing forest for

carbon breakdown and protection of water catchment areas respectively. Also, 85% approved of the preservation of natural scenic beauty particularly for tourism, as 87% approved of protection of biological resources for conservation, research and scientific purposes, while 78% approved of payment of entrance fees into private lands for collection of information.

Table 3: Use Pesticides and Wildlife Conservation

Use of pesticides kills important wild animals	Approve (%)	Disapprove (%)	Total (%)
Managing forest for carbon breakdown and pollution control			
Agree (%)	77.0	14.0	91.0
Disagree (%)	5.0	4.0	9.0
Total (%)	82.0	18.0	100
Managing forests for protection of water catchment areas			
Agree (%)	78.0	13.0	91.0
Disagree (%)	7.0	2.0	9.0
Total (%)	85.0	15.0	100
Preservation of natural scenic beauty, particularly for tourism			
Agree (%)	85.0	6.0	91.0
Disagree (%)	8.0	1.0	9.0
Total (%)	93.0	7.0	100
Protection of biological resources for conservation, research and scientific purposes			
Agree (%)	87.0	4.0	91.0
Disagree (%)	8.0	1.0	9.0
Total (%)	95.0	5.0	100
Entrance fees should be paid for entrance into private lands for collection of information			
Agree (%)	78.0	13.0	91.0
Disagree (%)	6.0	3.0	9.0
Total (%)	84.0	16.0	100

Source: Authors' field survey

Forest Reserves and Wildlife Conservation

The result in Table 4 revealed that all the respondents (100%) agreed that forest reserves helped to protect wild animal population. From among this lot, 82% of these respondents also managed forest for carbon breakdown and pollution control,

85% approved of managing forests for protection of water catchment areas. Also, 93% approved of preservation of natural scenic beauty for tourism, 95% approved of protecting biological resources for conservation, research and scientific purposes, while 84% approved that fees should be paid for entrance into private lands for collection of information.

Table 4: Forest Reserves and Protection of Wild Animal Population

Forest reserves helps to protect wild animal population	Approve (%)	Disapprove (%)	Total (%)
Managing forest for carbon breakdown and pollution control			
Agree (%)	82.0	18.0	100
Disagree (%)	-	-	-
Total (%)	82.0	18.0	100
Managing forests for protection of water catchment areas			
Agree (%)	85	15	100
Disagree (%)	-	-	-
Total (%)	85	15	100
Preservation of natural scenic beauty, particularly for tourism			
Agree (%)	93	7	100
Disagree (%)	-	-	-
Total (%)	93	7	100
Protection of biological resources for conservation, research and scientific purposes			
Agree (%)	95	5	100
Disagree (%)	-	-	-
Total (%)	95	5	100
Entrance fees should be paid for entrance into private lands for collection of information			
Agree (%)	84.0	16.0	100
Disagree (%)	-	-	-
Total (%)	84.0	16.0	100

Source: Authors' field survey

Contiguity of Forest and Wildlife Conservation

The perception of respondents indicated that leaving forests on adjacent lands next to one another was not significant in increasing the contiguity of forest which served as habitats for wildlife. In Table 5, however, most of the respondents (82%) agreed that leaving forest next to another forest helps to increase total home for wild animals. From the result of the

perception of the respondents, 67% and 68% approved of managing forest for carbon breakdown and protection of water catchment areas respectively. In addition, 78% also approved of preservation of natural scenic beauty for tourism and protection of biological resources for conservation, research and scientific purposes, while 68% approved of entrance fees payment into private lands.

Table 5: Forests on Adjacent Lands and Increase in Total Home for Wild Animals

Leaving forest next to another forest helps to increase total home for wild animals	Approve (%)	Disapprove (%)	Total (%)
Managing forest for carbon breakdown and pollution control			
Agree (%)	67.0	15.0	82.0
Disagree (%)	15.0	3.0	18.0
Total (%)	82.0	18.0	100
Managing forests for protection of water catchment areas			
Agree (%)	68.0	14.0	82.0
Disagree (%)	17.0	1.0	18.0
Total (%)	85.0	15.0	100
Preservation of natural scenic beauty, particularly for tourism			
Agree (%)	78.0	4.0	82.0
Disagree (%)	15.0	3.0	18.0
Total (%)	93.0	7.0	100
Protection of biological resources for conservation, research and scientific purposes			
Agree (%)	78.0	4.0	82.0
Disagree (%)	17.0	1.0	18.0
Total (%)	95.0	5.0	100
Entrance fees should be paid for entrance into private lands for collection of information			
Agree (%)	68.0	17.0	82.0
Disagree (%)	16.0	2.0	18.0
Total (%)	84.0	16.0	100

Source: Authors' field survey

Preservation of Water Catchment Areas/Riparian Forests and Wildlife Conservation

In Table 6, majority of the respondents (91%) agreed that leaving forest on the bank of a river helped to increase total home for wild animals. From among these 76% and 79% approved of managing forest for carbon breakdown and protection of water catchment areas respectively.

Also, 85% and 86% approved of preservation of natural scenic beauty for tourism and protection of biological resources for conservation, research and scientific purposes respectively, and 78% approved of entrance fees payment into private lands. All of these respondents also agreed that leaving forest on the bank of a river helped to increase total home for wild animals.

Table 6: Riparian Habitat and Wildlife Conservation

Leaving forest on the bank of a river helps to increase total home for wild animals	Approve (%)	Disapprove (%)	Total (%)
Managing forest for carbon breakdown and pollution control			
Agree (%)	76.0	15.0	91.0
Disagree (%)	6.0	3.0	9.0
Total (%)	82.0	18.0	100
Managing forests for protection of water catchment areas			
Agree (%)	79.0	12.0	91.0
Disagree (%)	6.0	3.0	9.0
Total (%)	85.0	15.0	100
Preservation of natural scenic beauty, particularly for tourism			
Agree (%)	85.0	6.0	91.0
Disagree (%)	8.0	1.0	9.0
Total (%)	93.0	7.0	100
Protection of biological resources for conservation, research and scientific purposes			
Agree (%)	86.0	5.0	91.0
Disagree (%)	9.0	-	9.0
Total (%)	95.0	5.0	100
Entrance fees should be paid for entrance into private lands for collection of information			
Agree (%)	78.0	13.0	91.0
Disagree (%)	6.0	3.0	9.0
Total (%)	84.0	16.0	100

Source: Authors' field survey

Urban Arboreta and Wildlife Conservation

Result in Table 7 showed that all the respondents (100%) agreed that trees and patches of forests within a town helped to harbor snakes and other wild animals. From this 82% approved of managing forest for carbon breakdown and pollution control, 85% approved of managing forests for

protection of water catchment areas. Also, 93% approved of preservation of natural scenic beauty, particularly for tourism, 95% approved of protection of biological resources for conservation, research and scientific purposes, while 84% approved that fees should be paid for entrance into private lands for collection of information.

Table 7: Urban Forest Patches and Habitat for Wild Animals

Population of snakes and other wild animals is not significantly reduced by patches of forest in urban areas	Approve (%)	Disapprove (%)	Total (%)
	Managing forest for carbon breakdown and pollution control		
Agree (%)	82.0	18.0	100
Disagree (%)	-	-	-
Total (%)	82.0	18.0	100
	Managing forests for protection of water catchment areas		
Agree (%)	85.0	15.0	100
Disagree (%)	-	-	-
Total (%)	85.0	15.0	100
	Preservation of natural scenic beauty, particularly for tourism		
Agree (%)	93.0	7.0	100
Disagree (%)	-	-	-
Total (%)	93.0	7.0	100
	Protection of biological resources for conservation, research and scientific purposes		
Agree (%)	95.0	5.0	100
Disagree (%)	-	-	-
Total (%)	95.0	5.0	100
	Entrance fees should be paid for entrance into private lands for collection of information		
Agree (%)	84.0	16.0	100
Disagree (%)	-	-	-
Total (%)	84.0	16.0	100

Source: Authors' field survey

Discussion

Generally, the findings of this study revealed that most of the respondents approved of managing forest for carbon breakdown and pollution control, managing forests for protection of water catchment areas, preservation of natural scenic beauty for tourism, protection of biological resources for conservation, research and scientific purposes, and also that fees should be paid for entrance into private lands for collection of information.

One way of rewarding people so that they can be seriously involved in sustainable forest management, conservation and restoration is to value ecosystem services provided through their efforts by placing a monetary value on these services. This is supported by the approval of respondents that fees should be paid for entrance into private lands for collection of information and also in line with the finding of Pearce (2001).

Imputing economic values to non-marketed benefits has the potential to radically change the way we look at all forests and to

make the pendulum swing back from exploitation in favor of forest conversion and sustainable use as reflected in the finding of Nowak *et al.* (2002). Respondents did not agree with the fact that noises from parking vehicles off roads and/or noise from anthropogenic sources disturb wild animals. This is, however, at variance with the finding of Patricelli and Blickley (2006) particularly on the attendant effect that noise has on wildlife, and the responses that wild animals exhibit to noises. Even though the result on sensitivity of wildlife to environmental disturbance was not significant, majority of respondents agreed that the use of pesticides kills important wild animals which is consistent with the finding of Schiesari *et al.*, (2013). To forestall this, pesticide use must be incorporated into Integrated Pest Management program best suited for the preservation of native habitat patches (Schiesari *et al.*, 2013).

The result of this study in which respondents agreed that leaving forest next to another forest increases the contiguity of forest for the habitats of wildlife is consistent with the findings of Laurance *et al.* (2007) that forest fragments and decreasing patch size of forests can have devastating effects on plant and animal population sizes, which of course may also lower their viability and genetic variation. These negative effects may be worsened by other threats imposed by man during the course of using the forest in the face of global climate change (Aragao *et al.*, 2014). Since the majority of the respondents agreed that leaving forest on the bank of a river helped to increase total home for wild animals, further confirming the importance of vegetation growing along water bodies observed in the study of Gundersen *et al.* (2010) and in harbouring special species (Sabo and Soykan 2006). Findings of Miller (2005) agreed with the results from this study

that urban arboreta comprising of trees and other vegetation types provide habitat and shelter for wildlife. However, rapid urban development processes may alter and replace native vegetation, which poses a great threat to global biodiversity especially birds and other wildlife populations at both species and community levels (Lerman *et al.*, 2014).

Conclusion and Recommendation

From the study, it was deduced that people have little knowledge of the implications of parking vehicles off roads and other anthropogenic activities with the attendant noise pollution on wild animals. The study also showed that the use of pesticides for agronomic practices by farmers has contributed to the dwindling population of wildlife in natural and private forest lands. There is an understanding that forest reserves also help to protect population of wild animals and that urban arboreta provides habitat and shelter for wild animals.

There should be awareness campaign on the disturbance effect of noise on wild animal population since most respondents disagreed that noises from parking vehicles off roads and/or noise from anthropogenic sources disturb wild animals. Farmers should be advised to use more of environmentally friendly practices on their farms. Farmers with forest land that is large enough to accommodate a handful of wildlife can exploit the opportunity to have a garden for recreation. The increase the contiguity of forests should be supported in order to increase total home for wild animals. A quantifiable area of forests along the banks of rivers, streams, lakes and other water bodies should be demarcated and marked as critical, primarily for the preservation of water catchment and secondarily for the conservation of wildlife and biodiversity for tourism.

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