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MECHANISM FOR FOREST BIODIVERSITY PROTECTION AND CONSERVATION TO ENHANCE FOOD SECURITY IN BENUE STATE, NIGERIA

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Abstract:
The study identified mechanism for forest biodiversity protection and conservation for enhancing food security in Benue state. Four research questions and three hypotheses guided the study. Descriptive survey research design was used for the study. The study was carried out in Benue State. The target population consists of 63 extension agents and 25 foresters. The total population was utilized, therefore there was no sampling. A 34 item structured questionnaire titled '*Forest Biodiversity Protection And Conservation Questionnaire*' (FBPCQ) was developed from literature and used for data collection. The instrument was subjected to face validation by three experts. Cronbach Alpha method was adopted to determine the internal consistency of the questionnaire items which yielded a coefficient of 0.71. The questionnaires were analyzed using mean to answer the research questions and t-test statistics to test the hypotheses at 0.05 level of significance. The result of the study revealed that respondents agreed on most items on the erosion control measures in the forest, tools and methods used to control forest fire, mitigation procedures adopted for biodiversity depletion and government regulation on the use of forest. It was recommended amongst others that state ministry of agriculture should implement mitigation procedures for reducing biodiversity depletion and adopt measures for controlling forest fire.

Keywords: forest, biodiversity, protection, conservation, forest biodiversity and food security

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Introduction

Forest is one of man's widespread and useful natural resources, it is therefore important the forests are preserved. Osinem and Mama (2008) reported that the removal of vegetation will completely destroy both plant and animals and human life will be in danger, hence, the need for protecting and conserving the forest for future generation. Protection from organic damage connotes those damages done through fungi, insects, other animals or micro- organisms. Folurunso and Kumoye (2013) affirms that it promotes diversified food resources production, ecological stability and biodiversity maintenance. Also, the careful pruning of infected plants is a useful treatment for long-lived plants, trees, and shrubs and to remove source of infection in order to reduce their biodiversity interference. Biodiversity in the view of Folurunso and Kumoye (2013) is the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystem. The author explained that it includes the variety of all forms of life on earth which provides the building blocks for our existence and ability to adapt to environmental changes in the future.

Biodiversity not only provides direct benefits like food, medicine and energy, it also affords us a life support system. Biodiversity is required for the recycling of essential elements such as carbon, oxygen and nitrogen. Kherellah and Felenchi (2002) submitted that biodiversity is responsible for mitigating pollution, protecting watersheds and combating soil erosion. It acts as a buffer against excessive variations in weather and climate. Furthermore, biodiversity is valuable in stimulating technological innovation and providing the framework for sustainable development. However, biodiversity depletion has been observed in Benue state in recent years. Proximate causes that had fanned the loss of biological resources such as clearing and burning of forests, over harvesting of plants and animals, indiscriminate use of pesticides and the deliberate substitution of diversity by uniformity of crops, trees and livestock. Unfortunately, this trend has thrived through development projects financed by aids from international agencies which had further worsened the crisis. Obviously, there is no plan to conserve these biological resources for man's use.

As explained by Ekele (2015), conservation is a positive action which embraces preservation, maintenance, sustainable utilization, restoration and enhancement of the natural environment. The author emphasize the need to conserve biological resources in the environment especially conservation of biodiversity within protected area such as forest reserve, game reserve, national parks and wild life. Thus, future increase in productivity in ecological agriculture could be achieved by checking potential changes in climate, sea level and ultra violet B- radiation. It is in this context that the forest

protection and biodiversity conservation (which involves erosion control measures in the forest, methods and tools for preventing forest fire, regulation and intervention measures against forest encroachment by man and mitigation procedures for biodiversity depletion) becomes important. In other words, the foresters (those farmers that take care of the forest in terms of maintenance) will have the opportunity to conserve forest resources.

Forest biodiversity is intertwined with agricultural biodiversity which is essential to cope with the predicted impacts of climate change. It is not only as a source of traits but as the underpinnings of more resilient farm ecosystems. Bengtson (2005) opined that forest and agricultural biodiversity are the basis of our agricultural food chain, developed and safeguarded by farmers, livestock breeders, forest workers and indigenous people throughout the world. Forest biodiversity ensures the maintenance of areas of land and water that will sustain production and further maintain agro-ecosystem for wider biological and environmental services. Forest biodiversity according to Gao (2003) provides for biological production emphasizing conservation, sustainable use and enhancement of the biological resources that support soil bio-data, pollinators and predators. The author noted that ecological and social services provided by agro-ecosystems include landscape and wildlife protection, soil protection and healthy soil(fertility, structure and function), water cycle and water quality, air quality and carbon(iv) oxide. Emphasizing on the need for forest biodiversity protection, Mccallum and Bury (2013) stated that global warming is making hot days hotter, rainfall and flooding heavier, hurricanes stronger and droughts more severe. This intensification of weather and climate extremes causes dangerous changes to the landscape of our world, adding stress to wildlife species and their habitat. Unregulated hunting and poaching causes major threat to forest and wildlife conservation. Along with this, mismanagement of forest department and forest guards triggers this problem.

The complete destruction of vegetation will mean that both animals and human life will be in danger. In forest plantation, many seedlings may become established but the number that survives declines rapidly over time. Many become infected by pathogens, or are consumed by herbivores. Consequently, Ekele (2015) noted that the increasing domestic demand for wood based industry showed that forest will not withstand supplies of its products. This situation calls for forest biodiversity to be protected and conserved for future generation. The objectives of forest biodiversity protection and conservation are to preserve biodiversity as source of products and industrial tree plantations, provide resources for sawn timber, pulp, fuel and fodder, provide shelter belts and wind breaks. Furthermore, forest biodiversity conserve and protect the environment including soil, water, fauna and flora, to protect the forest from

damaging phenomenon such as fire, flood and illegal grazing. Also, it minimizes forest depletion and curtails farming practices detrimental to high output of food production. There is need for erosion control measures in the forest, prevent forest fire, put in place measures against forest encroachment in order to achieve the aforementioned objectives.

Statement of the Problem

There is no stability in the ecosystem as natural hazards like erosion and swift mineralization are increased. Without Zero or minimum tillage, there is no reduction in the cost and time of seed bed preparation and this does not offer best natural resistance to erosion with existing vegetation cover. However, the researchers through interaction with farmers in the study area observed that over exploitation of forest resources such as overgrazing and deforestation has an adverse effect on the forest and its biodiversity. The extreme growing indifference of the public to forest conservation has assumed a disturbing dimension due to increasing population in Benue state of Nigeria. It therefore becomes necessary to explore mechanism for forest biodiversity protection and conservation for enhancing food security in Benue State. Specifically, the study identified mechanism for forest biodiversity protection and conservation in

i. Erosion control measures in the forest;
ii. Methods and tools for preventing forest fire;
iii. Government regulation and intervention measures against forest encroachment by man;
iv. Mitigation procedures for biodiversity depletion.

Research Questions

Based on the specific purpose of the study, the study answered the following research questions.

i. What are the erosion control measures in the forest to maintain sustainable biodiversity conservation?
ii. What are the methods and tools for preventing forest fire to maintain sustainable biodiversity conservation?
iii. What are the government regulations or intervention measures against forest encroachment by man to maintain sustainable biodiversity conservation?
iv. What are the mitigation procedures for biodiversity depletion to maintain sustainable biodiversity conservation?

Hypotheses

HO_1: There is no significant difference in the mean rating of the responses of extension agents and foresters on erosion control measures in the forest to maintain sustainable biodiversity conservation.

HO_2: There is no significant difference in the mean rating of the responses of foresters and extension agent on methods and tools for preventing forest fires in order to maintain sustainable biodiversity conservation.

HO_3: There is no significant difference in the mean ratings of the responses of extension agents and foresters on mitigation procedures for biodiversity depletion and for sustainable biodiversity conservation.

Methodology

The study was carried out in Benue state, Nigeria. Four research questions and three null hypotheses were formulated to guide the study. The study adopted descriptive survey research design which was found suitable for this study because questionnaire was used to collect data from the respondents to answer the research questions. The population of the study consists of 63 extension agents and 25 foresters (Benue state ministry of Agriculture, 2016). Due to the manageable size of the number of extension agents and foresters in the state, the entire populations of 88 respondents were used for the study; hence, there was no sampling. The instrument used for data collection was a 34 item structured questionnaire titled 'forest biodiversity protection and conservation questionnaire' (FBPCQ).

The instrument was validated by three experts one from the Department of forestry, two from the Department of vocational agriculture and technology education, all from university of Agriculture, Makurdi- Benue State. Cronbach Alpha method was used to establish the internal consistency of the instrument in which a reliability coefficient of 0.71 was obtained. Data for the study were collected with the help of two research assistants. Out of the 88 copies of the questionnaire administered to the respondents, 83 were retrieved and used for data analysis. This represents 94% return rate. Mean was used for answering the research questions while independent t-test statistics was used for testing the null hypotheses. The null hypothesis of no significant difference was accepted for items whose p-values were greater than 0.05 level of significance while hypothesis of no significant difference was rejected for items whose p-value were less than 0.05 level of significance.

Results

The results of the research questions and the hypotheses are presented on Tables 1-4 as follows.

Research Question One: What are the erosion control measures in the forest?

HO_1: There is no significant difference in the mean ratings of the responses of extension agents and foresters on erosion control measures in the forest in order to maintain sustainable biodiversity conservation.

Table1: Mean ratings and t-test analysis of the responses of foresters and extension agents on erosion control measures in the forest
(N=63, N=25)

S/N	Item statement	XF	XEA	XG	SD	P-value	Remarks	
							RQ	HO
1	Maintenance of natural vegetation.	2.82	3.10	2.96	0.42	0.72	A	NS, NR
2	Tree planting	3.24	3.00	2.96	1.04	0.84	A	NS, NR
3	Establish/plant cover crops	3.55	3.20	3.37	0.85	0.84	A	NS, NR
4	Practice strip cropping	3.20	2.64	2.92	0.61	0.51	A	NS, NR
5	Carryout contour cultivation	3.12	2.73	2.93	1.06	0.62	A	NS, NR
6	Practice terracing	3.40	2.75	3.07	1.09	0.68	A	NS, NR
7	Establish shelter belt for erosion control measures	3.00	2.53	2.76	0.88	0.55	A	NS, NR

Keys: XF=mean of foresters, XEA=mean of extension agents, XG=Grand mean, SD=standard deviation, RQ=Research question, HO=Null hypothesis, A=Agreed, NS=Not significant, NR=Not rejected.

The data presented in Table 1 above showed that the grand mean ratings of the responses of the respondents on the 7 items in the table ranged from 2.76 to 3.37 on a 4-point rating scale. The finding indicates that the 7 identified skills on erosion control measures in the forest were agreed by the respondents. The data presented on Table 1 (hypothesis one) revealed that the P-value of 7 items on the table ranged from 0.46 to 0.84 which were greater than 0.05 level of significance. This indicates that there are no significant difference in the mean ratings of the responses of foresters and extension agents on erosion control measures in the forest.

Research Question Two: What are the methods and tools for preventing forest fire?

HO_2: There is no significant difference in the mean ratings of the responses of foresters and extension agents on methods and tools for preventing forest fire.

Table 2: Mean ratings and t-test analysis of the responses of foresters and extension agents on methods and tools for preventing forest fire
(N_1=63, N_2=25)

s/n	Item statement	XF	XEA	XG	SD	P-value	Remarks RQ	Remarks HO
1	Suppress fire by reducing heat transfer	3.40	3.51	3.45	0.43	0.00	A	S, R
2	Remove convention current by preventing transmission of heat rays.	3.39	3.68	3.53	1.02	0.90	SA	NS,NS
3	Remove pre heating by blocking radiation	3.10	2.84	2.97	1.05	0.68	A	NS,NR
4	Remove fuel (any combustible material) in the forest.	3.70	3.67	3.68	1.23	0.45	SA	NS,NR
5	Establish barriers on forest landscape, bodies of water and rockslides	3.00	2.92	2.96	0.39	0.64	A	NS,NR
6	Application of H_2o.	3.80	3.53	3.66	1.09	0.36	SA	NS,NR
7	Use beaters to temporarily exclude oxygen.	2.50	2.77	2.61	1.04	0.45	A	NS,NR
8	Construct temporary breaks to contain fire.	3.10	2.84	2.97	0.40	1.15	A	NS,NR

Keys: XF=mean of foresters, XEA=mean of extension agents, XG=Grand mean, SD=standard deviation, RQ=Research question, HO=Null hypothesis, A=Agreed, SA=Strong Agreed. NR=Not Rejected. R=Rejected.

The data presented in Table 2 above showed that the grand mean ratings of the responses of the respondents on all the 8 items in the table ranged from 2.61 to 3.68 on a 4-point rating scale. This finding indicate that the 8 identified methods and tools for preventing forest fire were agreed to by respondents (items 2, 4 and 6 strongly agreed). The data presented on the table 2 on hypothesis two revealed that the p-values of 7 out of the 8 items in the table ranged from 0.36 to 1.15 which were greater than 0.05 level of significance. This indicates that there are no significant difference in the mean ratings of the responses of foresters and extension agents on methods and tools for preventing forest fire. The p-value of item 1 on the table was less than 0.05 level of significance. The finding implied that there is a significant difference in the mean ratings of the responses of the two groups of respondents and was therefore rejected for item 1.

Research Question Three: What are the government regulations or intervention measures against forest encroachment by man?

Table 3: Mean ratings and standard deviation of the responses of extension agents and foresters on regulation or intervention measures against forest encroachment

(N_1=63, N_2=25)

s/N	Items	XF	XEA	XG	SD	RQ (Remarks)
1	Unauthorized person are not allowed to enter forest reserves to fell trees.	4.00	3.86	3.93	0.55	SA
2	Indiscriminate hunting is prohibited.	4.31	4.02	4.17	0.47	SA
3	It is an offence to set the bush on fire.	4.09	3.55	3.81	0.90	SA
4	Restriction of farmers from entering the forest for farming activities.	3.64	3.89	3.76	0.74	SA
5	Regulation of cut based on number and age of forest stand.	3.80	4.06	3.93	0.56	SA
6	Avoid clear felling system	4.21	3.40	3.80	0.64	SA
7	Adopt selective exploitation.	3.12	2.60	2.86	0.53	A
8	Practice taungya system.	2.40	2.70	2.55	0.49	A
9	Encourage private forestry establishment.	3.12	3.52	3.32	0.51	A

Keys: XF=mean of foresters, XEA=mean of extension agents, XG Grand mean, SD=standard deviation, RQ= Research question, A=Agreed, SA=Strong Agreed.

The data presented in Table 3 above revealed that the grand mean ratings of the respondents on all the 9 items in the table ranges from 2.55 to 4.17 on a 4-point rating scale. This finding indicates that the 9 identified intervention measures against forest encroachment were all strongly agreed to by respondents. The standard deviation ranges from 0.47 to 0.90 indicating that that the respondents were not too far from one another in their responses.

Research Question Four: What are the mitigation procedures for biodiversity depletion?

HO_3: There is no significant difference in the mean ratings of the responses of extension agents and foresters on mitigation procedures for biodiversity depletion.

Table 4: Mean ratings and t-test analysis of the responses of extension agents and foresters on mitigation procedures for biodiversity
(N_1=63, N_2=25)

S/N	Item statement	XF	XEA	XG	SD	P-Value	Remarks RQ	Remarks HO
1	Avoid deliberate ecosystem destruction	4.02	3.90	3.96	0.61	0.00	SA	S,R
2	Avoid indiscriminate use of pesticides.	2.86	2.94	2.90	0.77	0.53	A	NS,NR
3	Reduce indulging in over harvesting of plants and animals.	4.40	4.33	4.36	0.54	0.03	SA	S,R
4	Stay away from clearing and burning of forest	3.46	3.37	3.41	0.86	0.57	A	NS,NR
5	Avoid pollution and over exploitation of forest to prevent global warming.	4.31	4.00	4.15	0.80	0.64	SA	NS,NR
6	Discouraging conversion of diverse natural ecosystem to agro ecosystem.	4.16	2.55	3.35	0.54	0.35	A	NS,NR
7	Identify, demarcate and fence valuable sites and forest reserves.	2.51	2.87	2.69	0.73	0.46	A	NS,NR
8	Stipulates and enforce sanctions against trespassers.	2.78	3.01	2.89	0.66	0.42	A	NS,NR
9	Allocate grants to local government authorities to support protection of natural resources.	3.50	2.89	3.19	0.56	0.37	A	NS,NR
10	Enlightenment campaign to generate awareness on ecological importance of forest.	4.22	4.35	4.28	0.88	0.59	SA	NS,NR

Keys: XF=mean of foresters, XEA=mean of extension agents, XG=Grand mean, SD=standard deviation, RQ=Research question, HO=Null hypothesis, A=Agreed, SA=Strongly agreed, NS=Not significant. S= Significant. NR=Not Rejected. R=Rejected.

The data presented in Table 4 above showed that the grand mean ratings of the respondents on all the 10 items in the table ranged from 2.69 to 4.36 on a 4- point rating scale. This finding indicates that the 10 identified items on mitigation procedures for biodiversity depletion were agreed to by respondents. The data presented on table 4 on hypothesis three revealed that the p-value of 8 out of the 10 items in the table ranged from 0.35 to 0.64 which were greater than 0.05 level of significance. This indicates that there are no significant difference in the mean ratings of the responses of extension agents and foresters on mitigation procedures for biodiversity depletion. The p-values of items 1 and 3 (0.00 and 0.03) are less than 0.05 level of significance. The finding implies that there is a significant difference in the mean ratings of the responses of extension agents and foresters on items 1 and 3. Therefore, the hypothesis of no significant difference in the mean ratings of the responses of the two groups of respondents was rejected for item 1 and 3.

Discussion of results

Findings from Table 1 revealed that 7 items skills were identified on erosion control measures in the forest as agreed by respondents. These findings are in consonance with the study by Ekele (2013) on strategies for enhancing crop production as adaptation to climatic change employed by farmers in Adamawa State, The author found out that cover crops, strip cropping and contour cultivation are practices that prevents erosion and maintain the fertility of the soil. The findings were also in line with the work of Adejoh and Ekele (2015) which emphasizes the use of leguminous crops as another method for controlling erosion. The authors explained the need for erosion prevention in forest to encourage biodiversity and arable land for crop production and identified shelter belt establishment as a panacea.

Findings from Table 2 showed that all the 8 (eight) methods and tools are needed for preventing forest fire. These findings are in agreement with the work of Osinem and Mama (2008) who submitted that identification, demarcation and fencing of valuable sites such as forest reserves are important. Similarly, the authors identified removal of combustible materials from the forest and the use of beaters to temporarily exclude oxygen as methods of preventing forest fire.

Finding from Table 3 revealed that all the 9 (nine) items on intervention measures against forest encroachment were all agreed to by respondents was in consonance with study by Ekele (2015) on forest management techniques and partnership required by farmers for sustainable development in North Central Nigeria. The author found out similar measures against forest encroachment and stressed that these intervention measures be enforced by various authorities in the region. Findings from Table 4 revealed that all the 10 items were responded to in the affirmative. The findings are in line with Gao (2003), Bengstoon (2005), Galluzi, Eyzaguirre&Negri (2010) when they reported that deliberate ecosystem destruction, over exploitation of the forest and burning of forest are factors that lead to forest biodiversity depletion.

Conclusion

The study has established that forest protection and biodiversity conservation relies on sound techniques which plays a significant role also in environmental conservation. The roles have some effect on soil fertility, crops, animals, man, and the environment. It is in this context that protection, conservation and sustainable utilization of forest biodiversity assumes importance. Preserving biological diversity is necessary, this means many species of wild plants and animals could be better protected. In other

words, they have significant economic potential which is currently undiscovered, undervalued or underutilized. More so, biological resources are essential to human existence and the preservation of biological diversity is significant to the maintenance and improvement of agriculture, forestry, ranching and fisheries. As a rational being, man is not morally justified to bring about massive destruction and possibly extinction of the other species that share the planet with him. Thus, conservation of the natural resources is a major responsibility of man.

Recommendations

1. Ministry of agriculture in Benue State should post or deploy more extension agents to various local government areas to enlighten farmers on erosion control measures in the forest in order to maintain sustainable biodiversity conservation.
2. Volunteer non- government organization should organize frequent workshops on methods of preventing forest fire and also make available tools for fire prevention to farmers.
3. Task monitoring committee should be set up to ensure the implementation of mitigation procedures for forest biodiversity depletion and enforce government regulations on forest encroachment.

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