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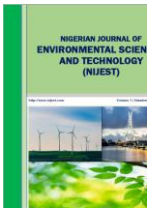

Willingness to Accept Compensation for Protected Area Conservation: Evidence from the Fazao–Malfakassa National Park, Togo

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ABSTRACT

Protected areas play a critical role in biodiversity conservation, ecosystem protection, and sustainable natural resource management. However, conservation restrictions may impose significant livelihood costs on local communities that depend on forest resources, potentially creating conflicts between conservation objectives and household welfare. This study examines the willingness of riparian communities around the Fazao–Malfakassa National Park (FMNP) in Togo to accept compensation for foregoing the exploitation of woody forest products (WFP) as a means of supporting protected-area conservation. Primary data were collected from 226 households residing in communities bordering the park. The Heckman two-step selection model was employed to account for potential selection bias arising from the decision to participate in WFP exploitation, and the amount of compensation households were willing to accept. The findings indicate that local households are willing to relinquish the exploitation of WFP in exchange for adequate compensation. The estimated mean willingness to accept (WTA) was $32.17 per household per month, representing the minimum compensation required to offset the welfare losses associated with conservation-induced restrictions on forest resource use. The findings further reveal that household income derived from non-timber forest products (NTFPs) is negatively associated with WTA. Specifically, households with higher income from NTFP activities reported lower compensation requirements, suggesting that alternative forest-based livelihood opportunities may reduce the perceived welfare costs of conservation restrictions. The results underscore the importance of incorporating local livelihood considerations into protected-area management strategies. Rather than relying predominantly on stringent restrictions and enforcement, conservation policies should incorporate appropriate compensation and incentive mechanisms that encourage local participation and reduce the welfare burden imposed on forest-dependent households.

Keywords: Contingent Valuation Method, Economics, Environment, Exploitation, Forest, Resource

1.0. Introduction

Protected areas are widely recognised as important instruments for conserving biodiversity, maintaining ecosystem services, protecting threatened species, and sustaining ecological processes. However, the establishment and management of protected areas can generate substantial costs for communities living within or around them. Natural resource management policies that exclude local communities have proved ineffective, both in preserving ecosystems and the biodiversity they harbour, and in contributing to local socioeconomic development (Bullock and Hanna, 2012; Bocci and Mishra, 2021).

In recent years, a significant trend has emerged toward the mapping and valuation of ecosystem services in general (Bunse et al., 2015), and in Protected Areas (PAs), including National Attraction Parks (NAPs) (Schägner et al., 2017; Fish et al., 2016). The NAPs provide numerous ecosystem services: regulating and supporting services as well as cultural services such as recreation and spiritual values (TEEB DE, 2016). These assets constitute a very important heritage both for the riparian population and for the territory. However, the creation of a park or protected area often weakens the economic situation of neighbouring

communities (Kiss, 2004). The imposition of restrictions, or even a total ban on certain agricultural practices and forest products, in the park creates significant income shortfalls for neighbouring communities, which are not always compensated for (Elliot et al., 2004). They can be exploited without significantly affecting the essence of the resource itself.

Consideration of the forestry sector from a socio-economic point of view is of the utmost importance, both for economic players and for the authorities. Forests play an extremely important role in the socio-economic development of countries and in improving the well-being of most of the population. Chao (2002) stated that the number of people directly dependent on forests is between 1.2 and 1.4 billion, or just under 20% of the world's population. According to the FAO (2014), forests contributed 1.1% of global GDP with 54.3 million jobs created in 2011.

In Togo, the forestry sector makes a major contribution to economic development. From firewood and charcoal to non-timber forest products (NTFPs), forest species play an important role in the daily lives of both rural and urban populations (UN-REDD+, 2018). Thiam (1991) estimated the forestry sector's contribution to GDP at between 8% and 10% in 1991, or around US$52 million (Yapi and Sessi, 1997). In 2006, it accounted for just 1.6% of GDP (FAO, 2009). According to the “Stratégie de Croissance Accélérée et de Promotion de l'Emploi” (SCAPE) document, since 2008, the forestry sector has generated an annual added value of over 16.5 billion FCFA (SCAPE, 2013).

In terms of jobs generated by the sector, the FAO (2009) estimates that the Roundwood sector alone created nearly 1,000 jobs in 2009. Estimated at four hundred and forty-nine thousand (449,000) ha in 1970, Togo's forest area has steadily declined over the years. In 1980, ten years later, this area had fallen to two hundred and eighty-seven thousand (287,000) ha, a variation of -36% (MERF/FAO, 2011). By 1990, it had fallen to just 140,000 ha, a variation of -51%. Dense forests represent only 5% of land area, compared with the recommended 30%, and are disappearing at a rate of 20,000 hectares a year, representing a deforestation rate of 5.1% (FAO, 2011). In 2015, according to the results of the first National Forest Inventory (IFN, 2015/16) (GIZ/MERF, 2016), Togo had a forest resource coverage rate of 24.24%. The main causes of this pressure are poverty, hunting, logging, the destruction of forests for other commercial purposes, extensive agriculture, and the sharp increase in population in certain areas (Newmark and Hough, 2000).

The Fazao–Malfakassa National Park (FMNP) in Togo provides an important setting for examining this conservation–livelihood dilemma (IUCN/PACO, 2008). The park is one of Togo's important protected landscapes and supports significant biodiversity while providing ecosystem and livelihood-related benefits to surrounding populations. Communities around the park depend substantially on agriculture, hunting, and the collection of forest products. Evidence from socio-economic assessments undertaken around the FMNP indicates that residents are predominantly farmers, hunters, and collectors of forest products (Ryan and Williams, 2011), while initiatives have increasingly sought to develop alternative livelihood activities to reduce pressure on the park's natural resources.

The dependence of surrounding households on natural resources means that stronger conservation restrictions may produce significant opportunity costs, particularly for households whose livelihoods are closely tied to forest exploitation. The tension between conservation and local welfare has stimulated efforts to promote sustainable livelihood alternatives around the FMNP. For example, interventions involving beekeeping, value addition to shea products, and ruminant production have been developed to increase rural incomes while reducing pressure on forest resources. Such interventions reflect a broader movement towards incentive-based conservation, in which local people are viewed not merely as potential threats to biodiversity but as important stakeholders whose economic incentives and participation can influence conservation outcomes. Payments and compensation mechanisms can be particularly relevant where conservation rules restrict activities that previously generated income or subsistence benefits for local households.

From an environmental economics perspective, the value of conservation cannot always be observed through conventional market prices because biodiversity, ecosystem services, landscape quality, and many forest benefits are non-market goods. Contingent valuation provides a framework for eliciting individuals' preferences and monetary values for such environmental changes by presenting respondents with a

hypothetical conservation scenario and asking their willingness to pay (WTP) or WTA compensation for a change in environmental quality or access (Bateman et al., 2002; Carson, 2012). While WTP measures the amount individuals would sacrifice to obtain an environmental improvement, WTA captures the compensation required to accept a loss or restriction. In the context of protected-area conservation, WTA is particularly relevant because households may be required to surrender existing resource-use opportunities in exchange for conservation benefits.

The WTA is therefore not simply a measure of households' preference for money; it represents the monetary equivalent of the welfare loss associated with foregoing a particular livelihood or resource-use opportunity. In protected-area settings, the compensation required by households can reflect the opportunity cost of conservation restrictions, including foregone income from timber and other forest products. Understanding this value is important for determining whether conservation policies are economically and socially feasible and for designing compensation packages that adequately recognise local costs. Empirical evidence indicates that WTA can vary according to household characteristics, resource dependence, income, land or forest characteristics, and attitudes towards conservation (Lindhjem and Mitani, 2012). Consequently, estimating an average compensation amount alone may be insufficient; identifying the socio-economic and behavioural factors underlying differences in WTA is equally important for effective policy design.

Despite the growing emphasis on community-based conservation and sustainable development, relatively little empirical evidence exists regarding the monetary compensation required of households surrounding the Fazao–Malfakassa National Park to voluntarily forgo exploitation of forest resources. This represents an important research gap because conservation policies that impose restrictions without adequately accounting for local opportunity costs may generate opposition, non-compliance, or displacement of resource-extraction activities. This raises the question: what are the socio-economic costs associated with these negative private externalities? What compensation do residents receive for giving up their resistance to conservation? The main objective of this research is therefore to analyse the social costs associated with the conservation of the Fazao-Malfakassa National Park borne by the local population

2.0. Methodolog

2.1 Study Area

This study was carried out in Fazao-Malfakassa National Park. Fazao-Malfakassa National Park is the largest protected area in Togo, covering about 1,920 square km across the Centrale and Kara regions. The park combines two former reserves and features a mix of savannah, gallery forest, and rugged hills that form part of the Atakora Mountain range. Its varied terrain and remote location make it one of West Africa’s more untouched wilderness areas.

The park supports significant wildlife, including forest elephants, antelope, baboons, monkeys, and over 300 recorded bird species. Though populations were reduced during past periods of instability, conservation efforts have been rebuilding habitats and anti-poaching patrols. Access is mainly via the town of Sokodé, and guided treks offer chances to see wildlife, waterfalls, and panoramic views of the forested valleys.

The Fazao Malfakassa National Park is in central-western Togo, on the Atacora Mountains, in the Guinean-Sudanese transition zone, between 8°20' and 9°30' North; 0°35' and 1°02' East. It enjoys a humid tropical climate. There are four types of vegetation: open forest, dry forest, gallery forest, and savannah, as shown in Figure 1.

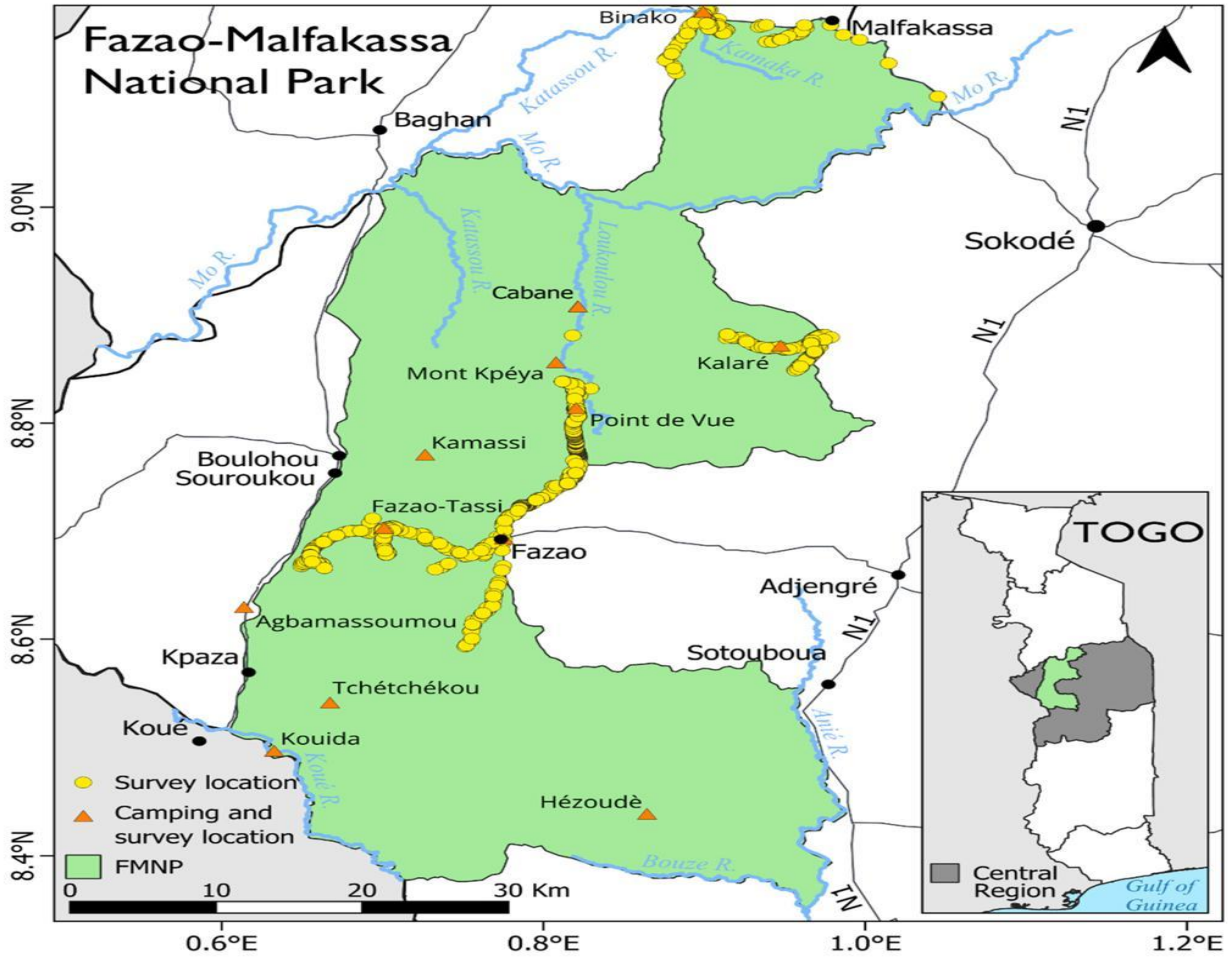

Figure 1. Location of the Fazao–Malfakassa National Park in central Togo and surrounding communities

2.2 Study Data

Primary data were used for this study. The data were sourced from a survey conducted in November 2021, using the classic household questionnaire survey method in the villages bordering the Fazao-Malfakassa National Park. The sample size for this research was obtained based on the following sample calculation formula, with 95% confidence and a maximum variability of 50% (Yamane, 1967):

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

Where: N = population size of the riparian area, n = sample size, and e = sample precision level.
Given the similarity or high degree of homogeneity of the riparian households, the precision level used to calculate the sample is equal to +/- 5%, and the total population size was 1986 riparian households in the park. The calculation formula gives the following sample size (n):

$$n = \frac{1986}{1+1986*(0{,}05*0{,}05)} = 277 \text{ respondents} \quad (2)$$

2.3 Sampling Procedure

A multistage sampling procedure was employed to select a cross-section of 226 households residing in villages bordering the Fazao–Malfakassa National Park in Togo. The study population comprised households located in communities whose livelihoods are directly or indirectly dependent on forest resources within and around the protected area. The classic household questionnaire survey method was adopted to obtain primary data on households' dependence on forest resources, perceptions of conservation restrictions, and willingness to accept compensation for foregoing the exploitation of woody forest products.

In the first stage, the 12 villages bordering the Park were identified based on their geographical proximity to the park and their interaction with the park's forest resources. In the second stage, the selected villages were stratified according to their location and degree of interaction with the protected area to ensure adequate representation of communities with varying levels of dependence on forest resources. In the third stage, 10 residential buildings within the selected 12 stratified villages were identified with the assistance of village leaders and local administrative authorities. A household was defined as a group of persons who ordinarily live together and share arrangements for food and other basic household needs.

In the fourth stage, two (2) households were selected using a systematic random sampling technique. A household listing was prepared for each selected residential building, and a sampling interval was obtained by dividing the total number of listed households by the required number of households to be selected from that residential building. A random starting point was then determined, after which every (kth) household was selected until the required sample size was attained, making a total of 240 households. Where a selected household was unavailable or declined participation, the next eligible household on the sampling list was approached, while care was taken to avoid duplicate selection.

The allocation of the sample across villages was proportionate to the number of residential buildings and households in each selected village. This approach ensured that villages with larger household populations contributed more respondents while smaller communities remained represented in the sample. The final sample after data cleaning consisted of 226 households, which were interviewed using a structured household questionnaire. The questionnaire was administered to the household head or another adult household member who had adequate knowledge of the household's forest-resource use, livelihood activities, and conservation-related experiences. Data collection covered household socio-economic characteristics, forest-resource dependence, participation in woody forest-product exploitation, perceptions of conservation restrictions, and willingness to accept compensation for foregoing such activities.
The multistage and systematic sampling approach was adopted to improve the representativeness of the sample and reduce selection bias while ensuring that the survey captured the perspectives of households living in proximity to the park.

2.4 Analytical Procedure

Both descriptive and inferential statistics were employed to analyse the data using Stata 17. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise the socio-economic characteristics of respondents and their responses to the contingent valuation questions. The inferential analysis employed the Contingent Valuation Method (CVM) to estimate households' willingness to accept (WTA) compensation for foregoing the exploitation of woody forest products (WFP) in the Fazao–Malfakassa National Park. Because the decision to accept compensation and the amount of compensation demanded constitute a sequential process, the Heckman two-step selection model was used to account for potential sample-selection bias (Heckman, 1979).

2.5 Contingent Valuation Method

The Dichotomous choice CVM was used to elicit the monetary compensation that households would require to voluntarily forego the exploitation of woody forest products as a contribution to protected-area conservation. The principle here is to evaluate the willingness to accept (WTA) to forego the exploitation of timber products from the forest resource. Based on Ami and Desaigues (2000), this study relates the explanatory variable, WTA, denoted Y_i, to the set of explanatory variables (X_{ij}) such that:

$$Y_i = \beta j X_{ij} + u_i; i = 1,2 \ldots n \quad (3)$$

β_j are estimable coefficients, while u_i is the model residual. The empirical specification for the study is expressed as:

$$WTA = a_0 + a_1 M + ajXij \quad (4)$$

where (M) represents the compensation amount presented to respondent (i) in the contingent valuation scenario, (Xij) represents the socio-economic characteristics of household (i), a_0 is the constant term, and a_1, and aj were estimated parameters.

The explanatory variables were:

X_1 is the Gender (1 = male; 0= female)

X_2 is the Marital status (1 = married; 0 = single)

X_3 is the Age of respondent (years)

X_4 is the Level of education (1 = uneducated; 0=No)

X_5 refers to the Interested in the forest (1 = yes; 0 = no)

X_6 denotes the Frequency (1= weekly; 0 = no)

X_7 refers to the Favours forest conservation (1 = yes; 0 = no)

X_8 is the Monthly income ($)

In the contingent valuation exercise, respondents first indicated whether they would accept compensation in exchange for foregoing WFP exploitation. Those who accepted were subsequently asked to state the minimum amount of compensation they would require. Consequently, the dependent variable has two related components: (i) a binary participation/acceptance decision and (ii) a continuous positive WTA amount. This sequential nature of the response creates the possibility of sample-selection bias because the observed WTA amounts are available only for respondents who stated a positive WTA. Estimating the WTA equation using only these observations without correcting for selection may therefore produce biased and inconsistent estimates if the unobserved factors affecting the acceptance decision are correlated with those affecting the compensation amount (Heckman, 1979).

2.6 Heckman Two-Step Selection Model

The Heckman two-step procedure was therefore applied. In the first stage, a Probit model was estimated to determine the probability that a household would state a positive WTA for foregoing WFP exploitation. Let z_i denote the binary response of household (i), defined as:

$$z_i = \begin{cases} 1 \; si \; y_i^*, \; > 0 \\ 0 \; otherwise, \end{cases} \quad \text{with} \quad y_i^* = X_i\beta + u_i \qquad (5)$$

where y_i^* is observed only if individual i declares a compensation amount greater than zero. Xi represents the observable explanatory variables for individual i, β is the estimated parameter, and u_i is the estimation residual, which follows a normal distribution N (0;1). And then estimate the probability that z_i = 1 by maximum likelihood.

$$Prob\ (z_i = 1) = Prob\ (y_i^* > 0) = (-u_i < \beta X_i) = F\ (\beta X_i) \qquad (6)$$

where y_i^* is an unobserved latent variable, Xi is the vector of explanatory variables, β is the vector of parameters, u_i is the vector of error terms following a normal distribution of mean 0 and variance σ2, and F(4) is the cumulative function of a normal probability distribution. Second step: using ordinary least squares, we estimate the equation explaining the WTA level.

$$\ln(WTA_i) = \beta X_i + \delta\lambda_i + u_i \text{ for } Z_i = 1 \qquad (7)$$

Where WTA_i is individual i's willingness to receive; β et δ vectors of parameters to be estimated, u_i vector of error terms, and λ_i vector of inverse Mills ratios from the estimation of the equation.

The statistical significance of the coefficient of the Inverse Mills Ratio was used to assess the presence of sample-selection bias. A statistically significant coefficient for indicates that unobserved factors influencing the decision to accept compensation are correlated with unobserved factors determining the amount of compensation demanded, thereby justifying the Heckman selection correction. The coefficients of the explanatory variables in the second-stage equation were interpreted as determinants of households' WTA for foregoing WFP exploitation.

Finally, the mean WTA was computed from the observed positive WTA responses and used to quantify the monthly compensation required by households to offset the perceived welfare loss associated with conservation restrictions on woody forest-product exploitation. The resulting estimates provide an empirical basis for designing compensation and livelihood-incentive mechanisms that can improve local support for protected-area conservation.

2.7 Questionnaire Validation

The structured questionnaire used for data collection was subjected to both face and content validation to ensure that the instrument adequately captured the objectives of the study. The questionnaire was developed based on the study objectives, the contingent valuation framework, relevant literature on protected-area conservation and household dependence on forest resources, and the socio-economic context of communities bordering the FMNP. A pre-test of the questionnaire was subsequently conducted among households with characteristics similar to those of the study population but outside the FMNP communities. The pre-test was used to assess respondents' understanding of the questions, the appropriateness of the response categories, the clarity of the WTA scenario, and the approximate duration of the interview. Ambiguous, repetitive, or poorly understood questions were revised before the main survey. The pre-test also helped to refine the wording and sequencing of the contingent valuation questions and improve the administration of the questionnaire.

2.8 Reliability Assessment

The reliability of the survey instrument was assessed during the pre-test using Cronbach's alpha coefficient for the multi-item constructs measured using Likert-type scales. The assessment focused on related items measuring respondents' perceptions of protected-area conservation, dependence on forest resources, perceived effects of conservation restrictions, and attitudes towards conservation and compensation. A Cronbach's alpha coefficient of 0.70 or above was considered acceptable for establishing internal consistency of the relevant scales. Items that substantially reduced the reliability of a construct or were found to be ambiguous during the pre-test were reviewed and, where necessary, modified or removed before the final administration of the questionnaire. The reliability assessment enhanced the consistency and dependability of the instrument used for the main survey.
It should be noted that Cronbach's alpha was not applied to the monetary WTA variable itself because WTA represents an elicited monetary response rather than a multi-item psychometric scale. The reliability assessment was therefore restricted to constructs for which internal consistency is conceptually appropriate.

2.7 Ethical Approval, Informed Consent, and Confidentiality

Ethical principles governing research involving human participants were observed throughout the study. Before commencement of the field survey, ethical approval was obtained from the University of Lome research ethics authority. The study protocol, questionnaire, informed-consent procedure, and data-management arrangements were reviewed in accordance with applicable institutional requirements.
Before each interview, respondents were informed about the purpose of the study, the nature of the information being requested, the voluntary nature of their participation, and their right to decline to answer any question or withdraw from the interview at any stage without penalty. Respondents were also informed that participation would not affect their access to the park, forest resources, government programmes, compensation, or any other benefits. Informed consent was obtained from each participant before the questionnaire was administered. Confidentiality and anonymity were maintained throughout the research process.

3.0. Results and Discussions

3.1 Determinants of households' participation in the FMNP sustainable management program

The Probit model enables us to determine the variables that influence the probability of individuals agreeing to participate in the FMNP sustainable management program. The results in Table 1 show five variables that have a significant effect on the probability of joining the program: Gender, Age, Educational level, Forest providing food and animals, and Forest reducing heat. The results clearly show the overall significance of the model (Prob>chi2 = 000).

Gender had a negative effect on participation at the 10% level. The coefficient of -0.540 and marginal effect of -0.0873 indicate that male respondents were less likely to participate in the FMNP sustainable management

programme than their female counterparts. This finding suggests that women may have stronger incentives to engage in community-based forest management activities, possibly because of their close dependence on forest resources for household subsistence and livelihood activities. Evidence from forest-governance research indicates that women's participation can be particularly important for conservation outcomes because women frequently possess extensive knowledge of forest products and household-level resource use (Agarwal, 2009). The result is also consistent with the broader argument that gender roles shape patterns of forest-resource dependence and conservation engagement. However, the finding should not be interpreted as evidence that women are universally more conservation-oriented than men; rather, it may reflect gender-differentiated livelihood dependence and opportunities for participation in the FMNP context. This is particularly relevant because communities around the park depend on farming, hunting, and collection of forest products for their livelihoods (UNESCO, 2023).

Marital status was negatively signed but statistically insignificant. The coefficient of -0.256 and marginal effect of -0.0413 suggest that married respondents were approximately 4.13 percentage points less likely to participate than respondents in the reference category, although this effect was not statistically distinguishable from zero. The result implies that household marital status, by itself, may not be an important determinant of participation in the FMNP sustainable management programme. A possible explanation is that participation decisions are more strongly influenced by livelihood dependence, resource-use patterns, perceived conservation benefits, and household characteristics than by marital status. Thus, conservation programmes may need to focus less on marital status and more on the economic and institutional factors that shape household engagement.

Age of the respondent had a positive influence on participation at the 5% level. This indicates that a one-year increase in age was associated with an increase in the probability of participating in the sustainable management programme, holding other factors constant. The result suggests that older household members may be more inclined to participate because of their accumulated experience with forest resources, greater knowledge of local ecological conditions, and stronger familiarity with traditional resource-management practices. The positive age effect has important implications for intergenerational conservation. Older community members may possess valuable indigenous ecological knowledge that can contribute to sustainable forest management, but conservation programmes should simultaneously create mechanisms for transferring this knowledge to younger generations. Such an approach would help ensure continuity of community participation and prevent conservation knowledge from being concentrated among older residents.

The coefficient of the "Education level" variable introduced into the model is positive and significant at the 5% threshold. This variable has a positive influence on the probability of respondents being in favour of the Forest Resource Management Program in return for compensation. The World Bank (1993) and Berrens and Vasquez (2009) also found that the level of education positively influences households' willingness to participate. Thus, when households have been to school, they are more willing to participate in forest management. This is because the theoretical education these households have received predisposes them to identify the importance of sustainable natural resource management in general, and that of the FMNP forest in particular.

The unexpected positive influence may reflect the livelihood structure of communities bordering the FMNP. Less-educated households may depend more heavily on natural resources for their livelihoods and therefore have stronger incentives to participate in programmes that influence access to, management of, or benefits from forest resources. UNESCO's assessment of communities around the FMNP similarly reports substantial dependence on farming, hunting, and collection of forest products. Therefore, the result may represent resource dependence rather than an education effect per se.

Exploitation of food and animals exerted a significant positive effect on participation at the 1% level. Its coefficient of 0.740 and marginal effect of 0.120 indicate that households involved in the exploitation of food and animals were approximately 12.0 percent more likely to participate in the FMNP sustainable management programme than households not involved in such activities. The result suggests that households whose livelihoods are directly connected to forest resources may have greater incentives to participate in sustainable management because their economic welfare depends on the continued availability and productivity of those resources. Rather than viewing resource-dependent households solely as potential sources of pressure on

protected areas, conservation policy should recognise them as important stakeholders whose participation can contribute to sustainable resource governance.

In contrast, perceived heat reduction had a significant negative influence on participation. This indicates that households reporting heat reduction were approximately 10.5 percentage points less likely to participate in the sustainable management programme. This negative relationship may appear surprising because the environmental benefits of forests, including microclimate regulation and temperature moderation, are generally expected to strengthen support for conservation. Households experiencing heat-related changes may perceive the environmental situation primarily through the lens of immediate livelihood or climatic stress rather than through formal conservation institutions. Alternatively, the result may indicate that households perceiving heat reduction as an existing environmental benefit do not see additional participation in the programme as necessary.

The results demonstrate that household participation in FMNP sustainable management is shaped more strongly by socio-economic and livelihood relationships with forest resources than by general conservation attitudes alone. The statistically significant effects of gender, age, education status, exploitation of food and animals, and heat reduction indicate that participation is heterogeneous across households. The strong positive effect of resource-related activities is particularly important because it suggests that households directly connected to forest-based livelihoods should be regarded as key partners in conservation planning rather than merely as beneficiaries or potential threats to the protected area.

The findings have important policy implications for the management of the FMNP. First, conservation programmes should strengthen inclusive and gender-responsive participation mechanisms, particularly by creating meaningful opportunities for women to participate in decision-making and resource-management activities. Second, the positive influence between age and participation highlights the importance of incorporating local ecological knowledge held by older residents while creating intergenerational knowledge-transfer mechanisms. This approach is consistent with initiatives already developed around the FMNP to promote beekeeping, shea-nut value addition, and livestock production as livelihood alternatives that can reduce pressure on the forest.

The results support a shift from predominantly restrictive conservation approaches toward participatory and incentive-based protected-area governance. The objective should not simply be to restrict local access to forest resources but to create institutional arrangements through which local communities have a meaningful stake in conservation outcomes.

Table 1: Determinants of households' participation in the FMNP sustainable management program

Variables	**Coefficient**	**Std. Error**	**Marginal effects**	
			(dy/dx)	p-value
Gender (1 = male; 0= female)	-0.540*	0.285	-0.0873*	0.046
Marital status (1 = married; 0 = otherwise)	-0.256	0.342	-0.0413	0.055
Age of respondent (years)	0.0245**	0.011	0.00396**	0.002
Level of education (1=educated; 0=otherwise)	0.412**	0.209	0.0666**	0.033
Frequency (1= weekly; 0 = otherwise)	0.079	0.316	0.0128	0.051
Favors forest conservation (1 = yes; 0 = no)	0.601	0.399	0.0972	0.067
Exploitation of food and animals (1 = yes; 0 = no)	0.740***	0.246	0.120***	0.039
Heat reduction (1 = yes; 0 = no)	-0.648**	0.232	-0.105***	0.039
Constant	-0.0897	0.828		
Observations = 226				
Log likelihood = -1137.28397				
Pseudo R2 = 0.0586				
Prob > chi2 = 0.0291				
LR chi2(8) = 17.08				

*, ** and *** indicate significance at 10%, 5%, and 1%, respectively. Source: Based on survey data

3.2 Determinants of the Willingness to Accept Compensation

Table 2 presents the results of the Heckman two-stage estimation of the determinants of households' WTA compensation for foregoing the exploitation of woody forest products in the FMNP. The results are presented for both the uncorrected model and the model corrected for potential sample-selection bias. The comparison is useful because households that report a positive WTA may differ systematically from those that do not, and estimating the WTA equation only for the selected group can therefore produce biased estimates when the unobserved factors determining participation are correlated with those determining the amount of compensation demanded (Heckman, 1979).

The selection-bias-corrected results indicate that gender, education, frequency of forest interaction, conservation preference, and monthly income significantly influenced the amount of compensation households were willing to accept. In contrast, marital status, age, and interest in the forest were not statistically significant determinants of WTA after correcting for selection.

The coefficient of the Inverse Mills Ratio (Lambda) was negative but statistically insignificant, suggesting that there is no statistically significant evidence of selection bias in the WTA equation. Nevertheless, the corrected estimates provide a more rigorous specification because they explicitly account for the possibility of non-random selection into the positive-WTA subsample.

Gender had a positive and highly significant effect on WTA in both the uncorrected and corrected models. In the corrected specification, the coefficient was 0.137 ($p < 0.01$), compared with 0.111 ($p < 0.01$) before correction. The positive coefficient indicates that male-headed households demanded higher compensation than their female counterparts, holding other factors constant. The increase in the magnitude of the coefficient after selection correction, from 0.111 to 0.137, suggests that failure to account for selection would underestimate the gender differential in compensation requirements. The finding explains the differences in livelihood roles, resource-use intensity, income-generating activities, and opportunity costs associated with relinquishing forest-resource exploitation. Men in forest-dependent communities may participate more intensively in activities such as timber harvesting, hunting, fuelwood collection, or other commercially oriented forest-resource activities, thereby facing greater perceived economic losses when conservation restrictions are imposed. The finding is consistent with the broader literature showing that gender influences the nature and intensity of household dependence on forest resources and participation in forest governance (Agarwal, 2009; Sunderland et al., 2014). While women often have strong subsistence-oriented relationships with forests, men may have greater involvement in market-oriented extraction activities in some contexts. Consequently, conservation restrictions can generate gender-differentiated opportunity costs. The result highlights the importance of incorporating gender considerations into compensation schemes rather than assuming that a uniform compensation package will adequately offset conservation-induced welfare losses across households. Lindhjem and Mitani (2012). found that the gender of the head of household does not drive the WTA of respondents.

Education was statistically significant and positively associated with WTA in both models. The coefficient was -0.0568 ($p < 0.05$) after correction for selection bias, compared with -0.0525 ($p < 0.10$) in the uncorrected model. The positive coefficient indicates that uneducated respondents required lower compensation than educated respondents, ceteris paribus. The finding suggests that education may influence the perceived opportunity cost of conservation restrictions. Educated households may have access to a broader range of livelihood opportunities and may therefore place a higher monetary value on the forest resources or economic activities they would relinquish under conservation restrictions. Alternatively, education may improve awareness of the economic value of natural resources and increase respondents' ability to articulate their minimum compensation requirements.

Concern about forest conservation has a significant negative influence on the WTA of the households surveyed, at the 1% threshold. The negative sign of the coefficient indicates that households with an environmental sensitivity to the preservation of forest resources tend to demand lower compensation than others. The variable "total income from activities" has a positive and significant influence on the WTA of households as financial compensation for the sustainable forest management program. This result provides some reassurance that households are rational in their response and testifies to the close relationship between income from PFL and the level of willingness to receive. The result is in line with those of Casey et al. (2006),

according to whom income is positively related to WTA. Thus, the higher a household's income from PFL-related activities, the higher the amount it declares. This is reflected in the fact that households with a high income expect a higher amount for having given up their activity. Similarly, this result contradicts the popular conclusion that budget constraint does not play a role in revealing WTA.

Table 2: Heckman's Two-Stage Estimation of the Determinants of the Willingness to Accept Compensation

Variables	**Without bias correction**	**With correction for selection bias**
Explanatory variables		
Gender (1 = male; 0= female)	0.111***	0.137***
	(0.0398)	(0.0461)
Marital status (1 = married; 0 = otherwise)	0.0530	0.0753
	(0.0494)	(0.0519)
Age of respondent (years)	0.00250	-0.0152
	(0.0142)	(0.0169)
Level of education (1=educated; 0=otherwise)	0.0525*	0.0568**
	(0.0270)	(0.0281)
Interested in the forest (1 = yes; 0 = no)	-0.0404	-0.0170
	(0.0359)	(0.0389)
Frequency (1= weekly; 0 = no)	0.0942	0.0881*
	(0.0580)	(0.0461)
Concern about forest conservation (1 = yes; 0 = no)	-0.249***	-0.214***
	(0.0643)	(0.0663)
Monthly income ($)	0.547***	0.137***
	(0.0775)	(0.0673)
Lambda		-0.0850
		(0.117)
Constance		4.794***
		(0.448)
Observations	226	226
Wald chi2(8) = 64.37		
Prob > chi2 = 0.0000		

*Standard errors are in parentheses. *, ** and *** indicate significance at 10%, 5%, and 1%, respectively.*
Source: Based on survey data

3.3 Predicted Average Household Willingness to Accept Compensation

Table 3 presents the predicted distribution of household Willingness to Accept (WTA) compensation for foregoing the exploitation of woody forest products within the park. The results indicate that the predicted average household WTA was US$32.17 per month, with a standard deviation of US$7.98. The predicted WTA ranged from a minimum of US$12.98 to a maximum of US$68.74 per household per month, based on the 226 households surveyed.

The mean WTA of US$32.17 per month indicates that households bordering the FMNP require, on average, approximately US$32.17 monthly to compensate them for the perceived welfare loss associated with foregoing the exploitation of woody forest products. This monetary value can be interpreted as an estimate of the minimum compensation required to induce the average household to accept restrictions on forest-resource

exploitation, conditional on the assumptions underlying the contingent valuation framework. The result demonstrates that conservation restrictions generate a measurable economic cost for local households whose livelihoods are connected to forest resources. This is consistent with the economic rationale for conservation compensation, whereby households bearing opportunity costs from conservation may require incentives to make conservation-compatible choices (Ferraro and Kiss, 2002; Wunder, 2007).

The minimum predicted WTA of US$12.98 per month suggests that some households would accept relatively modest compensation for foregoing woody forest-product exploitation. These households may have relatively low dependence on forest resources, alternative livelihood opportunities, or stronger preferences for conservation. In contrast, the maximum predicted WTA of US$68.74 per month indicates that some households would require substantially higher compensation. Such households may face greater opportunity costs because of stronger dependence on forest resources or more limited alternative sources of income. This range reinforces the importance of accounting for household heterogeneity when designing compensation programmes for protected-area conservation.

The estimated average WTA also provides an important indication of the private welfare cost of conservation imposed on local communities. In environmental economics, protected-area conservation can generate positive social benefits through biodiversity protection, ecosystem services, carbon storage, watershed protection, and climate regulation, while simultaneously imposing opportunity costs on local resource users through restrictions on access to natural resources (Balmford et al., 2002; Ferraro and Kiss, 2002). The predicted WTA of US$32.17 therefore represents an estimate of the compensation required to address part of the local welfare burden associated with conservation restrictions.

The estimated average household willingness to accept (WTA) compensation for conservation is 32.17, with a 95% confidence interval of $31.12 to $33.22. This indicates that, with 95% confidence, the true population mean WTA lies between $31.12 and $33.22 compensation units. The relatively narrow confidence interval reflects a reasonably precise estimate of the mean WTA.

Table 3: Predicted Average Household WTA Compensation

Variable	Obs.	Mean	Std. Dev.	Min	Max	95% Confidence Interval
Average WTA	226	$32.17	$7.98	$12.98	$68.74	$31.12 – $33.22

Source: Constructed from estimation data

3.4 Activities Related to Timber Forest Products

Figure 2 illustrates the distribution of household participation in timber forest product (TFP) activities around the Fazao–Malfakassa National Park. The results reveal that fuelwood collection (Bois de chauffe) is the predominant timber-related activity, undertaken by approximately 95% of the respondents. This is followed by charcoal production (Charbon de bois), with about 44% of households involved. In contrast, participation in construction timber (Bois de construction) activities is very limited, accounting for only about 5%, while there was virtually no reported involvement in timber logging (Bois d'œuvre) for commercial lumber production.

The overwhelming reliance on fuelwood reflects the critical role of forest biomass as the primary source of household energy in rural West Africa. Limited access to modern energy sources such as electricity and liquefied petroleum gas (LPG), coupled with low household incomes, compels rural communities to depend heavily on fuelwood for cooking and heating. Fuelwood collection is generally characterised by low entry barriers, requiring minimal capital investment, and therefore serves as an important livelihood activity for

both household consumption and income generation. Similar patterns have been reported across sub-Saharan Africa, where fuelwood constitutes the dominant forest product harvested by rural households and contributes significantly to household energy security (Food and Agriculture Organisation [FAO], 2022; Angelsen et al., 2014).

Charcoal production represents the second most important timber-based activity, involving nearly half of the sampled households. The relatively high participation suggests the existence of a vibrant local market for charcoal, driven by increasing urban demand for affordable cooking fuel. Although charcoal production generates higher financial returns than direct fuelwood sales, the traditional earth-kiln methods commonly used in rural communities are inefficient and require substantial quantities of wood, thereby intensifying pressure on forest resources. Previous studies have shown that increasing dependence on charcoal production is one of the major drivers of forest degradation and deforestation in many African protected landscapes (Chidumayo and Gumbo, 2013; FAO, 2022).

Conversely, the low participation in construction timber harvesting and the apparent absence of commercial timber logging indicate that high-value timber extraction is either effectively regulated or restricted within the vicinity of the national park. Protected area regulations often prohibit commercial logging to conserve biodiversity and maintain ecosystem integrity. The findings therefore suggest that local communities derive greater benefits from daily subsistence uses of forest resources than from commercial timber exploitation. This pattern is consistent with community resource-use dynamics observed in protected areas where subsistence extraction predominates because commercial timber harvesting is constrained by conservation laws and enforcement measures (Oldekop et al., 2016).

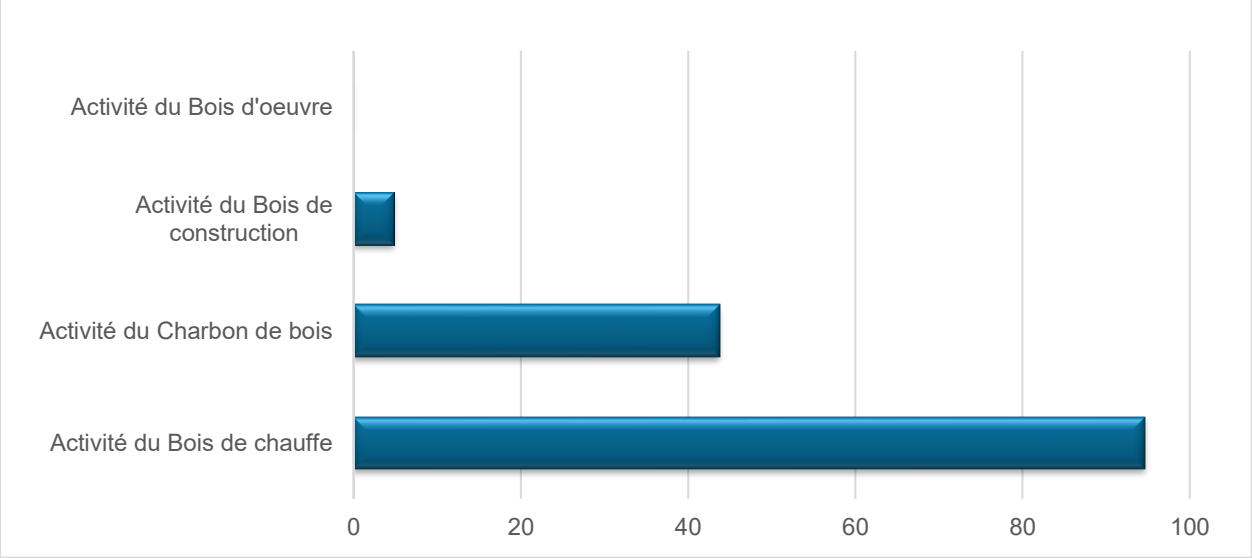

Figure 2: Activities related to Timber Forest Products
Source: Based on survey data.

4.0 Conclusion

This study examined households' willingness to accept (WTA) compensation for foregoing the exploitation of woody forest products as a strategy for promoting sustainable conservation of the Fazao–Malfakassa National Park (FMNP), Togo. The findings demonstrate that conservation restrictions impose measurable welfare costs on local households whose livelihoods are directly or indirectly connected to forest resources. The predicted mean WTA was US$32.17 per household per month, with considerable variation across households, ranging from US$12.98 to US$68.74. This variation reflects differences in household socio-economic circumstances, forest-resource dependence, and perceptions of conservation. The findings underscore the limitations of relying exclusively on restrictive or enforcement-oriented conservation

strategies in communities whose livelihoods depend on forest resources. Although restricting unsustainable exploitation is essential for protecting biodiversity and ecosystem services, conservation policies that fail to address the associated welfare losses may generate resistance among local populations and undermine long-term conservation outcomes. Compensation and incentive-based mechanisms can therefore provide an important bridge between conservation objectives and household livelihood interests.

The study concludes that sustainable management of the FMNP requires an inclusive, participatory, and livelihood-sensitive conservation framework. Compensation schemes should recognise differences in household dependence on forest resources rather than applying uniform payments to all households. In addition, monetary compensation should be complemented by sustainable livelihood opportunities, particularly through non-timber forest products, agroforestry, beekeeping, livestock production, and value-addition activities. Strengthening community participation, gender inclusion, environmental education, transparent benefit sharing, and local involvement in conservation decision-making would further enhance legitimacy and compliance. Ultimately, linking conservation incentives with improved household welfare offers a more equitable and potentially more sustainable pathway for protecting the FMNP while securing the livelihoods of its surrounding communities.

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