Public Willingness to Pay for Ecosystem Service Functions of a Peri-urban Forest In Abeokuta, Ogun State, Nigeria

*Adekunle M .F and Agbaje B .M.

Department of Forestry and Wildlife Management
College of Environmental Resources Management
University of Agriculture, Abeokuta, Nigeria

*Corresponding author: adekunlefm@yahoo.com

Abstract

The willingness to pay (WTP) format contingent valuation method (CVM) was adopted to elicit monetary values from some respondents in Arakanga forest reserve (AFR) (a peri- urban forest) in Abeokuta. This was to provide monetary estimates of the ecosystem service functions of the reserve. The respondents were randomly selected from both the neighbours and non-neighbours of the reserve. Data were collected with the aid of structured and pre- tested questionnaire administered interpersonally to the respondents. The questionnaire were 200 in number i.e 100 administered to each category of respondents. A total of 92 respondents (46%) were willing to pay money ranging from ₦100 to ₦1, 000 monthly. The modal value was ₦100 with the highest percentage of response (56.5%). An individual mean monthly WTP of ₦165.22 was recorded in the entire study area. This resulted into an aggregate of ₦15, 301,245.59 and ₦33, 263,577.38 minimum and maximum values respectively. These amounts represented the monthly monetary values of the ecosystem services functions of AFR .Income and household sizes are some of the socio-economic factors by which the monetary values of ecosystem services of AFR can be predicted as revealed by the multiple regression analysis. It can be concluded from this study that the respondents valued the reserve so highly to the extent that they are willing to contribute a part of their income to ensure the continued existence of the reserve.

Keywords: Ecosystem service functions, willingness to pay, peri -urban forest.

Introduction

The forests have been hitherto valued as a land bank rather than a valuable resource providing essential goods and services for livelihood generation. According to MEA (2005), the benefits derived from the forest are collectively referred to as ecosystem service functions (ES). The ES have been categorized into Provisioning services e.g. food, freshwater, fuel wood, fibre and medicine); Regulating services e.g. climate, water disease regulation and e.g. educational, aesthetic, cultural heritage values, recreation and tourism.

The loss of the forest ecosystem, and by implication its services, has been due to some drivers such s climate change, pollution, over- exploitation, land – use change and urbanization. It has been found out that 60% of ecosystem services assessed globally are either degraded or being used unsustainably (MEA 2005). The forest resources of Nigeria in general and Ogun State in particular are not excluded from these global assessment shortcomings. This situation can be attributed to lack of insufficient incentives for land owners to protect forest ecosystem and its services as they may receive little or no benefits from them. Economist often classify most forest ecosystem services as public goods, i.e. goods that are non- rivalrous and non-excludable in consumption (Coull and Valatin ,2008). The implication of this is that consumption of the goods by one individual does not reduce the amount available for consumption by others and no one can be excluded from using those goods. Putting a value (especially monetary values) on a good such as the forest ecosystem can help to provide an incentive for people to produce and conserve it. This is because the current economic crisis is leading to pressure on government budgets and on the budgets available to maintain existing forest reserve, especially the Arakanga forest reserve in Ogun State. This problem can be tackled through information on the monetary values of forest ecosystem services .These information are presently lacking, and where available, are always scanty and many a times inaccessible . Hence, the relevance of this study, which attempts to ascribe monetary value to the ecosystem services provided by Arakanga forest reserve situated in the peri -urban area of Abeokuta, Ogun State.

Various approaches have been used to attach monetary values to non–market goods and services of the forest by economists (White and Lovett 1999). They include revealed and stated preference methods. The revealed preference methods are based on how individual actually behaved in a real market situation while the stated preference methods are based on how individuals say they will behave under hypothetical market situation. Prominent among the stated preference method is the Contingent Valuation method (CVM) which is a means of quantifying public preference and willingness-to–pay (WTP) for forest goods and services or willingness to accept compensation for losing access to the forest goods and services. .There methods have been employed by researchers (Adekunle 2005; Adekunle and Sanni, 2009; Adekunle *et al*, 2008; Tkac, 1998; and Popoola and Ajewole, 2002) to ascribe monetary values to forest goods and services. This study therefore investigated public willingness–to–pay for the ecosystem services of a peri–urban forest with Arakanga forest reserve (AFR) as a focus .The information provided will assist landowners and users to make informed decisions and plausible trade-offs on forest reserves investment.

Study Area

This study was carried out in Arakanga forest reserve. It is one of the 9 forest reserves in Ogun State with a land area of about 2.39 km^2. The reserve is predominantly of high forest and savannah vegetation. It is situated at the border between Abeokuta North and Opeji ward of Odeda local government area. AFR is a peri–urban forest as described by Konijnendijk *et al.*(2004). A peri-urban forest reserve has been described as trees and forest resources outside, but close to urban areas, because they are major contributors of goods and services to urban society (Konijnendijk *et .al.* 2004). AFR is close to Abeokuta city, hence the description of Abeokuta is relevant in this study.

Abeokuta is the capital of Ogun State and the traditional home of the Egba's. It is divided into Abeokuta North and South local Government Areas. The Egba's have been traditionally divided into four, namely Egba Ake, Oke- ona, Gbagura and Owu. Three types of religion are widely practiced by the people. They are Christianity, Islam and traditional religion. The Christians predominates.

Geographically, Abeokuta lies on a latitude $7^0$15N and longitude $3^0$25E. The town is about 81 km southwest of Ibadan, Oyo State capital and 106 km north of Lagos, former Nigeria capital city. Abeokuta lies at an altitude of about 157m above sea level amidst isolated outcrop of natural formation of granite rocks which give the town's landscape its undulating characteristics. The ancient and historic 'Olumo Rock' is a popular tourist and holiday resort in the town. It is about 17,228 m above sea level and is located in the central part of the town. Itoku Market, popular for traditional 'Adire' cloth, is located close to the Olumo rock.

Abeokuta has a humid weather with an average temperature of about 27.4^0C and an annual rainfall of 128 cm in the southern part of the city to 105 cm in the northern part. The Ogun river transverses the town from the south to the western parts. The population of Abeokuta North and South Local Government area has been estimated to be 451,607 people (NPC, 2006).The town is a nerve centre of commercial activities such as banking, cloth weaving and dyeing, trading and carving. Both modern and traditional agriculture are widely practiced in the town. Some of the prominent agricultural products include maize, cassava, yam and livestock. The town is also an educational center with educational institutions providing formal education up to university level.

Materials and Methods

Data Collection

The multistage sampling procedure was adopted in the study. The area was stratified into 2 categories i.e. Neighborhood and Non–neighborhood. Areas that are within 1 km radius was classified as Neighborhood while those that are situated at more than 1 km radius were Non–neighborhood. In each category, four (4) settlements were randomly selected for sampling as summarized in the Table 1.

The main instrument of data collection was a structured and pretested questionnaire. The questionnaires were 200 in number and were administered interpersonally to 25 respondents in each of the settlements as shown in Table 1. The questionnaire was in two parts. Part A was made to address the socio- economic characteristics of the respondents while Part B dealt with the contingent valuation survey. The payment card system was used to elicit WTP values for ecosystem services from the respondents.

Table 1: Sampling Design

Category	Settlements	No of respondents	Total
Neighbourhood	Abe igi	25	
	Asela	25	
	Ayo Bus Stop	25	100
	Quarry	25	
Non – Neighbourhood	Iberekodo	25	
	Mokola	25	
	Elega	25	100
	Ajitadun	25	
Total		100	200

Data Analysis

Data gathered from the interview were encoded in Microsoft Excel program and processed using Statistical Package for Social Science (SPSS). Descriptive statistical tools such as frequencies, percentage, mean and mode was used to summarize the variables of interest. Multiple linear regression was used to find out some of the socio-economic factors by which WTP for ecosystem services can be determined and predicted.

The model specifications are as follows:

$$WTP = f(X_1+X_2+X_3+.....X_n+e) \quad (1)$$

where

WTP = Willingness to pay
X_1 = Age
X_2 = Income
X_3 = Educational level
X_4 = Sex
X_5 = Household size
X_6 = Marital status
X_7 = Native
X_8 = Year of residence
e = error term

Three functional forms were tried in order to choose the one with the best performance.

Linear : $WTP = b_o + b_1 X_{1+} b_2X_{1\ +} - - - - - - - - b_8X_{8+} Ed$ (2)

Semi log: $WTP = L_nb_o+b_1LnX_1+b_2LnX_2+..... b_8LnX_8+ LnEd$ (3)

Double Log: $LnWTP = Lnb_o + b_1Ln\ b_1X_1 +b_2LnX_2+ b_8Ln\ X_8+LnEd$ (4)

where

b_o = constant

$b_1b_2...b_6$ = Regression coefficient for WTP
Ed = Residual or error term
Ln = Natural logarithm

Results and Discussion

Percentage distribution of respondents on WTP for Ecosystem services of AFR

The distribution of respondents on WTP for Ecosystem services are summarized in Table 2. According to the table, 46% of the total respondents were willing to pay for ES. This percentage ranges from57% for the Neighborhood to 35% for the Non-Neighborhood. The large percentage of respondents on willingness to pay recorded among the Neighborhood could be because of their proximity to the reserve and because they benefit more from the services provided by the forest.

Distribution of responses on WTP values for ecosystem services function

The respondents are willing to pay amounts ranging from ₦100 - ₦1000 (Table 3). Both the respondents from Neighborhood and Non–neighborhood has ₦100 as their modal elicited value having recorded 52.6% and 62.9% responses respectively. This is in line with Ajewole (2002) and Adekunle *etal.* (2008). This result could be attributed to the fact that most of the respondents are low income earners and also because people are in most cases averse to paying for public goods and services such as the forest.

Table 2 : Percentage Distribution of Respondents on Willingness to pay for Conservation of Arakanga Reserve

Category		Yes	No	Total
Neighbourhood	No	57	43	100
	%	57	43	100
Non- Neighbourhood	No	35	65	100
	%	35	65	100
Total	No	92	108	200
	%	46	54	100

Table 3: Percentage Distribution of Respondent on Elicited Values of Individuals WTP (in Naira ₦) for ecosystem services

Category		₦ 100	₦ 200	₦ 500	₦ 1000	Total
Neighborhood	No	30	32	4	1	57
	%	52.6	38.6	7.02	2.04	100
Non- Neighborhood	No	22	13	-	-	35
	%	62.9	37.1	-	-	100
Total	No	52	35	4	1	92
	%	56.5	38.0	4.35	1.09	100

Mean monthly WTP for Ecosystem services in the study area across different socio- economic strata

The monthly mean WTP for ES in the study area across different socio –economic strata are summarized in Table 4. It can be observed from the Table that WTP for ecosystem services is not gender biased as there was a small difference between WTP by males (₦164.7) and WTP by females (₦153.4) . This could be because the benefits derived from the forest is not gender biased, as both males and females could be observed accessing the reserve for different ES benefits. However, these findings are not in line with Adekunle *et al.* (2008) which recorded a larger mean WTP values among male respondents in UNAAB urban community. As expected, the highest WTP values (₦94.8) was observed among the active working age group. This group must have realized that they need to plough part of their incomes back into the reserve for ES sustainability.

In the same vein, highest mean of WTP was elicited from the married respondents. This is an indication that WTP for ecosystem services can be transferred to their generations. As expected, the mean WTP skewed towards respondents in the high income brackets. Specifically, the highest amount of ₦132.5 was elicited from those earning between ₦20,000 and ₦50,000 monthly . These results agreed with Adekunle *et.al.* (2008). The low WTP values elicited from low income earners is expected. For instance, people are always reluctant, especially low income earners, to pay for forest goods and services. This is because of their characteristic nature and attitude towards public properties. Educational status for instance, up to tertiary level, could play a significant role in peoples WTP for ES as found in this study. For instance, respondents with postgraduate education, though few, had the highest mean monthly WTP (₦200). This is an indication that formal education could enhance people willingness to contribute for the sustenance of forest ecosystem services.

Table 4: Summary of Mean Willingness to Pay Across Different Socio –Economic Strata

GENDER	Average Willingness to pay (₦)		
	Neighborhood	Non-Neighborhood	Pooled
Male	184.4	145.0	164.7
Female	180	126.7	153.4
AGE (years)			
15-24	55.6	85.7	70.7
25-34	92.9	48.3	70.6
35-44	115.2	35.7	75.5
45-54	142.9	46.7	94.8
55 and above	-	-	-
Marital status			
Single	71.4	117.7	94.6
Married	116.7	155.6	136.2
Income level(₦)monthly			
1,000-10,000	80.9	36.8	58.9
10,000-20,000	56.52	25	40.8
20,000-50,000	182.14	82.8	132.5
50,000 and above	100	100	100
Educational level			
No formal	57.14	-	57.1
Primary	86.9	19.3	53.1
Secondary	86.1	43.9	65
Tertiary	157.7	95.8	126.8
Postgraduate	200	-	200

Mean and Aggregate Estimates of WTP values for forest Ecosystem services

The total monthly WTP ranged from ₦2,800 for Non-neighbourhood to ₦10,400 for Neighbourhood, with a mean monthly WTP of ₦165.22 for the ecosystem services (Table 5). This resulted into a monthly aggregate estimate value for forest ecosystem service function ranging from ₦15, 301, 245.59 to ₦33, 263, 577.38. These values represent the monetary estimates of ecosystem services of AFR. The management implications of these findings are that apart from values in use, forests has value in exchange. Hence, the forests, especially AFR, should no longer be viewed as a mere land bank which can be cleared for food crop farming. For example, the monetary estimates of economic benefits of ES of Hoge Veluwe Forest in Netherlands, was thrice the per hectare value generated by a nearby agricultural land (Heins, 2011). This finding is also in line with that of Ajewole (2002) who recorded an aggregate estimates value of between 155.5 and 240.9 million naira as the money residents of Ibadan (Nigeria) are willing to pay for environmental services of urban forests.

Mode and time of payment

Direct taxation and voluntary donations were the preferred mode of payments for the ES of the AFR. Both suggestions recorded 37% of the response from the respondents as shown in Table 7. The study further revealed that 48% of the respondents would want to pay the elicited values every week. This could be because majority of the respondents are non -government workers. They were notably artisans who earn their incomes daily or weekly.

Suggested Management strategies for the existing reserve

About 24.2% of the respondents would want non- forestry or non- forest related activities prohibited from AFR as a management strategy. This is to ensure a continued existence of the forest reserve.

Results of multiple regression analysis

The summary of multiple regression analysis to determine the socio-economic factors contributing to the monetary values of ecosystem services showed that double log has the best performance having recorded the highest coefficient of determination (R^2) of 12.8% The respondents income and household size had significant influence, at 5% and 10% respectively, on the amount the respondents are willing to pay for ecosystem services. This is an indication that WTP for ES can be determined and predicted through the income and household sizes of the residents.

Table 5 : Estimated monetary values of Ecosystem services in the study area

Category	No of respondents	Total WTP(₦)	Mean WTP(₦)
Neighborhood	57	10,400	182.46
Non-Neighborhood	35	2,800	80
Total	92	15,200	165.22

Table 6 : Means and Aggregate Estimate Values of Forest Ecosystem services of Abeokuta

No of respondents	Total WTP(₦)	Mean WTP(₦)	Population	Minimum Aggregate(₦)	Maximum Aggregate(₦)
92	15,200	165.22	201,329	15,301,245.59	33,263,577.38

Table 7: Mode and Time of Payment

Mode of Payment	Neighborhood		Non- Neighborhood		Total	
	Frequency	%	Frequency	%	Frequency	%
Direct Taxation	15	26.3	18	31.6	34	37
Conservation/Maintenance Levy	18	31.6	6	17.1	24	26.1
Voluntary Donation	24	42.1	10	28.6	34	37
Total	57	100	35	100	92	100
Weekly	30	52.6	14	40	44	47.8
Monthly	17	29.8	8	22.9	25	27.2
Yearly	10	17.5	13	37.1	23	25
Total	57	100	35	100	92	100

Table 8: Percentage distribution of Respondents on Management Strategies for AFR

Category		Disallow non-forestry use	Physical barrier	Education	Recreation activities	Managed by private org	Encourage production NTFP	Use of forest guards	Total
Neighborhood	No	23	16	19	5	18	7	12	100
	%	23	16	19	5	18	7	12	100
Non-Neighborhood	No	9	3	4	1	3	5	7	32
	%	28.1	9.4	12.5	3.1	9.4	15.6	21.9	100
Total	No	32	19	23	6	21	12	9	132
	%	24.2	14.4	17.4	4.5	15.9	9.1	6.8	100

Table 9: Regression results for the estimation of factors that determine WTP for forest trees ecosystem services for the entire study area

Regression	Bo	X_1 Age	X_2 Income	X_3 Educational Level	X_4 Sex	X_5 Household size	X_6 Marital status	X_7 Native	X_8 Year of residence	R^2	Adj. R^2	Sig. F
Linear	2.141 (1.771)	0.016 (0.721)	-2.606E-5** (-2.288)	-0.054 (-1.446)	-0.192 (-0.783)	-0.126* (-1.920)	0.578 (1.169)	0.378 (1.464)	-0.013 (0.513)	0.125	0.089	3.425
Semi-Log	0.464 (0.999)	0.008 (0.932)	-8.739E-6* (-2.000)	-0.017 (-1.227)	-0.089 (-0.948)	0.048* (1.890)	0.219 (1.155)	0.140 (1.411)	-0.006 (-0.594)	0.116	0.078	3.119
Double-Log	1.032 (1.167)	0.303 (0.973)	-0.170** (-2.254)	-0.175 (-1.042)	-0.114 (-0.844)	0. 402** (2.363)	0.377 (1.303)	0.213 (1.499)	-0.076 (-1. 028)	0.128	0.091	3.491

*** Represents sig. at 5%, * sig. at 10% , Figure in parenthesis are t –values.*

Conclusion

The study has shown that with appropriate economic tools, monetary values can be attached to non- market forest goods and services. There is need to engage in a meaningful dialogue with urban residents about forest and choices they can make to benefit themselves, as well as forest and ecosystem functions. Participatory forest management strategies are suggested for the sustainable utilization of forest resources. Forest managers and decision makers should embrace and emphasize the concept of Total Economic Valuation (TEV) of the forest. This is because the concept of forest valuation in the contemporary world is not measured only by the value of timber or by the value of forest products that have direct market prices. Regulations, land acquisitions, conservation easements and tax incentives are some of the conservation approaches that can protect and conserve the nation forests and grasslands.

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