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Effects of the Adoption of Forest Conservation Practices by Farmers in Kaiama Local Government Area, Kwara State

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Abstract: *The study examined the effects of the adoption of forest conservation practices in Kaiama Local Government Area of Kwara State (The case of Kainji Lake National Park). Purposive random sampling was used to select three wards dedicated to the national park viz; Gwanabe 1, Kemanji and Wojibe. Data were gathered through the administration of questionnaire to 25% randomly selected farmers from each of the 8 communities in the three wards. Descriptive statistics such as frequency counts, percentage and Likert-Scale were used to describe the data while probit regression was used to examine the effects of forest conservation practices adoption by farmers. The result shows that land acquisition was mainly (66%) through inheritance. Furthermore, rotational fallow was the major (79%) farming system practiced while other farming system such as mixed farming, mixed cropping were integrated with scattered trees (30%) on farm land. The level of adoption of forest conservation practices shows that scattered trees on farm land was highly adopted (4.8) by farmers in the study area. The Probit model result shows that age, gender, cooperative membership, road condition, extension contact, access to credit, access to land, farm size, trees on farm land and distance to the market had positive effects on forest conservation practices while education, family size, social infrastructure and FCP awareness had negative effect. However, the challenges of the adoption of forest conservation practices showed reduction in farm land as the most (30%) challenging while availability of forest products ranked 1st in the list of opportunities. The use of bio-security through live fencing, formation of farmers' cooperative society and training of farmers on forest management practices by relevant agencies of government among others were therefore, recommended.*

Keywords: *Challenges; Opportunities; Adoption and Conservation practices.*

I. Introduction

Nigeria is endowed with a great variety of ecosystems and habitats and a number of unique species that are found only in Nigeria due to the wide variety in physical environment, climate and vegetation zones. However, the country has always had a relatively high population with a corresponding high demand for agricultural land. By the end of the nineteenth century, the pressures on natural areas arising from bush fallow cultivation and other factors were becoming noticeable and protective measures were considered necessary

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(Egwumah, 2009). The main purposes for which forests are cleared are agricultural, wood production, industrial layout and human settlement.

More than 70 % of Nigerians live in rural areas, where they depend on agriculture and other natural resources for their survival (USAID, 2008). This growing rural population puts increasing demands on the natural habitats of plants and animal species, which decrease in extent and numbers as the human population increases. Akinola *et.al.* (2007) opined that the empowerment of rural dwellers in agricultural activities is imperative not only because their income boosts household revenue but also improves household food security.

Egwumah (2009) viewed forestry as the practice and art of managing forest land and other natural resources such as trees, other plants, wildlife, soil, water, air and the climate for human benefit. Forest and wildlife are renewable natural resources and their continuous existence and utilization for our own benefit will depend on their conservation and sustainable harvesting. Forest conservation is the foresighted utilization, preservation and/or renewal of forests, waters, lands and minerals, for the greatest good of the greatest number for the longest time (Sergei, 2008).

Rural communities in Kwara State are involved in the exploitation of forest resources for economic benefits. These forests have been significantly altered from the original state largely due to activities like harvesting of the resources, agricultural expansion and illegal exploitation of timber and non-timber products. The forests contribute significantly to the needs of the people and the economy at both the local and national level (Kalu and Adeyoju, 2008).

Conservation is essentially the “taking care” of our environment so that it may continue to be a fit place for living things. The popularity of the concept of conservation is the result of our overdue awareness of the serious environmental problems, which have been created by careless exploitation of natural resources and increasing population with its ancillary effects (Ahmad, 2001).

Problem Statement: The dependence of farmers on land and forest resources can hardly be over-emphasised and as such, the dedication of their farm lands used for various agricultural activities to national park has inhibited the use of shifting cultivation thereby resulting in the depletion of soil nutrients caused by continuous cropping on the available land. This has led to the movement of farmers outside their communities in search of farm lands, as no measure was put in place for re-allocation of their farm lands lost to park and provision of employment opportunities to them in the national park.

However, land, seascapes and natural resources that are supposed to be exploited for farming activities to meet the food demand of the increasing population are increasingly being set aside for protection in response to various drivers: to tackle biodiversity loss, to prevent deforestation as a climate change mitigation strategy and to restore declining wildlife by acquisition of land for Kainji Lake National Park. Within the biodiversity conservation sector, the impacts (positive and negative) of protected areas on local and indigenous communities have generated a lot of debate and discussions as observed by Amusa, Jimoh and Haruna, *(*2010). Despite widely voiced concerns(such as changes in attitudes and cultural practices, reduction of income due to restrictions on farmland and wild products harvesting) about some of the negative implications of protected areas for residents and neighbouring communities, and a growing interest in ensuring that they fulfil a range of social objectives as well as their more conventional conservation objectives (Amusa, Jimoh and Haruna, 2010), there is limited efforts in assessing the effects of the adoption of forest conservation practices by farmers in the study area. This study, therefore, assessed the effects of the adoption of forest conservation practices by farmers in Kaiama Local Government Area.

II. The Study Area

Kaiama Local Government Area, with its headquarters in kaiama, is found in Kwara North in the Northern guinea savanna ecology. It is bounded in the north by Borgu Local Government, New-Bussa (Niger State), in the south by Irepo Local Government, Kisi (Oyo State), in the west by Baruteen Local Government,

Kosubosu (Kwara) and in the east by Moro Local Government, Bode-Saadu (Kwara State). The Local Government has ten wards namely; Kaiama 1, Kaiama 11, Kaiama 111, Gwanabe 1, Gwanabe 11, Wojibe, Gwaria, Kemanji, Bani and Adena. It has a projected population of 185,892 in 2020 based on an annual growth rate of 3.2% (NPC, 2006). It lies between latitude 10^0 00^1 N and 8^0 00^1 and longitude 2^0 50^1 and 6 ^{0} 10E ^{1}.

The inhabitants of Kaiama are predominantly farmers, engaging in food crops production like yam, maize, sorghum, melon, groundnut, cowpea etc. The major language spoken is "Boko-baru" while Yoruba, Hausa, Fulani and Baruba language also predominate in the area. The predominant religion of the inhabitants is Islam, particularly among the indigenes while Christianity is freely practiced by the non indigenes and few indigenes.

Kainji Lake National Park was established in 1976 and it is situated between latitude 9^0 40^1 and 10^0 30^1N and longitude 3^0 30^1 and 5^0 50^1E and has a total land mass of 5,340.82km^2 (Meduna *et. al.*, 2009). Many indigenous people and local communities living within the region have developed a perception on the use of the natural environment in a manner that plays an important role in their livelihood strategy and the conservation of biological resources.

Sampling Technique

The target population for the study was the farming communities affected by the Kainji Lake National Park (KLNP) in Kaiama LGA. Purposive random sampling was used to select 3 wards covered by the National Park in the Local Government due to the dedication of the land areas in these wards to national park. These wards are: Gwanabe 1, Kemanji and Wojibe wards. The sampling frame for the study comprised farmers in the 8 farming communities in these wards (i.e. Gwanabe 1= 4 farming communities, Kemanji = 3 farming communities and Wojibe = 1 farming community). These 8 farming communities were identified through reconnaissance survey and they include: Tunga-maje, Wurumakoto, Woro, Nuku, Kemanji, Babete, Tenebo and Nanu. Simple random sampling was used to select 25% of farmers from each of the 8 communities in the three wards of Kaiama Local Government covered by the Kainji Lake National Park. A total of 160 farmers made up the sample size for the study.

Method of Data Collection

The data for the study were obtained from primary sources which were collected during the field survey by administering self-developed structured questionnaire to the farmers in the three wards.

Analytical Techniques: Descriptive statistics, likert scale and Probit model were used.

Descriptive Statistics: These include the mean, frequency counts and percentages. These were used to describe farmers mode of land acquisition, the forest conservation practices in the area, the farming system(s) adopted in the study area vis-a-vis the conservation practice and the challenges and opportunities faced by farmers in the adoption of forest conservation practices.

Likert Scale: This is a scale measuring the degree to which people agree or disagree with a statement, usually on a 3-, 5-, or 7-point scale. A five-point Likert-type scale of highly adopted, adopted, neutral poorly adopted and not adopted with nominal values of 5, 4, 3, 2 and 1, respectively was used to obtain a quantitative measure of farmers level of adoption of forest conservation practices.

Probit Regression: This is a way to perform regression for binary outcome variables i.e adopters of FCP =1, non-adopters = 0. It estimates the probability a value will fall in to one of the possible binary. It generates predictions taking in to account the correlation among all the predictive variables. The contribution of a particular variable depends on the magnitude of all the variables because the probit is a nonlinear model (Glick and Hutchison, 2013). Probit models are preferred to logit models for most adoption studies (Kassie, 2015). Farmers' decision to adopt FCP in the study was considered a two-level ordinate response to adopting the practices: adopters and non-adopters (yes/no). The adopters and non-adopters served as a binary dependent variable to calculate the effect of farmers' household, socio-economic, demographic, institutional and farm

characteristics (independent variables) on farmers' decision to adopt FCP. The FCP adoption decision function was defined according to Equation (2).

$Y^* = \beta^1 x + \varepsilon$ …… (2)

where Y* is the unobserved propensity variable, β is the vector of the estimated parameters, x is the vector for independent variables, and ε is the randomly distributed error term (assumed to be normally distributed with zero mean and unit variance).

The Probit model was expressed according to Equation (3), based on the observed ordinal FCP adoption participation data.

Y = 0 Y*≤ 0

1 Y*> 0 …… …….. (3)

Equations (4) and (5) were used to compute the probability of FCP adoption for a given period, provided that it is normally distributed with a zero mean and unit variance.

$Pr (Y= 0|1X|= \Phi(- \beta^1 X)$ …… (4)

$Pr (y = 1|X)=1- \Phi (- \beta^1 X)$ …… (5) where:

Φ(.) denotes the standard normal cumulative distribution function,

Y = 0 indicates no (non-adopters), and (y = 1|X) indicates yes (adopters of FCP).

Distribution of respondents by mode of land acquisition and farming system

Respondents' mode of Land Acquisition

Table 1 reveals that the major (66%) mode of land acquisition was through inheritance. Land acquisition by purchase and rent accounts for 21 and 10% respectively. Only 3% of the farmers acquired their land through leasehold. It implies that farmers may want to hold more land so as to concede some areas to future generation apart from shifting cultivation purposes. This is confirmed by Adeola (2000).

Farming System of respondents

The farming system description on table 1 shows that rotational fallow was the major (79%) farming system adopted by the farmers. Those who practice mixed farming and mixed cropping constituted 14% and 8% of the farming population respectively. This means that majority of the farmers will want to acquire more hectarage of land to enhance shifting from an exhausted land to a more fertile land from time to time.

Table 1: Distribution of Farmers by land acquisition and farming system

Variable	Frequency	Percentage
Land Acquisition		
Inheritance	105	65.6
Lease	5	3.1
Purchase	34	21.3
Rent	16	10
Farming System		
Rotational fallow	126	78.8
Mixed farming	22	13.8
Mixed cropping	12	**7.5**
Total	160	100

Forest Conservation Practices

Table 2 depicts the forest conservation practices in the study area. About 30% of the respondents practice scattered trees on farm land. This forest conservation practice is followed by homestead planting (22%), planting trees as yam stakes (20%), and orcharding (18%). However, only 5%, 4%, and 2% practice planting

trees as erosion barriers, live fencing and borderline planting respectively. This indicates that diverse forest conservation practices are incorporated in to farming to serve a particular purpose. Adeola (2000) affirmed the low involvement of farmers in live fencing, borderline planting, and use of trees as barrier against erosion.

Table 2: Forest Conservation Practices by Farmers

Practice	**Frequency**	**Percentage**
Orcharding	92	17.5
Live fencing	22	4.2
Scattered trees on farm land	157	29.9
Borderline planting	8	1.5
Homestead planting	115	21.9
Planting trees as yam stakes	105	20
Planting trees as erosion barriers	26	5.0
Total	525	100

* Multiple choices

Farmers' Level of adoption of Forest Conservation Practices

The level of farmers adoption of forest conservation practices as depicted on table 3 indicates a high index score (4.8) for scattered trees on farm land, meaning that the practice is highly adopted by farmers in the study area. Similarly, the index score for homestead planting (4.1), planting trees as yam stakes (4.0) and orcharding (3.5) shows that they are well adopted by farmers.

However, farmers are uncertain about the practice of live fencing and planting trees as erosion barriers while they do not adopt borderline planting and windbreaks at all. This is not unconnected with the absence of land conflicts and geographical location of the study area in guinea savannah vegetation belt.

The implication of this is that scattered trees on farm land will assist farmers in provision of shade where they can relax at different points while working, and as well provide storage points for farm tools. More so, the economic trees like sheabutter, parkia, baobab etc used for such purpose are additional sources of revenue to the farmers (Ogunwande *et al.*, 2011). Kareem *et al.* (2009) also elucidated that fruit trees yielded considerable high income to farmers.

Table 3: Farmers extent of adoption of forest conservation practices

Adoption of FCP	5	4	3	2	1	N (160)	$\bar{X}$
Orcharding	75	14	25	7	39	559	3.5
Live fencing	13	13	26	10	98	313	2.0
Scattered trees on farm land	125	33	1	1	-	762	4.8
Borderline planting	1	8	35	16	100	274	1.7
Homestead planting	77	48	12	12	11	648	4.1
windbreaks	3	-	38	3	116	251	1.6
Trees as yam stakes	85	27	20	14	14	635	4.0
Trees as erosion barriers	-	17	47	8	88	313	2.0
Aggregate score						3755	3.0

Effects of the Adoption of Forest Conservation Practices

Probit regression was estimated and it fit the data well since the Wald Chi Square of 42.8 was significant at 1% and the log-likelihood had the right negative sign. The result of the Probit model shows that presence of trees on farm, farm size, access to land and social infrastructure are significant at 1%, while education and gender are significant at 10%. Farmers education was found to negatively and significantly affect FCP, implying that an increase in years of education lead to a decrease in adoption of forest conservation practices. This mean that farmers with high level of education are more likely to get white collar job. Thus, education has negative effect on adoption. This concurs with the findings by Luciana *et al*. (2018) where it was observed that increase in education lead to poor attitude of rural residents towards motivators for hunting and deforestation. Also, male farmers had 13% high probability of adopting FCP. This means that females are less likely to adopt FCP due to the prevalence of males in farming in the study area. Gender has positive relationship with adoption at 10% level of significance, implying that the more the male farmers in the study area, the more will be the adoption of FCP. This agrees with the findings of Nkamleu and Manyong (2005) where it was opined that male farmers are more likely to adopt agroforestry technologies. Social infrastructure is significant and negatively related to adoption at 1%, implying that a unit increase in social infrastructure will bring about 15 % decrease in adoption of FCP in the study area. This means that an increase in social infrastructure will bring about a decrease in adoption due to the change in source of livelihood of farmers from farming to other sources. This concurs with the submission by Pello *et al*. (2021) that with high access to infrastructural facilities, the intensity of adopting agroforestry technology decreases.

Similarly, access to land and farm size are positively related to adoption of FCP at 1% level of significance, implying that a unit increase in access to land and farm size will lead to about 41% higher probability of adoption in the study area. This means that the more a farmer has access to land and the more the farm size increases, the more will be his level of adoption of FCP. This is in line with Mwase *et al*. (2015) who established that an increae in farm size led to a rise in adoption of agroforestry-based technologies. Finally, having trees on farm is positive and significantly related to adoption at 1%, implying that having trees on farmland increase the probability of adopting FCP by 15%. This suggest that trees on farmland positively influences the adoption of FCP by farmers. This is consistent with submission by Dhakar and Rajesh (2020) who established that farmers with trees on farmland are more likely to adopt agroforestry practices.

Table 4: Results of the Probit model on the Effects of Forest Conservation Practices Adoption by Farmers.

Table 4: Results of the Probit model on the Effects of Forest Conservation Practices Adoption by farmers

Dependents variable**:** Adoption of FCP (1=yes, 0=no)

Variable description	**Coefficient**	**Robust Standard error**	**Marginal effect**
Farmers education (years)	-0.033*	0.007	- 0.012
Age of farmers (years)	0.01	0.027	0.023
Gender (1=M, 0=F)	0.376*	0.081	0.134
Family size (numbers)	-0.008	0.011	-0.003
Cooperative membership (1=yes, 0=no)	0.130	0.060	0.049
Road condition (1=good, 0=bad)	0.371	0.256	0.13
Social infrastructure (1=yes, 0=no)	-0.4***	0.057	-0.153
Extension contact (number of visit/yr)	0.187	0.064	0.071
Access to credit (1=yes, 0=no)	0.048	0.097	0.018
Access to land (1=yes, 0=no)	1.087***	0.113	0.406
Farm size (1=large, 0=otherwise)	1.121***	0.108	0.405
FCP awareness (1=yes, 0=no)	-0.108	0.063	-0.041
Presence of trees on farm (1=yes, 0=no)	0.407***	0.057	0.148
Distance from farm to market (Km)	0.004	0.004	0.001
Constant	-1.135	0.224	

Wald Chi Square: 42.8

Log likelihood: -228.21

*Significant @ 10%, ** significant @ 5%, *** significant @ 1%

Challenges of the Adoption of Forest Conservation Practices

The challenges of forest conservation practices presented in table 5 reveals that reduction in accessible farm land is the main (30%) challenge of the farmers in the study area. This is closely followed by changes in cultural practices of the farmers (29%), invasion of farms by wildlife, lack of technical support and reduction in farmers' income represent 24%, 10% and 8% of the farmers' challenges respectively. The implication of this is the emigration of farmers from their home communities where conservation policy prohibits farming, hunting and grazing in reserved area considered as fertile by farmers to other communities where the policy does not hold. The restriction on farmland and wildlife will limit access to bush meat and invariably affect the revenue base and farmers standard of living.

Table 5: Challenges of the adoption of forest conservation practices

Challenges	Frequency	Percentage
Changes in cultural practices	144	29.4
Reduction of farmers income	39	8.0
Reduction of accessible farm land	147	30.0
Invasion of farms by wildlife	118	24.1
Lack of technical support	47	9.6
Total	490	100

* Multiple response

Opportunities of Forest Conservation Practices Adoption

The opportunities from the Adoption of Forest Conservation Practices as depicted by Table 6 indicate greater (32%) availability of Forest products in the study area. This is followed by opportunity for improved personal health (17%), better nutrition (13%), and increased food yield (11%). However, opportunity for improved income (8%), improved land productivity (7%), employment (6%), natural disaster control (4%), and improved social life (3%) ranked 5th, 6th, 7th, 8th and 9th respectively in the study area. The use of indigenous plant species according to Balogun *et. al.* (2011) has been a cultural practice, and is not unconnected with their socioeconomic importance to the inhabitants either as food, fuelwood or herbs, or for shade, windbreak, fencing and beautification (Meregini, 1992, Balogun, 2005). The implication of this is that forest products such as barks and leaves of medicinal trees, fruits and nuts, as well as wood fuel will be readily available for the farmers' use and sales, thereby contributing to small scale farmers' income. This also explains the predominant use of wood fuel and tradomedical care by the farmers in the study area. If properly carried out, land productivity can be enhanced due to conservation measures through the use of improved fallow and hedge rows intercropping strategies.

Table 6: Opportunities from the adoption of Forest Conservation Practices.

Opportunities	Frequency	Percentage	Rank
Forest products availability	51	31.9	1
Improved personal health	27	16.9	2
Better nutrition	21	13.1	3
Increased food yield	17	10.6	4
Improved income	13	8.1	5
Improved land productivity	11	6.9	6
Employment opportunities	9	5.6	7
Natural disaster control	7	4.4	8
Improved social life	4	2.5	9
Total	160	100	

III. Conclusion

Forest conservation practices can be a dependable innovation that can be adopted to serve the aims of sustainable development in agriculture. As natural vegetation is cleared for agriculture and other development, the benefit that trees provide are best sustained by integrating trees in to agriculturally productive land. Through the integration of forest conservation practices to farming system, farmers are able to increase their access to forests products for different purposes, sustain farm income and above all mitigate the effect of climate change. Above all, farmers education, gender, social infrastructure, access to land, farm size and presence of trees significantly affect FCP. Consequently, Forest Conservation Practice has received community embrace as it is environmentally friendly and requires local knowledge that places the rural farmers at the fore. As a result, the adoption requires the involvement and training of extension agent who will better disseminate and educate farmers as a result of their proximity to them.

IV. Recommendations

1. It is crucial that the government improve infrastructure facilities, such as roads, to ease farmers' mobility and to get farm produce to the market. Further, governments should scale up their involvement in enacting policies tailored to improving FCP adoption and provide more generous incentives, such as issuing free seedlings to farmers.
2. The use of bio-security should be encouraged among farmers through the advocation of live fencing and borderline planting to stem wildlife invasion on farm land.
3. Training of farmers on forest management practices by the relevant agencies at both local and state government level will assist in addressing the effects of tree canopies.
4. The formation of cooperative society by farmers will help in the sourcing of farm inputs and credit facilities to facilitate forest conservation practices.
5. The use of organic manuring should be integrated with forest conservation practices by farmers in order to mitigate the effect of the demand for land occasioned by rotational fallow system of farming in the study area. This is consequent upon forest policy which prohibits encroachment in to government reserved land.

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