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Full Length Research Paper

Public willingness to pay for ecosystem service functions of a peri-urban forest near Abeokuta, Ogun State, Nigeria

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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) near Abeokuta. This was to provide monetary estimates of the ecosystem service functions of the reserve. The respondents were randomly selected from both the neighbors and non-neighbors to 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 that is, 100 administered to each category of respondents. A total of 92 respondents (46%) were willing to pay amounts of money ranging from ₦100 to ₦1000 monthly. The modal value was ₦100 with the highest percentage of response (56.5%). An individual mean monthly WTP of ₦165.22 (₦150 = 1USD) 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 although indicative, represented the monthly monetary values of the ecosystem service functions of AFR .Income and household sizes are some of the socio-economic factors by which the monetary values of ecosystem service functions 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.

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

INTRODUCTION

The forests have been hitherto valued as land banks rather than a valuable resource of its own right providing essential goods and services for livelihood generation. According to MEA (2005) the benefits derived from the forests 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. Educational e.g. aesthetic, cultural heritage values, recreation and tourism.

The loss of the forest ecosystem and by implication its services have been due to some drivers, such as climate change, pollution, overexploitation, landuse change and urbanization. It has been found out by MEA (2005) that 60% of ecosystem services assessed globally are either degraded or being used unsustainably. The forest resources of Nigeria and Ogun State are not excluded from these global assessment shortcomings. This situation can be attributed to lack of sufficient incentives for land owners to protect forest ecosystem and its services as they may receive little or no benefits from them. Economist often classifies most forest ecosystem services as public goods, that is, 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 that goods. Putting a value

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(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 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 attempted 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; 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.

MATERIALS AND METHODS

Environment of the 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 periurban 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). In the light of the above AFR is closer to Abeokuta city, hence the description of Abeokuta is relevant in this study as described in Adekunle and Oluwalana (2000).

Abeokuta is the capital of Ogun State and the traditional home of the Egba's stratified into Abeokuta North and South local Government Area. 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. Such as includes Christianity, Islam and traditional religion. The Christians are predominating.

Geographically, Abeokuta lies on a latitude 7°15N and longitude 3°25E .The town is about 81 km South–West of Ibadan, Oyo State capital and 106 km North of Lagos former Nigeria capital city. Abeokuta lies at an altitude of about 157 m 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 17,228meters above sea level and is located in the central part of the town while the popular '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°C and an annual rainfall of 128 cm in the Southern part of the city to 105 cm in the Northern part. The Ogun river transverse through the town from the south to the western part. The population of Abeokuta North and South Local Government area has been estimated at 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.

Data collection

The multistage sampling procedure was adopted in the study. The area was stratified into 2 categories that is, the neighborhood and non–neighborhood: areas that are within 1 km radius was classified as neighborhood while those that are situated 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 questionnaire was 200 in number 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.

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 regressions were 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:

$WTP = f(X_1+X_2+X_3+\ldots\ldots\ldots X_n+e)$ (neighborhood and non-neighborhood)
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: $WTP = b_o + b_1 X_{1+} b_2X_{1+} - - - - - - - - b_8X_{8+} Ed$

Table 1. Sampling design.

Category	Settlements	No of respondents	Total
Neighborhood	Abe igi	25	100
	Asela	25	
	Ayo bus stop	25	
	Quarry	25	
Non-neighborhood	Iberekodo	25	100
	Mokola	25	
	Elega	25	
	Ajitadun	25	
Total	8	100	200

Semi log: WTP= $L_nb_o+b_1LnX_1+b_2LnX_2+$…….. b_8LnX_8+ LnEd
Double Log: LnWTP- Lnb_o + $b_1Ln\ b_1X_1$ +b_2LnX_2+ $b_8Ln\ X_8$+LnEd

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 WTP for ecosystem service functions (es) of Arakanga reserve

The distribution of respondents WTP for ecosystem services is summarized in Table 2. According to the table, 46% of the total respondents were willing to pay for ES .This percentage ranged from 57% (Neighborhood) to 35% (Non-Neighborhood). The large percentage of respondents willingness to pay recorded among the neighbors could be because of their proximity to the reserve and an indication that they benefit more from the services provided by the forest.

Distribution of respondents' elicited WTP values for ecosystem service functions

The respondents were willing to pay amounts ranging from ₳100 to ₳1000 (Table 3).Both neighborhood and non – neighborhood respondents had ₳100 as their modal elicited value but different levels that is, 52.6 and 62.9% responses respectively. This result agreed with the findings of Ajewole (2002) and Adekunle et al. (2008). This result could be attributed to the fact that most of the respondents are low income earners. It could also be because people are in most cases averse to paying for public goods and services such as the forest.

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 little 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 to the reserve for ES sustainability. In the same vein, highest mean 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 a low income earners are in most cases 'free riders' especially when open access resources like the forests are involved. This is because of their characteristics nature as 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 towards the sustenance of forest ecosystem services in the society

Mean and aggregate estimate WTP values of forest ecosystem services

The total monthly WTP ranged from ₦2, 800 from non-neighborhood ₦10, 400 for the neighborhood, with a mean monthly amount of ₦165.22 for the ecosystem services (Table 5). This resulted into a monthly aggregate estimate value for forest ecosystem service function that ranged from ₦15, 301, 245.59 to ₦33, 263, 577.38 minimum and maximum values respectively (Table 6). These values although indicative represent the monetary estimates of ecosystem service functions of Arakanga forest reserve. The management implications of these findings are that apart from values in use, forests has value in exchange. Hence, the forests especially could no longer be viewed as a mere land banks, which can be

Table 2. Percentage distribution of respondents on willingness to pay for conservation of Arakanga Reserve.

Respondents		Yes	No	Total
Neighborhood	No	57	43	100
	%	57	43	100
Non- neighborhood	No	35	65	100
	%	35	65	100
Total	No	92	108	200
	%	46	54	100

Table 3. Percentage distribution of respondents' individual elicited WTP values (Naira: ₦) for ecosystem services.

Respondent		₦ 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

Table 4. Summary of mean WTP across different socioeconomic strata.

Variable	Average Willingness to pay (₦)		
	Neighborhood	Non-neighborhood	Pooled
Gender			
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

Table 4. Contd.

Primary	86.9	19.3	53.1
Secondary	86.1	43.9	65
Tertiary	157.7	95.8	126.8
Postgraduate	200	-	200

Table 5. Estimated monetary values of ecosystem services in the study area.

Respondent	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.

	Neighborhood		Non- Neighborhood		Total	
Mode of payment	**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

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 according to Heins (2011). These also findings also agreed with that of Ajewole (2002) who recorded an aggregate estimates value of between 155.5 and 240.9 million naira as the amount 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 table 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 not government employees.

Suggested Management strategies for the existing reserve

About 24% of the respondents would want non- forestry or non- forest related activities prohibited from AFR as a management strategy Table 8. This is to ensure the continued existence of the forest reserve for posterity.

Results of multiple regression analysis

The summary of multiple regression analysis to determine the socio economic factors contributing to the

Table 8. Percentage distribution of respondents on management strategies for AFR.

Respondent		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

monetary values of ecosystem services showed that the double log function had the best performance having recorded the highest coefficient of determination (R^2 of 12.8) out of the 3 regression models tested. The respondents' income and household size had significant relationships with their WTP for ES at 5% probability levels. This is an indication that WTP for ecosystem services can be determined and predicted from peoples' incomes and household sizes especially in the study area.

Conclusion

The study has shown that with appropriate econometric tools, monetary values can be attached to nonmarket forest goods and services. There is need to engage in a meaningful dialogue with urban residents about forest and choices they can make to benefits themselves, forest and ecosystem function. 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 aim to protect and conserve the nation forests and grasslands should be put in place by policy makers.

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