Chapter

Analysis of Anthropogenic Impediments to African Forest Ecosystems Conservation: Case of Gambari Forest Ecosystem, Ibadan, Nigeria

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Abstract

Gambari Forest Reserve (GFR) is located in Oyo State, in the south-western region of Nigeria, in the Mamu locality (Gambari Forest), co-ordinate 3.7 and 3.9E" and latitude 7°26 1 N and longitude 3°5 1 E. i.e. 17 km South-East of Ibadan, along the Ibadan/Ijebu-Ode road. The major taxa studies for this research include the forest tree species forest ecosystem in Gambari Forest Reserve, such as: *Leucaena leucocephala, Leucaena glauca, Gliricidia sepium,Tectona grandis, Gmelina arborea, Swietenia macrophylla, Acacia spp., Albizia spp., Cassia siamea, and Pithecellobium saman*. 200 key respondents participated in this study, which were drawn from the seven main communities namely Ibusogboro, Oloowa, Daley North and south, Onipe, Mamu, Olubi and Onipanu respectively. The results revealed that there are significant anthropogenic interventions taking place in the study area. It is therefore imperative to conserve and safeguard GFR ecosystem resources, as ensuring that ecosystem services and biodiversity function at optimum levels. This study therefore recommends continued research to be undertaken, in addition to consistent monitoring and conserving our fragile forest resources, with the aim of achieving optimum functioning and service delivery.

Keywords: conservation, deforestation, ecology, forest ecosystem, forest degradation, environment, Gambari forest reserve (GFR), non-wood forest products (NWFPs)

1. Introduction

It is expedient to elucidate that on the average, forest ecosystems all over the world contain not less than an estimated 80% of the earth's biodiversity. According to Olatoye, [1], tropical forests are particularly rich in species. Furthermore, forests cover not less than 10% of the total terrestrial surface, and approximately 50% of the total area covered by the world's forests serve as habitat to considerably more than 60% of all terrestrial and freshwater biodiversity [2–4]. From the foregoing, Benayas, [5] opined that about 10 million people are employed in forest management and conservation all over the world. In the same vein, over 1.6 billion people- including more than 2000 indigenous cultures depend on forest Land Use Land Cover (LULC) as a means of livelihood [6], thereby providing a wide range of environmental services [3, 4], including biodiversity conservation, water supply, carbon sequestration, flood control [1], and protection against soil erosion and desertification [5].

According to Green, [7]; FAO, [8], forests offer wide- ranging services for the marketing of wood and non-wood forest products (NWFPs), examples include timber, fuelwood, nuts, fruits, as well as medicinal plants. As elucidated by Seto, [9], forest products accounted for more than US$300 billion, or 4% of the total value of international trade in commodities in 2004. Additionally, many people also place spiritual, religious and cultural values on forests as well as NTFPs, while others utilize them for leisure and recreational purposes [3, 4]. Despite the decline in the global forest area over centuries, the rate of deforestation has accelerated to alarming proportions. Gardner, [6] reports that the change in the African forest cover over the last three decades has largely been dependent on forest-clearing for agriculture/pastures, as well as for firewood collection. Further, population pressures in rural African communities were recognized as the main driving force accountable for the forest land- use and land- cover changes, while most of the deforested areas are unsuitable for long-term farming or grazing. It is on this premise that FAO, [8] stated that the very few of the remaining African tropical forests have little potential for sustainable agriculture.

One of the major enemies of forests is its use for domestic fuel consumption. Demand for fuel destroys near villages and towns in many countries [7]. Fuel wood gathered from the forest is the most important source of domestic energy in the rural areas of many developing countries. The collection and consumption of fuel wood are complexly linked to the management of environmental and natural resources. There exists a two-way relationship between fuel wood collection and deforestation. On one hand, the excessive demand for fuel wood causes forest degradation, thereby exacerbating fuelwood collection above its sustainable conservation. The degradation of forests, on the other hand, concomitantly results in fuel wood scarcity, thereby leading to global fuel wood crisis [2]. From the foregoing, there are a several consequences of forest degradation, such as the loss of biodiversity, watershed deterioration, the release of excessive atmospheric carbon dioxide (CO_2) as well as soil erosion.

The de-reservation of forest areas for community expansion purposes, commercial agriculture as well as infrastructural development have assumed a startling dimensions in many African rainforest regions from the end of the 20th century. According to Nahuelhual, [10] de-reservation, lack of articulate policies

on forest conservation/management, the preponderance of illegal selective logging as well as unsustainable harvesting of NWFPs, inadequate funding and under-staffing of government forest management parastatals, excessive bureaucracy, lack of harmonized coordination as well as inadequate reliable inventory for planning and forest regeneration activities, are major challenges to the sustainability of African forest conservation. Furthermore, it should be noted that the extinction of flora and fauna species, as well as the conversion of fragile forest ecosystems to other land-uses have culminated in fragmentation, serial extinction and genetic erosion of rare and endemic timber species.

2. Statement of problem

Forests today are destructively exploited in Africa for timber, fuelwood, fibers, ornamentals and pharmaceutical products without genuine effort to replenish them [11]. From the foregoing, the destruction of essential forest resources such as vegetation cover, fertile soils wildlife, as well as environmental pollution emanating from oil spillage are alarmingly evident in several African countries, this is coupled with the high rate of population increase which is responsible for agricultural and industrial growth, resulting in the continuous expansion of land. This has gone a long way in the degrading of the environment causing different types of problems [1, 3, 4].

Forests exhibits a fragile ecosystem in Africa in particular, and all over the world in general, and in Ref. to the study area, this requires constant monitoring and update information for just in time interventions to promote sustainability [6]. This is because, forests not only sustain high biodiversity and productivity but captures sediments and nutrients, stabilize and provides food and livelihoods for the human populations that surround them. In Africa, loss of forest resources is caused by both anthropogenic and/or naturally occurring factors. It was observed that forest resources at the study area are threatened by numerous anthropogenic activities leading to degradation of the most heavily threatened natural systems. However, the present status in terms of extent, nature, at species richness and local people's perception are not known despite the increasing population growth and urbanization in the area. Further, Olatoye, [1] opined that forests are greatly threatened and are depleting fast in the study area due to human factors. These have been found to jeopardize these natural habitats and triggering climate change [9].

It is also imperative to state that forest loss has continually reduced the GFR ecosystems biodiversity, which the surrounding rural communities depend upon. Hence, it is urgent need to know the status of the resource to ensure the sustainability of the GFR ecosystem. Further, there are various environmental problems requiring urgent attention in the study area, and these include degradation of forests, expansion of rural settlements around GFR conservation areas, degradation and erosion of fertile soils on account of unsustainable forest LULC practices. Other environmental problems include the preponderance of invasive/alien flora species, as well as the illegal dumping of refuse in the study area [12].

3. Aim of the study

This study investigated the anthropogenic impediments to the conservation of Gambari Forest Ecosystem, Ibadan, Nigeria.

3.1 The study area

Gambari Forest Reserve (GFR) is located in Oyo State, in the south-western region of Nigeria, in the Mamu locality (Gambari Forest), Co-ordinate 3.7 and 3.9E" and latitude 7°26 1 N and longitude 3°5 1 E. i.e. 17 km South-East of Ibadan, along the Ibadan/Ijebu-Ode road. GFR falls within the low land semi- deciduous forest belt of Nigeria and covers a total land area of 17,984 hectares, between River Ona on the West and the main road from Ibadan to Ijebu-Ode on the East. The effective productive area of the plantation is therefore 306.9 acres, no allowance being made for subsidiary roads and compartment boundaries. The Forest Reserve is owned by Oyo/Ogun State governments and forms part of what was the Mamu Government Forest Reserve. Formerly Ibadan District Council Forest Reserve, GFR is divided into five series namely Onigambari, Busogboro, Onipe, Olonde and Mamu. It was originally 12,535.6 ha of which 1036 ha was de-reserved by the Oyo State Government for the Cocoa Research Institute of Nigeria. Later in 1986, another 1000 hectares was given to Safa Splints Nigeria Limited for its industrial plantation. Presently, the working area in the reserve is 10,429.6 ha (**Figure 1**).

3.2 Justification for the study

This research seeks to bring to the awareness of government and stakeholders on the uncontrolled threat to the ecological system in the study area, and hence the need to asses, monitor and prevent the threatened and endangered endemic forest resources from extinction. Therefore, this study will provide information to guide

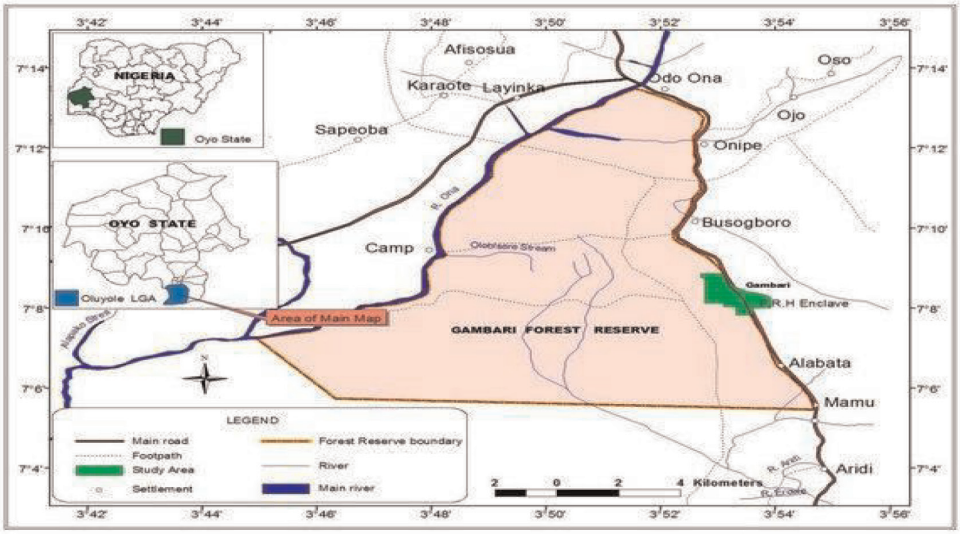

Figure 1.
Map of study area within Oyo state and Nigeria.

improvements to the management and restoration of forest vegetation in GFR to commercial activities and local economies [13]. This research also seeks to examine related causes and other basic driving forces on account of forest loss as well as proffer solutions towards optimal conservation and sustenance of biodiversity in the study area. Finally, this study calls for the need to provide vivid information on threats encountered at the study area, such as threats due to population pressure, climate change, nutrient loading, pollution and over-exploitation.

4. Materials and methods

The methodology adopted in the course of this research is the mixed method, i.e. qualitative and quantitative methods. In this study, a total of 200 key respondents participated in it, which were drawn from the seven main communities namely Ibusogboro, Oloowa, Daley North and south, Onipe, Mamu, Olubi and Onipanu respectively. These included government officials, civil servants (related to vegetation conservation), headsmen, local leaders, traditional healers, farmers, traders, artisans, grass root dwellers, fishermen, hunters, lumbers, community members and the general public residing in the study area. Out of the 200 copies of the questionnaire distributed, 194 were returned, giving a response rate of 97%. This offered rich information about the impacts of forest loss at the study area. Copies of the questionnaire were distributed covering areas listed in **Table 1** below.

4.1 Features of Forest loss changes in study area

This section analyses the respondents reaction to the features of forest loss in GFR,

4.1.1 Causes of Forest loss in GFR

This section analyzed respondents' opinion to the causes of forest loss in GFR. The analysis of the responses is tabulated in **Table 2**.

Table 2 depicts the total number of causes of forest loss which were received from the GFR respondents, chief of which is illegal logging (190/97.9%), and this assertion is consistent with existing literature by Mantyka-Pringle [14]. This is seconded by deforestation (169/87.1%). Also, climate change, which is caused by human activities in the study area, (e.g. through carbon emissions, deforestation, urbanization, population increase, etc.) accounts for 128 (65.9%).

4.1.2 The anthropogenic interventions in the study area

In response to the survey form, the researcher sought to know the anthropogenic factors that occur in GFR. The study reveals the viewpoints of the respondents, as presented in **Table 3**.

Table 3 above reveals the depicts the total number of anthropogenic interventions that take place in GFR, which reveals that most respondents (i.e. 188 or 96.9%) were of the opinion that illegal logging was a major anthropogenic action in the study area, and is evident in locations such as Mamu, Ibusogboro, and environs. This assertion is further buttressed by Adedeji [15], who stressed that over 5240 hectares of forest vegetation was lost to other land uses from year 1984 to 2014 (average of over 140 hectares/year loss). Additionally, land development and illegal woodcutting accounts

Variable	Frequency	Percentage
Sex		
Males	101	52.1
Females	93	47.9
Age		
21-30	39	20.1
31-40	51	26.3
41-50	47	24.2
51 and above	57	29.4
Marital status		
Single	76	39.2
Married	83	42.8
Divorced	12	6.2
Widow/Widower	23	11.9
Educational level		
No formal education	38	19.6
Primary education	29	14.9
Secondary education	73	37.6
Tertiary education	14	7.2
Household size		
≤ 3	11	5.7
4-6	65	33.5
7-9	54	27.8
10-12	46	23.7
Above 12	18	9.3
Income level		
≤$100	54	27.8
$101-$300	61	31.4
$301-$500	33	17
$501-$700	28	14.4
Above $700	18	9.3

Table 1.
Gender respondents characterization.

for 162 (57.9%) and 188 (96.9%) responses respectively, while conversion of ecosystem for agriculture accounts for 167 (86.1%). Also, judging from the responses, it is evident that illegal waste disposal at vegetation land cover areas is still an environmental challenge in the study area, and this poses negative environmental effects, and this include inhibition in the population and activities of soil microbes as well as enzyme activities required for soil fertility, [16], reduction in the percentage of soil organic matter, decreased soil basal respiration [17], etc.

(a) Deforestation 169 (87.1%)	(d) Government Policy 106 (54.6%)
(b) Illegal Logging 190 (97.9%)	(e) Climate change 128 (65.9%)
(c) Crop Cultivation 120 (61.9%)	
Total	254 (100%)

Table 2.
Causes of Forest loss in the study area.

Illegal woodcutting/selective logging 188 (96.9%)	Informal settlements 66 (34.02%)
Conversion of forestland for crop cultivation 167 (86.1%)	Bush fires 74 (38.1%)
Land development 162 (57.9%)	Illegal waste disposal 71 (36.6%)
Overgrazing 104 (53.6%)	Illegal sand mining 128 (66%)
TOTAL	**194 (100%)**

Table 3.
Anthropogenic interventions in GFR.

4.1.3 The reasons for anthropogenic influences in GFR

The analysis of question 17 of the questionnaire is centred on the reasons for the anthropogenic influences of the inhabitants in GFR, which centred on poverty, weak implementation of government policy and ignorance. The result is presented as pie chart in **Figure 2** below.

Figure 2 illustrates the reasons for anthropogenic factors by the respondents. The highest frequency related to the aforementioned is poverty, which is 117 (60.3%). Poverty is still a major challenge in the study area, and this viewpoint is in conformity with Adeoye [18], who opined that about over 33% of surveyed respondents in the study area earn below N25, 000 monthly. Also, 41 (21.1%) respondents underpinned the weak implementation of government policies, while 36 (18.6%) claimed it could be due to ignorance.

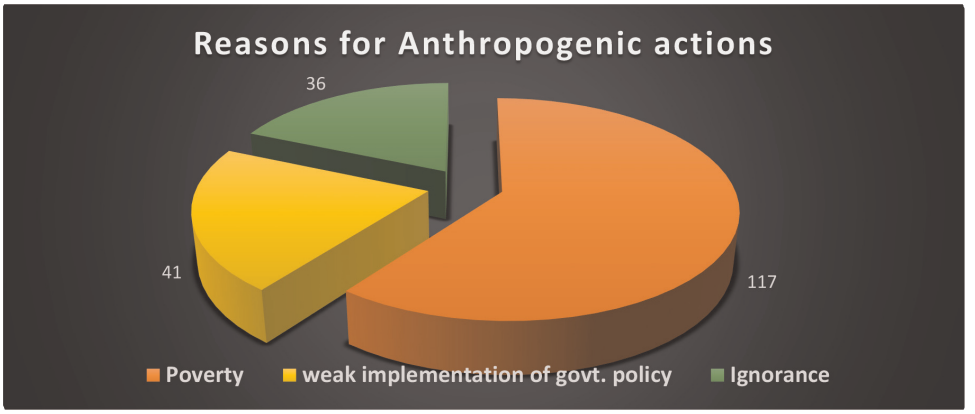

Figure 2.
Pie chart depicting reasons for anthropogenic actions in the study area.

4.1.4 The perception of respondents to forest reserves

This section epitomizes the perception of Gambari respondents to forest reserves. This is purposed to decipher the respondents' level of understanding, care as well as the determination of how significant they uphold conservation of FRs. From the foregoing, the results are pictorially presented as pie chart in **Figure 3** below.

At this juncture, it is expedient to state that the importance of a phenomenon is a function of the value placed on it. In laying credence to this assertion, **Figure 3** above diagrammatically illustrates the perception of respondents regarding their impression of forest reserves (FRs) in the study area. The result reveals that 156 (80.4%) respondents are of the opinion that FRs are not urban spaces for development. This group of respondents are those that place great value on FRs on account of its numerous ecological benefits to man, wildlife and the environment. On the contrary, 38 (19.6%) respondents are of the opinion that FRs are wastelands or virgin territories awaiting clearing/vegetation removal for other land uses such as infrastructural development, agriculture and other land uses. This situation is consistent with existing literature such as Akinluyi [19]; Raheem [20] and Adekola [21]. In addition, the respondents also responded to question 23 on whether it is necessary to protect vegetation resources, the results states that 225 (90.4%) responded in the affirmative, while 23 (9.2%) respondents stated otherwise. From the foregoing, it is expedient to orientate community dwellers, and more especially, decision makers on the need to consider the conservation of ecosystems as sacrosanct.

4.1.5 Proposed strategies towards the conservation of timber species in GFR

This study also sought to proffer solutions to illegal logging as well as the degradation in the study area and control strategies were proposed in this regard. The result is tabulated and graphically illustrated in **Figure 4** below.

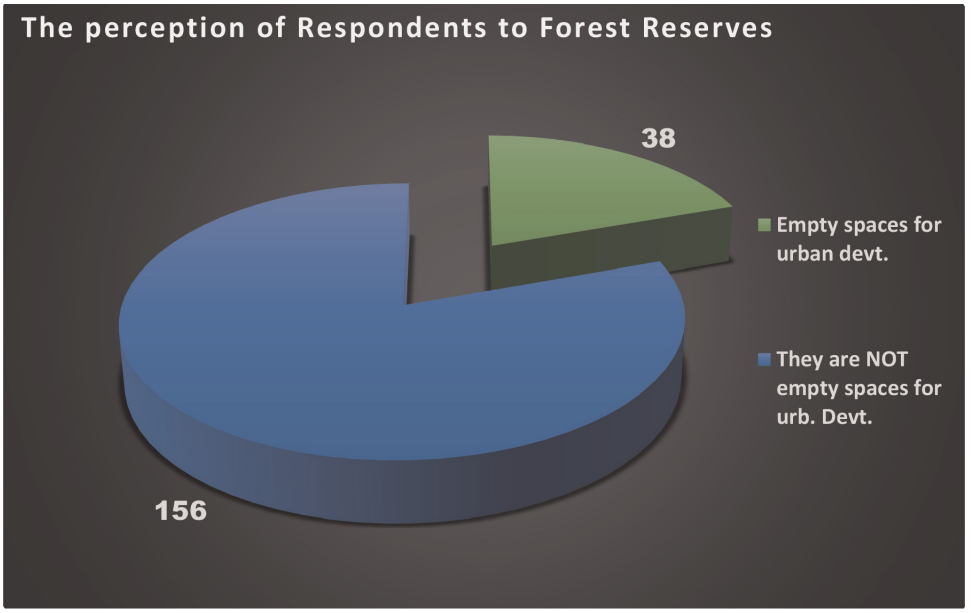

Figure 3.
Pie chart depicting the perception of respondents to the conservation of Gambari Forest reserve.

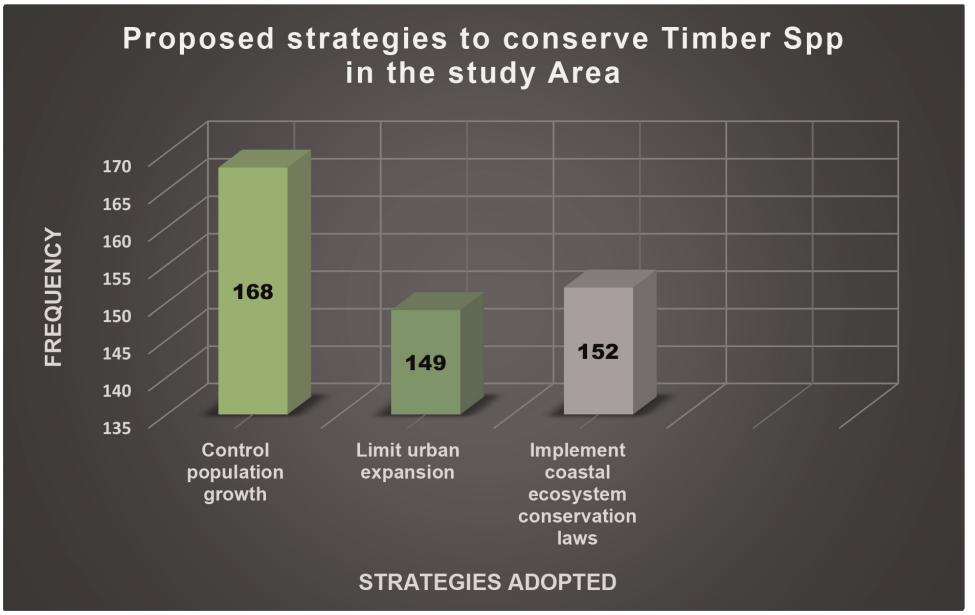

Figure 4.
Bar chart depicting proposed strategies towards the conservation of timber species in Gambari Forest reserve.

Figure 4 presents a graphic illustration of the suggested strategies proposed by the respondents for the conservation of timber species in GFR. The greatest frequency of respondents (i.e. 168 or 86.5%) supported population growth control. This assertion is consistent with existing literature such as Potatov, [22]; Olatoye, [3, 4]; Olatoye, [1], who stated that there is a high correlation between population growth and ecosystem/biodiversity loss. They further opined that controlling human population growth levels will gradually reduce stress on ecosystems. Further, 149 (58.9%) respondents were of the opinion that limits should be placed on urban expansion, for the purpose of ensuring sustainability of ecosystem resources, and this confirms the position of ecosystem scholars such Sadorsky [23]; Deng [24] On a global scale, Sadorsky [23]; posited that global urban expansion will continue unabated, even as the world's human urban population is estimated to rise by more than 3 billion people by year 2050, and this will be due to high urban fertility rates and re-categorization of rural territories into urban centers [23, 25].

5. Conclusion

The impact of anthropogenic actions on forest ecosystems is alarming, as it ultimately results in exploitation of virgin territories for the purpose of meeting higher demands on wood utilization, agriculture, housing, transportation and other basic human infrastructure to cater for the teeming population. In the same vein, population has an adverse effect on the preservation of biological diversity, and the consequences of population increase is decline in ecosystem service delivery as well as flora and fauna habitat loss. For example, over 5240 hectares of forest vegetation was lost to other land uses from year 1984 to 2014 (average of over 140 hectares/year loss)

in the study area due to poverty, unemployment, government negligence and inadequate security at the reserve. Another observation of important significance is the attitude of fuel wood collectors to issues of environmental degradation. Despite government policies and awareness on the need for forest conservation, protection and sustainable forest management practices, some of them still regard fuel wood as a free gift of nature. This in consequence makes it difficult for them to believe in the adverse effects of their action. The low literacy level in the study area and environs and the general belief in the traditional practice of tree felling and bush clearing have also contributed to environmental degradation in the study area. While healthy ecosystems are highly resilient to impacts of environmental change on account of their capability to sustain ecosystem services on one hand, ecosystems are more vulnerable due to their poor state and they cannot provide the required delivery of service. It is on this premise, therefore that this study calls for prompt and proactive attention as regards conservation of the highly vulnerable GFR ecosystem as population increase is fast encroaching on the study area, a situation which continues unabated. Further, rapid growth in population results in multifaceted landscape changes, which further culminates in the altering of forest ecosystems structure and functioning, no wonder they have been imperiled by severe stresses from human interventions due to the uncontrolled and largely mismanaged exploitations of forest resources which has culminated in resource loss, degradation, degeneration, reduced productivity levels, and socio-economic opportunity costs. From the foregoing, the environmental pollutants that are released due to high levels of deforestation, energy consumption and environmental degradation in the study area pose negative implications on human health and well-being. Also, it is clearly stated in the referenced literature that deforestation in the study area significantly alters soil microbial and hydrological activities, and consequentially raising budgets devoted to land surface radiation. It is therefore imperative at this juncture to advocate for the control of deforestation in its totality, and in addition, it is germane for town planners to ensure that sustainable urban development policies are implemented in state laws. Finally, it is important to state that the future of our societies will depict our decisions, values and interests, and ultimately, our actions on the ecosystem, and these will consequentially determine the fate of the human, flora and fauna species. Therefore, the exploitation of forest resources have to embrace the sustainability of ecological systems in scientific practice and as its ultimate goal.

6. Recommendations

In conclusion, the African forestry sector can be developed in the following ways:

- Firstly, there is need for government to restore public awareness campaign in the area of deforestation and environmental resource management.
- Increasing allocation to fund forestry research.
- There is need for sustainable exploitation and management of forest resources. More forests need to be established through afforestation and reforestation, while the existing ones should be protected. If there is need for exploitation, it should be done in a sustainable manner.

- Recycling and reduction of wood wastes and establishment of gene banks to prevent forest species extinction, introduction of domestication programmes and workable legislation in the forestry sector.
- Enforcement of a properly conducted Environmental Impact Assessment (EIA) as a pre-condition for approving projects in various sectors of the African economy.
- Updating of forest legislation among member countries.

Focusing on the unique products and services required locally and globally and strengthening local institutions can be important ways of addressing forest resource depletion in the African continent. Such efforts should build on successful experience with locally based sustainable resource management integrating agriculture, animal husbandry and forestry, taking advantage of local/indigenous knowledge. The growing demand for environmental services- especially biodiversity and carbon sequestration provides particular opportunities in Africa.

On account of population pressure around forest land uses in Africa, it is therefore imperative to conserve and safeguard forest resources across the world, as well as ensuring that ecosystem services and biodiversity function at optimum levels. It is on this premise that this research therefore makes a clarion call for continued research to be undertaken, in addition to consistent monitoring and conserving our fragile forest resources, with the aim of achieving optimum functioning and service delivery.

A. Appendix- Questionnaire

A.1 Analysis of anthropogenic impediments to the conservation of gambari forest ecosystem, Ibadan, Nigeria

A.1.1 Section A: demographic characteristics

1. Gender.

Male	Female

2. **Age** … … … … … … … … … … … … … … … … … .
3. **What is your highest level of education?**

(a) No education	(f) Matric
(b) Primary	(g) University degree
(c) Middle school	(h) Undergraduate Student
	(i) National Diploma

A.1.2 Section B: conservation of forest resources

4. Do you know about the conservation of forest resources and the environment?

(a) Yes	(b) No

5. Do you care about the conservation of forest resources and the environment?

(a) Yes	(b) No

6. Which benefits do you derive forest resources in the study area? (Tick as many choices).

(a) Food	d) Economic
(b) Raw Material	(e) Others (Please specify)
(c) Medicinal purposes	

7. In your perception, which of these have changed regarding the conservation of forest resources in your area?

the overall quality	species abundance	Ecosystem diversity	Do not Know

8. With regards to your answer in number 8, what is the degree of change? It has.

Increased	No change	Decreased	Do not know

9. On a scale of 1 to 10, how do you rate the management and conservation of the coastal vegetation resources in your location? (1 = extremely poor, 10 = Excellent), please provide your score in the box below:

A.1.3 Section C: challenges encountered in the conservation of gambari forest ecosystem

11. Are there environmental challenges in your location?

a. Yes	(b) No

12. What are the causes of forest loss in your area? Tick as many as possible.

a. Deforestation	(e) Government Policy

(b) Urban expansion	(f) Climate Change
(c) Crop Cultivation	
(d) Others, specify	

13. On a scale of 1 to 10, How has the environmental challenges in your location affected you? (1 = Extremely Adverse Impact; 10 = Excellently Positive Impact), please provide your score in the box below:

14. Select the anthropogenic activities that take place in your location:

(a)Illegal woodcutting/selective logging	(f)Informal settlements
(b) Conversion of ecosystem land use for crop cultivation	(g) Bush fires
(c) Land development	(h) Illegal waste disposal
(d) Overgrazing	(i) Others (specify)
(e) Illegal sand mining	

15. In your own perception, what are the reasons for these anthropogenic influences? (Tick as many as applicable).

(a) agriculture	(d) Weak implementation of conservation policies
(b) urban expansion	(e) Ignorance
c) Poverty	(f) Others (specify)

16. As an individual, have you been able to manage or adapt to the environmental problems in your location?

a. Yes	(b) No

A.1.4 Section D: ecosystem goods and services

17. What are the major ecosystem services provided by the study area? (Tick as many as possible)

a. **Provisioning:**

Timber	**Fuelwood**	**Pines**	**Genetic Resources**
Medicinal/Cosmetic Plants	Livestock	Fiber Crops	Tree Plantations
Food			

b. **Cultural**

Recreational	**Tourism/Ecotourism**	**Landscape beauty**	**Education**
Scientific research	Traditional knowledge	Cultural heritage	Religious

c. **Regulating**

Erosion control	**Hydrological regulation**	**Climate regulation**	**Soil purification**
Water purification	Waste treatment	Flood buffering	Pest prevention
Air Quality	Habitat maintenance	Carbon sequestration	Environmental stabilization
Nursery			

18. Which ecosystem goods and services do you know that are no longer available, or diminished in this area and state why?

A.1.5 Section E: urban expansion and conservation of gambari forest ecosystem

19. In your opinion, what are the reasons for urban expansion: Tick as many as applicable?

a. Population growth	c. Need for development
b. Agriculture (Food security)	d. Others

20. What are the impacts of urban expansion? (Tick as many as appropriate).

Pollution	**Environmental degradation**
Ecosystem biodiversity loss	Infrastructural development
	Others (Specify)

21. Do you consider Gambari Forest Reserve as empty space for urban development?

(a) Yes	(b) No

22. On a scale of 1 to 10, what impact does urban expansion have on the conservation of coastal vegetation? (1 = adversely poor impact; 10 = excellently positive impact), please provide your score in the box below:

23. Do you think that forest resources should be conserved in the study area the so that they do not cause long term depletion or affect the diversity of the ecosystem?

(a) Yes	(b) No

24. In your opinion, what strategies have been adopted to contain urban expansion and conserve forest resources in the study area? (Tick as many as appropriate).

(a) Control population growth	(c) Implement forest conservation laws
(b) Limit urban expansion	

Thank you.

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References

[1] Olatoye TA. Impact of Urban Expansion on the Conservation of Coastal Vegetation in Buffalo City Metropolitan Municipality; a Doctoral Thesis Submitted to the Department of Geography and Environmental Science, Faculty of Science and Agriculture. Alice Campus, South Africa: University of fort Hare; 2020. 330pp

[2] Hosonuma N, Herold M, De Sy V, De Fries RS, Brockhaus M, Verchot L, et al. An assessment of deforestation and forest degradation drivers in developing countries. Environmental Research Letters. 2012;**7**(4):044009

[3] Olatoye TA, Kalumba AM & Mazinyo SP 2019a. Exploratory review of urban expansion, coastal vegetation environments (CVEs) and sustainability paradox. Being a paper published in the Journal of Human Ecology, India. REF NO: JHE-041-19/3152. **67**(1-3): 21-30

[4] Olatoye TA, Mazinyo SP, Odeyemi AS. Forest Systems Services Provisioning In Africa: Case of Gambari Forest Reserve, Ibadan, Nigeria. Hindawi Limited, Adam House, Third Floor, 1 Fitzroy Square, London W1T 5HF, United Kingdom: Published in the International Journal of Forestry Research; 2019b

[5] Benayas JMR, Bullock JM. Restoration of biodiversity and ecosystem services on agricultural land. Ecosystems. 2012; **15**(6):883-899

[6] Gardner T. Monitoring Forest Biodiversity: Improving Conservation through Ecologically-Responsible Management. Routledge; 2010

[7] Green JM, Larrosa C, Burgess ND, Balmford A, Johnston A, Mbilinyi BP, et al. Deforestation in an African biodiversity hotspot: Extent, variation and the effectiveness of protected areas. Biological Conservation. 2013;**164**:62-72

[8] Food and Agriculture Organization of the United Nations. 2017. USA: The Future of Food and Agriculture: Trends and Challenges

[9] Seto KC, Güneralp B, Hutyra LR. Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. Proceedings of the National Academy of Sciences. 2012; **109**(40):16083-16088

[10] Nahuelhual L, Carmona A, Lara A, Echeverría C, González ME. Land-cover change to forest plantations: Proximate causes and implications for the landscape in south-Central Chile. Landscape and Urban Planning. 2012;**107**(1):12-20

[11] Bradshaw CJ. Little left to lose: Deforestation and forest degradation in Australia since European colonization. Journal of Plant Ecology. 2012;**5**(1):109-120

[12] Olatoye TA. Analysis of land cover change and fuelwood production in gambari forest reserve, Ibadan, Nigeria: A Masters dissertation submitted to the Department of Geography, Faculty of the Social Sciences, University of Ibadan: Nigeria; 2013. 76pp

[13] Mcleod E, Chmura GL, Bouillon S, Salm R, Björk M, Duarte CM, et al. A blueprint for blue carbon: Toward an improved understanding of the role of vegetated coastal habitats in sequestering CO_2. Frontiers in Ecology and the Environment. 2011;**9**(10):552-560

[14] Mantyka-Pringle CS, Visconti P, Di Marco M, Martin TG, Rondinini C, Rhodes JR. Climate change modifies risk

of global biodiversity loss due to land-cover change. Biological Conservation. 2015;**187**:103-111

[15] Adedeji OH, Tope-Ajayi OO, Abegunde OL. Assessing and predicting changes in the status of Gambari forest reserve, Nigeria using remote sensing and GIS techniques. Journal of Geographic information system. 2015; **7**(03):301

[16] Thavamani P, Malik S, Beer M, Megharaj M, Naidu R. Microbial activity and diversity in long-term mixed contaminated soils with respect to polyaromatic hydrocarbons and heavy metals. Journal of Environmental Management. 2012;**99**:10-17

[17] Wangai PW, Burkhard B, Müller F. A review of studies on ecosystem services in Africa. International Journal of Sustainable Built Environment. 2016;**5** (2):225-245

[18] Gbiri IA, Adeoye NO. Analysis of pattern and extent of deforestation in Akure Forest Reserve, Ondo State, Nigeria. Journal of Environmental Geography. Nigeria: Academic Publishers; 2019;**12**(1-2):1-11

[19] Akinluyi ML, Adedokun A. Urbanization, Environment and Homelessness in the Developing world: The Sustainable Housing Development. Mediterranean Journal of Social Sciences. 2014;**5**(2):261

[20] Raheem ID, Tiwari AK, Balsalobre-Lorente D. The role of ICT and financial development in CO_2 emissions and economic growth. Environmental Science and Pollution Research. 2020; **27**(2):1912-1922

[21] Adekola J, Fischbacher-Smith M, Fischbacher-Smith D, Adekola O. Health risks from environmental degradation in the Niger Delta, Nigeria. Environment and Planning C: Politics and Space. 2017; **35**(2):334-354

[22] Potapov PV, Turubanova SA, Hansen MC, Adusei B, Broich M, Altstatt A, et al. Quantifying forest cover loss in Democratic Republic of the Congo, 2000–2010, with Landsat ETM+ data. Remote Sensing of Environment. 2012; **122**:106-116

[23] Sadorsky P. The effect of urbanization on CO_2 emissions in emerging economies. Energy Economics. 2014;**41**:147-153

[24] Deng X, Shi Q, Zhang Q, Shi C, Yin F. Impacts of land use and land cover changes on surface energy and water balance in the Heihe River Basin of China, 2000–2010. Physics and Chemistry of the Earth, China: Parts A/B/C. 2015;**79**:2-10

[25] Jiang L, Deng X, Seto KC. The impact of urban expansion on agricultural land use intensity in China. Land Use Policy. 2013;**35**:33-39